

Risk management



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JOINT RISK MANAGEMENT SECTION

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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 Sim Segal, editor, at sim.segal@watsonwyatt.com.

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

PUBLICATION DATES

June 2009
September 2009

SUBMISSION DEADLINES

April 1, 2009
July 1, 2009

PREFERRED FORMAT

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

- Word document
- Article length 500-2,000 words
- Author photo (quality must be 300 DPI)
- Name, title, company, city, state and email
- One pull quote (sentence/fragment) for every 500 words
- Times New Roman, 10-point
- Original PowerPoint or Excel files for complex exhibits

If you must submit articles in another manner, please call Kathryn Wiener, 847.706.3501, at the Society of Actuaries for help.

Please send an electronic copy of the article to:

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Covering You with TARP

By Sim Segal

STARTING WITH THE DECEMBER 2008

issue, we pledged to bring you at least one article in each of five topic categories, to broaden our ERM coverage. The categories include: risk identification; risk quantification; risk response; risk culture & disclosures; and a general category. We have honored this pledge once again in this issue, thanks to our contributors, our editorial staff, friends of the section, section council members and the professional editors at the SOA.

Thanks may also be due in part to our newly-introduced \$500 award for best article in one of three categories for which articles are scarce—risk identification, risk response and risk culture & disclosures. In this issue, we have six articles eligible for the award. The winner will be announced in the June 2009 issue. Please take special note of these articles and see if you can predict which will win the award.

Consider the \$500 award as a “Troubled Article Relief Program.” Now you have a shot at your own personal bailout funds—just author an article on an eligible topic. See the December 2008 Editor’s Note for a sample list of topics defining these categories.

We have not yet received any comments since last issue’s announcement of two \$50 awards for the best comments received on each issue, which we intend to publish in a reader feedback section. So, your odds of winning are pretty good right now, and all you need to do is send me an e-mail; feel free to send in any feedback, including topics you would like covered in future issues or commentary on any of the articles in this issue. We will maintain your anonymity, unless you specify otherwise.

Finally, we have made two other enhancements to *Risk Management*. In the past, we have published intermittently with about three issues annually. We are now committing to a quarterly publishing schedule. Also, in the past, we have published in black-and-white. We are now publishing in color and with a new look-and-feel. So, as of this day, change has come to *Risk Management*. We hope you enjoy it. ♦



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Got Risk?

By Donald F. Mango

THE ACTUARIAL PROFESSION has long enjoyed a strong professional presence and voice. True, we could probably stand to act more unified at times, but we do have a coherent professional “brand,” which is well represented by the image of the actuary campaign (www.imageoftheactuary.org/). We will definitely look to leverage this brand as we aim for actuaries to have a leadership position in ERM.

While the image campaign does include ERM expertise under the brand proposition, it is primarily a resource for actuaries to promote themselves and the profession. If actuaries want to lead the evolution of risk management, we must effectively promote what we bring to the table. This means **publicly** stretching ourselves more than we ever have by actively **promoting our skills and value**. ERM is a hotly contested, lucrative, burgeoning field, flush with well-armed competitors who will not voluntarily concede us territory, even if we believe our leadership

proposition to be self-evident. We will have to earn it in the public space, winning the hearts and minds of many publics—including lay audiences and those who have never heard of an actuary.

What endgame are we shooting for? Heck, it's a new year, so let's dream big. When people think solutions for risk, we want them thinking “actuary,” the same way they think “architect” when they want a home design, or “doctor” when their health is in question. How about a pithy tagline—“Got Risk? Get an Actuary.”

AN ERM PUBLIC RELATIONS STRETCH GOAL

It is well and good to want to be indispensable in the risk space, but how can we actually get there? While we have done much in ERM to educate our members and create technical content, we now need to bolster the public **perception** of actuaries as risk management professionals. I boldly suggest we make this a stretch goal for ourselves in 2009: to elevate our profession's

public image in the ERM space. This will be less about technical journal articles and seminars, and more about trade publications and interviews. We will need to step outside our comfort zone.

Speaking of steps, we actually recently took an excellent first one, when the JRMS, along with the SOA Investment Section, the International Network of Actuarial Risk Managers (INARM), and the Enterprise Risk Management Institute International (ERMII), sent out a call in late October seeking short essays on the financial crisis. The essay format was chosen specifically to provide for concise expression of individual expert views.

The response was a happy deluge of high quality submissions, from which a crack team of volunteers (assisted by SOA staff)¹ selected and categorized the best thirty-five for publication. The final product can be found on the SOA Web site at www.soa.org/essays.

I encourage everyone to take a look. The essay format makes for easy piecemeal reading (a necessity for me in this fast-paced world).

While this essay collection is a great achievement in its own right, upon reflection, we see it represents an even bigger win by providing us a template to replicate going forward. We now have a proven vehicle to amass the thought leadership of our members in a responsive, timely fashion, and publish it under the actuarial profession's brand.

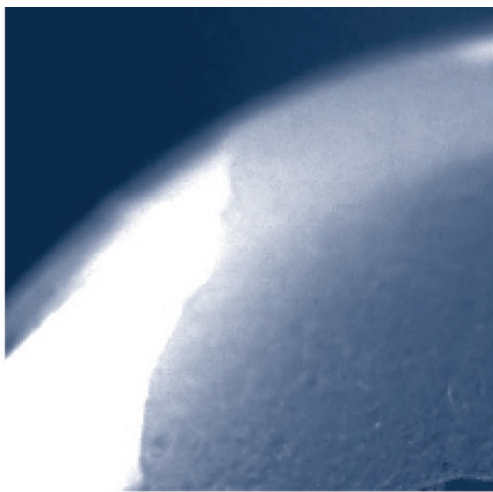
The JRMS Council will be discussing how to standardize this process and replicate its success on a regular basis in the future. This will benefit our members by expanding opportunities to contribute, and increasing the actuarial “risk management profile.” ♦



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FOOTNOTES:

- ¹ Editors: Bob Wolf, Steve Siegel, Frank Sabatini and Gary Hatfield.
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A Global ERM Credential

By Mike McLaughlin

INTEREST IN ENTERPRISE RISK MANAGEMENT (ERM) is not just a North American phenomenon.¹ The financial crisis, epidemics, natural disasters, and terrorism unfortunately exist all over the world. New risks are emerging and they can spread rapidly. They affect not only insurers but individuals and organizations of all kinds. Actuaries around the world are affected, whether we like it or not. But, risk is opportunity! Our profession has the opportunity with ERM—perhaps the duty—to apply our skills much more broadly than before, to help our clients, employers, and the public. As actuaries we should consider a wider range of risks, acting in combination rather than in isolation, and we should be looking outside our traditional areas of pensions and insurance, and across geographic boundaries.

