



RISK MANAGEMENT SECTION

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Actuaries

Risk is Opportunity.sm

Variety is the Spice of Life!

by Douglas W. Brooks

One of the great things about risk management is the variety of issues that one can become involved in. As actuaries, we have the opportunity to apply our training, skills and knowledge to many different types of issues. These include developing risk models and techniques for financial risks, developing methodology for measuring “non-financial” risks such as operational risks, and building approaches and models to aggregate risks across an organization. There is also the “management” side of enterprise risk management, and methods for managing, as well as measuring, risks must also be part of the framework.

For actuaries practicing as risk managers in organizations, it is also necessary to look at issues such as developing and/or maintaining a strong risk culture (the single most important factor in the success of an enterprise risk management initiative). Communication with business managers and finding ways to make business leaders aware of risk management tools, methods and measures are also critical.

To be successful we must push forward in all of these areas. If the actuarial profession is to become known as the experts in enterprise risk management, we must demonstrate a willingness to embrace the chance to apply our training, knowledge and perspectives in many different areas. This may mean that we have to operate out of our “comfort zone” at times. However, it's important to recognize that our training does not prepare us to deal only with the specific issues that are part of our education, but to apply those principles to new areas.

Looking at some of the articles in this issue of the newsletter, and at other recent issues,

there is an exciting range of subjects. Some involve drilling more deeply into issues that are closely related to actuarial training, developing new techniques or expanding and refining familiar ones. New developments abound, and provide great opportunities for research and application of our skills. You will also see articles in this issue that emphasize the “human” aspect of risk management—organizations are all about people!

Economic capital is one of the fundamental building blocks of a sound enterprise risk management framework. A number of the articles in this issue touch on aspects of economic capital development. There are many opportunities to contribute to the development of economic capital theory and practice. Issues such as aggregation are challenging technical issues, and are excellent topics for research.

Just as importantly, we must take on issues such as the measurement and management of operational risk. Finding a way to put measures around operational risk is a necessary part of a comprehensive framework, and economic capital is not complete without recognition of operational risk (see the articles by Dave Ingram and Denise Lang for rating agency and regulatory perspectives on comprehensive approaches). Operational risks may not be as readily quantifiable as financial risks, but are at least as important in the overall context of managing risks. Most failures of financial institutions have their roots in operational risks—the failures of processes and people. These manifest themselves as financial risks, but the roots are operational. Similarly, a strong risk culture is a critical component of an enterprise risk management framework, but something that is difficult to



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measure—though as one regulator said to me, “you can tell whether it exists when you walk into an organization and talk to the people.” Numbers without disciplined processes have little value. See the interview with Ellen Lamale in this issue, and note the emphasis on cultural and operational issues. This is a good example of bringing actuarial skills and discipline to the management of risks that are outside the traditional actuarial realm.

We must also develop the skills and tools to communicate effectively the results of our work. Deep analytical work has no value if not presented in such a way that the user of the information can relate to the issues he or she is facing or the business decisions that need to

be made. The actuarial profession has been criticized for being less than fully effective in communication. We need to develop and share ideas on how to communicate technical information to a variety of audiences.

Finally, get involved in moving enterprise risk management forward, whether through research, development, implementation, management or communication. There are areas for all interests and opportunities for everyone to participate and to contribute. ♦

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New York City Economic Capital Seminar

by Hubert B. Mueller

Economic capital is a key metric within an ERM framework, and has become an effective measure for assessing risks and allocating appropriate capital.

A successful seminar on economic capital (EC) was held on November 30 and December 1 in New York City. The seminar was co-sponsored by the Society of Actuaries (SOA) and the Tillinghast business of Towers Perrin (Tillinghast). With over 130 people attending, the seminar had to be closed for new registrations well in advance of the Early Bird registration deadline.

The seminar was split into two broad topic areas related to EC: the first day was designed to provide an overview of recent market trends on EC including reports from several multinationals on their experience in implementing EC in North America and on a global basis. In addition, all four major rating agencies provided their views of how EC fits into ERM, and their willingness to consider proprietary company EC models when evaluating capital adequacy.

The second day of the seminar was focused on providing in-depth case studies on various applications of EC, including:

- Use of EC in pricing and performance management,
- Use of EC in hedging,

- Use of EC in mergers/acquisitions, and
- Use of EC in financial modeling.

In addition, a panel of speakers from several large North American insurance companies, including several composites, rounded out the day by providing feedback on their experiences in integrating EC into their business decision processes.

The first day of the seminar was moderated by Hubert Mueller, while the second day was moderated by Jack Gibson, both with Tillinghast. In addition to several other speakers from Tillinghast, speakers represented the following companies:

- Allianz Life
- AEGON USA
- AIG
- Allstate
- The Hartford
- ING US
- Lincoln Financial Group
- MetLife

plus, all major rating agencies (A.M. Best, Fitch, Moody's and Standard & Poor's).

Key themes discussed at the seminar included:

- EC has become an important tool for large domestic companies and multinationals for assessing risk, and determining the appropriate amount of capital to be held.
- Other companies are starting to catch on to this as well, observing their peers in the marketplace and reacting to current regulatory and rating agency scrutiny.



- EC is a significant undertaking, and can be implemented across business segments. In addition to financial risks, companies increasingly focus on determining the capital needed for operational risks.
- Once implemented, EC can be used for pricing, risk and capital management, and in assessing the value of potential acquisitions.
- EC has become a key metric within an ERM framework, increasingly becoming the subject of scrutiny by third parties like regulators and rating agencies. When able to disclose their current framework, companies can expect to receive some credit towards capital adequacy requirements from the rating agencies, particularly S&P and Fitch.
- With increasingly complex regulatory requirements requiring enhanced modeling capabilities to determine risk-based capital, EC is becoming a critical tool for success in the current marketplace.
- Companies who have successfully implemented EC are leveraging this knowledge in pricing and capital management, by developing innovative products while mitigating tail risk, resulting in lower capital requirements and lower risk to the company, and hence, lower cost to consumers.
- Implementing EC can be a time-consuming process if a full stochastic modeling approach is chosen—using a fast track (stress-testing) methodology allows implementation in a period of just a few months, at substantially lower cost. This

is the preferred methodology being used by companies currently implementing EC.

- In particular, several multinationals have been using this stress-testing methodology for calculating EC, in accordance with the requirements of Solvency II, the European framework for determining minimum solvency capital requirements which is currently in the process of being implemented.
- Once initial EC has been developed using the fast track methodology, an enhanced EC implementation plan can be developed by leveraging the results of the initial analysis.

Discussion among attendees was lively on both days, including the reception at the end of the first day. Feedback received from the seminar attendees has been very good. About 50 percent of participants have asked for a repeat of the seminar on an annual basis. Based on this feedback, a follow-up seminar on EC is planned for late in 2007 or early in 2008, most likely in Chicago.

For comments or questions, please call or e-mail Hubert Mueller at (860) 843-7079, hubert.mueller@towersperrin.com. ♦

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Developing a New Canadian Insurer Solvency Framework

by Denise M. Lang

In recent years, insurance supervisors around the world have been moving away from traditional 'add-on' capital requirements and moving toward more advanced total balance sheet (TBS) frameworks that better recognize the risks assumed and retained by an insurer to assess the insurer's asset adequacy. Australia, Switzerland, Netherlands and the United Kingdom have made moves in this direction, the EU is currently developing its own Solvency II initiative, and the Canadian Life Insurance industry has been actively working to develop more advanced solvency requirements.

Since the early '90s, the Canadian regulatory framework has incorporated financial reporting based on valuing company-specific risks, scenario testing the company's

key risks to assess capital adequacy and risk-based capital requirements. The Canadian risk-based capital requirement, the Minimum Continuing Capital and Surplus Requirements (MCCSR) formula, was introduced in 1992 as a factor- and formula-based capital requirement that is 'added-on' to the Canadian

GAAP liabilities. A factor-based methodology is very limited in its ability to reflect company-specific risk management practices and therefore the resulting capital requirement might not be representative of the risks. In recent years, the MCCSR has become somewhat more sophisticated to better reflect each company's specific risk profile. The most advanced example of recent changes relates to segregated fund guarantees for which some companies are using internal sto-

chastic models to determine the TBS asset requirement. Also, the lapse component is calculated using a standardized scenario-based method rather than a factor approach.

The insurance industry in Canada is devoting considerable effort to modernize its risk-based capital frameworks. The Canadian insurance supervisors and the industry recognize the advantages of assessing insurer solvency risk through more advanced risk-based capital requirements and have begun work to develop a new Solvency Framework for Life Insurers. New capital requirements under this framework are expected to follow a TBS approach, under which economic principles are applied consistently to the insurer's assets and liabilities to assess all the insurer's risks and determine the appropriate TBS provision (i.e., the total asset requirement) to cover all risks at a high level of confidence. Under a traditional 'add-on' capital framework, the capital requirement is determined independently and doesn't take into consideration the level of margins in the balance sheet liabilities. In a TBS framework, the total asset requirement is independent of the financial reporting basis and the capital required is the difference between the total asset requirement and the assets backing the balance sheet liabilities. Therefore, in a TBS framework a company with more conservative margins in its balance sheet liabilities would be expected to require proportionately less capital relative to its risks than a company with less conservative margins.

