



RISK MANAGEMENT SECTION

"A JOINT SECTION OF SOCIETY OF ACTUARIES, CASUALTY ACTUARIAL SOCIETY AND CANADIAN INSTITUTE OF ACTUARIES"

Risk

Management

Canadian
Institute of
Actuaries



Institut
canadien
des actuaires

December 2006, Issue No. 9

Published in Schaumburg, Ill.
by the Society of Actuaries

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Actuaries

Risk is Opportunity.™

Looking Ahead in 2007

by Doug Brooks



Doug Brooks, FSA, FCIA, MAAA, is senior vice president and chief financial officer at Equitable Life Insurance Company of Canada. He can be reached at dbrooks@equitable.ca.

Another year begins for the Risk Management Section and the world of risk management continues to evolve at a rapid pace. Our goal as a section is to ensure that we also continue to make changes to keep our members up-to-date and provide opportunities for actuaries and the actuarial profession.

The actuarial profession is relatively small by the standards of some other professional and quasi-professional organizations. In order to compete as a profession, and in fact gain a reputation as experts in the broad field of risk management, I believe that we must combine efforts as broadly as possible. Last year, the

Casualty Actuarial Society (CAS) became a joint sponsor with the SOA of the Risk Management Section. This results in a more focused approach toward education, research and issues, and is also a reminder of the fact that risk management problems benefit from different perspectives. Methodologies used to explore a particular risk issue are often valuable when the concepts are applied to different risks that may have traditionally employed different methods.

This fall the Canadian Institute of Actuaries (CIA) became a joint sponsor of the Risk Management Section. This is another first for the section, as well as a new event for the CIA. Including the CIA as a sponsor is a further signal that it is important for actuaries to combine efforts to make a mark in the rapidly expanding risk management territory on a more global basis. The CIA does not bring a long list of prospective new members, as most CIA members are already members of the SOA or CAS. However, it does bring organizational capacity. Additionally, the CIA has generously helped fund the section with a \$20,000 contribution. (see photo on left.)

The section's excellent newsletter will, as a result of the CIA becoming a joint sponsor, now be translated into French. This is a first step to potentially translating the newsletter into other languages.

Dave Ingram has been the chair of the Risk Management Section for the past year. I have personally appreciated the leadership and vision he has brought to the section. While Dave is leaving the section council, I am very happy that he will continue to be involved in the work of the section. In particular, Dave



Doug Brooks (left) chairperson of the Joint Risk Management Section, and Robert Beuerlein (right) President of the SOA, received a \$20,000 contribution from Normand Gendron (center), President of the CIA. This transaction occurred at the SOA/CIA General Session, Oct. 18, 2006 in Chicago.

will be leading an effort to reach out to other actuarial bodies to move further toward combining efforts and sharing knowledge globally. I think this is both a very exciting and important initiative for the profession. The Mexican actuarial profession is already represented at Risk Management Section Council meetings, and there has also been initial contact with other actuarial groups, who have expressed a great deal of interest in joining together to further the actuarial profession's place in the risk management field.

The actuarial profession brings to risk management true professionalism. The actuarial profession has education and qualification standards, continuing education, standards of practice and discipline processes—the necessary requirements for professionalism. These areas must be developed in the context of risk management practice to enable actuaries to be seen as the true professionals in the crowded risk management arena.

The Risk Management Section will also continue efforts to promote the actuarial profession in risk management, as will the

sponsoring organizations. The ERM Symposium is an important part of this effort, as it has become an important event in the risk management calendar. In addition to providing actuaries with learning opportunities and a forum for discussion of research, it also includes non-traditional areas of practice and industries.

The actuarial profession has much to offer the field of risk management. We are true professionals in this field where many are attempting to stake out their territory. We must continue to develop and promote our expertise in this field. We must do this by combining the efforts of actuaries across areas of practice and national boundaries.

Last but not least, my heartfelt appreciation goes to Dan Guilbert, Dave Ingram, Hubert Mueller and Frank Sabatini for their dedicated and uncompromised years of services as council members. Let me also take this opportunity to welcome our newly elected council members—David Gilliland, Todd Henderson, Hank McMillan and Bob Wolf. I look forward to working with them. ♦

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The actuarial profession has much to offer the field of risk management. We are true professionals in this field where many are attempting to stake out their territory. We must continue to develop and promote our expertise in this field.

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Attend the 2007 Investment Symposium

Mark your calendar and plan to attend the SOA/PRIMIA Investment Symposium, April 18-20, 2007 at the Sheraton New York Hotel and Towers. The Symposium will include three unique tracks—investment, finance and ALM/Risk Management.

There will be top-notch insurance and investment professionals speaking on important issues and a variety of networking opportunities.

More information coming soon at www.investmentactuariesymposium.org.

Farewell and Here Is the Next Volunteer Opportunity

by David N. Ingram

Old risk managers never die, they just get further away.

“Put out the Fire When You Die.”

– David Jacobs-Strain

By the time you read this, my term as chair of the Risk Management Section and my term on the section council will have come to an end. I have had a grand time watching this new effort go from a task force with an incredible 200 volunteers to a new section, to the largest joint activity of the Society of Actuaries (SOA), the Casualty Actuarial Society (CAS) and the Canadian Institute of Actuaries (CIA) ever.

The volunteers and section council members and the SOA have been great to work with. I have seen folks go from volunteers with little to no experience in risk management to volunteer leaders to risk management positions in their companies to CRO positions over the past six years. Actuaries who thought of themselves as late to the risk management show are now confidently making major contributions to the field and leading risk management efforts in dozens of firms. The ERM Symposium led the way to both self-confidence of their value in the risk management space and recognition of that value by other risk management professionals. In addition, it provided an opportunity for actuaries from the SOA, the CAS, and the CIA to work together in the new risk management field for the first time.

Best of luck to the Risk Management Section Council and Doug Brooks as the new chair. And many thanks for the service to the section of outgoing section council members Hubert Mueller and Dan Gilbert. Hubert has served

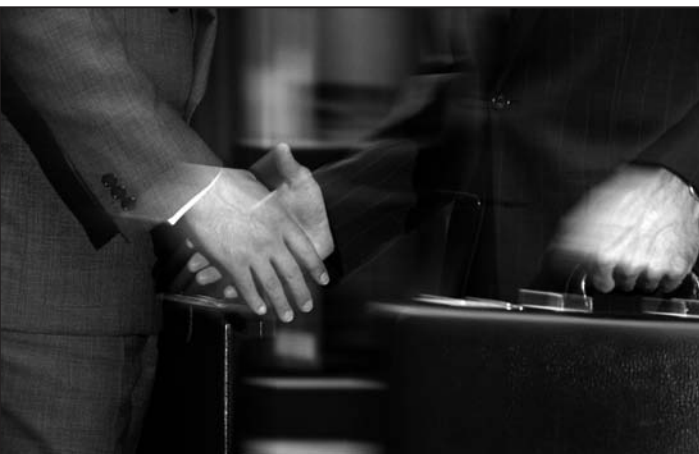
as an original member of the Risk Management Task Force, led the Economic Capital subgroup and has been the coordinator for the Risk Management Section sessions at the SOA meetings and has helped to organize web casts and stand-alone seminars.

Thanks also to Larry Rubin and Hank McMillan for rejoining the section council. And welcome new council members David Gilliland, Todd Henderson and Bob Wolf.

Finally, farewell to Frank Sabatini, who is leaving the council to join the SOA Board of Governors. Frank has been an officer of the council in each of its three years of existence and was active in the group that worked to form the council. The risk management contingent on the board is impressive with Frank, Sim Segal, Craig Raymond, Charles Gilbert and Max Rudolph.

I will mention that Max has always been a key factor in actuarial risk management developments. Max has served on the risk position reporting study committee (which may be the first “risk management” activity of the SOA), the ALM Practice Guide committee, the Risk Management Concepts Committee, the Risk Management Task Force organizing committee was a key member of several subgroups, and has served as the SOA board liaison to the Risk Management Section Council. In addition, Max acted as the godfather to the RMTF when he was the Investment Section chair providing both financial support and access to the 4,000 members of the Investment Section for RMTF volunteer recruitment. Max continues as the SOA Board liaison and on the program committee of the ERM Symposium. He also recently headed the board committee on implementation of the risk management strategy.

My next step as a volunteer is to start a new International Committee for the Risk Management Section. We have been in discussions with actuaries in the United Kingdom, Australia, Hong Kong and Mexico about



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different types of cooperative projects. We are considering creating an international version of this newsletter that we would have translated into Chinese and/or Spanish. (The CIA will be translating a French version.) We are also considering some efforts to create an international ERM Web portal that would facilitate education and research with easy access to work from all parts of the globe. In addition, we will be looking for research or other projects to perform collaboratively.

The international efforts will be organized around the following principles:

A. The main purpose of the affiliation would be to advance the quality and effectiveness of actuarial practice in the area of ERM through strength of numbers, which will allow us to develop the critical mass to compete with other organizations that are or will become global. Critical mass will enable the efficiency and effectiveness of other aspects, including cooperation on things like research, publications, etc.

B. The purpose will be supported by sharing of knowledge and experiences, by joint research and publications and by mutual support.

C. Mutual support includes recognizing that there are more similarities than differences in the ERM problems that we face around the world. In addition, it means that we recognize each other's contributions. Finally, it means that we accept each other's level of current practice without prejudice.

D. We commit to making this affiliation a positive force in the development of actuarial ERM practices by agreeing to regular communication with the other members of the affiliation.

E. As professional standards of practice develop for risk management work by actuaries, we will share our findings with the hopes that some commonality will develop globally.

If you want to join these efforts, either as a committee member or as a participant in one or more projects, please let me know.

And remember that there are many other volunteer opportunities. See the box at the bottom of this page. ♦

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Volunteers Needed

	Contact Person	E-mail	Phone
Basic Education	Kathy Wong	kathleen.wong@axa-equitable.com	(212) 314-4487
Continuing Education	Tony Dardis	tony.dardis@towersperrin.com	(404) 365-1561
ERM Symposium	Kevin Dickson	kevin.dickson@towersperrin.com	(312) 201-6310
International	Dave Ingram	david_ingram@standardandpoors.com	(212) 438-7104
Newsletter	Ken Seng Tan Ron Harasym	kstan@uwaterloo.ca ronald_j_harasym@newyorklife.com	(519) 888-4567 x36688 (212) 576-5345
Research	Fred Tavan	ftavan@rgare.com	(416) 943-6785
Special Projects: Operational Risk Risk Terms ERM Online Guide Best Practices	Michel Rochette	mrochette@soa.org	(847) 706-3591

Life Insurer Systemic Risk

by Stuart F. Wason

One of my responsibilities at Assuris (the corporation which protects Canadian policyholders against a loss of benefits due to the failure of a member company) is to identify the potential sources of systemic risk and the exposures and potential impacts for our member life insurance companies. These members may operate their business only in Canada; in multiple jurisdictions; or in Canada as part of a foreign based insurer.

A definition of systemic risk is,

“Systemic risk represents the danger that specific problems spread more broadly to affect the entire financial system in a country or more globally.”

Systemic risk is becoming increasingly important as a result of globalization, integration and the growing complexity of world economies. The sources of such risk appear more numerous than in the past; their sources are more unpredictable and many have the potential to spread more rapidly than in the past. In the words of

André Icard, Deputy General Manager of the Bank for International Settlements, in a Nov. 8, 2005 speech,

“The consensus view, therefore, is that systemic disturbances are now more likely than in the past to erupt outside the international banking system and to spread through market linkages rather than lending relationships.”

“The financial system has become more complex. This complexity, in turn, has resulted in more uncertainty as to the origin and nature of shocks

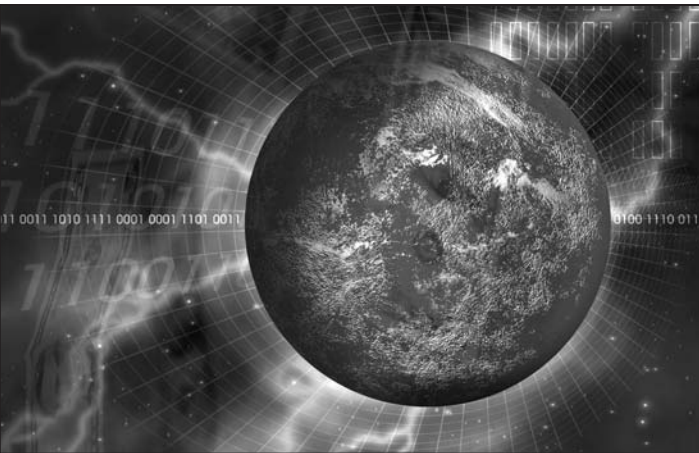
to that system and how these will actually play out.”