In response, the Society of Actuaries introduced the Chartered Enterprise Risk Analyst (CERA) in June 2007.² The CERA is the first actuarial ERM credential in the world. The SOA modified its exam structure, created a grandfathering provision, and embarked on a marketing campaign to promote the benefits of ERM by actuaries. This was done in record time. There are over 300 CERAs as of the end of 2008, and there is a target of over 600 CERAs by

the end of 2009. The SOA wants to increase the supply of credentialed experts, so as to extend the benefits of our actuarial approach, while of course allowing no compromise in the quality and rigor of the credential.

The CERA credential identifies the set of skills that will be needed by employers and clients in executing the discipline of ERM. It is intentionally much less life insurance-specific than other SOA credentials.³ Already, based on



anecdotal evidence and a formal employer survey, there is good evidence that the credential is badly needed and will gain broad acceptance. Of course, a credential is a starting point for a professional. Based on the initial survey responses, employers place high value on experience in the chosen industry. A second, more detailed phase of the employer survey is already underway.

GLOBAL INITIATIVE

Recognizing the value of the CERA in North America, an international group of actuaries led by Harry Panjer and Fred Rowley is working toward a global ERM credential. While this is not officially under the auspices of the International Actuarial Association, the IAA supports the concept. The concept was initially discussed at an IAA meeting in Banff. Then in Dublin in 2007, a group of eight organizations signed their intent to develop the concept.⁴ At that meeting, the SOA and CAS both indicated general support, subject to approval of their respective Boards. Since then, approximately 15 more IAA member organizations have expressed interest in this effort.



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FOOTNOTES:

¹ Enterprise Risk Management is the discipline by which an organization in any industry assesses, controls, exploits, finances, and monitors risks from all sources for the purpose of increasing the organization's short- and long-term value to its stakeholders. Definition, courtesy of the Casualty Actuarial Society.

² CERA is pronounced C-E-R-A, not "seerah" or "sarah."

³ Life insurance content was removed from the ASA syllabus, and ERM related content was added, to produce an alternative path ASA-level credential, the CERA. Over time the content of the CERA (and indeed all credentials) may evolve.

⁴ Actuarial Society of South Africa, Association of Mexican Actuaries, Canadian Institute of Actuaries, Faculty of Actuaries, Institute of Actuaries, Institute of Actuaries of Australia, plus SOA and CAS as mentioned specifically.

“Recognizing the value of the CERA in North America, an international Group of actuaries is working towards a global ERM credential.”

The Global ERM Credential qualification is supported by two working groups. The first, led by Dr. Panjer, is developing the syllabus. An extensive set of overall objectives and learning objectives have been defined. The SOA has supported the efforts of the syllabus working group, through the knowledge and hard work of Kathy Wong, Bob Wolf and others. In fact, the learning objectives as defined are heavily based on the CERA. There is some debate around the level of the credential, with one school of thought more advanced (namely, a fellowship credential or post-fellowship specialty certificate), the other less advanced. At this time the credential appears to be similar to an ASA-level credential, although there isn't complete unanimity among the organizations. Perhaps various IAA member organizations will select their own level.

The second working group, led by Fred Rowley, is addressing recognition of the credential around the world. A Treaty of Recognition and Accreditation has been drafted to coordinate the various signatory organizations. Provisions of the Treaty include a common global syllabus, full mutual recognition by all signatory organizations, a code of ethics, requirements that each organization promote the credential, and education standards. Education will be provided—depending on the country—by examinations, universities, other parties, or a combination. Due diligence on each country's organization will be provided initially and at periodic intervals thereafter, to maintain consistency of education. The SOA has supported this working group also, through the efforts of Sim Segal and others.

Creating a global credential is an ambitious project. The working groups are dealing with many of the same issues that the SOA addressed in creating the CERA, but with many more participating constituencies. As just one example, what should the new credential be named? It's not a trivial problem. The name has to be available in many countries, and it has to work not just in English but other languages as well. The global credential is code-named “XRX” as a placeholder. But all the “good” three letter credentials with R for risk in the middle,

are gone. So for example, PRM is Professional Risk Manager, but PRMIA uses that. FRM is Financial Risk Manager, but GARP has that.

Perhaps the biggest obstacle to the XRX is consistency across borders. A global credential that varies by country is not a global credential. For example, will different organizations set the credential at different learning levels? Will they substitute some syllabus content, and if so how comparable is the content to that of other countries? Will university-only education be equivalent to self-study and examinations? Would an XRX from France be an automatic member of the professional organization in Germany? There seem to be no other global credentials formed by consensus among multiple organizations. The working groups are really blazing a trail.

SOA POSITION⁵

The SOA participated in the global ERM credential discussions at IAA meetings throughout 2007 and 2008, first in Dublin and again in Cyprus. As mentioned previously, the SOA also has supported the efforts of the working groups through diligent volunteer and staff efforts. The SOA supports the idea of a global credential and is willing to work with other organizations to achieve that goal. However there are some concerns. If the SOA became a signatory, we would need to recognize and promote the XRX as issued by all other signatory organizations. There is some concern about consistency of the XRX from different organizations, and concern that promoting the XRX in North America would confuse the marketing message around the CERA.

These issues were discussed at length at the SOA Board meeting in October 2008. In summary, blanket full recognition of another credential would be a major shift from the current very careful, case-by-case approach toward mutual recognition that is now taken. Equally important, the CERA is already a global ERM credential. While most CERAs currently are North American-based

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FOOTNOTES:

⁵ This article represents the author's opinion and is not necessarily the official position of the SOA Board of Directors.

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professionals, the credential is available to candidates throughout the world, as are the ASA and FSA. The SOA doesn't actively recruit members where another IAA member organization already offers credentials by examination, but is a global-reaching organization, with over 15 percent of SOA membership based outside of North America. The SOA Board has approved CERA grandfathering to members of other organizations including the Casualty Actuarial Society, the Actuarial Profession in the United Kingdom (namely, the Institute and Faculty), and the Institute of Actuaries of Australia. Perhaps SOA efforts should be focused on continuing to develop the CERA globally.

The SOA has had preliminary discussions with a few organizations, on a case-by-case basis, to explore the pos-

sibility of their using the CERA, under certain constraints, as their own ERM credential. Although it would not automatically extend to all IAA member organizations, this would expand the CERA as a global credential. The marketing and development already done for the CERA would immediately benefit other organizations.