Development of the new framework started in the fall of 2004 when the Canadian Institute of Actuaries' (CIA) Risk Management and Capital Requirements Committee formed the Solvency Framework Sub-Committee (SFSC). In its first



year, the SFSC focused on articulating the need for change, surveying industry practices and articulating the key principles for risk-based capital. During the same period, the Canadian Insurance supervisor, the Office of the Superintendent of Financial Institutions (OSFI), also created draft principles for evolving the MCCSR framework for discussion.

In the fall of 2005, the MCCSR Advisory Committee was formed to assess and provide advice on broader solvency framework issues and the SFSC moved into doing technical work on methodology and model development. The MCCSR Advisory Committee consists of representatives from all major Canadian stakeholders, including supervisors (OSFI, Autorité des Marchés Financiers and Assuris), insurance industry and CIA. The committee is chaired jointly by OSFI and the CIA. The first objective of the MCCSR Advisory Committee was to reach agreement on a single set of key principles.

Key Principles for the Future Direction of the Canadian Insurance Regulatory Capital Framework

The MCCSR Advisory Committee reached agreement on the key principles for the future direction of the Canadian Insurance Regulatory Capital Framework early in 2006, and OSFI communicated them to the Canadian Life Insurance Industry in May. The 12 key principles outlined below focus on risk measurement, risk management and risk monitoring.

Principles on Risk Measurement

1. Consider all risks—This implies comprehensively considering all risks on a company-specific basis reflecting risk mitigation, pass-through, concentration and diversification.
2. Determine assets and liabilities on a consistent basis.
3. Be practical, but technically sound—A standardized approach will be available for all risks. Companies will need to meet minimum standards to use a sophisticated approach.
4. Reflect existing risks on going concern basis and consider winding-up and restructuring.
5. Use measures (e.g., CTE) that are comparable across risks and products—The time horizon and risk measure should be consistent across all risks and institutions.

Principles on Risk Management

6. Ensure that capital is prudent—This implies a comprehensive measurement process (e.g., using a TBS approach) to ensure capital will cover unexpected losses on both sides of the balance sheet in stress conditions.
7. Encourage good risk management—Sophisticated approaches should reward companies that manage their risks to prudent levels.
8. Adapt international principles and best practices.

Principles on Risk Monitoring

9. Allow comparison of similar risks across financial institutions.

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10. Be transparent, validated and based on credible data.
11. Use reliable processes with assumptions sustainable in times of stress.
12. Be part of intervention levels for supervisory action.

The complete text of the communication sent to the Canadian Life Insurance industry can be found at the following location on OSFI's Web site at:

www.osfi-bsif.gc.ca/app/DocRepository/1/eng/guidelines/capital/guidelines/MCCSR_cmt_e.pdf

Technical Development on the Canadian Solvency Framework

The CIA SFSC has written several technical papers that have been discussed by the MCCSR Advisory Committee. These papers have focused on considerations for selecting the time horizon, risk measures and terminal provision methodology (terms discussed below). The SFSC has also developed principles for reflecting pass-through and risk mitigation in a sophisticated risk-based capital framework. The CIA has worked with the IAA Solvency Sub-Committee and stayed in touch with other international developments throughout this work.

Economic capital methodologies involve calculating a level of capital that is sufficient to meet future obligations with a defined level of confidence. This can be done by modeling risks over a fixed time horizon or over their full lifetime. If a fixed time horizon is used, it is necessary to determine a terminal provision at the end of the time horizon for the remaining obligations. The SFSC analyzed three options,

namely a one-year time horizon, an intermediate (e.g., five-year) time horizon and a lifetime horizon. The advantages and disadvantages of each time horizon are documented in the "Economic Capital–Time Horizon" paper.

The primary risk measures analyzed are a percentile (or VaR) approach and a CTE (conditional tail expectation or TailVaR) approach. This analysis is documented in the paper "Selection of Appropriate Risk Measures for Economic Capital." The percentile approach is simpler to use and explain, but it does have significant flaws since the result could be less than the expected cost, and it doesn't reveal any information about the level of losses in extreme scenarios. The CTE approach is more effective and doesn't have similar flaws, but is more complex to implement. Although the MCCSR Advisory Committee agreed that CTE is the better risk measure, the committee feels that the sophisticated approach for a given risk should not necessarily require stochastic modeling and the choice of the best approach will involve considering a number of factors including the risk distribution (e.g., for a highly skewed distribution, a CTE approach would likely be used for the sophisticated approach since simpler methods might not provide an appropriate measure of the risk).

Based on the technical work to date, the MCCSR Advisory Committee has agreed on the "working hypothesis" of a one-year time horizon and CTE risk measure with an appropriate terminal provision at the end of the one-year horizon. Technical development will test and build upon this hypothesis.

“ Economic capital methodologies involve calculating a level of capital that is sufficient to meet future obligations with a defined level of confidence. **”**

In a one-year time horizon, the TBS requirement is the amount of assets required to withstand adverse experience at a very high confidence level over the one-year time horizon and have “sufficient assets” remaining at the end of the year to enable the company to meet its remaining obligations (i.e., an appropriate terminal provision). Theoretically, the company would stochastically model its risks over the one-year time horizon and determine for each scenario the costs within the year and the appropriate terminal provision at the end of the year based on scenario-specific stochastic calculations. A stochastic upon stochastic methodology for all risks and products would be extremely complex to implement and for practical reasons, we anticipate the need to develop appropriate approximations.

The terminal provision has to provide sufficient assets to meet the obligations of the company for their remaining life and therefore would need to cover expected costs plus provide an appropriate margin. Different methods to determine the terminal provision have been analyzed and discussed, namely real world, risk neutral and hybrid methods. A real world approach would use a more traditional actuarial methodology based on historical experience. A risk neutral approach would reflect the market prices at the end of the one-year time horizon. At this time, most MCCSR Advisory Committee members favor a real world approach unless robust prices are available in the market to close-out the risk. Documentation of the analysis to date is in the paper “Economic Capital: Calculation of the Terminal Provision.” Further discussion and analysis on this issue is planned for 2007.

In addition, two working groups were formed early in 2006 to focus on the specific issues of guidance for risk assessment models and ALM/market risk capital requirements.

1. The **Model Working Group** has been diligently working on a Guidance Note for Risk Assessment Models and has been involved in the work of the IAA Solvency Sub-Committee on a best practices paper for risk assessment models. Guidance on the development of risk assessment models is being provided to enable accuracy, comparability, consistency, transparency, reliability and practicality of results. The model paper provides some background information on the international and Canadian work underway and provides guidance in the areas of model design, model implementation, model validation and calibration, governance and reporting. The first draft of the paper is almost complete. Over the next few months, the paper will be reviewed and refined.
2. The **ALM/Market Risk Working Group** is developing methodology to reflect ALM/market risk on a sophisticated company-specific basis. We selected this risk as the first to delve into because the current MCCSR component related to “changes in interest rate environment” does not effectively reflect the risk differences between products and doesn’t consider company-specific risk management practices. Also, the IASB’s proposals for international insurance accounting are expected to require using a risk free rate for valuing actuarial liabilities which will

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A real world approach would use a more traditional actuarial methodology based on historical experience.

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eliminate the company-specific provision for interest rate risk currently reflected in the Canadian GAAP valuation. This working group has developed a draft methodology document that was discussed with the MCCSR Advisory Committee and has started testing simple products with different mismatch positions and simple ALM strategies under this method. The plans for 2007 involve testing sample company data with simple ALM strategies, more complex ALM strategies and Canadian companies' actual business. The testing will enable comparison of the impact of different time horizons (i.e., one-year versus lifetime), confidence levels and methods for determining the terminal provision.

CIA members can access any of the technical papers discussed in this article in the documents section (location below) of Risk Management and Capital Requirements Committee page on the CIA Web site. If you are not a CIA member and would like a copy of the papers, please send me an e-mail at denise_lang@manulife.com.

www.actuaries.ca/members/organization/PC/RISK/PC_RISK_Docs_e.cfm?CODE=RISK

Next Steps

During 2007, we will complete the Guidance Note for Risk Assessment Models and the testing of the ALM/market risk methodology and expose this work to the industry. We will also be starting a credit risk working group to develop a methodology for including credit risk in the new framework. Additional working

groups will be created over the next few years to develop the methodology for risk aggregation, insurance risks and operational risk.

The implementation of the new Canadian Solvency Framework will be a long process and enhancements will be implemented over several years. December 31, 2008 is the earliest possible date at which the transition period could begin for the initial improvements from this work.

Developing the new Solvency Framework involves a large number of volunteers. Limitations in the number of volunteers and the time they are able to devote to this work will impact the pace at which the work can progress. If you or someone in your company is interested in helping move this work forward, please contact Denise Lang, chair of the CIA Solvency Framework Sub-committee, or Simon Curtis (e-mail: simon_curtis@manulife.com), chair of the CIA Risk Management and Capital Requirements Committee and co-chair of the MCCSR Advisory Committee. ♦



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Lessons Learned: Insight into Economic Capital Implementation

by Matthew P. Clark

Among life insurance enterprise risk management activities, economic capital (EC) is generating much attention and internal resource investment. Globally, EC is capturing the interest of senior management, boards of directors, regulators, rating agencies and other external constituencies. The current growing consensus is that implementation and integration of an EC process into life company risk management and reporting practices will provide an opportunity to gain a competitive advantage. Strategic decisions will be based on insight into how those decisions impact an organization's capital and risk profile. While rating agencies and risk management activities appear to be the primary driver of EC implementation, companies say they have extensive plans to use their EC framework as a business and decision-support tool.