Systemic risk can manifest itself through highly visible “disturbances” (e.g., terrorism, pandemics, etc.) as well as through processes that are more gradual and less newsworthy (e.g., continued decline in long term interest yields; divergence in interests of insurers, regulators and/or policyholders).

Systemic risk differs from risks with which we may be more familiar (such as credit or market risks) because it is highly evolutionary in nature. The key drivers of systemic risk tend to be ever-changing and probing (and sometimes intrusive) in nature, looking for weaknesses in the operational fabric of our environment. The consequence is that whether it be global terrorism, the bird flu, or changing consumers attitudes, risk assessments and contingency plans need to be frequently reviewed, tested, validated and refreshed. People need to think outside of the box when dealing with systemic risk as often the issues and topics are outside of our comfort zone.

Life insurers can be impacted by systemic risk arising initially either locally or from foreign sources. The nature of systemic risk is that while it may arise initially from either local or foreign sources it can spread and impact other jurisdictions. Similarly, the impact (if significant enough) can ripple through a global insurer and possibly impact its ability to deliver on its local responsibilities. Some possible sources of systemic risk to the life insurance industry are listed in the following table.

The threat of a flu pandemic is perhaps one of the most readily identifiable sources of systemic risk. According to Dr. Don Low (chief microbiologist at Toronto’s Mount Sinai Hospital) during a recent speech on this topic, the occurrence of a pandemic is not a question of “if” but a question



Possible Sources of Systemic Risk

- **Political environment**
 - Global terrorism
 - Regulation (e.g., increasingly risk-based; home versus local supervision)
- **Economic environment**
 - Housing price bubble
 - World dependence on oil
- **Societal attitudes**
 - Changing consumer attitudes and needs for financial services
- **Insurance risk**
 - Avian flu or any pandemic
 - Longevity
- **Credit risk**
 - Counterparty failure (reinsurer, derivative or hedge fund)
 - Generalized increase in credit risk
- **Market risk**
 - Weakness in U.S. economy
- **Operational risk**
 - Misaligned interests (e.g. between distribution channel and customer; product manufacturer and customer; employee incentive plans)

of “when.” Many insurers and regulators are studying the possible impact of such a pandemic on their operations and financial positions. While a primary impact of a pandemic is increased rates of mortality, insurers should consider the chain-like events that systemic risk can lead to. For example, in the bird flu scenario, people may stay home and work remotely, but given the limited bandwidth on the communications infrastructure, such a solution may provide a false sense of security. Insurers need to be thinking through their contingency plans and performing “walk-throughs” with reality checks. This should not be new, as insurers should already have experience in performing disaster recovery tests of their IT infrastructure. Consideration should also be given to the impact on the economy as consumers stay home and travel less often during the pandemic.

In considering systemic risk, it is important for insurers and regulators alike to:

1. Identify the possible sources of systemic risk to the life insurance industry
2. Explore their impact on the life insurance industry
3. Discuss early detection measures

Assuris has been active in Canada in stimulating discussion regarding systemic risk with chief risk officers. I would encourage broader global discussion, debate and research on this important risk management topic by the profession, chief risk officers and regulators. I would like to thank Ron Harasym, vice president and actuary at New York Life, for his review of, and insights for, this article. You can contact me at my e-mail address swason@assuris.ca. ♦



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Latest Research Enterprise Risk Management for Property/Casualty Insurance Companies¹

by Shaun Wang

Editor's Note: The following article is reprinted with permission. It originally ran in the Actuarial Review, Volume 33, No. 4, 2006.

The Casualty Actuarial Society (CAS), the ERM Institute International, Ltd (ERM-II), and the CAS/SOA Risk Management Section have released their jointly commissioned research report titled “Enterprise Risk Management for Property-Casualty Insurance Companies.” I coauthored the report with Robert Faber (executive, underwriter), and several highly regarded CAS members contributed valuable comments. The research report proposes a new conceptual framework for Enterprise Risk Management (ERM) and applies it to property/casualty insurance companies.

The report defines ERM as the discipline of studying the risk dynamics of the enterprise, the interactions of internal/external players and forces, and how players' actions (including the risk management practices) influence the behaviors of the risk dynamics, with the ultimate goal of improving the performance and resiliency of the system.

This definition takes an engineering-like approach and paves the way for a “scientific”

approach. The authors believe that risk dynamics modeling holds great promises when combined with a true understanding of the dominant risk drivers.

The report advocates that an actionable ERM should be embedded in each step of the company's decision-making processes. ERM should start with an analysis of the business model and the company's strategic position in relation to the external environment, followed by examining the company's internal operational processes and how they have impacted the company's financial performance.

An enterprise risk model for a property/casualty insurer must give due considerations to (at least) the following dominant risk dynamics:

1. Inherent risks associated with the product design, risk origination, risk selection, and risk valuation as embedded in the marketing, underwriting, pricing, claims handling, and reserving processes;
2. Constraints imposed by rating agencies and regulators;
3. Actions and behaviors of competitors (market leaders and participants);
4. Exposures to catastrophic or correlated losses (on both asset and liability sides of the balance sheet); and

¹ The report is available on the Web at www.ermii.org.

5. Impacts of market valuation fluctuations and accounting conventions on company balance sheets and earnings.

The report highlights a basic truth that risk dynamics cannot be known completely due to the multiple forces at work, where knowledge about the risk dynamics can be gained through experience, insights, and modeling. One should try to objectively evaluate the knowledge level of the risk dynamics and the competitive edge relative to competitors. A common pitfall is that when one has little knowledge (or less than a competitor's knowledge) about the risk dynamics of a line business, for example, or fails to identify the underlying trends, one tends to perceive the risk dynamics as "pure volatility," and put his or her faith in diversification. Although diversifying a portfolio of risks is usually beneficial, such diversification has to be weighted against the increased risk due to the reduced knowledge one has for each risk. Lack of knowledge of the underlying risks often shows up in the form of inadequate reserves, which is a lagging indicator of poor enterprise performance.

The report documented empirical findings that, for commercial lines (including workers compensation and general liability), large national insurers tend to show worse underwriting results than the small regional companies. For general liability and workers compensation, the inherent loss reporting delay provides a backdrop for the varying company behaviors in underwriting, pricing, and reserving practices. Differences in underwriting/pricing behaviors (e.g., average number of years of experience on the book, underwriter

turnover, extent of reliance on experience rating modification, etc) in small company versus large companies provide explanations for the differing underwriting results.

The report recognizes that an enterprise has multiple risk dynamics at multiple levels (e.g., company, business segment, and product levels) with multiple forces (e.g., financial rating concerns at company level, competition at local business segment level, and contract terms at product level). To gain an overall picture we need to understand the interactions of risk dynamics at different levels and to reconcile the multiple perspectives. While traditional actuarial analysis focuses more on the individual risk level, ERM advocates a high-level analysis that incorporates the macro risk drivers such as market competition, natural catastrophes, the cost fluctuation of hedging (through reinsurance), and regulatory constraints on profitability.

The value proposition of ERM is self-evident in the premise that actions taken by key participants (for example, insurance company executives, underwriters, actuaries, rating agencies, and regulators) can exert great influence on the behaviors of risk dynamics. Indeed, underwriting and pricing of the current book is a critical first line of defense in risk management, and is the first area that the insurer should consider in altering its future objectives and risk profile.

Properly constructed risk metrics and valuation models can shed light on the behavior of risk dynamics; they are powerful forces and

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Latest Research...

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essential tools for taking a structured and disciplined approach that aligns business strategies with the processes, people, technology, and knowledge within the organization. In the meantime, risk modeling itself introduces an inherent risk, namely the model risk, which is not random by nature. The report analyzes the drivers of pricing and reserving cycles and develops risk valuation models for loss ratio volatility, reserve development volatility, and risk capital requirements.

The research report advocates the use of “leading indicators,” rather than “trailing indicators,” in guiding business decisions. Actuaries have been predominantly relying on experience-based trailing indicators that are subject to estimation bias due to information lag and incentive problems such as tying bonuses with top-line premium growth. What the insurance industry needs are leading indicators that can be developed by closely monitoring rating level changes per unit of exposure, emerging trends, potential impacts of new regulation or new technology, actions by key competitors, and changes in competition due to the entry or exit of other insurers.

In the past, the property/casualty insurance industry has focused much time and energy on the prediction of the loss component of the loss ratio. The problem with so much emphasis on this component is that it is a trailing indicator. Only after several years can one effectively draw conclusions on the longer tail lines. Going forward, we must focus more attention on the denominator in the loss ratio calculation, namely the effect of rate levels on exposure. Rate levels, which are generally known at the inception date of the policy, can be considered leading indicators that are more timely and effective in predicting loss ratios, and therefore pricing cycles.

ERM is a journey and an ongoing learning process that requires a humble attitude and disciplined approach. Implementation of an ERM framework should enable a property/casualty insurer to accomplish the following:

- A clearly-defined business model that includes focusing the business, enhancing the competitive edge, and establishing a risk tolerance level;
- A well-articulated risk appetite and risk strategy, risk exposure accumulation;
- A well-integrated business processes for sales, marketing, underwriting, pricing, claims handling, reserving, and investment functions and processes; and
- A developed and tested robust risk valuation and risk model that are operational for day-to-day business management.

Although the specific contexts are pertinent to property/casualty insurers, the risk dynamics concept and the risk valuation methodology presented in this paper are universal and applicable to other industry sectors such as life and health insurers.

Readers can address their comments to Dr. Shaun Wang at swang@ermii.org. ♦



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Actuaries—Leading the Charge of Chief Risk Officer

by Ronald J. Harasym

In recent years, Enterprise Risk Management (ERM) has emerged in the forefront of the financial services and products landscape. There is no question that the operating environment has increased in complexity over time. As the transfer of information becomes quicker and more efficient, so does the increased capability for external parties to take opportunistic advantage of companies. If you don't identify your weaknesses first, not to worry (or do worry) as others will find them for you!

Many key risk drivers have now taken on dynamic properties and are being modeled using advanced stochastic and analytical techniques. The requirement to develop effective and efficient risk policies, procedures and practices in concert with these winds of change has become mission critical to many companies. Given the nature of the situation and the experience and training that actuaries bring to the table, who better is suited to the role of ERM than actuaries?

This article is the first of two conversations with Ellen Lamale of the Principal Financial Group (the Principal). In this conversation, Ellen talks about her rise to and role as chief risk officer. In the next issue of *Risk Management*, Ellen will focus on key issues faced by chief risk officers operating in a global capacity. That is, differences she has observed between the integration of risk management practices into domestic operations versus international operations.

So, let's get started.

Ellen Lamale is an executive with the Principal. She is senior vice president and chief actuary, with responsibility for actuarial, business risk consulting, corporate treas-

ury, and capital markets and is also the company's chief risk officer.

Lamale first worked for the company during 1976 as a summer actuarial intern. In 1977, she joined the company on a full-time basis as an actuarial student. She has held various actuarial positions over the years and has been at her current position since 1999.

Lamale received her bachelor's and master's degrees in mathematics from Ohio University in Athens, Ohio in 1975. She also received another master's degree in mathematics from the University of Michigan in Ann Arbor, Mich. in 1976. She is a Fellow of the Society of Actuaries (SOA), a member of the American Academy of Actuaries (the Academy) and a member of the Des Moines Actuaries Club.

What do you see as the primary motivation(s) for elevating the ERM function in your company?

Risk management, even ERM, is not new. The Principal has been effectively practicing risk management for years—it has provided a fundamental foundation for our success. In fact, we are in the business of taking risks—we provide value to many of our customers by taking on their risks. ERM enables us to do that on an informed basis so that we can identify and effectively manage those risks that present profitable growth opportunities, and walk away from those that don't.

Has the focus on ERM increased over time?

Absolutely. The focus on ERM has definitely heightened, and for good reason. For starters, we're seeing the fallout of debacles such as



Ellen Lamale

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Actuaries—Leading the Charge...

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Enron and WorldCom, which led to tighter and more visible requirements around controls, disclosures and risk management. More importantly, we're seeing increased consumer demands for innovative and complex new products with more aggressive guarantees and somewhat complicated structures (for example, variable annuity guaranteed minimum withdrawal benefits and universal life secondary guarantees). New accounting guidance is sometimes vague and subject to interpretive risk.