Despite the concerns about another credential, the SOA supports actuaries in ERM globally and is not opposed to the XRX initiative. Actuaries should play a major role in assessing, controlling, exploiting, financing, and monitoring risks from all sources for organizations in any industry, in any country. ♦

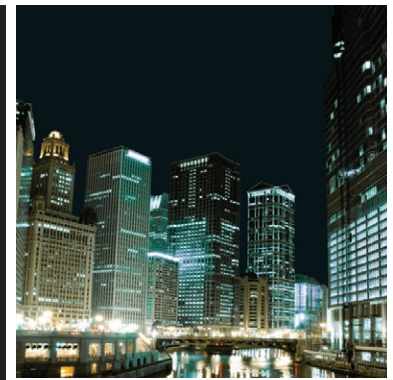


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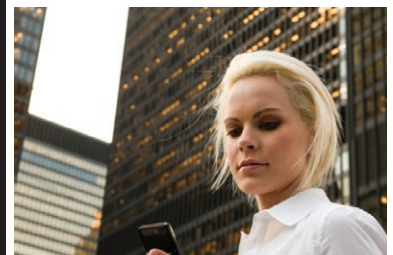
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The Financial Crisis—the CRO Forum’s Views on the Consequences for Enterprise Risk Management and Regulation in the Insurance Industry

By CRO Forum



Editor’s Note: This article was originally published by the CRO Forum in October 2008. It is reprinted here with permission.

INTRODUCTION

THE RECENT DEVELOPMENTS in the financial markets have raised serious questions about the effectiveness and efficiency of risk management in financial services. The CRO Forum addresses this topic from an insurance industry perspective and will focus on the implications of the crisis on Enterprise Risk Management and regulation in the industry as a whole.

While we acknowledge that it may be premature to undertake a comprehensive post mortem on the current financial crisis, we nevertheless wanted to express our view now, in particular in the light of the ongoing efforts in terms of insurance regulation (Solvency II).

ENTERPRISE RISK MANAGEMENT (ERM) —LITMUS TEST PASSED SUCCESSFULLY?

The insurance industry is not immune towards the effects of the current crisis. Insurance companies have significant asset bases that are affected by the currently depressed market values of assets, both from lower equity values as well as a significant widening of credit and liquidity spreads. Also, certain insurance undertakings are part of larger financial groups, and may hence suffer from contagion effects.

Nonetheless, the insurance industry as a whole has managed to navigate through the crisis, although there are exceptions. Is this because ERM is strongly embedded into the genes of the organisations? Or just because exposures to “toxic products” have been lower as compared to the banking industry?

Indeed, insurers in average have been more cautious in terms of taking on structured credit risk. This has certainly also been driven by lessons learnt in the past, in particular the 2000/2003 crisis, which triggered large scale improvements in ERM, for instance a strong focus on Asset Liability Management. In this regard, the CRO Forum is confident that ERM has helped the insurance industry coping with the crisis.

The CRO Forum also believes that this crisis, which is characterized by a complete dryout of credit and a subsequent collapse of liquidity, naturally hits the insurance industry to a lesser extent. Insurers are primarily funded by policyholders, which is a naturally more resilient source of funding. In P&C insurance, an insurance event needs to occur before policyholders can demand funds, while surrender penalties and tax considerations provide a hurdle for policyholders to lapse their traditional life insurance policy.

Nevertheless, just like the rest of the financial industry we do rely on risk models and hence there is a need to carefully analyse the reasons for risk management failures in financial institutions, and draw the conclusions for our models and ERM approaches.

“QUO VADIS, RISK MANAGEMENT?”— WHAT HAS BEEN LEARNT IN THE LIGHT OF THE CRISIS

A good deal of the pre-crisis discussion went around the details of risk modelling. If there is one thing the crisis reinforces, it is: Risk management is much more than models. The CRO Forum believes that risk models are indispensable for managing the business. However the risk models must be—and in many cases are already—complemented with Internal Controls, such as risk concentration limits on a notional gross and net basis, Probable Maximum Loss (PML) limits, or stress and scenario testing. Finally, there is no substitute for a deep understanding of the risks involved in the business—and for common sense.

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Every crisis of this dimension is associated with fundamental changes of business models and hence implies changes of basic parameters. Parameter values, e.g. default probabilities and equity market stresses, which have been estimated from pre-crisis times may no longer be adequate during and maybe even after the crisis. Risk management is just as much about preparing for what has not happened as it is for understanding and preparing for what has been experienced in the past. Stress tests and scenario planning can address the problems related to system change. Consequently these tools will become increasingly important and commonly used.

In terms of valuation, we believe that the market consistent valuation approaches that are the basis for our risk models have proven to be a suitable approach in times of crisis. The essence is the word “consistent” in the term market consistent: Insurance liabilities are usually not traded in liquid financial markets, but are often fulfilled over the lifetime of a policy. Market consistent valuation therefore means that components of the insurance liabilities that can be replicated in liquid financial markets shall be valued at market values, and the components that can't shall be marked to model. The liquidity of a market can change over time, in which case the valuation is adjusted accordingly. It is our view that very much the same approach can be applied to value assets for which trading has ceased to exist. Furthermore, due to the fact the insurance liabilities are not traded in liquid markets, the valuation of those liabilities should reflect actual illiquidity spreads. We have expressed this view in detail in our paper “Market Value of Liabilities for Insurance Firms”, published July 2008.

Given the huge market value losses in certain financial institutions, the CRO Forum believes that Risk Management must be viewed as an investment into the company's future rather than simply as a cost factor. We expect to see management and regulators seeking to further strengthen ERM functions, resulting in growing powers and responsibilities of CROs and their teams. Given the role of risk management as second line of defence after line management, it is important that risk teams have the freedom and the capability to take an independent view from business management. A word of caution here: independence does by no means imply ignorance. We

are firmly convinced that both operating units and risk management functions need a deep understanding of the business. Independence has to be supplemented by mutual understanding and respect. Hence risk management will increasingly become an integral part of the business.

THE IMPACT ON REGULATION— SOLVENCY II ON THE RIGHT TRACK

The financial market crisis has demonstrated that a principles based, economic and risk based regulatory framework is essential for the stability of the financial industry. For example, the absence of appropriate risk-sensitive capital charges for sub-prime related lending and for CDOs has contributed to the current crisis. Traditional regulatory approaches did not identify and mitigate these critical risk concentrations. Differences between regulatory regimes create arbitrage opportunities and hinder efforts for greater industry transparency which in turn contributes to an increased risk of instability and crises. Consequently we favour an approach to regulation that is consistent across legislations.