With this in mind, Ernst & Young recently conducted a survey of North American life insurance companies to capture some of the insights they have reached during their EC journey. This article highlights trends, methodologies and uses of first-generation EC frameworks. Overall, our survey confirmed that EC implementation is, indeed, a journey, and that invaluable lessons can be learned as companies realize EC can be a powerful tool and driver of change within their organizations.

Opportunity for Capital Reduction

One of the most compelling survey findings is that an EC framework can provide the basis for lowering capital requirements. The life insurance industry has enjoyed a robust period of innovative product development. New product

features and the bundling and unbundling of guarantees and risk elements have led to a diverse portfolio of life products. Product innovation continues to evolve and risk management and regulatory efforts must keep pace. To date, the regulatory environment has proven in many cases to err on the side of conservatism. The life insurance industry claims that current statutory and rating agency capital requirements exceed the capital needed to fund their liabilities. Survey participants confirmed this claim, with 80 percent of the companies who have quantified results saying their models resulted in lower capital requirements, and 80 percent of the remaining companies saying they anticipate a lower capital requirement. Seventy-eight percent of respondents plan to use their EC results to discuss a reduction in capital levels required by external audiences.

While the regulators have provided some hope for the industry in the form of principles-based reserves, the rating agencies are actively working with the industry to explore EC techniques to assist in establishing rating and capital requirements. The current expectation is that companies will employ a holistic risk management process with an emphasis on EC techniques. The industry is optimistic that the regulators and rating agencies will recognize the validity of EC models and ultimately reduce current capital requirements.



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Uses of Economic Capital Framework

While regulatory and rating agency requirements appear to be a catalyst for the development of many EC frameworks, companies have plans to leverage their efforts to support numerous other activities. Currently 80 percent of the survey participants are using their EC models to satisfy risk management and rating agency demands. Nearly all of the companies plan to use their EC framework to support processes such as pricing, capital allocation, performance measurement, stakeholder communication and senior management compensation.

There are, however, challenges in implementing an EC framework that will support these multiple processes. First, it is not clear that a single methodology can support multiple audiences (management, regulators, rating agencies, investors, etc.) because each party has a different solvency perspective. Second, it is unproven whether a company's current infrastructure and its EC processes will be able to produce dependable results on a timely basis. A fully implemented EC framework essentially represents another accounting system; and, therefore, appropriate production processes, controls, systems infrastructure and resources are needed to ensure accurate, meaningful and timely results.

Economic Capital Methodologies

What is an EC survey without an inquiry into choices of methodology? There are three EC methodologies that have been discussed in the industry: fair value, statutory and cash balance methods.

Fair Value—provides sufficient funds today to ensure an adequate amount of as-

sets at market value to cover the fair value of the liabilities one year forward using a target confidence level. The focus is the fair value balance sheet in one year. This is the European Union's Solvency II approach.

Statutory—provides sufficient funds to ensure statutory solvency at any future point using a target confidence level. The focus is the statutory balance sheet over the life of the liabilities.

Cash Balance—provides sufficient funds to meet all financial obligations over the life of the liabilities. The focus is on cash flow with no accounting considerations.

To date, the fair value and statutory methods have been the dominant methodologies adopted by North American life insurers. (This does not mean that the cash balance method is not a viable option.) Our survey participants favor the fair value approach (80 percent) versus the statutory method (20 percent). On the surface, these results appear to imply that the fair value approach is evolving as a standard for North America. However, taking a closer look at the results, we find that those companies that have chosen their methodology are split 60 percent in favor of the fair value method and 40 percent in favor of the statutory method. This finding is explained by the fact that 30 percent of the participants are subsidiaries of European insurers and 20 percent are Canadian insurers, and both of these jurisdictions are moving toward fair value methods. The remaining 50 percent of the participants are domiciled in the United States.

There are other arguments, pro and con, for both methods; however, a discussion of them is beyond the scope of this article. Regardless of methodology, EC consistently measures the relative risk on a company's balance sheet and pro-

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vides a consistent framework for measuring that risk. There is no single right or wrong answer. In the end, it is most important that the insurer use the results to better understand and guide management actions.

It is plausible that multiple methodologies will be required to serve the needs of the wide array of intended audiences. Regardless of the methodology—or methodologies—an organization implements, the key point is that the EC process is an additional tool in management's decision-support toolbox. However, management should not abandon its current management tools and techniques.

Implementation Challenges

Companies have found that the implementation of their EC framework is a journey with complexities and challenges that do not fit into their current infrastructure. Survey results indicate it can take two to four years to develop an EC framework, and several more years to bring it to full production.

The industry is challenged with the continual development and integration of an ever-expanding EC framework. For example, 90 percent of the companies identified the reconciliation and validation of their EC results as a challenge in their implementation efforts. On the other hand, only 10 percent of the companies identified funding as a primary challenge, while 50 percent identified lack of qualified human resources as a primary challenge—i.e., the challenge of recruiting the right skill sets needed to support the methodology selection and implementation. Allocating dedicated resources versus part-time resources is another concern.

These tactical issues may well point to the more basic issue that successful EC implementation

requires the organization to embrace the introduction of the EC framework and proactively integrate EC measurements into its operations. Consistent with any other significant changes that face an organization, the ability to implement and produce dependable results with limited stress on the current operations is the goal. Management must set a supportive tone that drives culture change as well as provide the dedicated resources needed to complete a timely implementation.

Additional Considerations

The survey also addressed the recognition of income taxes and new business in the EC calculation, the discount rate for cash flows (portfolio-earned rate, risk-free rate, company rating) and the allocation of diversification benefits. The results show that use of these methodology components is generally split evenly among participants. The time horizon and tail metric results were not split evenly, however. Ninety percent of respondents use a one-year horizon, and 70 percent use a percentile (versus conditional tail exposure) tail metric. In most cases, the choices made are correlated with the methodology selection. It is important that the approach a company selects is consistent with intended management uses and target audience requirements.

The allocation of the diversification benefit is important. EC frameworks are generally designed to capture the risk profile and capital requirements of the organization. The ability to incorporate the diversification benefit created by the management of various risks facing the organization is the primary selling point for EC. However, the integration of EC results with the current granular management and reporting

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Management must set a supportive tone that drives culture change as well as provide the dedicated resources needed to complete a timely implementation.

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Lessons Learned ...

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structure of the organization presents serious challenges and issues.

Economic capital purists will argue that EC is only meaningful at the top organization level and should not be calculated or reported at granular levels. In fact, 60 percent of the participants currently allocate benefits to the business unit or product level, and 80 percent plan to do so in the future. While this might make sense from an intellectual perspective, it is important to recognize the cultural challenges and the need to integrate EC with current management techniques and frameworks. Additionally, there is a risk that the allocation of diversification benefits could reward or direct management activities that do not optimize the risk profile or capital allocation at the organizational level.

Lessons Learned

While companies do not yet agree on a single methodology or approach to EC, it is clear EC is evolving and is here to stay. Companies agree that the measurement and management of an organization's aggregate risk profile is a powerful tool that will assist in overall risk management within the industry. Implementation and integration of an EC framework is a challenge that will require the resources and support of management across the organization. Aligning the EC framework with the current performance management structure and culture is imperative. It is important to understand the intended uses of results and the needs and perspectives of the intended audiences. ♦



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Enterprise Risk Management and Insurance Company Ratings—One Year On

by David N. Ingram

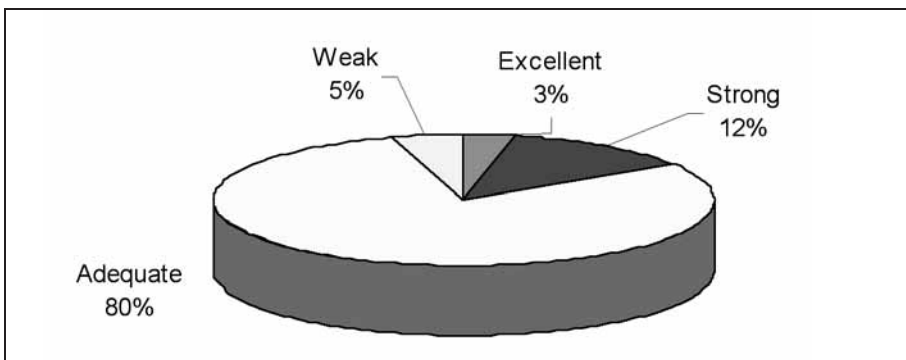
In the first year of reviewing ERM practices of insurers across the globe, S&P has found that about 80 percent had Adequate practice. This is the third best quality rating of four (Weak, Adequate, Strong and Excellent). Over 200 insurers and reinsurers have been reviewed in North America, Europe, Bermuda, Asia and Australia. Other findings were 5 percent Weak, 12 percent Strong and 3 percent Excellent.