We've become more global, which introduces new risks via different cultures, regulatory environments, markets, currencies, competitors and time zones. We're seeing fiercer competition with resultant pressures on our profit margins. Compounding all of this is the speed with which things change today—technologically, demographically and in the political/legislative arenas.

What have you observed as a key benefit of having a robust risk management function?

ERM enables us to avoid surprises, to ensure that we deliver on our promises to all of our constituencies. This includes meeting customer obligations, satisfying regulatory requirements, optimizing shareholder returns relative to the risks we take, contributing to the growth and development of our employees and participating in our communities.

A robust, comprehensive, enterprise risk management program is essential to ensuring we have the tools, resources, processes and metrics to successfully implement our strategy amidst the complicated, changing environment in which we operate.

Who have been the strategic sponsors of the ERM initiative?

As I mentioned earlier, ERM is not new. And it certainly is not an initiative or project—terms that suggest ERM has an ending or completion date. ERM is a way of managing risk that is both ongoing and evolutionary. It is the continual building upon the strong risk management fundamentals, tools, knowledge, processes, and metrics already in place to reflect changing markets, the economic environment, new laws and regulations, new and innovative product designs, new technologies and so forth. That said, ERM at the Principal does have a sponsor in the sense that our Board of Directors and our senior management team are actively involved in ERM with good understanding and knowledge of our organization's activities and risks, and full accountability for enterprise risk management. Risk management accountability then cascades down throughout all levels of the organization.

How does your experience make the transition into this position easier?

I came into the chief risk officer's (CRO) role after almost 25 years in various actuarial positions throughout the company, including almost 10 years as the organization's chief actuary. I've had exposure to several of our different business units as well as to the overall corporate perspective. I came into this role with good working relationships with many of the business unit leaders and their key financial, actuarial, and operational staff, and a good grasp of many of the risks faced by the Principal.

What gaps have you recognized since becoming CRO?

Since becoming CRO, I've had to become more knowledgeable about some of our non-insurance businesses (asset management,

“ERM enables us to avoid surprises, to ensure that we deliver on our promises to all of our constituencies.”

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mutual funds) and work to build relationships with those businesses' leaders and risk management teams.

What is the mission statement of the office of the CRO in your company?

We don't have an official mission statement for the office of the CRO. If I had to create one it might be along the lines of:

"Enable the organization to achieve its strategy by ensuring we have the appropriate culture, knowledge, staff, tools, policies, processes, controls, metrics and discipline to effectively:

- Identify and understand the risks facing our organization.
- Monitor, measure and evaluate our risks.
- Report on our risks and manage our risks through appropriate actions."

Many of the decisions we make today and actions we take will have impacts and consequences far into our organization's future. ERM should ensure that our decisions and actions are based on a good understanding of these potential long-term impacts.

What do you see as your number one challenge as CRO?

There are situations in which my team and I act in a police capacity and situations when we are appropriately invited in as a partner or consultant. It's critical that my corporate risk management team and I successfully balance our collaborative and consulting role with our authoritative/police role. To effectively do that, we must maintain the total trust and respect of our business unit and corporate leaders and staff so they never hesitate to keep us informed or invite us to a discussion, no matter how potentially controversial an issue or topic may be. Full disclosure and transparency on the part of our business

unit and corporate partners are critical to our ability to ensure effective risk management oversight, consistency and integration.

How would you describe the risk management function's relationship with the various business units in your company today?

Our risk management program is executed via a federated model, with business units directly responsible for their business risk management under the guidance and oversight of a central corporate risk unit. The units know their business best and are thus accountable for identifying, understanding, measuring, monitoring, managing and reporting on their own risks. They also must understand and take an enterprise view of risk, which requires an understanding of the potential impact their business unit decisions, and activities have on the total organization. The risk management functions within the business units work closely with the CRO and corporate risk unit via continual communications and participation in various committees and groups. They report directly up through their business unit management, but have a dotted line relationship to the CRO.

What makes a federated model for risk management successful at the Principal?

This federated approach may not work for every organization, but it works well for us for several reasons:

Our culture lends itself readily to a federated approach—our actuarial, finance, compliance,



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Actuaries—Leading the Charge...

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and IT communities each operate quite successfully within a federated model (business unit professionals in the business units reporting directly up through the business unit, and dotted line reporting to the chief actuary, corporate controller, chief compliance officer, and chief information officer), and have for many years.

We have a strong, knowledgeable, well-respected corporate risk unit to provide oversight, integration, coordination and consolidation.

We stay informed via frequent and regular interactions via committees, meetings and various reports.

We have a well-established culture of being disciplined—which fosters a willingness to identify and remedy any potential risk management gaps or weaknesses.

Do you see any ongoing major challenges?

One of our biggest challenges is to ensure that our corporate risk management team stays fully informed and connected to our business units, so that we have an adequate understanding of the various risks within the organization. That can become challenging as new people join business units, as we venture into new products, markets, distribution sources and become exposed to new risks.

How do you view the integration of risk management within the company?

Integration of risk management is difficult within a diversified, multiline, global company. There is no one single model or system that will allow us to perfectly integrate all of our risks. We have to make some assumptions, categorize and

prioritize our risks. We do have well-developed financial models, at the business unit and overall consolidated and corporate levels, that provide us with the ability to analyze and stress test many of the key drivers of our organization's risk profile. However, some risks are difficult to model—such as litigation risk or branding risk.

Understanding and integrating these risks into the picture requires a lot of networking and discussions with key players and experts. That points to the critical need for maintaining trusted relationships that keep me, as CRO, fully connected and informed so that I can get good answers to questions asked about various risks. Another key to successful risk management integration ties back to a comment I made earlier—business units need to be able to not only know and manage the risks in their operating areas, but they must also be able to take an enterprise-wide view. Our business unit leaders have accountability not only for the risks of their particular unit, but for the impact their decisions and actions could have on the total organization as well.

How do you categorize risk?

There is nothing magical or unique about how we categorize risk. We use common categories like pricing/product development (insurance risk), financial, investment, market and operational. Of course there are several subcategories within these. We try to prioritize our risks based on potential frequency and severity to the organization; again, nothing unusual about that. When we think about risks, we assess the economic/financial impact, accounting perspectives, litigation/regulatory risks, headline/reputational risks and pure risk/risk of business disruption.

“

Understanding and integrating these risks into the picture requires a lot of networking and discussions with key players and experts.

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What risks get the most attention and why?

We pay a lot of attention to pricing risks, especially for products that have long tails and where liabilities will be with us for a long time. We spend a lot of time doing financial modeling and stress testing the drivers of our businesses to understand what the future could hold, so we can take mitigating action if needed. And we spend time thinking about new and emerging risks—things that aren't on our radar screen today—but could be in the future.

Discuss the risk governance structure at your company. To whom do you report?

I report to our company's chief financial officer. As described earlier, we operate with a federated model. There is a small corporate risk management unit that reports to me, providing oversight over corporate modeling, capital management, financial forecasts, liquidity, reinsurance and certain GAAP issues (e.g., DAC, reserving). Many of these activities are closely coordinated with other corporate areas, including capital markets, corporate treasury, and business risk consulting (internal audit).

Do you have board-level reporting?

I provide a written risk report to the board each quarter that highlights one or two current relevant risk topics or issues. Additionally, annually, I give a presentation to the board with an update on our risk management program. Our board and its committees (Audit, Human Resources, Nominating and Governance) meet quarterly and also regularly receive reports and updates on various risk topics (liquidity, investment performance, reserves, operational risk, litigation, succession planning, etc.).

Is there an executive-level ERM Committee?

We do not have one single formal executive level ERM Committee. Instead, we have a few overlapping senior management groups and committees that each meet on a regular and frequent basis to discuss various issues and risks associated with our businesses. It is through the overlapping membership and frequent meetings and discussions that the senior management members of these committees provide executive-level risk management oversight and sponsorship.

Finally, what advice do you have for actuaries who aspire to become a CRO?

Nothing earth shattering. The basic training to become an actuary provides a great foundation for a risk management role. Build upon that by working hard to understand your company's business and the types of risks to which it is exposed. If your company is multiline, try to get exposure to more than one line of business. Build relationships with business unit employees from as many different disciplines as possible—actuarial, financial, IT and other operational, investment, legal and with all levels from clerical/technical up to management. And finally, as is true for anyone who wants to do well in any role, stay current and educated on the latest thinking and trends in technology, product designs, methodologies and tools. ♦



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Credit Suisse Longevity Index Provides Basis for Settling Longevity Trades

by Caitlin Long

Credit Suisse created the first index designed specifically to enable the structuring and settlement of longevity risk transfer instruments such as longevity swaps and longevity structured notes. The Credit Suisse Longevity IndexSM (CSLI) is a standardized measure of the Expected Average Lifetime for a general population.

The CSLI is intended for use by institutional and retail investors, insurance companies, reinsurance companies and providers of post-retirement benefits as well as other longevity and mortality risk managers. By providing market participants with a single, transparent reference tool, Credit Suisse believes the Index, the Sub-Indices, and the underlying mortality rates will spur the development of a liquid, tradable market in longevity risk. Credit Suisse and Milliman, the Index calculation agent, will release the CSLI annually. It is based on government mortality and population statistics, initially for the U.S. population.

The CSLI's 2006 **U.S. Composite Index Value**¹ is 80.6 years. This represents an increase of 2.40 months over the 2005 Composite Index Value. The 2006 Male Index Value increased by 2.88 months and the 2006 Female Index Value increased by 1.97 months, respectively, over the 2005 Gender Specific Indices.

Key Observations:

(1) Male Life Expectancy Increasing Faster Than Female: While females continue to exhibit higher Expected Average Lifetimes than males (82.8 years versus 78.3 years), male life expectancy continues to improve at a faster rate than that of females. Over the last 10 years, the average annual rate of improvement in mortality rates has been 2.07 percent for males compared to 0.91 percent for females.

(2) Index Has Generally Been Stable: Generally speaking, the average annual change in the Expected Average Lifetime has been only 0.16 percent, which suggests the Index is fairly stable. The highest annual change in the Index

since 1983 was an increase of 0.35 percent, and the smallest change was a decrease of 0.01 percent.

(3) Pandemics Can Materially Affect The Index: The 1918 flu pandemic, if the same pandemic were to hit today, would cause the 2006 Composite Index Value to drop from 80.6 years to 76.2 years. This would represent more than a five standard deviation move in the Index².

Historical and Projected U.S. Index Values

Chart 1 on page 17 shows historical, current and projected values of the CSLI. As illustrated in Chart 1, the Composite Index improved from 77.7 years in 1983 to 80.6 years in 2006.

U.S. Index values are based on the most recent available mortality data released by the United States National Center for Health Statistics (NCHS). This data currently represents the mortality experience three years prior to the Index release year. For example, the 2006 Index is based on the 2003 NCHS statistics.

Historical Index values are calculated assuming the population mix weightings, applicable to the corresponding year. For example, the 1998 Index Value, 79.4 years, is determined using the 1995 population mix, where, for example, people age 50 were 1.1 percent of the population. Data for 1995 are used due to the lag in reported mortality statistics.

To illustrate the effect of population mix, we held the 2000 population mix constant from 1983 to 2006 and the **U.S. Normalized Composite Index Values**³ improved from 78.0 years in 1983 to 80.5 years in 2006. This demonstrates that a majority of the increase in the Composite Index Value resulted from improving mortality rates rather than from the slow demographic shift to an older population.

Projected Values of the Index are also available as seen in Chart 1. These values are determined assuming the 2003 population mix remains



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constant throughout the projection period (currently 30 years), and assumes a historically based rate of improvement in mortality throughout the projection period. Projected Index values are available on composite and gender-specific bases.

Age and Gender Commentary

In addition to the Composite Index Values, the CSLI also includes Sub-Indices that show estimates of total life expectancy at attained ages of 50, 55, 60, 65, 70, 75 and 80. As Chart 2 to the right shows (for decennial ages only), the Expected Average Lifetime for the entire male population has increased by 4.0 years (or 5.3 percent), from 74.4 years to 78.3 years, over the 24 years covered by the Index. This is larger than the increase in the Composite Index, which increased by 2.9 years (or 3.7 percent), from 77.7 years to 80.6 years, over the same period.

Chart 3 on page 18 shows the same data for females. While the Expected Average Lifetime for the entire female population is higher than that of the Composite Index, the rate of increase in the Female Index, which increased by 1.9 years (or 2.3 percent) over the 24 years covered by the Index, is lower than that of the Composite Index in the same period.