The CRO Forum therefore believes that the current crisis strongly reinforces the case for Solvency II, in particular its principle based, economic and risk-sensitive approach. In many respects, Solvency II is a reflection of the advances the insurance industry made in terms of ERM in the aftermath of the 2000/2003 crisis. While the impact of the current crisis on these efforts needs to be evaluated, we are very confident that the basic principles of ERM and Solvency II remain equally valid. We therefore believe that the EU legislators should adopt the Solvency II directive as soon as possible, and not postpone the legislative process. Insights resulting from the crisis shall be addressed through the implementing measures (level 2 of the legislative process).

The necessity for the group supervision and the group support regime has also been reinforced. It has become clear that there is a need to also supervise holding companies in a similar fashion to other group entities. Group supervision would stimulate communication between group companies, its subsidiaries and regional regulators. The CRO Forum views lack of communication and silo mentality as one of the main drivers in the current crisis.

Attention shall be paid to the potentially pro-cyclical nature of the Solvency II regulation. In particular, forced sales of assets in market downturns should be discouraged. A decrease in available capital due to distressed market prices for assets shall not require immediate regulatory intervention. We strongly believe that this should be dealt with in Pillar 2 as part of the regulators' ladder of intervention, rather than reflected in the capital requirements.

In responding to the crisis the regulators need to recognize the structural difference between the banking and the

insurance industry. Imposing actions on insurance companies solely based on observations in the banking industry would not be appropriate.

As with risk management and the operating business, the CRO Forum strongly advocates the equality of talent between regulator and industry. Only then can regulators take appropriate decisions. ♦



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Preparing for a New View of U.S. Earthquake Risk

By Prasad Gunturi and Kyle Beatty

INTRODUCTION

THE UNITED STATES GEOLOGICAL SURVEY (USGS) released the latest version of its National Seismic Hazard Maps (NSHM) in April 2008. The maps, which were last updated in 2002, define the latest scientific view of earthquake hazard at varying probability levels across the United States. These maps along with the 2007 Uniform California Earthquake Rupture Forecast (UCERF) report have formed the foundation of the catastrophe model updates that will be introduced by the commercial modeling companies (AIR, EQECAT and RMS) in early 2009 and, ultimately, will have a significant impact on the risk modeled for property and workers compensation portfolios.

Three key themes have emerged from these studies that could have significant implications on the insurance industry:

1. The greatest magnitude changes in seismic risk have occurred in California, with significant but lesser changes in the Pacific Northwest.
2. Measurements from recent large earthquakes around the world indicate that tall buildings in California may experience less shaking in a large earthquake than was previously thought.
3. The vendor models (AIR, EQECAT and RMS), however, will be fully recalibrated and therefore the seismic hazard changes summarized in this article may be offset or amplified by changes to other modeling components, such as engineering or demand surge models.



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The table above summarizes the changes in seismic hazard between the 2008 and 2002 USGS' maps. The remainder of the article focuses the changes to the USGS'

Changes in Seismic Hazard Between the 2008 and 2002 USGS' Maps by Region and Building Type

	0.2 sec Spectral Acceleration (2-Story Building)	1.0 sec Spectral Acceleration (10-Story Building)
	475 Year Return Period	475 Year Return Period
CALIFORNIA	Moderate to small decreases -15% to 0%	Large to moderate decreases -35% to -15%
PACIFIC NORTHWEST	Moderate to small changes -15% to +5%	Moderate to small decreases -25% to 0%
INTERMOUNTAIN WEST	Moderate changes -25% to +15%	Large to moderate decreases -35% to -15%
NEW MADRID	Moderate to small decreases -25% to -5%	Moderate to small decreases -15% to 0%
NORTHEAST	Moderate to small decreases -25% to -5%	Moderate to small decreases -15% to -5%
SOUTH CAROLINA	Moderate to small decreases -20% to -5%	Moderate to small decreases -15% to -5%

earthquake hazard in the California region for high rise (10-story) buildings.

EARTHQUAKE HAZARD DEFINITIONS

Spectral acceleration (SA) is one of the hazard descriptors commonly used in the USGS hazard maps. The shaking experienced by a building is dependent on its height (which determines its resonant frequency). Spectral Acceleration (SA) is used to distinguish the hazard experienced by buildings of differing heights. SA is expressed in units of "g" at different periods, such as 0.2 sec or 1.0 sec; however, it is more intuitive to translate these periods into approximate building heights. As a rule of thumb, you can approximate the building height by multiplying the time period by 10—0.2 sec period \approx 2 stories and 1.0 sec period \approx 10 stories.

Maps presented in this article are for 1.0 sec SA (10-story) at 475 years (10 percent exceeding probability in 50 years), to give you insight into how the changes in seismic hazard vary for a representative building type. The maps

“...model changes will affect underwriting guidelines, capital requirements and portfolio management strategies.”

assume uniform soil conditions and assume a hypothetical, uniform distribution of buildings at every location. In reality, high-rise buildings will be concentrated in city centers, business parks, and other commercial areas. Therefore, the actual changes in seismic hazard experienced by the industry will be a blend of the 1.0 sec maps and other frequencies that are not presented here.

NEXT GENERATION ATTENUATION (NGA) EQUATIONS

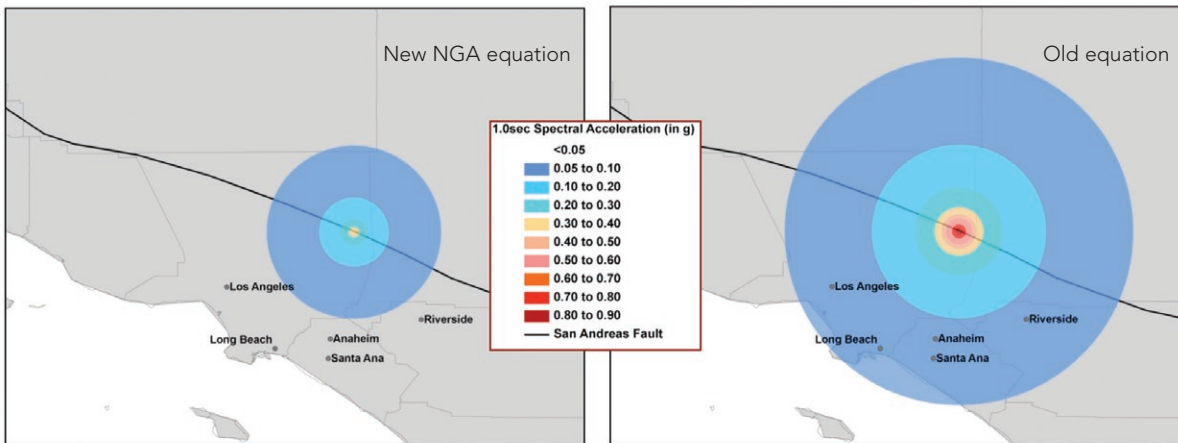
The changes in the USGS’ seismic hazard estimates in California were primarily the result of implementing new groundmotion attenuation models called Next Generation Attenuation (NGA) equations. Attenuation equations predict how groundmotion decays with increasing distance from an earthquake’s epicenter and are used to determine the size of the earthquake footprint. Attenuation equations vary based on the fault type, the fault rupture characteristics, and the ground-motion modifications that occur along the path between the source and the site (e.g., soil

type). Following an expert panel’s recommendations, the USGS considered three of the five NGA attenuation equations for calculating the ground motion from crustal earthquake sources in the western United States. The ground motion was calculated for each of the three attenuation relations separately, and then combined using a weighted logic tree approach.