While generally these findings were seen to be supportive of the current ratings, in a small number of cases, upgrades were made based on positive ERM findings, positive or negative outlooks were established based on ERM findings and positive and negative credit watches were resolved in part due to ERM findings.

In October 2005, Standard & Poor's undertook to consolidate all of the parts of the ratings analysis of insurers that related to risks and risk management under a single heading in the ratings process. This undertaking allows S&P to have greater confidence that all risks and risk management issues were being appropriately considered in the rating process and promoted the idea of raising the importance of risk within the rating process.

The ERM analysis focuses on five areas: risk management culture, risk controls, emerging risks, risk models and strategic risk management. (See March 2006, Issue No. 7 of this newsletter) The analysis is performed primarily by the regular ratings team with assistance from ERM specialists. Usually the ERM discussion is a part of the regular management meeting discussion, but in some cases separate ERM only discussions are held.

Overall ERM Evaluation (207 Insurers—All Sectors)



After six months of actual ERM reviews, based on feedback from insurers, the S&P analysts and from other interested parties, S&P published an additional paper that provided some adjustments to the ERM review criteria and quite extensive examples of risk control processes that could be important in the review process.

One of the changes was to clarify the definition of the requirements for a Strong ERM score. This has had a very significant impact on the distribution of ERM findings reported at the outset of this article. The minimum requirements for a Strong score are for Strong or Excellent risk controls for major risks, Adequate or better emerging risks management score and Strong or better strategic risk management.

The definition of Strong strategic risk management was also sharpened to specifically require that an insurer have a comprehensive view of risk and a practice of looking across all of their risks with a focus on the quantitative risk reward trade-off. For life insurers, this means looking at

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Enterprise Risk Management ...

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Other ERM Activities

In addition to using enterprise risk management as a rating factor for insurance companies, Standard & Poor's has also been using it for energy sector companies with trading activities since October 2005, and for financial institutions, which encompasses banks, investment banks, brokerages and mortgage lenders, since September 2006.

The key elements of ERM are risk governance, operational risk, market risk, credit risk and risk to a firm's liquidity and funding, and are applicable to companies in all industry sectors where such risks exist. In addition, economic capital assessment is also a key component of the ERM assessment process. Market risk assesses risk management practices for both trading risk and for asset-liability management (ALM) or interest rate risk. In credit risk, a firm's underwriting processes, credit risk analytics and portfolio management practices are evaluated. For funding and liquidity risk, funding composition, liquidity management and stress-testing practices are assessed.

The methodology to assess and rate ERM at these two types of companies is consistent with the Trading Risk Management (TRM) assessment methodology developed and implemented at Standard & Poor's in August of 2004. Standard & Poor's ERM criteria assesses the quality and robustness of an institution's risk culture, its risk appetite, how it aggregates risk at the enterprise level, its risk disclosure quality and the practices it uses to ensure against business, legal and reputation risk. A set of factors, which assess elements that can strengthen or weaken a company's ERM practices and processes, produces qualitative ERM scores of Excellent, Strong, Adequate or Weak.

While economic capital evaluation is outside the scope of the process for now, Standard & Poor's is looking in greater detail at the economic capital assessments some banks have developed to quantify these different risk types more consistently, and will be issuing criteria on this in the future.

For financial institutions, process and practice assessments of risk governance, operational risk, market risk, credit risk and liquidity and funding—its five key areas—are used to assess and rate ERM quality.

In the energy sector, ERM assessment will focus on providing an expanded review of risk management practices at these companies. At first, only energy companies with large trading and marketing segments were targeted, but the focus was recently expanded from a TRM approach to a broader view of overall risk management practices.

Standard & Poor's evaluation of an energy company's TRM practices focuses on the effectiveness of three key aspects: its risk management policies, its infrastructure and its methodologies (PIM)—the same three aspects in the TRM approach. PIM provides a framework to organize and systematically compare companies' risk management practices.

The relative importance of each aspect of ERM in formulating our opinion of the quality of a company's risk management practices will depend on the complexity, size and range of risk for each individual firm. Standard & Poor's continuously enhances its rating process to ensure that every company's rating captures the risks that the company is taking. This initiative will provide a more in-depth analysis of some of the key components that determine a company's creditworthiness.

The factor sets are by no means exhaustive or static. As the ERM practices of organizations evolve, S&P's ERM assessment factors will most likely evolve as well.

credit, equity, interest rate, and insurance risks across all of their products and businesses. For property/casualty insurers, the challenge often is to extend this sort of process to encompass both the investment and insurance risks.

In Europe, we have found that many of the largest insurers have implemented economic capital models that form the basis for a comprehensive view of firm risk and a risk/reward trade-off. However, in some cases, groups with a Strong strategic risk management process have not uniformly developed their risk controls and fall short of the Strong ERM designation for that reason. In North America and Bermuda, a number of insurers with Strong Risk Controls have not developed any comprehensive quantitative view of risks beyond regulatory or rating agency capital requirements. S&P feels that neither our capital model nor the NAIC RBC model are sufficiently robust to be the basis for accurate risk reward analysis for most insurers. It is important for insurers to have a capital management process that is concerned with traditional issues of funding the business, and the use of an outside standard for level of funding is good practice. The insurers that S&P has found to have Strong SRM have used economic capital or another comprehensive risk measure that reflects a much more detailed understanding of the actual risks that the insurer is exposed to rather than the external models that rely on broad industry averages and summary level information about the company.

The idea that an insurer use an accurate determination of its own risk position in its strategic risk management is seen by S&P to be no less important than asking an insurer to use its own sales results to manage its marketing efforts rather than focusing on industry sales and its own financial statements to manage profitability rather than average results for the entire mar-

ket. The rating agency and regulatory capital models represent average risk across the industry for a given level of activity.

Some insurers do have a comprehensive view of their risks and capital requirement, but use this information primarily to inform management about capital adequacy. Once they have verified that the outside capital requirements are higher than their internal assessment, they move on to the capital management process for assuring that capital is adequate to satisfy those external standards. This is not seen by S&P to be Strong SRM either. S&P views that an insurer with Strong ERM will be leveraging the risk management information to optimize its selection of business concentrations.

Another area where S&P places high emphasis is the development of an overall risk tolerance for the insurer. This is seen as a part of the risk management culture. S&P has observed that best practice is to have an overall enterprise level risk tolerance that is ultimately directly linked to the specific risk limits that are established by an insurer for each risk or business or risk within business.

Emerging risks management is the process that some insurers use to identify and prepare for the new risks that may cause future problems. Some insurers have robust formal processes that continuously identify potential risks and periodically prepare threat analysis reports that may lead to advance preparations or preventative actions. Other insurers have informal, ad hoc processes and many wait until threats, such as flu pandemics, make it to the cover of *Time* magazine.

Mergers and acquisitions are seen as another activity where an ERM discussion might have a significant impact on the S&P ratings. There are

three specific areas of discussion. The first is the impact of the transaction on the risk profile. Some acquisitions are made to add to strategic mass of an existing business. These would be additive to risks that the insurer already has. Other acquisitions are meant to be complimentary, bringing in risks where the insurer is currently less concentrated. In either case, S&P would want to determine the insurer's awareness of the impact on risk profile and to learn whether the resulting risk profile is acceptable to the insurer. If the resulting risk profile is not exactly acceptable, the plans of the insurer to trim the profile will be discussed. The second area of concern is the operational risk posed by the new business combination that is being formed. This has always been a key concern for S&P and is an example of a longstanding area of analysis that is now seen as a part of ERM. Finally, the third area of concern is the integration of the risk management staffs of the two organizations.

During the first half of 2007, S&P expects to develop a process for evaluating insurer economic capital models and for incorporating the information from that review into our view of capital adequacy. This process will be related to, but not a part of the ERM evaluation process. S&P will expect to do this review only for insurers with Strong or Excellent ERM processes. There are two reasons for this restriction. First, we would expect that it is more likely that insurers with Strong or Excellent ERM would have a high chance of maintaining risk positions at the end of a year that are consistent with their risk positions at the beginning of the year due to their disciplined risk control practices. In addition, insurers with Strong and Excellent ERM were found to have at minimum Strong SRM, which indicates that they are relying on their economic capital models for support of major decisions within the insurer. ♦



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CROs—Operating in a Global Capacity: An Interview with Ellen Lamale (Part II)

by Ronald J. Harasym



Ellen Lamale

This article is the second of two conversations with Ellen Lamale of the Principal Financial Group (the Principal). In the previous issue of *Risk Management*, Ellen talked about her rise to and role as chief risk officer. Her advice to actuaries who aspire to become a chief risk officer was fairly candid. The basic training to become an actuary provided a great foundation for a risk management role. Keep building upon that by working hard to understand risks and consequences. Get exposure to as much of the business as possible. Network and build relationships with key people from as many different disciplines as possible and stay current and educated on the latest thinking and trends in technology, product designs, methodologies and tools.

In this conversation, Ellen focuses 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 versus international operations.

So, let's get started.

Ellen Lamale is an executive with the Principal Financial Group (the Principal). She is senior vice president and chief actuary, with responsibility for actuarial, business risk consulting, corporate treasury, 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 and her 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, a member of the American Academy of Actuaries and a member of the Des Moines Actuaries Club.

Given the Principal's global span of operations, what differences have you observed between the integration of risk management practices into domestic operations versus international operations?