When observing both population shifts and changes in mortality, the 40-49 age group is the driver of the increase in both the Male and Female Composite Sub-Indices. This age group showed a relative increase of more than 6.2 percent, versus a 5.3 percent increase in the overall Male Sub-Index. This is primarily due to the fact that this age group, as a percentage of the total male population, increased by more than 50 percent while the Index Value for this age group increased in line with the increase in the Male Composite Sub-Index. The largest relative decline in the Male Composite Sub-Index was in the 20-29 age group.

For females, the 40-49 age group showed a relative increase of 5.6 percent, versus a 2.3 percent increase in overall Female Sub-Index. Interestingly, this increase is almost entirely offset by the relative decline of 4.1 percent in the 20-29 age group. This offset is a result of the 20-29 age group's large decline as a percentage of the total population, despite a positive increase in their Index Value.

continued on page 18

Chart 1

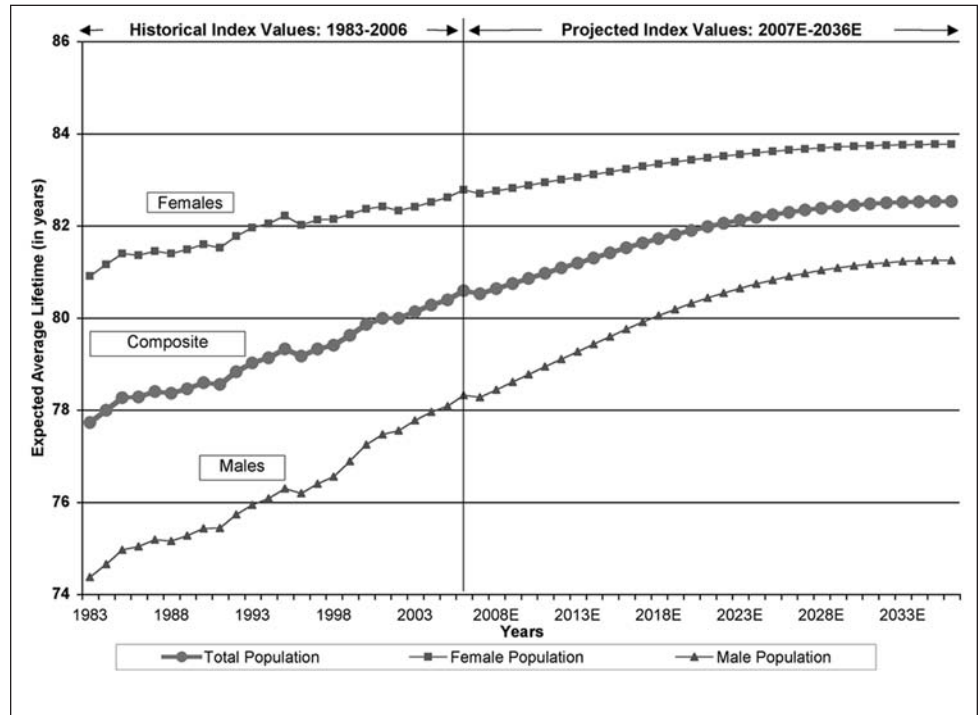
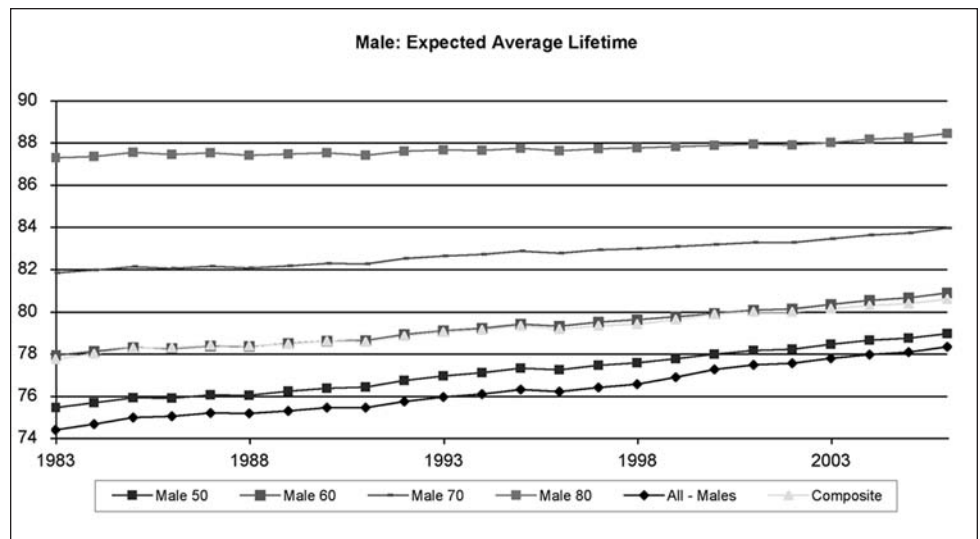


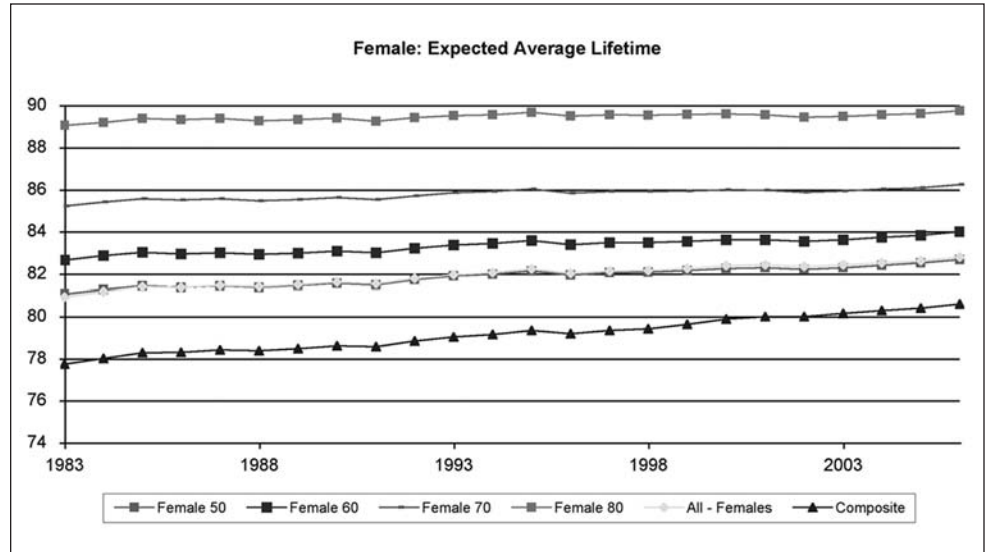
Chart 2



U.S. Composite Index...

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Chart 3



Closing Comment

Future commentary on the Index will be issued when annual Index data is released. ♦

Data Sources:

U.S. Department of Health and Human Services; U.S. Census Bureau: National Population Estimates; Milliman, Inc.; and Credit Suisse Securities (USA) LLC.

Disclaimers: The Credit Suisse Longevity IndexSM (the "Index") has been prepared based on assumptions and parameters that reflect good faith determinations as of a specific time and are subject to change. Those assumptions and parameters are not the only ones that might reasonably have been selected or that could apply in connection with the preparation of the Index or an assessment of a transaction or product referencing or otherwise utilizing the Index or its components. A variety of other or additional assumptions or parameters, or other factors and other considera-

tions, could result in a different contemporaneous good faith composition or calculation of the Index. The Index has been obtained from and based upon sources believed by Credit Suisse Securities (USA) LLC ("CSS") to be reliable, but CSS does not represent or warrant its accuracy or completeness. The Index does not purport to contain all of the information that an interested party may desire. Actual results or performance may not match or have any correlation to the Index. The Index is not intended to supplement or replace actuarial data and should not be used as such. CSS has no obligation to take the needs of a party entering into, buying or selling a transaction or product referencing or otherwise utilizing the Index or its components into consideration with respect to the composition or calculation of the Index. In all cases, interested parties should conduct their own investigation and analysis of a transaction or product referencing or otherwise utilizing the Index or its components. Each person viewing the Index should make an independent assessment of the merits of pursuing a transaction or product referencing or otherwise utilizing the Index or its components and should consult their own professional advisors. CSS is not acting in the capacity as a fiduciary or financial advisor. CSS or its employees or affiliates may enter into, buy or sell transactions or products referencing or otherwise utilizing the Index or its components. Copyright © 2005 Credit Suisse Securities (USA) LLC. All rights reserved. Longevity Index is a servicemark of Credit Suisse Securities (USA) LLC.

¹ The **Composite Index Value** is an estimate of the age at death over the current population assuming a continuation of the mortality rates experienced in the year of the Index. It assumes that the individual experiences the same mortality according to the mortality table of that year, throughout the rest of his or her lifetime, and is not gender-specific.

² The standard deviation of the Historical Pro Forma Index Values between 1983 and 2006 was 0.82.

³ The **Normalized Composite Index Values** are normalized by using the 2000 population weighting for each year.

Risk Management Section – Social Event in Hartford

by Hubert Mueller

The Risk Management (RM) Section held a social event on Oct. 12, 2006 in Hartford, Conn., geared toward the local members of the section and other risk management professionals interested in ERM. Organized by RM Section council members Hubert Mueller and Frank Sabatini, the event featured a brief introduction on current activities of the section by Hubert and Frank, followed by a keynote speaker, Craig Raymond, who is the chief risk officer (CRO) for The Hartford. Craig described the importance of ERM to the Hartford risk management decisions and financial management framework in

a very nontraditional manner, using slides with pictures only, no bullets.

More than 50 guests attended the event, including industry analysts. Following the prepared remarks, guests enjoyed hors d'oeuvres and networking with other risk management professionals.

Other similar RM social events were recently held in New York, Toronto and Hong Kong. It is envisioned that similar events will also be held in the next few months in Chicago and Atlanta. ♦



Frank Sabatini (left) and Craig Raymond (right).



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Enterprise Risk Management Quantification— An Opportunity

by Christopher (Kip) Bohn and Brian Kemp

Abstract

Enterprise Risk Management (ERM) has been getting an increasing amount of attention in recent years. While various industries, regions of the world and professional organizations may have coined different names for their general framework, the underlying theme is the same. Companies and organizations are recognizing the value in assessing, prioritizing and quantifying the risk that they face with the ultimate goal of choosing the most effective mitigation or exploitation options available to them.

With the exception of the insurance and banking industries, much of the focus has been on the qualitative aspects of framework with quantification only briefly touched

on. Quantification of enterprise risks often requires developing models that are outside the classic casualty actuarial frequency and severity model realm. However, actuaries' experience and understanding of risk presents tremendous opportunity to expand upon our skill set and both assist and steer the future course of operational and financial risk modeling.

A Brief Introduction to the Present State of Enterprise Risk Management

ERM is a hot topic in today's business environment. Demands from analysts, auditors, regulators and stakeholders in response to legislation and business events helped spark initial interest. Business leaders such as the CFO, treasurer, risk manager and chief risk officer (a recent addition to an increasing number of organizational charts) are recognizing the ERM framework as a vehicle to:

- Provide transparency to analysts, auditors and stakeholders;
- Aid in the development of a financial disclosure framework that will support regulatory compliance initiatives; and
- Promote better capital allocation and decision making.

A number of professional organizations have also taken an interest in and are recognizing the value they can add to the advancement of the ERM framework. A brief sample includes the Casualty Actuarial Society, the Society of Actuaries, the Risk and Insurance Management Society and the Professional Risk Managers' International Association.

A number of ERM frameworks are currently being used. While they may vary in name, industry and region, they share a common theme: the identification, prioritization and quantification of risk in order to help corporations effectively manage their exposure. While many of the frameworks focus on mitigation, exploitation of risk should also be considered. Here is a brief description of three popular frameworks:

- Committee of Sponsoring Organizations of the Treadway Commission (COSO): *Enterprise Risk Management—Integrated Framework*. This is perhaps the most popular framework being implemented in the United States. The definition of ERM offered by COSO is purposely broad and is geared to achieving an entity's risk management objectives in four categories: strategic, operational, reporting and compliance. While discussing various techniques for assessing risk, the methods are more qualitative than quantitative in nature from an actuarial point of view.
- Bank for International Settlements, Basel Committee on Banking Supervision (Basel II), *International Convergence of Capital Measurement and Capital Standards; A Revised Framework*. Targeted at banks and



financial institutions, the standard is based on three “pillars” that include minimum capital requirements, supervisory review processes and market discipline. The standard also separates risks into three broad categories: credit risk, market risk and operational risk. While banks arguably are comfortable quantifying credit and market risk, operational risk is new territory. As pointed out by Rech,¹ the insurance industry is beginning to run in parallel with this three-pillar approach. Of the three examples given, Basel II puts more emphasis on the quantification of risk and suggests a value at risk approach for allocation of capital. However, recent attempts to implement a modeling framework produced results that were more widely dispersed and resulted in lower required capital than expected. This, among other factors, has led to pushing back the implementation date of the accord.