The new NGA equations are significantly different from previous equations (especially for tall buildings). The following maps contrast a M=7.0 event footprint (for a hypothetical single-point rupture) for a 10-story building (1.0 sec SA) as predicted by the new and old attenuation equations for an earthquake scenario on the South San Andreas Fault.



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Comparison of Campbell & Bozorgnia 2003 attenuation equation with Campbell & Bozorgnia 2006, NGA. M7.0, strike slip faulting, soft rock site conditions.

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Estimates of shaking felt by high-rise buildings (10-story) using the new NGA equations is more than 40 percent lower compared to the estimates using old equations and the size of the damage footprint for high-rise buildings is significantly smaller in size for the new NGA estimates as compared to the old equations.

CALIFORNIA REGION

The USGS' National Seismic Hazard Maps (NSHM) and Uniform California Earthquake Rupture Forecast (UCERF) are two studies that describe the latest view of earthquake risk in California. These studies use two different techniques to quantify the earthquake risk in California.

The USGS' NSHM for California is based on a *time independent* earthquake forecast in which the probability of each earthquake rupture is completely independent of the timing of all others. The NSHM describe the probability of shaking caused by these quakes ("seismic hazard") at a given location.

The Working Group on California Earthquake Probabilities (WGCEP) team develops the Uniform California Earthquake Rupture Forecast (UCERF) for California. The UCERF is based on a *time dependent* earthquake forecast, in which the probabilities of a future event is conditioned on known previous earthquakes have occurred. The latest time dependent model, the 2007 UCERF, was released in early 2008, where the earthquake forecast was expanded to cover the entire state of California using a uniform methodology. The UCERF study describes the probability of an earthquake of various magnitudes (M) occurring along various faults in California. However, this study does not describe the probability of shaking caused by these quakes ("seismic hazard") at a given location. This is an important distinction between NSHM and UCERF.

Time dependent model provides a more accurate representation of the probability of a California earthquake, since most faults have been well studied. Areas with a low probability of a local fault rupture, however can experience strong shaking and damage from distant, powerful earthquakes. For this reason, these two studies together will provide a complete view of the seismic risk in California.

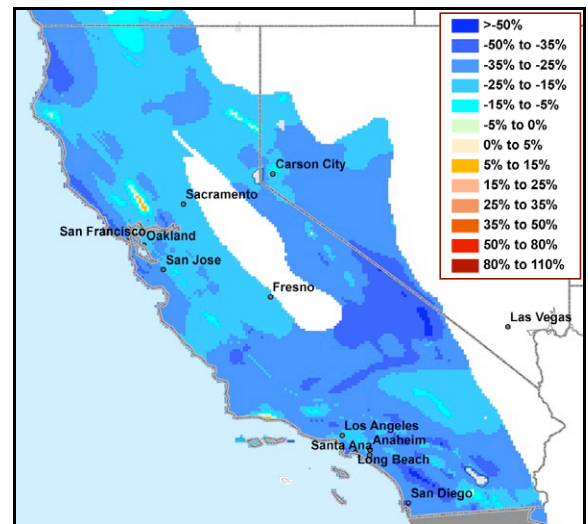
Seismic Hazard (Time-Independent view)

The new USGS seismic hazard maps for California are significantly different from the previous maps. The seismic hazard related to high-rise buildings in particular has decreased. The primary reason for the large decreases in the modeled hazard is due to the implementation of the Next Generation Attenuation (NGA) equations

The map below shows the spatial patterns of change in the amount of shaking experienced by high-rise (e.g., 10-story) buildings at the 475-year return period. Only those areas where hazard is significant enough to result in damage at these return periods are shown on this map. The areas along many of the fault traces are where changes in modeled damage could be lower than the changes in modeled hazard presented in the map. This conclusion is based on a representative building damage function. Outside these shaded areas, it is possible for the change in modeled damage to exceed the changes in modeled hazard.

Change Between the 2002 and 2008 USGS Hazard Maps at 475 Year Return Period for 10-Story Buildings

(+) increase/ (-) decrease



“Adoption of NGA equations could mean risk managers need to update business rules based on the distance to a fault.”

These significant changes to the seismic hazard could mean catastrophe risk managers will need to update their business rules and underwriting guidelines. Especially, business rules that are based on the distance to a fault, such as exposure aggregate thresholds, underwriting guidelines or insurance rates, will be significantly affected by these changes.

Earthquake Probabilities (Time-Dependent view)

The UCERF study describes the probability of an earthquake of various magnitudes (M) occurring across California. The results of the new study are similar to those in previous studies; however, the new probabilities calculated for the Elsinore and San Jacinto Faults in Southern California are about half of the previous predictions.

The new forecast indicates that California has a 99.7 percent chance to experience a $M \geq 6.7$ earthquake in the next 30 years and the likelihood of $M \geq 7.5$ earthquake in the next 30 years is 46 percent. The southern San Andreas Fault (near Los Angeles) has the highest probability (59 percent) in California of generating at least one $M \geq 6.7$ earthquake in the next 30 years, which is 23 percent higher than the time-independent probabilities.

In the northern California, Hayward-Rodgers Creek Fault (near Oakland) has the highest probability (31 percent) of generating at least one $M \geq 6.7$ earthquake in the next 30 years, which is 33 percent higher than the time-independent probabilities. The time-dependent probability for an $M \geq 6.7$ earthquake to occur on the northern San Andreas Fault (near San Francisco) is about 13 percent lower than time-independent view.