Our risk management practices and programs were developed over many years for our domestic business. Expanding our operations internationally (the Principal operates in 11 international countries primarily in Asia and Latin America) introduced some new challenges and risks:

- Different culture, values and perspectives,
- Different currencies,
- Different local regulatory environments,
- Different local/regional economic markets,
- Geographical differences,
- Different languages,
- Time zone differences,
- Distance from home office,
- Different skill sets and credentials and
- Some loss of control.

The basic practices and requirements of integrated risk management have to be the same

internationally as domestically, but the implementation may be modified somewhat to reflect the differences abroad.

What risk management practices have worked for the Principal's international operations?

You may recall that 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. We use a similar model to successfully integrate risk management throughout our international operations, whereby we created a small international corporate division at our parent home office to oversee our member companies through a federated international approach. We've implemented an international company leadership structure very similar to our domestic operations, with a CEO, CFO, CIO, chief actuary, chief investment officer, chief compliance officer, etc. for each of our international locations. We designated primary subject matter experts and contacts in our home office for each discipline—accounting, actuarial, tax, product, compliance and treasury. We require each international office to adopt the same standards, policies and practices, consistent with those of the parent home office.

What role does the International Corporate Division play?

At the parent level, we provide strong training, education and support to enable practical local implementation of our required policies and standards (e.g., code of ethics, security and safety, technology standards, privacy, e-mail

security, pricing and product development, documentation, etc.). We train and provide information in the local language. We conduct reviews and audits and require annual certifications to measure compliance. Sometimes we have transitionally used expats to help transfer and enable the parent company culture and philosophy, and to provide on-site education and training, as well as oversight. The key to our success is through building strong, trusting relationships—no different than the relationships we develop with our business units domestically. Our goal is to ensure our international operations take ownership for risk management, and feel that they are a part of a total organizational team—not simply an attachment that needs policing.

How does the Principal manage its joint-venture relationships?

Joint-venture relationships present risks similar to our international fully owned operations. They also bring with them additional complexities and risks via our partners' possibly differing perspectives, views and priorities, as well as dilution of our level of control. We apply the same risk management practices to our joint-venture relationships as to our fully owned operations, with even additional communications, additional education and additional assistance, resources and funding. Our goal is to achieve full transparency through creation of strong trusting relationships with our joint-venture partners.

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Network and build relationships with key people from as many different disciplines as possible and stay current and educated on the latest thinking and trends in technology, product designs, methodologies and tools.

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CROs—Operating in a Global ...

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Outsourcing and its inherent risks seem to be on companies' radar screens these days. How does the Principal manage outsourcing?

There are different definitions of outsourcing. For the purpose of this discussion, let's define outsourcing as contracting out jobs to a third-party resource—either domestically or internationally. Outsourcing can provide several different benefits including lower cost, increased access to available talent and expertise, better technology, ability to operate 24/7 and share work globally, and higher quality, to name a few. But, outsourcing can introduce additional risks, including loss of control, risks around privacy and confidentiality of data and information, compliance, reputation, quality, skill/talent of workers and language, distance, time zone and cultural differences. Most of these are similar to the risks to which we are exposed with our fully owned or joint-venture international operations.

What are some of the key levers used to manage outsourcing risk?

Strong oversight and management of vendors and outsourcing relationships is critical:

- Each operating unit is required to have a primary contact accountable for vendor management. In addition, we also have a point person at the corporate level with overall oversight responsibility for outsourcing relationships. All of our contract negotiations go through our centralized purchasing area to ensure we have tight contract negotiations with clearly defined requirements, objectives, tasks and responsibilities, and we do appropriate and full due diligence.

- It's important to develop a trusting and strong relationship with vendors—that's part of the role of the operating area's person with accountability for vendor management. This relationship is critical—we want our vendors to care about the quality of work they do for us.
- Our Corporate Technology Policies apply to all entities and companies doing business with us or having a business relationship with us, to ensure we have clearly defined standards regarding transfer of or sharing of data, retention or purging of data and physical security of premises.
- We require vendors to have a well-defined and tested disaster recovery/business continuity plan.
- Not only do we have clearly defined and communicated quantitative and qualitative expectation of results from our vendors, we require regular vendor attestation that key deliverables and results are according to expectations.
- We have metrics to measure risks and consequences for non-performance.
- We have a disaster recovery or exit plan. For example, we may use more than one vendor so we can shift work from one to another if one is not delivering. We may also maintain some employee expertise in house to whom we could quickly move work back if necessary.
- In some situations we require the third-party vendor to dedicate a room for work solely for our company. Work done for us may be segregated and not commingled with other clients. The room may even be guarded. We sometimes do not permit external devices or machines (no CD burners, floppy disks) or printers, and restrict paper from leaving the premises.

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Outsourcing can provide several different benefits including lower cost, increased access to available talent and expertise, better technology, ability to operate 24/7 and share work globally and higher quality ...

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How does the Principal manage offshoring?

I'll define offshoring as moving jobs overseas to a 100 percent captive firm. The risks here are quite similar to those of a fully owned international operation. A few additional risks associated with offshoring include domestic company employee morale and job security concerns as well as customer reaction.

What are some of the key levers used to manage offshoring risk?

Managing offshoring risks is very similar to managing risks of our international operating businesses:

- We have someone accountable locally and in the parent. We try to leverage local management in countries where we already have an operation; they know the culture, the regulatory system, and have already developed relationships.
- Where possible, we save costs by leveraging common infrastructures in international locations—such as IT or HR.
- We use industry and/or company standard processes and technology to enable better integration with the rest of the company as well as better future flexibility (for example, if we need to move information back to the parent, it's easier to do so if it's been processed/stored using industry or company standards).
- We limit offshoring activities to non-core, non-customer interactive tasks.
- We select countries with appropriate language skills and education.
- We assign compliance responsibility to a local employee.
- We maintain up-to-date, well-defined business continuity and disaster recovery plans at the offshored location.

- As with outsourcing, we may maintain some vendors or home office employee back-up.
- We have a formal plan to address staff planning and training/development in the captive.
- We have communicated openly to home office or other employees whose jobs could be impacted.
- We communicate and enforce strong guidelines around security/data protection/ intellectual property.
- We're sensitive to cultural differences. We have dedicated relationship managers in the United States who work directly with our leaders in our captive and with our U.S. executives.

Our goal is to have as much control over activities as before offshoring—as if the work were being done in the building next door.

Finally, given the broad span of operations of the Principal, how do you stay informed and connected?

Strong relationships and open and regular communications are key to staying in the loop. My staff and I participate on several key committees and attend key meetings around the company. Plus, we receive regular formal risk reports, other reports and memos, and many ad hoc relevant communications. It helps that I've been with Principal many years. I've had opportunities to work in and get familiar with different business units and develop good trusting relationships with management teams and staff around the company. ♦



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Strategic Planning Models

by Gary G. Venter

ERM has gained a good deal of momentum from regulatory interest. However, the ability to model a wide range of risks a firm faces, and to do so with consistent metrics across risks, also provides a platform for analysis of strategic options. This may lead to a somewhat different choice of risk metrics and modeling approaches than those in a regulatory-focused model.

One fundamental step in strategic modeling is to develop methods for quantifying risk-adjusted profitability by business segment. This can give an indication of which segments are worth developing further, as well as the segments that may require restructuring. Two basic approaches to risk-adjusting profits are explored here: capital allocation and capital consumption. But to address these properly, the overall capital requirements of a company and choices of risk measure need to be touched upon as well.

Overall Capital Requirements—Beyond Economic Capital

One of the typical outputs of financial risk models is economic capital. That is usually specified as a remote percentile of the probability distribution of outcomes—perhaps the 1-in-2500 or 1-in-3333 point on the distribution. Economic capital can be useful for regulators, by showing how bad results could get. It actually reveals very little information about the full probability distribution; so under the assumption that regulatory information becomes public information, it does not inform competitors very

much. This combination makes economic capital useful as a regulatory standard.

Economic capital can be estimated by a simulation approach, or even by estimating the mean and variance of outcomes and assuming a distributional form. Usually the particular percentile used is selected to be a round number that is as high as possible under the constraint that economic capital is less than actual capital. The company will then appear to be financially sound by the selected criteria, which in turn will look appropriately conservative.

The advantages of economic capital for regulatory purposes may be detriments for strategic planning, however. For strategic planning, company management may want to look at more than a single percentile of its distribution of outcomes. Having more capital than is economically needed may not be acceptable to owners either. They usually want their target return to be met on total capital, not some smaller amount. Also, there is little to support the idea that a percentile so selected will be the right capital level for a company.

An alternative approach to capital requirement is setting capital at the level that maximizes the franchise value of the firm, defined here as the excess of the market valuation over the capital held. This target for capital does not necessarily appear by inverting a probability distribution function. Determining it may require a more detailed analysis of business opportunities available, effect of capital levels on attracting and retaining customers, etc. Whatever it is determined to be, the need for an extra margin beyond that would depend on the company's relationship with capital providers. If a company has a close relationship with its investors, it may be able to give them back any temporarily unneeded capital with the confidence that it will



be resupplied if necessary. More commonly, however, a company that finds itself needing capital may be able to raise it only at a good deal of expense. In that case, more than the otherwise optimal amount may be worth retaining in order to absorb possible adverse fluctuations. But then the company will still be held accountable for return on the total.