- Standards Australia / Standards New Zealand, *Australian/New Zealand Standard: Risk Management* (AU/NZS 4360). First introduced in 1995, this is currently one of the more popular frameworks being implemented outside of the United States.² Like COSO, this standard provides a generic guide for the establishment and implementation of the risk management process and involves the identification, analysis, evaluation, treatment and monitoring of risks. Quantification is addressed but only broadly.

Given its popularity in the United States, for the purposes of this discussion, we will be focusing on the COSO framework. However, as noted above, most frameworks focus more on the qualitative aspects of ERM. For those that do have more discussion around quantification, there is more work to be done.

An Opportunity

Studying the COSO framework from an actuarial and quantitative perspective has led us to the following conclusion: There is a clear opportunity for the actuarial and mathematical communities to not only add value to organizations interested in implementing an ERM framework but to also aid in the development of a more rigorous quantitative framework.

COSO defines eight key elements to the ERM framework that begins with an understanding of an organization’s internal environment, moves on to risk identification and prioritization, touches on the assessment and quantification risk and finally discusses risk response, mitigation and monitoring activities.³ Of note to those of us with a quantitative background, the 2004 framework doesn’t give much guidance on the topic of risk assessment and quantification. In fact, only eight out of 125 pages are dedicated to the assessment of risk.

In September of 2004, COSO published an application techniques guide. The purpose was to “provide[s] practical illustrations of techniques used at various levels of an organization in applying enterprise risk management principles.” This document has more content around the topic of risk assessment (22 out of 112 pages) and discusses both qualitative and quantitative methods. Focusing on the quantitative methods, the guide offers three broad techniques: probabilistic, non-probabilistic and benchmarking techniques. We would argue that from an actuarial point of view, the latter two are really more qualitative in nature while probabilistic techniques are of more interest to our specific skill sets.

The probabilistic techniques discussion touches briefly on “at-risk” models such as value at risk, cash flow at risk and earnings at risk. The section says this about modeling risk:

*Certain operational or credit loss distribution estimations use statistical techniques, generally based on non-normal distributions, to calculate maximum losses resulting from operational risks with a given confidence level. These analyses require collection of operational loss data categorized by root cause of the loss, such as criminal activity, human resources, sales practices, unauthorized activity, management process, and technology. Using these loss data and reflecting data on related insurance costs and proceeds, a preliminary loss distribution is developed and then refined to take into account the organization’s risk responses.*⁵

A clear opportunity is presenting itself to the actuarial community. We can apply our statistical expertise to the determination of non-

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Certain operational or credit loss distribution estimations use statistical techniques, generally based on non-normal distributions, to calculate maximum losses resulting from operational risks with a given confidence level.

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Enterprise Risk Management...

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symmetric probability distributions and the creation of stochastic models to determine risk at a given confidence interval. Many of the risks are emerging out of the implementation of an ERM framework and do not fall within the classically insurable subset of operational and financial risks which gives rise to three additional opportunities.

- First, these risks do not have the luxury of extensive databases of relevant loss and event data. In some cases, the risks identified may have not occurred at all, especially with any significant impact. This presents the opportunity to help develop procedures for the collection and storage of operational and financial loss information that will aid in the quantification of the exposure.
- Second, understanding your risk will only get you half way. As the ERM acronym implies, you need to *manage* risk across your organization. There are a number of ways to achieve this: avoidance, mitigation and transfer. Through the quantification of risk, we can aid in the understanding of the cost/benefit tradeoffs of various management strategies.
- Finally, the ability to quantify risk will also advance the development of new transfer products available in the marketplace.

COSO is evolving under the expectation that organizations such as the Casualty Actuarial Society will step up to the challenge of advancing the overall ERM framework. As stated in Application Techniques, "Over time, we believe that additional guidance will evolve as professional organizations, industry groups, academics, regulators, and others develop material to assist their constituencies." This is the opportunity to add value by applying our actuarial and quantitative expertise in the development of a financial and operational risk modeling framework. This modeling framework should be broad enough to apply not only to COSO but also to all ERM frameworks.

A Quantitative Modeling Framework

Guiding Principles

When developing a model framework, keep in mind the underlying premise of the COSO ERM framework:

*The underlying premise of enterprise risk management is that every entity exists to prove value for its stakeholders. All entities face uncertainty and the challenge for management is to determine how much uncertainty to accept as it strives to grow stakeholder value. Uncertainty presents both risk and opportunity, with the potential to erode or enhance value. Enterprise risk management enables management to effectively deal with uncertainty and associated risk and opportunity, enhancing the capacity to build value.*⁶

Based on this, primary considerations in the development of a modeling framework were not only the quantification of uncertainty surrounding a particular risk or portfolio of risks but also, perhaps more importantly, the ability to assess the cost/benefit tradeoffs of various avoidance, mitigation and transfer options. The result is an iterative six-step process: see Exhibit 1 on page 23.

What follows is a discussion of these six steps. For illustration, we have also included excerpts from a case study on a supply chain model we recently developed for a corporate client.

Determine the Underlying Risk Process

There are a few key considerations that are critical to the first phase of the modeling framework:

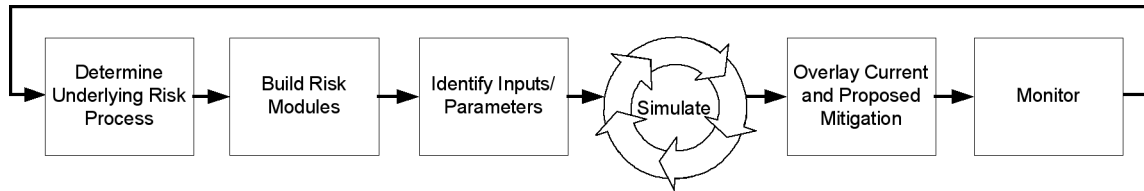
Clearly define the risks you wish to model. When defining the risks, it is often helpful to frame problem into three components: the underlying exposure (which may be as general as the business operations of the company or a specific process or asset); key events that can impact that exposure and finally; and key consequences that arise from those events. It is important to only

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All entities face uncertainty and the challenge for management is to determine how much uncertainty to accept as it strives to grow stakeholder value.

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Exhibit 1



focus on significant exposures, events and consequences to the enterprise.

In our case study the underlying exposure was defined as the supply chain for the corporation, from suppliers of raw materials to delivery of the finished products. The supply chain was broken into nine discrete components. Key events were defined as those that could affect an entire location (e.g., natural disaster, fire, etc.) and those that would affect only one process or location. Key consequences were defined as the inability to complete a particular step in the process, which affected each subsequent step. The bottom line consequences were defined as impacts to projected sales (due to lack of product to sell) and potential impacts to future demand (due to loss of market share to competitors).

Determine desired output. Before you begin the design of the model, it is imperative that you have a clear understanding of what outputs or key performance indicators you wish to track. You should also consider how you wish to measure the risk associated with the key variables. There are a large number of papers on various measures to use: VaR, RAROC, etc., so we will not discuss them here. The key is to understand the risk measures used by the company and design the model accordingly.

For our case study, our output was the deviation to planned sales and cash flow. The company has in place a fairly sophisticated forecasting model that takes into account some of the business risk. As the ERM process has evolved, they have recognized several additional sources of risk, such as the supply chain risk discussed here. The selected model outputs work well with their existing framework.

Keep in mind potential mitigation strategies that may be implemented. Risk transfer through insurance is often one of the easiest mitigation strategies to implement in your model

(although one should consider the potential for the denial of coverage). The impacts from operational changes, new policies and procedures or perhaps a new manufacturing facility can be more challenging and it is best to have this in mind when designing the model.

Don't reinvent the wheel. Review any deterministic models that have already been created. In addition to gaining insight into management's current view of the risk process, you will also discover key performance indicators and mitigation strategies that are currently being considered by management.

Map out the risk process. With these considerations in mind, we have found that developing a flowchart of the risk process is beneficial. Historically, when the actuarial community discusses loss modeling, the risk process is based on the determination of a single frequency distribution and a single severity distribution (in many circumstances, a multi-modal severity distribution). While adequate for casualty lines of business where the major mitigation tool is often through insurance products, operational risk modeling often requires a more complex model. It is critical that the design of the risk process be a collaborative effort with those in the organization and the industry that are most familiar with the identified risk.

In our case study example, the risk process essentially followed the manufacturing process. The model captured the dependencies in the process as raw materials were transformed into finished goods. A single frequency and severity model would not be robust enough to adequately model this risk (e.g., outputs from one process are inputs to the next, the physical location of many of the processes are the same and are thus exposed to same loss event). The model accounted for existing risk mitigation in the form of inventory and excess capacity. Another

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design consideration was the fact that the model needed to cover a multi-year timeframe that enabled the company to see the change in risk over time. This was important given the lag in implementation of different strategies. During this design phase we worked closely with people responsible for the entire supply chain to ensure our model was a reasonable depiction of their processing and mitigation strategies.

This first stage of the modeling framework does not involve any collection of data or defining of any exposure, event or consequence probability distributions. Rather, it is intended to be the foundational blueprint on which your final quantitative model will be built.

Build Risk Modules

With the blueprint in hand, you now need to convert the risk process into a stochastic model. The more consideration you gave to the design of your risk process blueprint, the easier the coding of the model will be. There are many software packages available and your choice will likely depend on your interest in writing actual code as opposed to relying on more familiar spreadsheet applications.

When building or coding your risk model, make sure to consider the key considerations that were the foundation in the development of the risk process blueprint:

- Identified exposures, events and associated consequences
- Key performance indicators you are interested in tracking
- The ability to overlay various mitigation and transfer strategies

When building your model, we suggest taking a modular approach that will allow you to easily add or remove exposure, event and consequence modules. You will gain the ability to add consistency to your overall loss model. A simple example of this could be having a single property

catastrophe event module that impacts several risk exposure modules.

Finally, consider the incorporation of correlation and causation into your loss modules. While an in-depth discussion is beyond the scope of this paper, it should be noted that many outside of the mathematical community often confuse correlation with causation. At a minimum, you should understand the relationship or potential relationships between your identified exposures, loss events and consequences. As mentioned earlier, there were certain loss events in our case study that would affect several processes given their physical location. In addition, given that some raw materials are used in multiple products, a loss event for a particular supplier could impact sales and cash flow for multiple products. By creating a single model (built from multiple modules) for the entire supply chain process, we were able to directly establish these relationships rather than having to rely on a correlation matrix.

Identify Inputs and Parameters

This stage of the framework involves determining the probability distributions and their associated parameters. In many typical actuarial applications there is a wealth of organization-specific loss and event data. In lieu of this, we would prefer to fall back on industry data. However, as stated earlier, many of the operational risks that organizations are interested in do not fall within those historically underwritten by insurance companies. This would not be cause for concern if organizations had been tracking losses and events associated with these risks. Unfortunately, this is often not the case. A prime example is the banking industry. Before Basel II, banks were not tracking many of the operational risks that they now are accountable for from a capital adequacy standpoint. Many banks have begun to collect this data and a few consulting groups have recognized the opportunity to compile and supply industry event data.

If no organizational or industry event data is available, one alternative is to rely on our experience regarding the general shape of risk distributions. For example, we can be reasonably sure

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Historically, when the actuarial community discusses loss modeling, the risk process is based on the determination of a single frequency distribution (in many circumstances, a multi-modal severity distribution.

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that the distribution around the size of a court decision is not likely normally distributed.

Once we have determined reasonable shapes for the distributions and have incorporated them into our loss modules, we need to determine their parameters. Again, the lack of data may make some in the actuarial community squeamish. However, even in the insurance world, actuaries will sometimes have to rely upon the opinion of experts and judgment in pricing new coverages for example. We argue that this expertise should be used as a starting point when determining parameters in the absence of hard historical data. Querying risk experts within the company about what the specific parameters are for particular probability distributions will not likely get you very far. Rather, consider collecting expert opinions on qualitative statistics such as the average, minimum, maximum foreseeable, most likely events that might be pulled from the distribution in question. This information can be used to select reasonable parameters and validate the distributions selected in your model. This will likely be an iterative process. What may seem like reasonable assumptions may produce unreasonable results.