IMPLICATIONS OF NEW STUDIES ON VENDOR MODELS

The studies performed by the USGS and the WGCEP are very comprehensive, and have had wide scientific and catastrophe modeler adoption. These studies are the impetus for commercial catastrophe risk modeling companies to make periodic updates to their U.S. Earthquake models. The commercial modeling companies, however, cannot directly implement the National Seismic Hazard Maps and the Uniform California Earthquake Rupture Forecast into their models. This information must be translated into an event-based catastrophe model that is suited for the insurance industry. Therefore, although all modeling

companies may start their development activities from a similar place, their implementation of these studies will result in different answers to the same question.

How will changes to the commercial models differ from the USGS changes?

There are three ways the changes in the commercial models will differ from the USGS:

1. The commercial models are broader in scope than the USGS. (e.g., site-specific amplification, basin effects, fire following, loss amplification, time dependency, etc.)
2. The commercial model developers will selectively differ in their scientific assumptions than the USGS.
3. The commercial modelers will recalibrate their models. It is plausible that changes to the engineering components of the models will offset or amplify changes to the seismic hazard.

Commercial models are broader in scope than the USGS' maps, but this point has significant implications for how we interpret the information in this article. For example, the modeled risk to the structure coverage for 10-story buildings may go down in the new models, however, new methods for modeling loss amplification may offset some of these changes. In addition, some of the modeling assumptions made in the new maps might have already existed in the current version of the vendor models. Therefore, the changes in the USGS' seismic hazard maps cannot be used to precisely predict changes that will occur in the vendor models.

In addition, commercial modelers often take the opportunity to upgrade many other model components, in addition to seismic hazard. Ultimately, the insurance industry is most interested in the product of all these components working together to assess the full catastrophe risk of a portfolio—not by each component in isolation. Therefore, the modelers will recalibrate their models to ensure that the results are well validated, whilst ensuring that each component is scientifically defensible. As such, changes in the seismic hazard component of the model may lead to refinements in the damage/ vulnerability

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model. These multiplicative changes could result in offsetting or amplifying effects.

CONCLUSIONS

We can not exactly predict how the commercial models losses will change based on the USGS hazard changes. However, the USGS modeled hazard decreases for high-rise buildings are so substantial, significant decreases in modeled losses are likely to occur if the vendors fully adopt the NGA equations. One way we can get more insight into these changes is by studying the spatial patterns of change in hazard estimates and understanding the loss sensitivities from changes to the hazard. By virtue of the shape of a building damage function for earthquakes, the amount of damage a building incurs rapidly decreases as the ground motion attenuates from the fault (all other components remaining constant). Therefore, as an example, a 20 percent decrease in hazard can equal a 30-50 percent decrease in expected damage. This means that modeled damage for 10-story buildings may decrease by a much larger amount than the change in modeled hazard shown in the maps presented in this article. The exception to this rule is the immediate vicinity of faults where marginal changes in hazard have little effect on modeled damages.

At this point, we can conclude that model changes will be significant for many portfolios, and the patterns of change will be complex and multifaceted. These changes will affect underwriting guidelines, capital requirements, and portfolio management strategies. Also, these changes will affect the downstream risk to Workers Compensation portfolios. Changes to portfolio loss estimates in the Western United States will be highly influenced by the new NGA equations, especially for mid-rise and high-rise buildings and business rules that are based on the distance to fault will be significantly affected. Changes to loss estimates in the Central and Eastern United States will be relatively low compared to changes to the Western United States.

This article is a shortened version of a report by authors, released by Willis in 2008 entitled: "Preparing for a New

View of U.S. Earthquake Risk." This article focuses on the critical changes to the view of earthquake risk in California region. We encourage readers to refer to the original document for information on other regions, which is available at http://www.willisre.com/html/reports/catastrophe/Willis_Report_Preparing_for_a_New_View_of_US_EQ_Risk.pdf ♦

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Survey of Emerging Risks

By Max J. Rudolph

EMERGING RISKS can be thought of from two perspectives; completely new risks that have never been seen before, and risks that are evolving in unexpected ways. Examples of the former include the release into the human population of the AIDS virus and the development of the atomic bomb, while the latter would include the home mortgage market in the United States and liability regimes (litigiousness). Many emerging risks fall in a gray area. After the fact, some claim to have predicted the risk. Others repeatedly claim yet another “Perfect Storm,” absolving them of accountability. Part of a risk manager’s job is to provide environmental scanning of potential risks. According to Nassim Taleb, author of *The Black Swan*, the goal is to turn a lack of knowledge about emerging risks into tools that aid decision making.

The recent financial environment has provided credibility to those who have been laughed at for years while trying to place topics like financial leverage on the strategic agenda. Firms of all sizes (and individuals) had no game plan in place to address the current crisis. In reality very few were prepared for the extent of the recent impact on a wide range of financial instruments. Firms with high amounts of leverage, such as hedge funds and investment banks, were especially susceptible to the downturn. A risk manager prepares a firm to succeed across a variety of potential scenarios.

WHEN THE MUSIC STOPS...

Emerging risks require managers and modelers to think outside their comfort zone. This is not easy. There is often no incentive to incorporate risks being ignored by competitors. Consider this quote from Chuck Prince, CEO of Citigroup, in summer 2008.

“When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you’ve got to dance. We’re still dancing.”

He was referring to subprime loans. Had he elected to take Citigroup out of this market he would have been under great pressure from external stakeholders to maintain financial growth rates. When markets are calm, CEO’s are fired for making reasonable risk-driven decisions. When markets become volatile, they are fired for exposing the firm to these unanticipated risks.

SURVEY BACKGROUND

This article summarizes an emerging risk research project completed by the Joint Risk Management Section. The full report can be found at <http://www.soa.org/research/risk-management/research-2009-emerging-risks-survey.aspx>. Rather than creating a unique set of emerging risks to consider, a set developed by the World Economic Forum was chosen as reasonable. Their reports, starting in 2007, can be found at www.weforum.org. The 23 risks have been categorized as Economic (5), Environmental (5), Geopolitical (7), Societal (4), or Technological (2). These emerging risks were held constant between the two surveys to allow comparisons. The current survey added questions related to current topics.