Relating Capital to Risk Measures

Economic capital is a risk measure of company results, also called value-at-risk (Var). It is set at such a high probability level that it is difficult to measure with any degree of confidence, however, under the current state of risk models. Actual capital could also be expressed as Var at some high percentile, but again there could be a good deal of doubt about what percentile that actually is. The advantage of economic capital is that the reciprocal of the probability is a round number. For strategic planning purposes, the advantage of actual capital is that the investors will typically want to see what the return is to actual capital. Holding unneeded capital for investment only is not usually popular outside of Omaha.

An alternative to Var at a remote probability is to express capital as a multiple of a risk measure that is more readily calculated. Var at a lower percentile is one such possibility; so is standard deviation, or semi-standard deviation. These have been criticized as missing skewness risk, since they are based on second moments only. A moment-like risk measure that is responsive to heavy tails is $E(Xe^{cX})$ for some value of c .

A popular tail-based measure is tail value at risk (Tvar), sometimes called conditional tail expectation (CTE). It is the average of all losses beyond the selected percentile. For example, if

there is a 15 percent chance the company will suffer a loss, then Tvar at the 85th percentile would be the average loss when there is a loss. Then capital can be expressed as a multiple of that risk measure. For instance, on the average when there is a loss, 10 percent of capital might be lost. Then capital can be allocated as 10 times the allocated Tvar at 85 percent. Sometimes Tvar at much higher percentiles is used, but that runs in to the calculation problems of economic capital, as well as ignoring important but less severe risk at lower probability levels. Tvar has also been criticized for its linear treatment of large losses, which is in violation of the idea that losses get more painful as they get larger.

While there are many possible risk measures, one promising family is risk measures based on transformed probability distributions. If more probability is given to the adverse outcomes and less to the favorable ones, the result is a riskier distribution. The transformed mean is a risk measure which is more adverse than expected results. Measures like Tvar can be done with transformed probabilities as well, which then does give more weight to the larger losses. Classical risk-pricing formulas like Black-Scholes and the capital asset pricing model can also be expressed as expected values under transformed probabilities, so this type of risk measure has potential to represent the market value of the risk being measured. That would be a useful comparison to actual profits achieved. In fact, the very idea of comparing profit to risk suggests that the risk measure corresponds to the economic value of the risk being taken. Thus the choice of risk measures to use should reflect the relationship of risk to value.

One popular probability transform is the Esscher transform with parameter h . For a con-

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A popular tail-based measure is tail value at risk (Tvar), sometimes called conditional tail expectation (CTE).

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Strategic Planning Models

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tinuous random variable X , its density $f(x)$ is transformed to $f^*(x) = f(x)e^{hx}/Ee^{hx}$, assuming this exists. If X is a compound Poisson distribution with frequency λ^* and severity $g(y)$, its Esscher transform can be shown to be given by $\lambda^* = \lambda Ee^{hx}$, and $g^*(y) = g(y)e^{hy}/Ee^{hy}$. While typically used in pricing, these transforms can also be used as risk measures to quantify the riskiness of a variable X and the value of the risk.

Allocating Risk Measures

Once capital has been expressed as a multiple of a risk measure, it can be allocated to business segment by so allocating the risk measure. One way to do this is to calculate the risk measure for each segment and allocate proportionally. This does not show the contribution of the business segment to the overall company risk measure, however. The method of comeasures is designed to do this, and it is applicable to many, but not all, risk measures. Comeasures generalize the idea of covariance. Just like the covariances of the segments with the total company sum up to the variance of the company, the sum of the comeasures will be the total risk measure.

If Y is the variable for the results of the whole company and is a sum of the results of the business segments X_j , and the risk measure $\rho(Y)$ can be defined as:

$E[h(Y)g(Y) | \text{condition on } Y]$, where h is additive, i.e., $h(U+V) = h(U) + h(V)$, then the co-measure for X_j is

$r(X_j) = E[h(X_j)g(Y) | \text{condition on } Y]$. These add up over the segments to $\rho(Y)$.

For instance, $\text{Var}_\alpha(Y) = E[Y|F(Y) = \alpha]$, so $r(X_j) = E[X_j|F(Y) = \alpha]$ is co-Var. This is a completely additive allocation of Var, and the allocation to each business segment is its contribution to the

overall Var. In fact, this is more of a decomposition of Var to its component pieces than an allocation, which implies a somewhat arbitrary process. Common risk measures like standard deviation, Tvar, etc. all have such co-measures. For example, $\text{Tvar}_\alpha(Y) = E[Y|F(Y) \geq \alpha]$, so $r(X_j) = E[X_j|F(Y) \geq \alpha]$ is co-Tvar.

Marginal Decomposition

Even though co-measures are always additive, they are not always marginal. The (incremental) marginal impact of a business segment on a company risk measure is the decrease in the overall risk measure that would result from an incremental proportional decrease to the business segment. That marginal impact is the contribution of the increment to the overall risk measure. It can happen that all these marginal impacts sum up to the total company risk measure. In that case, the allocation is called a marginal decomposition of the risk measure.

If profit is compared to marginal impact, this is consistent with the economic principle of pricing in proportion to marginal costs. Another advantage of marginal decomposition is that if the risk-adjusted return is the profit of the segment divided by its marginal risk, growing the units with the highest risk-adjusted profit will increase the risk-adjusted profit for the company as a whole. This is a desirable feature of risk-adjusted profit, but is not guaranteed for allocations other than marginal decomposition.

For a risk measure to have a marginal decomposition, it has to be scalable. That is, $\rho(aY) = a\rho(Y)$ for any constant a . Standard deviation, Var and Tvar all are scalable, but variance is not. For a scalable measure $\rho(Y)$, the marginal decomposition is defined as:

$$r(X_j) = \lim_{\epsilon \rightarrow 0} [\rho(Y + \epsilon X_j) - \rho(Y)] / \epsilon.$$

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The marginal impact is the contribution of the increment to the overall risk measure.
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A theorem of Euler's shows that these do add up to ρ . For instance, for standard deviation, it is not difficult to show that $r(X_j) = \text{Cov}(X_j, Y) / \text{Std}(Y)$ is the marginal decomposition. This is a co-measure. The co-measures just mentioned for Var and Tvar turn out to be marginal as well, as does any risk measure defined as a transformed mean.

Thus, if risk-adjusted profit is based on allocating capital, there are advantages to allocation by marginal decomposition of a risk measure, and using a risk measure that reflects the value of the risk. There is no need to restrict attention to a single risk measure, either, as the different perspectives from different risk measures may prove worthwhile.

Capital Consumption

Allocating capital is not the only way to risk-adjust profits, however, and it has some inherent disadvantages. First of all, it is artificial, in that a segment is not limited to the capital allocated to it, and may in fact use up the entire firm capital if its results are unfavorable enough. Also it is arbitrary, in the sense that there is no one canonical risk measure that stands out.

Capital consumption is one way to get around these problems. Instead of computing a return on allocated capital, an imputed cost of capital is subtracted from segment profits to get the value added of the segment. The cost of capital imputed to the segment is the value of its right to call on the assets of the company in case it loses money on its own. The company is implicitly providing the segment with that option, so the value of the option is the cost to the company of supporting that business segment.

This is a somewhat complex option to evaluate, as there are no time or cost constraints on

the payout. Whenever the segment needs the money, it can take it, and continue doing so as its cash flow demands. Moreover, the profit of the segment can also be considered an option: the company takes all the profit, if there is any. Thus the value added of the segment is the difference in value between these two contingent claims. ♦

Further Reading

Venter, Major and Kreps "Marginal Decomposition of Risk Measures" in last ASTIN.

Mango "Insurance Capital As A Shared Asset," *ASTIN Bulletin*, November 2005.

Merton and Perold, "Theory of Risk Capital in Financial Firms," *Journal of Applied Corporate Finance*, 6:3, Fall 1993.

Moller "Stochastic orders in dynamic reinsurance markets," *ASTIN Colloquium* 2003.



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Enterprise Risk Analysis for Property and Liability Insurance Companies

by Paul J. Brehm

Editor's Note: Guy Carpenter's InStrat® unit is publishing a book on enterprise risk modeling and management. This must-have book on the subject—with Web-based support (ermbook@guycarp.com)—is designed for property and casualty insurance professionals (CFOs, CROs, actuaries, etc.) and academics.

The book builds on Guy Carpenter's strength in insurance hazard modeling for risk management purposes, especially reinsurance purchasing, in insurance companies. While InStrat actuaries have produced dozens of journal articles related to ERM over the years, this is Guy Carpenter's first initiative to tie all of these works into a single text. The book is an anthology of readings authored by Paul Brehm, Spencer Gluck, Rodney Kreps (retired), John A. Major, Don Mango, Richard Shaw, Gary Venter, Steve White and Susan Witcraft.



Enterprise risk analysis strongly advocates getting the theory right in risk modeling, but also addresses practical implementation issues. Emphasis is placed on topics to which modelers must pay particular attention, such as identifying the correct risk distributions, parameter uncertainty and the nature of dependencies between variables. The text is divided into six chapters, and a full table of contents is listed on page 27.