In our case study, we concentrated on events that would impact a production location or process for certain specified time periods. It proved easier for our experts to envision scenarios that could lead to three or six month shut-downs than to assess the probability of a shut down of any length. This project also demonstrated the value of the iterative process. After the first set of probabilities was incorporated into the model, we produced some benchmark results and reviewed them with our project sponsors. The magnitude of the losses was higher than expected. After reviewing the model and assumptions, we discovered the issue: although the probabilities felt reasonable in isolation, they did not make sense when aggregated in the model. The second iteration of the model used an aggregate probability of loss to scale the probabilities of losses at individual locations and processes to what was felt to be a more reasonable level.

Simulate

At this point, you are ready to actually run your model, which is likely made up of a number of

modules, and evaluate if the results are reasonable. If you have relied on professional judgment to determine the shape and parameters of various distributions, it is wise to sensitivity test those assumptions. Also, pay close attention to the number of iterations that your model cycles through. Increasing the number of distributions and modules you incorporate into your overall model will increase the number of iterations required. Many simulation packages offer a feature to determine if the aggregate distributions of your key performance indicators are converging. Whether or not your software package includes this feature, it may be worthwhile to sensitivity test the number of iterations you cycle through your model.

Additional value can be derived from your model through scenario analyses. Completely turning off all variability is one option. The result that the model creates should match the expected plan of the organization. Another option could be to manually select events that will impact your modeled exposures and let the consequence distributions vary. This will give you a feel for the potential risk associated with specific events. Finally, scenario testing is another way to test the reasonableness of your model. If you can reach agreement that the results from a specific scenario or set of scenarios make sense, your model gains credibility.

This has been a key step in the validation process in our case study. We were able to walk our expert contacts through specific loss event scenarios showing how the event in one step impacted subsequent steps and the resulting outputs. By showing them how the model works in a deterministic sense, we increased their comfort level that the aggregate loss distribution produced was reasonable.

Overlay Current and Proposed Mitigation

At this step, the organization can utilize the model results to make strategic decisions about the amount of risk it wishes to retain, transfer or avoid entirely. If not already built into the model, the current mitigation and transfer strategy should be incorporated to set a baseline. Running various alternative scenarios through the model and comparing the

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Enterprise Risk Management...

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reduction or increase in risk will be of interest to the organization. Considering the additional cost or savings of the alternative mitigation strategies will enable the organization to compare the risk/return tradeoffs of various risk mitigation strategies.

Possibilities for risk exploitation should also be investigated. Through your quantification of risk, you may determine that certain risks do not carry the exposure to loss or variability that was originally perceived. You might also discover that natural hedges exist within the organization. In these instances, relaxing the mitigation strategies and shifting risk management capital to other risks should be considered.

Another benefit of comparing various financing and mitigation strategies is that it may prompt an organization to think more diligently about its appetite for risk. In many cases, the mitigation strategy for a particular risk is based on a qualitative perception of individual risk characteristics. The quantification of risk may alter these perceptions and cause an organization to rethink its appetite for a particular risk. Also, by combining multiple risks, the organization is able to recognize the portfolio effect and may determine that a more aggressive mitigation strategy is warranted.

Finally, additional reasonability and consistency checks can be made at this time. For example, if the move to a less aggressive risk retention strategy does not result in a reasonable reduction in risk, the modeler should revisit the process, distribution and parameter assumptions.

Monitor

As with the overall ERM framework, risk modeling should not be considered a one-time analysis but rather a continual process implemented within the organization. As time passes, a number of elements of your quantitative model will likely change:

- You will likely refine the risk process. Complexity or additional modules may be added to your model to make it more robust.

Conversely, you may determine that certain modules do not add precision or reflect your current view of the risk process and thus a simplification is in order.

- As time passes, the organization will evolve and new risks may be identified as candidates for quantification. Conversely, some risk may diminish and no longer warrant a modeling exercise.
- Probability distributions, parameters and key performance indicators can change over time.
- New mitigation options and insurance products may become available.
- Changes in the business model, competitive landscape or regulatory environment.

It is also important to recognize innovations in technology, computing power and modeling techniques that are sure to present themselves in the future. Indeed, it is our expectation that this basic framework will also evolve and be built upon over time.

A Word of Caution

George E.P. Box is attributed with the following quote, "All models are wrong, some models are useful." We need to be wary of process, parameter and model risk. It is important to fully disclose assumptions and simplify assumptions that we build into our models. Care should be taken to understand the sensitivity of the model to these items, and to make sure that decision-makers understand them too. What must be kept in mind is that we are not building a model that will take over the decision-making process. We are building a tool to assist in the process. In this case, it helps the decision maker understand what can happen if things go wrong and help value options for reducing, eliminating or transferring that risk.

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Another benefit of comparing various financing and mitigation strategies is that it may prompt an organization to think more diligently about its appetite for risk.

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Conclusion

The goal of enterprise risk management is to identify and manage risk, align risk appetite with the organization's strategy, enhance risk response decisions and improve the deployment of capital. Most, if not all, ERM frameworks recognize the added value that the quantification of risk brings to the overall process. The need for the development of a quantification framework is a clear opportunity for the actuarial and mathematical communities. Through the development of this framework we will be presented with additional opportunities. Aiding organization in the understanding of risk, the quantification of the cost/benefit tradeoffs of various mitigation strategies, the development of new databases of loss and event data and the development of new transfer products are just a few.

Currently the focus of the actuaries has been in the insurance and banking world with respect to ERM. ERM initiatives are much broader than that. There is an opportunity for actuaries to apply a skill set already developed to this broader world as well.

Risk modeling cannot evolve without venturing into new territories. In the 19th and mid 20th century, weather modeling accuracy was a fraction of what it is today. But, without the develop-

ment of that initial foundation, we would not have the sophisticated models that we rely on today. Finally, we leave you with this food for thought:

The world is moving into a new age of numbers. Partnerships between mathematicians and computer scientists are bulling into whole new domains of business and imposing the efficiencies of math. This has happened before. In past decades, the marriage of higher math and computer modeling transformed science and engineering. Quants turned finance upside down a generation ago. And data miners plucked useful nuggets from vast consumer and business databases. But just look at where the mathematicians are now. They're helping to map out advertising campaigns, they're changing the nature of research in newsrooms and in biology labs, and they're enabling marketers to forge new one-on-one relationships with customers. As this occurs, more of the economy falls into the realm of numbers. Says James R. Schatz, chief of the mathematics research group at the National Security Agency:

"There has never been a better time to be a mathematician."⁷ ♦



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¹ James E. Rech. "Enterprise Risk Management for Insurers; Actuarial Theory in Practice," *Contingencies* (November/December, 2005).

² Most companies in the United Kingdom have been following the Financial Reporting Council's Internal Control: Guidance for Directors on the Combined Code (Turnbull). Recently, The Association of Insurance and Risk Managers—Risk Management Standard has been gaining popularity in the U.K. and Europe. As with the other frameworks noted, our opinion is that quantification guidance is lacking.

³ For additional detail, please refer to The Committee of Sponsoring Organizations of the Treadway Commission (COSO). Enterprise Risk Management—Integrated Framework (2004).

⁴ The Committee of Sponsoring Organizations of the Treadway Commission (COSO). Enterprise Risk Management—Application Techniques (2004), 1.

⁵ COSO. Application Techniques (2004), 41.

⁶ COSO. Integrated Framework, 1.

⁷ Stephen Baker with Bremen Leak. "Math Will Rock Your World," in BusinessWeek Online, <http://www.businessweek.com/print/magazine/content/06_04/b3968001.htm?chan=gl> (23 January 2006).



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Operational and Reputational Risks: Essential Components of ERM

by Michel Rochette

Financial institutions have faced many losses recently due to operational incidents. In turn, this has led their regulators, rating agencies, and investors to focus their attention on this risk. In addition, the Basel Capital Accord II for banks, recent frameworks like COSO II, Sarbanes Oxley and rating agencies' capital methodologies are encouraging financial institutions to devote resources to assess, measure and manage this risk.

In the insurance industry, similar initiatives are underway as part of newly established enterprise risk management frameworks. However, contrary to the proposed regulatory framework for banks, the actual regulatory framework for insurance companies and its capital calculation don't have an explicit requirement in this regard. The only similar capital requirement as in the Basel Capital Accord is a small capital requirement for business risk in the life and health sectors. The casualty business has no such requirement. In some insurance circles, operational risk is not perceived as requiring as much dedicated resources as other financial and insurance risks. However, rating agencies' new ERM evaluation approaches for insurers should encourage insurance entities to manage this risk more explicitly.

From a business perspective, insurance companies face as much operational risk exposure as other financial institutions. Based on the same definition of operational risk as used by the financial community, insurance companies have to deal with operational incidents due to the products and services that they market, face fraud risk continuously either externally or internally, make mistakes and errors in the many internal processes that support the management of their products, claims, underwriting, reserving and accounting functions. Also, they have to deal with the consequences of human behavior, are subject to external events beyond their control like terrorism or avian flu, and face legal liabilities regularly like class action suits and regulatory fines.

In summary, operational risk is part of the dynamic of the business of insurance as in any other field. Operational incidents have happened, are happening and will continue to affect this industry as many financial institutions have learned recently.

Different Types of Operational Risk Incidents

Most financial institutions report in their financial statements, press releases, SEC filings and other similar sources, operational incidents on a regular basis. These incidents can be classified in many different ways. One accepted terminology in the industry is to classify them as near miss, expected, unexpected and catastrophic, referring indirectly to their probability of occurrence and financial impact.

Near misses are incidents that affect a company without causing a direct loss. However, they are important to record as they reflect possible inefficiencies in a company's operations. A classic example is an error in a process where employees have to redo repetitively the same work to correct a problem.

Expected incidents are the costs of being in business by most companies. Unexpected incidents are events where the probability of occurrence is low but which have a large financial impact on a company. Also, when a capital calculation is done, unexpected incidents usually represent the largest component of economic capital to hedge them. Finally, catastrophic events are usually the ones that can simply kill a company, and hedging them would be prohibitive. Governments and guarantee funds act then as the protectors of last resort, like central banks.

Since operational incidents can be broad, one should try to better define the types of incidents that are considered to be operational. One possible definition of operational risk is given by the Basel II Capital Accord, which includes operational incidents that result in "direct and indirect loss from inadequate or failed internal processes, people and systems or from external events including legal risk but excluding strategic and reputation risk." Thus, based on this definition, the certification of financial statements mandated by SOX simply becomes a subset of operational risk, mostly focusing on the process and related controls of producing and publishing financial information.



Exhibit 1: Components of Reputational and Risks

Types	Financial Impact
Decrease in long-term credit rating Decrease in insurance financial strength rating	<ul style="list-style-type: none"> - Additional financing costs. - Additional collateral to post. - Limitation on capacity to enter some derivative transactions. - Reduction in interest rate spread on new business.
Delays in SEC filings	<ul style="list-style-type: none"> - Limited access to capital markets and additional financing costs.
Regulatory investigations	<ul style="list-style-type: none"> - Limitation on company's ability to pay dividends. - Impact on risk-based capital ratios and possible penalties. - Possible suspension of state/provincial/federal licenses.
Future business	<ul style="list-style-type: none"> - Reduction in business submitted by independent distributors. - Reduction in business due to regulatory investigators. - Reduction in brand value.

This definition has become the standard definition within the broader financial community. Thus, in order to compare insurance companies to other financial institutions, insurance companies and their regulators should consider adopting a similar definition, at least for their published financial statements and economic capital calculations. However, for internal purposes, a broader definition could be adopted in order to achieve other business objectives.

Reputational Impact of Operational Incidents

In most companies, as they undertake new projects, conceive new products, and start new operations, assessing and managing *ex-ante* the consequences of operational risk and their reputational impact is relevant as reputational risk is often the largest risk that companies face in addition to direct and indirect losses. Exhibit 1 shows some examples of the components of reputational risk.

Operational Risk Economic Capital

Operational risk can be hedged by different means including controls, business continuity planning, traditional casualty insurance

policies, explicit reserves and capital set up *ex-ante* of the risk. At this time, most companies set up reserves only when operational risk incidents are known, and when their losses can be estimated with reasonable assurance, the accounting approach. However, insurance companies should develop an actuarial approach like in the banking world.