INFLUENCED BY OUR ENVIRONMENT

An article describing an earlier survey completed with the INARM (International Network of Actuarial Risk Managers) group can be found on pages 18-21 of the *International News* August 2008 issue (International Survey of Emerging Risks, <http://soa.org/library/newsletters/international-section-news/2008/august/isn-2008-iss45.pdf>). You might expect surveys of potential future risks to be stable over time. This has not been the case. The respondents were clearly impacted by the current environment. At the end of April 2008, when the first survey was issued, the S&P 500 stood at 1,386 (according to Yahoo Finance), the price of a barrel of oil was \$114 (per the Energy Information Administration), and the U.S. dollar was at 1.56 Euros. At that time the top four emerging risks were

1. Oil shock/energy supply interruptions (57 percent)
2. Climate change (40 percent)
2. Blow up in asset prices/excessive indebtedness (40 percent)
4. U.S. current account deficit/fall in U.S. dollar (38 percent)



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The current survey was issued in early November 2008. By the end of October, using the same sources, the S&P 500 had dropped 30 percent to 969, the price of a barrel of oil had dropped 40 percent to \$68, and the U.S. dollar had strengthened 23 percent to 1.27 Euros. Each respondent was asked to list up to five emerging risks that would have the greatest impact over the next few years. The 412 total responses, including nine in the Other category, total 4.6 per respondent. The top four emerging risks from the survey are

1. Blow up in asset prices/excessive indebtedness (64 percent)
2. U.S. current account deficit/fall in U.S. dollar (48 percent)
3. Oil price shock/energy supply interruptions (39 percent)
4. Middle East instability (34 percent)

As might be expected for a group of risk professionals completing a survey asking what they were worried about, the Economic category received the most responses, followed by Geopolitical. The others trailed far behind. It will be interesting to trend over time to see if this is a lagging indicator or a contrarian indicator. Are risk professionals able to step outside their current surroundings to predict emerging risks or do they get locked in to today's major issues and ignore the risk that is about to explode into consciousness after years of calm. Many would argue this is what happened with the recent financial problems, where managing the economy to avoid the ebbs and flows made it too easy to take risk, and managers were lulled into a false sense of security. The best risk managers will need to overcome this bias.

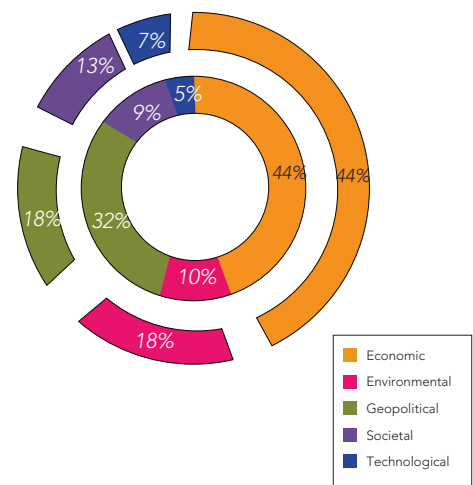
The world changed materially between the two points. In the future, it might be useful to average the response rates across time to overcome this bias, and the data will be saved in order to accomplish this. Most of the same risks received top billing, but when oil prices were high in May we were more concerned about oil prices, and when oil prices dropped and asset prices blew up we moved our concerns to the risk most associated with the current financial crisis. The Mumbai attacks occurred in late November 2008 after most of the participants had completed their survey and did not impact the overall results, although it should be noted that the two responses completed after

the attacks occurred both included International terrorism as one of their top five emerging risks and one voted for it as the top emerging risk. It is human nature to react to our surroundings. Another way of looking at this data is to distribute them by category.

1. 179 responses Economic
2. 129 responses Geopolitical
3. 39 responses Environmental
4. 37 responses Societal
5. 19 responses Technological

Figure 1 compares Emerging Risks by Category across the two surveys. Looking at the distribution by major category shows that Geopolitical increased from 18 percent to 32 percent at the expense of Environmental, Societal, and Technological. This may be due to the timing of the U.S. Presidential election during the later survey, with more media coverage of these topics creating an anchor for respondents.

FIGURE 1
Emerging Risk by Category
 (Spring 2008 outer circle, Fall 2008 inner circle)



Respondent demographics are similar between the two surveys based on employer type, with most coming from insurance companies or consulting backgrounds. Geographically, Europe was not as well represented in the current survey so North American viewpoints are more heavily weighted. A total of 89 responses were received.

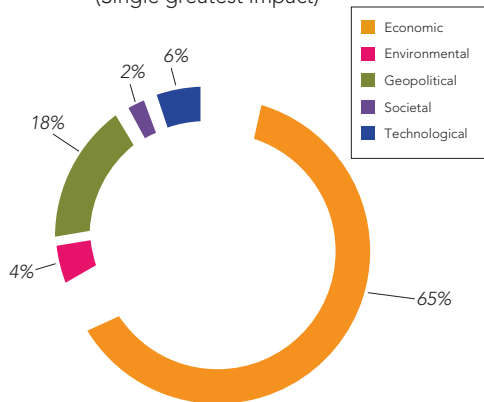
Respondents were also asked to choose the single most important emerging risk. The top four specific responses came from the Economic category, with the fifth from Technological. 68 percent of results are explained by the top five responses.

1. 25 percent Blow up in asset prices/excessive indebtedness
2. 18 percent U.S. current account deficit/fall in U.S. dollar
3. 12 percent Oil price shock/energy supply interruptions
4. 7 percent Fiscal crises caused by demographic shift
5. 6 percent Breakdown of critical information infrastructure (CII)

Figure 2 shows the breakdown by category. With Economic risks taking the top four spots it is not surprising to see the Economic category with over half the responses.

FIGURE 2
Emerging Risk by Category

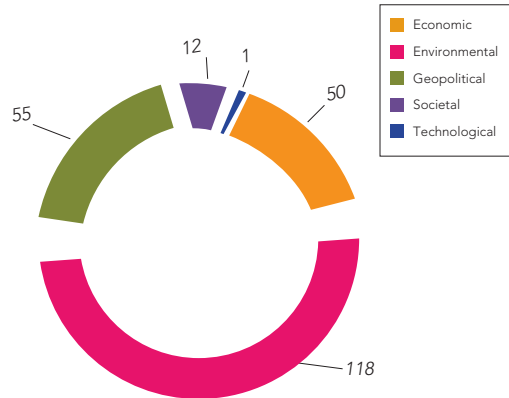
(Single greatest impact)



Local food shortages often lead to unstable regions of the world. Respondents were asked to combine emerging risks that could lead to regional food shortages. The leading combination of risks, with 25 percent, was *U.S. current account deficit/fall in U.S. dollar and Blow up in asset prices/excessive indebtedness*. These two emerging risks were used as components of other leading combinations, along with *Oil price shock/energy supply interruptions, Middle East instability, and Fiscal crises caused by demographic shift*. As shown in Figure 3, Environmental risks account for half of the 236 responses.