True to its title, the text covers traditional topics such as loss distribution modeling and loss reserve models. Even in these traditional areas, however, Guy Carpenter actuaries have brought forth some new ideas. For example, the section on frequency and severity distributions includes recognition of limiting and special cases of the transformed beta distribution with intuitive interpretation of its parameters, alternative parameterization of the negative binomial distribution with implications for changes in its variance with exposure growth, a very flexible three parameter frequency distribution and alternative estimation methods. The discussion of loss reserve models provides a summary of existing methodology, but also includes a chapter on improved fitting methods to reduce the estimate of the variance of the reserves.

As for "emerging solutions," Guy Carpenter is publishing, for the first time, cutting-edge InStrat research that includes the following.

- A dynamic financial modeling paradigm that simulates activities (such as loss transactions) over a timeline, rather than for discrete periods. This enables better analysis of time-sensitive contracts and the impacts of the time order of events.
- Methodology is presented for the identification of the appropriate form of a copula to express the nature of dependence between variables. Several new copulas are introduced.
- Risk management and reinsurance are linked directly to capital optimization and market value, merging the ideas of stochastic control and specific weaknesses of the Modigliani-Miller assumptions.

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- Frameworks are presented for modeling the insurance pricing cycle, in ways that reflect their stochastic nature and the impact of shock loss events.
- Models for reinsurance receivables risk go beyond the traditional credit risk associated with the ability to pay, and address a counterparty's willingness to pay.
- A wider selection of risk measures, not restricted to tail-based measures, is presented, going beyond traditional presentation of economic capital. Using either a capital allocation that maintains marginal pricing

principles or alternatives for allocating the cost of capital—without allocating capital per se—in risk-adjusted profit measurement is advocated.

Also included is Rodney Kreps' "Continuous Distributions" as a reference guide in the appendix.

The book is scheduled to be released in mid-February. Guy Carpenter has planned a variety of book-related events in conjunction with industry conferences throughout 2007. ♦



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An Exciting Line-Up of Sessions in Phoenix Sponsored by the Risk Management Section

by Todd Henderson and Anthony Dardis

The Risk Management Section is planning an exciting program at the 2007 Life Spring Meeting that will be held at the JW Marriott Desert Ridge May 10-11. This year's Spring Meeting is taking a slightly different format to previous years. A handful of special topic areas will be highlighted, with a number of sessions built around these topic areas. Having a wide variety of sessions will mean that each topic area can be examined in considerable depth and also cover the full range on the career ladder between the very technical and the managerial.

The highlighted topic areas for the Risk Management Section at the meeting are Extreme Events and, in conjunction with the International and Financial Reporting Sections, Value Added Risk Management.

Two sessions are planned under the Extreme Events topic area:

Extreme Events—Those of Most Concern and How to Model

This will be our "flagship" session under the Extreme Events topic heading. Panelists with practical experience of managing operational risks will discuss the impacts of "extreme events" such as pandemics, hyper-inflation, weather catastrophes, political meltdowns, etc. The following topics will be addressed:

- * Modeling the probability and measurement of extreme events

- * "Tail risk"

- * Biggest concerns for insurers

- * Implications to financial institutions

- * Reinsurance solutions and issues

Attendees will hear about various predictive methods and reporting and obtain information on which methods and reports are more useful than others.

Reputation Risk

A panel of risk management experts with practical experience managing operational risks will define reputation risk. What are its implications? How can reputation risk be measured and managed? The panel will consider various predictive methods and reporting and obtain information on which methods and reports are more useful than others. As a result of attending this session, attendees will be ready to take the first steps in assessing their firm's reputation risk and review protocols that are in place today for protecting its reputation using common industry terminology and practices.

Four sessions are planned under the Value Added Risk Management topic area:

The Actuary's Role in the Development of Economic Capital

This will be the highlighted session under the Value Added Risk Management topic area heading, and the session is being cosponsored with the International and Financial Reporting Sections. Economic capital is currently a hot topic in the insurance industry. It provides insurance companies with valuable information with respect to the optimal uses of capital, the differentiation between required capital and free capital. This panel discussion session focuses on the latest developments in the research for economic capital from an insurance company perspective. Companies in the EU and other parts of the world are developing economic capital models to enhance enterprise risk management processes. The panel will address the differences in approaches and assist the actuary in practical issues in implementing economic capital, the cost and reward relationship and the current best practice in the industry.

Latest Thinking in Value Added ERM

A panel of senior practitioners involved in ERM policy and implementation will present the current ERM developments, international thinking, ERM best practices and risk management in other industries.

ERM Modeling

A panel of expert practitioners involved in ERM modeling will identify what "best practice" companies are doing to get the most out of their risk management models and what are the

emerging techniques? You will gain familiarity with industry best practices in ERM modeling. The other topic area that the Risk Management Section will be examining at the meeting will be The Actuary as a "C" Level Risk Manager. There will be one session presented under this heading:

Emergence of the Chief Risk Officer

A panel of CROs will explain the function and skill sets required to serve as a Chief Risk Officer. How well placed are actuaries to work in this role? Attendees will learn what skills need to be acquired to sit in the "C" suite. Or, for the company executive, understand better how this role can serve the needs of their firm.

I hope you'll all agree that the program that's planned by the Risk Management Section has a lot to offer. We look forward to seeing you in Phoenix! ♦



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The Risks of Actuarial Software

by Trevor C. Howes

Actuarial software has come a long way during my life insurance career. Incredible advances in sophistication and speed of software now enable you to cope with the demands of the pending principles-based approach (PBA) in both valuation and capital assessment, and to build holistic approaches to risk management that were unimaginable even just a few years ago.

State-of-the-art actuarial systems will be critical to making a confident assessment of economic capital based on the financial risks arising from the assets and contract liabilities of the whole enterprise. However, at the same time it is likely that increased reliance on advanced actuarial software for strategic management decisions, statutory reporting, solvency assessment, business planning and enterprise risk management, will also increase your exposure to operational and model risk associated with the software itself.

It will be important therefore for you to consider these risks and adopt appropriate strategies and controls related to the design and use of modeling software that effectively balance risks, functionality and costs.

Software Programming Risks

With any new development or acquisition of software, you must consider the risk that the complex program code may not be operating as intended. An adequate control environment, including validation tests and signoffs during user acceptance testing, upon implementation and thereafter, can normally address this risk.

The need to perform validation tests to assure actuarial software quality is by no means new. Software used for all actuarial applications under the new paradigms will, however, be dra-

matically different from the past. Merely reproducing a selected sample of static reserve calculations under prescribed assumptions will not be a sufficient validity test for software that is performing stochastic analysis based on aggregate portfolio cash flows arising from newly written and in-force business, assets held and projected reinvestment actions. However you approach this critical issue of validation, the process is certain to become more complicated and time-consuming in the future.

When advanced risk analysis techniques based on complex software are used for pricing and key strategic decisions, as well as for justifying lower levels of statutory reserves and capital, as anticipated under the emerging PBA, the discovery and correction of software-based errors could well be a significant event, causing you competitive and financial disadvantages. Adverse consequences could include restatement and refile of statutory returns, heightened levels of scrutiny by regulators, auditors and rating agencies, damage to your market reputation, increased levels of minimum regulatory capital pending proof of adequate controls and the potential for longer term consequences of mispricing.

Recognizing that appropriate validation processes will require greater effort, there are several strategies that may help to mitigate your software quality risk:

- *Reduce risk with convergent software*—When complex code performing modeling and actuarial calculations is shared across actuarial applications, such as pricing, valuation, capital assessment, risk management and business planning, the benefits of validation efforts are also shared. With more users examining model results more regularly, errors are more likely to be detected under normal use. Conversely, if

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application specific software is retained in different departments and enhanced independently, the risks and costs of validation will be compounded and the opportunity to leverage the benefits of convergent software will be lost.

- *Revalidation is easier than validation*—Perform thorough initial validation tests on new software and follow up with regular retesting to confirm consistency of results over time. Incorporate appropriate quality assurance standards with controlled updates within software maintenance practices, or get assurance that your vendor follows them. Plan software for long-term use, so as to avoid total system replacement, and deal only with vendors who treat the software business and their client relationships as long-term investments.
- *Share the validation burden*—Another way to avoid the bleeding edge is to let others do the bleeding for you. Use vendor supplied programs that are common to many users, and if possible have been tested over a period of time. Minimize the amount of customization you perform on vendor software as stand-alone customization can greatly increase model risk. This will allow you to benefit from the validation efforts of other users before you, provided that the vendor treats bugs seriously, and promptly responds with software updates.

Model Building Risks

Quality concerns are by no means restricted to program code. You need assurance that the entire process of model building and maintenance will reliably produce supportable and consistent results within target time frames and with reasonable impact on resources.

Comprehensive risk analysis processes intrinsic to emerging valuation and capital assess-

ment frameworks will require stochastic processes over product lifetimes, which present run-time challenges especially for large portfolios processed on a seriatim basis. As the size of investment and business portfolios, and the complexity of risk mitigation techniques such as reinsurance and hedging increase, there will be ever-increasing pressure to balance staff and information technology (IT) resource investments with modeling tradeoffs. Model simplifications and compression techniques will lower runtimes but increase the risk that such models introduce approximation error.