In the banking world, financial institutions must estimate economic capital *ex-ante* in order to hedge an institution's operational risk exposure. There are three proposed methods. The Basic and Standard methods are simply based on ratios of operational risk exposure by lines of business while the third approach, the Advanced Measurement Approach (AMA), can use any appropriate methodology that can be justified on sound risk principles.

Most of the banks that are implementing this latter approach have so far used a loss distribution approach, with scenarios to make it forward looking and taking into account the effectiveness of controls. This approach models the aggregate amount of losses that a company could experience over a one-year period. Then, the amount of required capital is set at

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Operational Risk

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the 99.9 percent level of annual aggregate losses.

This is an approach well known in the actuarial circles mainly risk theory. In particular, the number of losses can be modeled using different statistical distributions including the Poisson distribution. As to the distribution of each individual loss, a theoretical statistical distribution like Pareto or some other “fat tail” distribution can be used. Alternatively, an empirical distribution based on actual losses can be used.²

In addition, the required operational risk economic capital should cover both expected and unexpected losses. Alternatively, expected losses can be excluded from the economic capital calculation and included in the pricing of products and services explicitly. Operational risk economic capital would be based only on unexpected losses above a deductible.

Financial Institutions’ Operational Risk Capital

Exhibit 2 on page 31 compares operational risk data for four major U.S. financial institutions, where AIG was assumed to be a “bank”. The total regulatory capital is based on the operational risk definition of the Basel Capital Accord. The total economic capital includes strategic risks as well. In general, operational risk economic capital based on AMA should be lower than the one based on the Basic Indicator Approach because of the recognition of the effectiveness of the control environment within a financial institution. This is the case for Citigroup, but not for AIG as this information was not available publicly, and not included in the calculations.

In the insurance industry, there is no such explicit capital requirement for operational risk as in the banking industry. The only regulatory requirement is found in the NAIC’s risk-based capital formulae, which has an explicit amount of required capital for business risk, that is operational and strategic risk based on a simple calculation on life and health insurance premiums, similar to the Basic approach in Basel. Based on NAIC’s calculations, the required capital for AIG’s operational risk would be 560 million dollars. This amount of capital is clearly insufficient when compared to economic capital. Finally, large international banks and insurers face similar operational risk exposure as the economic

capital calculations imply, at about 15 percent of total economic capital.

Accounting for Operational Risk

At this time, operational risk capital calculations performed by financial institutions are compared to minimum ratios mandated by their respective regulators and taken into account in risk-adjusted returns. However, for GAAP accounting purposes, the minimum operational risk capital amount should appear on their financial statements instead of being relegated to notes only.

One possibility would be for the operational risk capital to be part of a company’s equity as an appropriation of equity. It would be built up over time. When a major operational risk incident occurs, the financial impact of the incident would be written off against this provision instead of being charged to shareholder’s equity when it becomes known, as is the situation right now, reducing earnings volatility.

For example, Citigroup has recently set up an explicit provision—ex post—close to \$5 billion just to cover lawsuits over the collapse of WorldCom, Enron and other matters. However, the operational risk provision based on the preceding operational risk capital calculation—ex ante—would be around \$8.1 billion in order to hedge almost completely its actual and future operational risk exposure.

AIG had to pay 1.6 billion dollars recently in regulatory fines as well as incur other administrative expenses to correct operational incidents. Its many operational incidents resulted in a loss of 2.26 billion dollars to shareholders’ equity. Also, some class action lawsuits are not settled yet. Thus, if AIG had set up a provision ex-ante of 5.4 billion dollars based on economic capital calculations, it would have completely hedged its operational risk exposure. It should continue maintaining it in the future as well.

However, the operational risk economic capital of 5.4 billion dollars is only a fraction of the loss suffered by shareholders when AIG’s operational risks materialized. The reputational impact was almost a 30 percent drop in AIG’s share price.

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In the insurance industry, there is no explicit capital requirement for operational risk as in the banking industry.

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Exhibit 2: Comparison of Large International Financial Institutions (Million \$)¹

Financial Institution	Assets	Total Regulatory Capital: Basel II Approach	Total Economic Capital	Op Risk Economic Capital: Basel II AMA Approach	Op Risk Regulatory Capital: Basel II Basic Indicator Approach
Citigroup	\$1,484,101	\$100,899	\$52,200	\$8,100	\$10,621
Bank of America	\$1,044,660	\$92,266	\$69,300	N/A	\$6,065
JP Morgan Chase	\$1,157,248	\$96,807	\$34,900	\$4,500	\$4,305
AIG	\$798,660	\$73,317	\$40,000	\$5,388	\$4,875

Conclusion

From the previous analysis, assessing and managing operational risk would be as relevant to insurance companies since we observe similar results of operational risk capital as for banks.

In addition, not only does operational risk management reduce the frequency and severity of direct and indirect losses, it does reduce the overall probability of bankruptcy of any firm, especially when reputational risk is taken into account.

However, the current insurance regulatory framework in the United States doesn't oblige insurance firms to be as proactive as banks in this regard and as insurance companies in the U.K. and the rest of Europe in the proposed Solvency II regulatory regime. If one uses the 100 billion dollars of assets as a minimum above which financial institutions should assess and manage this risk, which is the minimum amount that the

U.S. banking regulators are using as a starting point, about 10 major insurance companies would be obligated to assess the financial consequences of their operational risk exposure.

Finally, managing operational and reputational risks should be more than a compliance exercise. In many recent operational incidents, the value of shareholder's wealth was reduced dramatically following the announcement of some incidents. This is even more so for insurance companies due to the long-term nature of their business as was revealed in a study by the Wharton School of Economics, which has demonstrated that operational risk incidents have a larger market value impact on insurance companies than on other financial institutions. In this context, assessing and managing operational and reputational risk in insurance companies would certainly bring positive results, enhancing shareholders' wealth as well. ♦



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¹ The values were extracted from each institution's December 2004 financial statements. Estimates were obtained when the values were not available. For example, the operational risk capital based on the Basic Indicator Approach was based on the definition in the Basel II Capital Accord. The AMA amount was estimated based on the approach mentioned in this article. AIG was assumed to be a "bank". AIG's figures were calculated based on published and public data of unexpected incidents.

² An excellent reference is *Operational Risk: Modeling Analytics*, H. Panjer, Wiley, 2006.

Economic Capital: The Controversy at the Water Cooler

by Matthew Clark and Chad Runchey

Economic capital is generating intense debate at insurance company water coolers all around the world. Everyone seems to agree on the definition: economic capital is the amount of capital needed to meet future obligations arising from existing business with a high degree of certainty over a defined time horizon. Likewise, there is agreement that today's insurance market requires capitalization guidelines that are linked to the risk composition of each organization. However, opinions differ sharply when it comes to deciding just which

method of measuring capital requirements is the "right" one.

The plethora of choices is enough to make one's head spin. Several jurisdictions around the world have introduced economic capital frameworks, including:

- United Kingdom: Individual Capital Assessment
- Switzerland: Swiss Solvency Test
- European Union: Solvency II
- Australia/New Zealand: Standard 4360
- United States: C3 Phase II

The consensus seems to be that while most of these methods are easy to talk about, they present many challenges in implementation. Some practitioners say the end justifies the means. In other words, the method used to calculate eco-

omic capital depends on the desired use of that capital and/or the customer being served.

With all of the discussion, one would expect some similarities in how the industry approaches economic capital. But it appears that while most people have strong opinions on the subject, everyone's view is different when it comes to determining how required capital should be calculated, the degree of certainty we should seek, and the time frame over which to make the assessment. Beyond these issues, there are a number of related debates about methodologies and assumptions, especially how diversification/aggregation effects should be recognized, correlation assumptions, and the treatment of regulatory capital in excess of EC estimates.

The Path to Economic Capital

How did we get ourselves into this quandary? Traditional, factor-based insurance risk capital calculations date back to the 1970s. The current U.S. risk-based capital (RBC) calculation is an example of this approach. The factor-based approach served the industry well while the products offered by the insurance market were both simple, in that they lacked complex guarantees and options, and homogeneous, in that the risks inherent in the products did not differ materially from company to company.

However, the last 10 years have been an active time for insurance product development as new products and product features have evolved at unprecedented rates. Two primary examples are the living and death benefits now attached to both annuities and universal life products. Traditional capital models and valuation methodologies are not equipped to handle the new features found in today's insurance products, which are no longer homogeneous or simple.



As a result, the traditional factor-based capital, reserve and valuation systems have started to be questioned or to be replaced. On the valuation front, we have witnessed the emergence of principles-based reserves in Canada and their exploration in the United States, stochastic and market-consistent embedded value in Europe, and the fair-value concepts in international financial reporting standards (IFRS). Meanwhile, the regulators and rating agencies have struggled to keep up with the emergence of capital requirements. The approaches used by rating agencies such as S&P, Moody's, and Fitch are all marked by increased sophistication and a movement toward the EC concept.

Are We That Far Apart?

The emerging capital methods can be classified into three categories: fair-value methods, regulatory solvency methods and cash balance methods. Each of these approaches can do a good job of measuring relative risk across products and risks, but each produces different absolute levels of capital. Each method also has its advantages and disadvantages (see Exhibit 1).

Fair-Value Method

In Europe, Canada and Australia, a fair-value approach is taking hold and is extending into the United States as foreign-owned companies implement the methodology used by their parent company. The capital requirement is based on the volatility of the value of assets and liabilities over one year, with all options and guarantees measured at fair value.

In general, the fair value of assets is easy to quantify. As always, quantifying the fair value of the liabilities is the challenge. This method quantifies the capital needed to cover extreme net fair-value changes over a one-year period, which includes a liability sufficient to support

its transfer to a third party at the end of the one-year time horizon. While the time horizon is one year, the remaining life of the assets and liabilities must, of course, be considered in determining the market value of the assets and liabilities. The liability calculation is typically performed using a risk-neutral calculation discounted at risk-free rates.

Capital is typically defined by examining the distribution of the present value of economic surplus (defined as the fair value of assets less the fair value of liabilities) one year hence, resulting from simulations across the various risk elements (independently or fully integrated). The resulting present values of economic surplus, when rank-ordered, define a distribution, and a point in the tail of the distribution is used to define the capital amount. Economic capital in this context is the amount needed today to ensure economic solvency (including the ability to transfer the business) to a stated probability level one year hence.

Regulatory Solvency Method

In the United States, regulators are taking a statutory solvency approach, as exemplified by the recent development of C3 Phase II, a methodology designed to capture the option risk on variable annuities. The regulatory solvency method calculates the capital necessary to remain solvent on a regulatory basis over a defined time horizon.

Solvency is defined from a regulatory perspective. In other words, like the fair-value method, this method looks at the balance sheet. However, unlike the values used in the fair-value approach, here the values for assets and liabilities are defined by the regulatory framework. In the United States, for example, these

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Capital is typically defined by examining the distribution of the present value of economic surplus. ...

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Exhibit 1: Pros and Cons of Methods of Calculating Economic Capital

	Pros	Cons
Fair-Value Method	<ul style="list-style-type: none"> • Consistent with emerging practice in Europe. • Consistent with banking methods. • Can be consistently applied across businesses, geographics and jurisdictions. • Naturally aligns with emerging ALM and credit risk measurement practices and tools. 	<ul style="list-style-type: none"> • No consistent basis for calibrating the liability and certain asset class fair values, making the resulting absolute level of capital highly dependent on the discount rate. • Computationally difficult when the liability contains path-dependent options. • One-year time horizon is counter intuitive to traditional insurance industry thinking about assets and liabilities. • Ignores statutory insolvency considerations when not consistent with statutory basis. • No link to GAAP or statutory accounting frameworks, but could become consistent with IFRS.
Regulatory Solvency Method	<ul style="list-style-type: none"> • Consistent with emerging principles-based methods in the United States. • Linked to statutory capital frameworks used by regulators. • Does not require the use of nested stochastic processes. • Time horizon consistent with the long-term nature of the liabilities and the way insurance professionals view them. 	<ul style="list-style-type: none"> • Highly correlated with a regulatory/accounting regime, and difficult to apply consistently across different regulatory regimes. • Difficult to apply across different businesses: life vs. P/C vs. banking. • Inconsistent with emerging ALM and credit risk measurement practices.
Cash Balance Method	<ul style="list-style-type: none"> • Consistent with the desire to quantify capital needed to assure the payment of policyholder obligations. • Can be consistently applied across businesses, geographies and jurisdictions. • Similar to regulatory solvency method, except that there are no balance sheets, and income statements do not have to be projected. • Does not require the use of nested stochastic processes. • Time horizon consistent with the long-term nature of the liabilities and the way insurance professionals view them. 	<ul style="list-style-type: none"> • Not linked to GAAP or statutory requirements. • No link to emerging practice in U.S. or Europe. • Ignores accounting balance sheet, which could result in a calculation that fails to recognize a regulatory insolvency. • Inconsistent with emerging ALM and credit risk measurement practices.

typically would be book values. In addition, whereas fair value uses a one-year horizon, the regulatory solvency method typically looks at the life of the liabilities. It quantifies the capital a company needs to fund the remaining liability cash flows while remaining solvent from a regulatory perspective.