Modeling challenges arising from the need to compress business models may be partly addressed by additional staff resources and by investing more IT resources, including hardware, software, network infrastructure and IT support. Conflicts with realistic budgets and available staffing will tend to be resolved in favor of greater use of model compression techniques than might otherwise be preferred, resulting in risk that is difficult to manage.

The problem is that the impact of data compression on a model's results can seldom be assessed with confidence without running the same calculations on the model without compression. There is danger that this cannot be done until after results are finalized and reported, if at all. A compression technique that produced an acceptable error at the previous reporting date may result in a more significant approximation error with aging and growth in portfolios, changes in invested asset position and changes in the economic environment.

The potential significance of modeling risk is similar to software quality risks, and deserves as much attention. Effective ways to reduce and manage modeling risk will typically attempt to

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The potential significance of modeling risk is similar to software quality risks, and deserves as much attention.

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The Risks of Actuarial Software

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reduce the effort needed to simplify or compress the models.

- *Design or purchase faster software*— Preferably, the software should be fast enough to minimize or avoid data compression altogether. Unfortunately, this strategy has been frustrated by the trend to readily customizable software, which typically will restrict the vendor's freedom to optimize program designs at both structural and detailed levels, compared to a system professionally designed and built for speed and efficiency from the bottom up.
- *Use distributed processing effectively*— Innovative use of grid processing techniques can help lower runtimes, but may involve a significant increase in purchase and maintenance costs, depending on how grid processing is implemented. Look for grid approaches that are easy to manage and highly scalable.
- *Use common or compatible software*— Adopting convergent software promotes greater built-in model consistency between applications, and also facilitates consolidation of multiple component models. Convergence requires carefully controlling or avoiding internal customizations of code. The reduced workload related to model management, validation and reconciliation allows actuarial staff to do a better job of model compression when it is unavoidable, as well as spend more time on analysis and interpretation.

Software and Model Maintenance Risks

Software and model changes will be more frequent and more substantive in coming years because of the rapidly evolving techniques of risk analysis and the changing regulatory paradigms under the PBA. The PBA by definition will also force more frequent model updates to adapt to the changing business profile and the current

economic and risk environment. The pressures to produce more complex analysis on large portfolios will accelerate the speed with which new technology will be embraced, opening new hardware options, new architectures, new operating systems, etc., which in turn will force additional application changes.

Product development and pricing processes will quickly adapt to the new regulatory paradigms, and new product designs will emerge based more on market demand than on exploiting loopholes in the former rules-based valuation methodologies. Hopefully, benefit design restrictions imposed by regulation will be relaxed once the safety net of PBA is in place and properly appreciated.

Once the organization relies on an advanced model in its reporting and ongoing risk management processes, it will be committed to keeping the model including the application software, up to date with regulatory, economic and business demands. Failure to do so will be unacceptable; yet making timely and effective software change may present challenges, especially when the need for change is unpredictable.

The first question is whether you (or your software vendor) will have the required expert resources available to make program changes on a timely basis. Newly hired staff are unlikely to be productive in complex programming environments for some time, and a dedicated, experienced team takes commitment and planning. Such a resource, once developed, must be fully utilized.

Changing software will also impact actuarial staff who maintain and operate the models. It is very unlikely that the same staff, with the skills to program changes in actuarial software efficiently and safely, will also be available to manage the application models, and interpret results on an ongoing basis. The skill sets are not necessarily

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Software and model changes will be more frequent and more substantive in coming years because the risk of the rapidly evolving techniques of risk analysis and the changing regulatory paradigms under the Principles-Based Approach.”

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the same. Therefore, ongoing training and support for operating staff will be required, in order to cope with regular changes in software features and capability, as well as with issues such as staff turnover and emergency projects requiring staff with software operating experience.

Software changes will also impact the ongoing validation effort, since whenever software is changed and enhanced, there is a risk of new bugs being introduced. The risk is commensurate with the scope of the change, and can be mitigated in part by proper standards of programming, use of version control software and careful discipline in testing and promotion of changes to production models. Unfortunately, this increased validation effort will coincide with the additional work of implementing the new software version and updating models.

Lower Risk Software Strategies

How then can you effectively control these risks in an era of increasing software complexity and frequent change? The critical step is to identify the problem and adopt a software build or buy strategy that recognizes the new realities. Consider building the following elements into that strategy.

- Minimize programming risks by designing or choosing software that is flexible with respect to product or investment definitions and actuarial assumptions without requiring user written code. That is, separate the programmers from the users and allow each to become specialists.
- Design software for the long term, and plan ahead for changes in business requirements and technology evolution, or choose a vendor who is committed to this philosophy. Recognize that a decision to customize purchased software code may effectively lock you in to maintaining that software yourself (if even possible), as opposed to utilizing vendor updates.
- Adopt a process of testing and implementing software updates that is smooth and manageable, with minimal impact on con-

sistency of results period-to-period, and minimal user intervention required to maintain the model definition.

- Minimize staffing risks by choosing convergent, flexible software that can be used for multiple applications or in multiple business units, since operating staff are then more easily transferred, or loaned in emergencies. Core programming teams, if required, should be anchored by longer term employees with established systems skills and not new recruits or rotating interns.
- If buying software, look to a vendor offering software that is easy to operate and maintain, and with a proven record of providing quality training and support.



Vendor Risk

While the software risks and mitigation strategies discussed above generally apply to both in-house and vendor-supplied software, there is no doubt that vendors will continue to fill a major role in the provision of and continued enhancement of actuarial systems. Accordingly, vendor risk will also become more significant as companies come to rely more heavily on third-party actuarial software.

Beyond the software quality and maintenance risks shared by both in-house and purchased systems, vendors may present counterparty risk in various forms. In addition to simply going out of business, software vendors may choose to deemphasize or abandon a product line, or software development in total, if they have other core businesses to fall back on. They may also find it more efficient and profitable to market a replacement product based on new technology rather than invest the time and effort to continuously improve the installed product, and keep it at the state-of-the-art.

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The Risks of Actuarial Software

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Even when the vendor continues to offer support for the software, there is a risk that they may lack the resources or incentives to proactively follow pending changes in regulation, accounting standards, actuarial practice and technology, and to incorporate necessary enhancements on a timely basis or at reasonable cost.

The willingness and ability of vendors to fix bugs and enhance functionality in existing software products may be compromised by the loss of key personnel, changes in financial condition or ownership or changes in business activities such as consulting that were closely linked to the software practice.

There is also a vendor performance risk arising from the development model chosen by the vendor, and the degree to which the vendor is able to deliver a fully functioning system solution on time and within budget. Popular yet risky alternatives to ready-to-use software at a fixed price include:

- *Buying a system concept:* The vendor agrees to provide a solution meeting a broadly described need, but has yet to develop it, perhaps wanting to have customers pre-fund the expensive development phase. The risk is that the vendor cannot deliver a working product within the cost and timeframe promised, if at all, leading to the label “vaporware.”
- *Buying a system shell:* The vendor describes the existing system as supporting a defined need, or promises it will. What is delivered is a system platform, perhaps with tools or templates, more or less applicable to the defined need, but the user must code the required functionality. This is called the “empty box” approach.
- *Buying a customization project:* The vendor offers a base system proposing that the required features can be incorporated by the buyer alone, or with vendor assistance, similar to administration system projects.

Vendor customization charges are based on time spent at consulting rates, but the project time and scope are ill-defined. This is known either as a “gold mine” or as a “bottomless pit,” depending on your viewpoint.

Given the above choices, clearly the lowest risk will be found in fully tested and functioning software products, integrated into a common stable system solution, providing well defined features with multiple users, delivered on time and within budget, and with the promise of ongoing maintenance and support. When major customization is required by the vendor, check their track record of customer satisfaction on similar projects, make sure that the scope and complexity of the project is understood, and that extra costs are contained.

While it would be nice to avoid vendor risk completely, the alternative of programming advanced actuarial software in-house is unlikely to be viable for all but the largest of companies, and outsourcing of software will continue to be the most common practice.

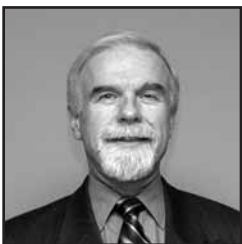
Thus the careful choice of a vendor would seem to be the best defense against the counterparty risk. Commitment to the product line and the market, evidenced by a track record of satisfied and loyal customers, plus a sound software business philosophy that is self-supporting and sustainable offers the best assurance of the longevity of your vendor and the continued quality of their product.

In Summary

There is no doubt that complex actuarial software will present increasing risk management challenges in the future. With some foresight and planning, however, the risks related to the use of advanced actuarial software tools can be faced and managed, allowing its incredible promise to be realized for the benefit of your insurance enterprise.

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There is also a vendor performance risk arising from the development model chosen by the vendor ...

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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.

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Preferred Format

In order to efficiently handle articles, please use the following format when submitting articles:

Please e-mail your articles as attachments in either MS Word (.doc) or Simple Text (.txt) files. We are able to convert most PC-compatible software packages. Headlines are typed upper and lower case. Please use a 10-point Times New Roman font for the body text. Carriage returns are put in only at the end of paragraphs. The right-hand margin is not justified.

If you must submit articles in another manner, please call Susie Ayala, (847) 706-3573, at the Society of Actuaries for help.

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Thank you for your help.



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