The regulatory solvency approach requires that assets and liabilities be projected over their remaining lifetimes. Income statements and balance sheets are projected for future periods, and regulatory capital is determined at each future point in time. A large number of simulations of this type are produced across all risk types. For each simulation, the projected future statutory surplus at each future point is discounted to the current date.

As with the fair-value method, the resulting present values of regulatory surplus, when rank-ordered, define a distribution of capital, and a point in the tail of the distribution is used to define the capital amount. The capital amount represents the amount of funds needed today to ensure solvency in each future period with a certain confidence level. In this context, the discount methodology is linked to the underlying investment performance of the assets.

Cash Balance Method

A third emerging approach, the cash balance method, has had limited use to date. It calculates the capital necessary to fund future liability cash flows, without consideration of regulatory measures of capital. It is not necessary to project accounting results or the market valuation of the assets and liabilities. A forecasted balance sheet is not needed, because only the liability cash flows are necessary. The exception would be when the liability cash flows are dependent on the statutory balance sheet, as in the case of participating dividends. Like the fair-value method, this method is attractive to

companies that need to calculate capital requirements across jurisdictions.

As with the regulatory solvency method, this method requires that assets and liabilities be projected over their remaining lifetimes. Cash flows from the assets are used to fund liability outflows, with positive net cash flow reinvested and cash deficiencies funded through assets sales (or other disinvestment/funding approaches).

When asset cash flows have been exhausted, the remaining liability (unfunded cash flows) defines the capital requirement. As with the other methods, a simulation across all risk types is used to develop a distribution of results. The resulting present values, when rank-ordered, define a distribution, and a point in the tail of the distribution is used to define the capital amount. The capital amount represents the amount of funds needed today to fund the liability outflows over the projection horizon with a certain confidence level.

Putting Economic Capital in Perspective

When we compare the three methods described above, we can draw several broad conclusions:

- All three methods produce comparable relative amounts of capital. If one business has twice the risk of another business, all three methods generally draw that same conclusion (assuming common assumptions).
- Each of the methods will produce different results in an absolute context. Note that the differing time horizons of the methods will require using lower probabilities of solvency for longer time horizons. The inherent

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A third emerging approach, the cash balance method, has had limited use to date. It calculates the capital necessary to fund future liability cash flows, without consideration of regulatory measures of capital.

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Economic Capital ...

▶ continued from page 35

nature of each method will drive more or less capital than the other.

- Ignoring regulatory mandates, the use of one method over another depends on a number of factors, including the end use of the capital results. One extremely important factor is the business and geographic mix. It is difficult, for example, to adopt a regulatory-based approach across businesses subject to different regulatory regimes.
- All three methods are highly dependent on assumptions and inherent computational approaches that ultimately could distort results or prevent meaningful comparisons.
- The ultimate uses of capital should also drive the selection of a particular method.

Note that when comparing the results of the different methods, the tail metric used should reflect the time horizon. Given the one-year time horizon of the fair-value method, a comparison to an alternative method would require using a higher probability of solvency for the fair-value method due to the shorter time horizon (one year). Longer time horizons may result in targeting a lower probability of solvency.

To illustrate one method, we constructed a simple case study that examines the three alternatives. We used a block of in-force immediate annuities supported by non-callable corporate bonds and determined the capital needed to support the inherent interest-rate risk. In this example, the assets backing the liabilities were shorter than the liability cash flows.

Exhibit 2: Capital Amount Calculated

	Regulatory Solvency Method	Cash Balance Method	Fair Value Method
Percentile	Capital Amount Needed		
99.5%	\$24,104	\$18,675	\$9,707
99.0%	\$23,901	\$18,425	\$5,295
98.0%	\$23,285	\$18,167	\$2,773
97.0%	\$22,930	\$17,268	\$1,879
96.0%	\$22,690	\$17,003	\$1,421
95.0%	\$22,489	\$16,309	\$1,142
90.0%	\$21,548	\$15,007	\$577
75.0%	\$19,958	\$13,450	\$232
50.0%	\$18,414	\$12,266	\$116

Note: Example prepared without consideration of taxes.

Keeping the assets and liabilities fairly simple allowed us to avoid complicating the comparison and helped with some of the computational processes. Exhibit 2 on page 36 presents the capital amounts defined by each method for the simulations in the tail of each distribution. Results are shown per million dollars of liability using Modified Conditional Tail Expectation (CTE).

Note that when comparing the capital requirements across methods, different percentiles would likely be used to be more in line with the time horizon of the underlying calculation. For example, the one-year horizon of the fair-value method may require looking at extreme points of the distribution, potentially out to a 99.95 percent confidence level. Longer horizons may lead to looking at a less extreme point—95 percent, for example.

Our preliminary research indicates that at the extreme tails the three methods are likely to converge and show less of a difference. In addition, as the time horizon of the fair-value method is increased, the capital requirements under this method should converge to that under the other two methods.

As shown in the exhibit, on an absolute basis the regulatory solvency approach produces the greatest amount of capital. This should not be surprising, since the regulatory balance-sheet framework causes insolvency before the cash balance method actually runs out of assets to fund the annuity payments. Both the regulatory solvency method and the cash balance method have the same liability cash flows. The difference is simply the timing of the recognized surplus deficiency, resulting from the change in statutory asset and liability values, and its relationship to the discount rate.

The difference between these two methods will become even greater when higher regulatory reserve requirements cause an insolvency, even though there may never be a time when assets are not sufficient to fund claims. Universal life reserve requirements under Regulation XXX and Actuarial Guideline 38 are clear examples of this outcome. This may seem counter-intuitive to those who would argue that in circumstances where cash deficiencies do not exist, there should be no capital requirements. The counter argument is that the method is capitalizing at the level the regulator would use to come and “close the doors.” Having enough cash to fund claims is not the requirement. It’s having sufficient levels of regulatory capital, a type of “going concern” requirement.

The fair-value approach produces materially lower capital. This should not be too surprising either. With this method, the one-year dispersion of interest-rate scenarios is not nearly as severe as that produced over the 30-year projection horizon used in the other two methods. While the valuation of liabilities at the end of the one-year horizon does require the projection of the cash flows over 30 years, the valuation is based on mean values, not tail results, for each one-year scenario.

Other Differences and Challenges

The numerous decisions insurance companies must make when determining capital requirements present the opportunity for different answers. Some of the common issues



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Economic Capital ...

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faced in implementing a risk capital methodology include:

New Business: The addition of new business will affect the amount of capital required. In some cases, it will reduce the amount of capital; in others, it will increase it. Depending on the purpose of the analysis, new business might or might not be desirable to include. For example, regulatory or rating agency compliance might reasonably exclude new business. But capital planning and budgeting should consider new business requirements.

Tail Definition: The discussion about tail definition can have a significant impact on the capital levels generated. There are two popular approaches used by the industry: Value at Risk (VAR) and Tail VAR (TVAR or CTE). The VAR approach identifies the capital level using a defined value in the tail of the distribution. This is achieved by ranking the results and identifying the scenario that corresponds to the desired confidence level.

The Tail VAR is similar to the VAR, with one important exception. The Tail VAR takes the average of the tail scenarios defined by the desired confidence level (e.g., Tail VAR using a 95 percent confidence level would take the average of the value between 95 percent and 100 percent).

How one handles positive results in the Tail VAR approach can also affect overall capital levels. Not allowing positives produces higher capital and may change the relationship of capital amounts across risks and products. This method of excluding the positive results is referred to as Modified CTE. Naturally, the approach taken has implications for the level of capital.

Confidence Level: The desired level of assurance regarding solvency will determine the

confidence level selected. The confidence level selection will drive different absolute and relative levels of capital. The notion that the selected value should be linked to a company's rating is a popular approach. This means that higher-rated companies require higher levels of capital.

Aggregation Techniques and Assumed Risk Correlations: How results are aggregated will affect overall capital requirements. Fully integrated risk models that reflect the non-linear nature of correlations can alleviate this problem, but this frequently is impractical. Common aggregation approaches are scenario combination, the use of Copulas, and correlation matrices. The scenario combination approach combines the risk distributions, typically using rank order or similar techniques. Copula and correlation approaches employ statistical techniques that require the parameterization of the relationship between risks.

In all methods, a key decision is the degree of correlation among risks, especially the correlation of risks when risk factors are in distress. The relationship between risk elements over the distribution of events is typically not static, and such an assumption between risk elements is suspect. This area clearly requires greater research and understanding, yet it is a major driver of the level of capital indicated by any calculation method.

Scenario Generation: This always presents a problem, because how one calibrates scenarios will drive different capital results. Integrating elements such as credit and inflation further complicates the problem.

Double Counting: The double counting of the impact a risk(s) has on the capital requirement is a recurring implementation issue, especially when independent measurement of capital for different risks is employed.

Period-to-Period Reconciliation: Once results are produced for two different periods, analyzing why everything changed presents a monumental challenge. We favor developing methods to roll capital forward from period to period and to reconcile changes over time.

Selecting the “Right” Method

As the above examples show, there are many issues to consider when estimating economic capital requirements. Most, if not all, of these issues arise regardless of which method of calculating capital is used.

Each of the methods of calculating capital has its advantages and disadvantages, its supporters and critics. The selection of a method should be driven by several factors, including:

- The question you are trying to answer and how to use the results.

- The perspective (e.g., shareholder, regulator, rating agency, policyholder, management) from which you want to calculate the capital needed.
- Whether you are trying to calculate capital over multiple jurisdictions.
- Whether your goal is to quantify capital requirements or to manage risk.

This is where your head might start to spin. Why are there so many different methods? Which is the right one? Like a child in the candy shop, insurers are faced with many choices, each of which has merit, and there’s a danger that you will have buyer’s remorse when you get home. The challenge facing insurers is to evaluate their options and adopt an approach that is consistent with their needs. ♦

Attend the 2007 Enterprise Risk Management Symposium

The 5th Annual Enterprise Risk Management (ERM) Symposium, sponsored by the Casualty Actuarial Society (CAS), the Society of Actuaries (SOA), and the Professional Risk Manager’s International Association (PRMIA) will take place March 28-30, 2007 in Chicago, Ill.

The ERM Symposium will cover various topics within the risk management field with a focus on analysis and practical tools. Presentations will range from discussions of financial and operational risks, creating value through ERM, interaction between risks, and integrated ERM.

Take advantage of this opportunity to broaden your skills, learn more about the current and emerging trends of risk management, and keep up to speed with the latest ERM developments.

Past ERM Symposia have featured speakers on a range of topics and general ERM themes including: ERM and the role it plays in a particular company or industry, value creation through ERM, risk capital management, and the theoretical foundation of ERM.

As the ERM Symposium date nears, more information on registration, papers topics, and presentations will be made available at <http://www.erm-symposium.org/>



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Articles Needed for Risk Management

Your help and participation is needed and welcomed. All articles will include a byline to give you full credit for your effort. If you would like to submit an article, please contact Ken Seng Tan, editor, at kstan@uwaterloo.ca or Ron Harasym, co-editor, at ronald_j_harasym@newyorklife.com.

The next issue of *Risk Management* will be published:

<i>Publication Date</i>	<i>Submission Deadline</i>
March 2007	January 2, 2007
August 2007	June 1, 2007

Preferred Format

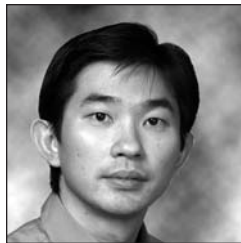
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If you must submit articles in another manner, please call Joe Adduci, (847) 706-3548, at the Society of Actuaries for help.

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Thank you for your help.

Risk Management Issue Number 9 December 2006

Published by the Society of Actuaries
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This newsletter is free to section members. A subscription is \$15.00 for nonmembers. Current-year issues are available from the Communications Department. Back issues of section newsletters have been placed in the SOA library and on the SOA Web site: (www.soa.org). Photocopies of back issues may be requested for a nominal fee.

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