FIGURE 3
Regional Food Shortages by Category

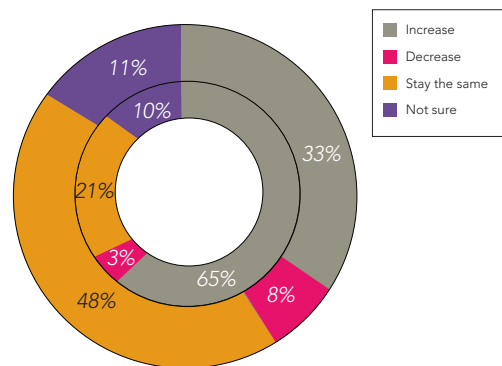
(up to 3 responses per participant)



The survey also asked about expectations for ERM-focused activities in 2009. Not surprisingly, given the recent financial turmoil, 65 percent expected the activities for their organization or clients to increase. As shown in Figure 4, only 33 percent expected funding to increase for these activities. Budgets may not allow increased quantitative analysis, so projects will need to be prioritized and leveraged to meet multiple needs.

FIGURE 4
Enterprise Risk Management 2009

(outer circle funding, inner circle activity level)



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IMPLICATIONS FOR THE FUTURE

Thinking about emerging risks can add to the complexity of a risk manager's job and perhaps lead to some sleepless nights, but addressing potential scenarios qualitatively in advance can reduce the probability of bankruptcy and stabilize earnings. Repeating this survey in the future will help respondents learn from their own choices as well

as those of the group. By combining results across time periods we may be able to discern additional information from the results. As the survey reported, risk managers will continue to be expected to accomplish more with a limited budget. Prioritization of effort, including thinking about emerging risks, will lead to the best results. ♦

GLOSSARY OF RISKS

The following 23 core risks were defined in *Global Risks 2007: A Global Risk Network Report*, and can be found at www.weforum.org/pdf/CSI/Long_Global_Risk_Report_2007.pdf.

□ ECONOMIC

- Oil price shock/energy supply interruptions
- US current account deficit/fall in US dollar
- Chinese economic hard landing
- Fiscal crises caused by demographic shift
- Blow up in asset prices/excessive indebtedness
- Interstate and civil wars
- Failed and failing states
- Transnational crime and corruption
- Retrenchment from globalization
- Middle East instability

□ ENVIRONMENTAL

- Climate change
- Loss of freshwater services
- Natural catastrophe: Tropical storms
- Natural catastrophe: Earthquakes
- Natural catastrophe: Inland flooding

□ GEOPOLITICAL

- International terrorism
- Proliferation of weapons of mass destruction (WMD)

□ SOCIETAL

- Pandemics
- Infectious diseases in the developing world
- Chronic disease in the developed world
- Liability regimes

□ TECHNOLOGICAL

- Breakdown of critical information infrastructure (CII)
- Emergence of risks associated with nanotechnology

Quantifying Defined Contribution Risk

By Minaz H. Lalani

INTRODUCTION

GLOBALLY, OVER THE LAST DECADE, there has been a shift towards the establishment of Defined Contribution (DC) Plans (Refer to IFRS—Definition of DC Plan). Traditionally most actuaries have participated in managing and quantifying Defined Benefit (DB) risks; however, there is sparse literature on managing and quantifying Defined Contribution (DC) risks. This lack of literature can be explained by the fact that the prevalent view is that plan sponsors bear the risk of DB plans and employees bear the risk in DC plans. The reality is that DC plans do carry material risks for sponsoring employers, and these risks should be actively managed and quantified. This article provides some insights into how actuaries can quantify DC plan risks.

DEFINED CONTRIBUTION RISKS AT A GLANCE

In order to better manage DC risks, DC stakeholders should be aware of the key risks inherent in DC plans. Table 1 summarizes the key DC risks within four broad risk categories usually used in an Enterprise Risk Framework (ERM).



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INTERNATIONAL FINANCIAL REPORTING STANDARD (IFRS)— DEFINITION OF DC PLAN

Defined contribution plans are post-employment benefit plans under which an entity pays fixed contribution into a separate entity (a fund) and will have no legal or constructive obligation to pay further contributions if the fund does not hold sufficient assets to pay all employee benefits relating to employee service in current and prior periods.



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Table 1

Risks	Applicability of Risks to DC Plans (DC Risks)
<i>Financial</i>	
Market Investment Longevity Inflation Settlement	<p>DC members rely on market returns (via investment options) to provide the desired levels of investment returns to accumulate savings over their working lifetime and withdraw savings during their retirement years. Due to increasing life expectancies and inflationary expectations, there is a risk of outliving these savings and incurring losses in the real value of these retirement savings.</p> <p>From a plan sponsor standpoint, it is prudent to provide an adequate number of investment options, including default options, to provide the desired level of investment returns and inflation protection. Also, it is imperative that employees via use of modelling tools are made aware of the withdrawal (settlement) options at retirement and the likelihood of outliving their savings</p>
<i>Strategic</i>	
Design	<p>Plan sponsors should be designing DC plans that support business and human resource objectives. Failure to design strategic DC plans could result in the provision of an inadequate level of income and retaining retirement-eligible employees with unintended workforce management issues and potential impact on the business plan. A strategic DC plan should provide for a well-defined level of retirement income, instill a level of accountability on the employee for retirement savings and ensure that there is well documented and mutual understanding between the employer and employee regarding the responsibility of each party on retirement.</p>
<i>Legal and Regulatory</i>	
Governance Legal Communication	<p>DC plans should adhere to a high standard of governance, comply with all regulatory requirements and meet contractual commitments. It is imperative that the plan sponsor commitments implied ,or explicit regarding future investment returns, level of retirement income and other DC related provisions are well articulated and documented to minimize potential risk.</p>
<i>Operational</i>	
Vendor Education Modelling	<p>Operational risks are risks due to inadequate processes, systems, or ill-trained human resources. DC Plan sponsors should be aware that even well designed DC plans have significant risks if performance standards are not met by internal HR support, or external vendors (for example, there may be risk if accurate account balance reports with clear investment education material are not distributed on a timely basis). Also, It is important to ensure that DC members are provided with sophisticated models that are based on well conceived notions, best practices and robust assumptions to ensure operational excellence and support the strategic business intent for establishing the DC plan.</p>

Source: Adapted from the Canadian Institute of Actuaries Bulletin, Volume 18, Number 3, November 2007: The Role of Actuaries in Managing Defined Contribution Risks by Minaz H. Lalani.

“...there are significant interrelationships between the identified DC risks which create additional risks.”

It is important to note that this list of DC plan risks is not exhaustive or mutually exclusive within the risk categories; there are significant interrelationships between the identified DC risks which create additional risks. For example, at the time of writing in December 2008, most global markets had double digit market losses resulting in significant decline in the employee account balances. The interrelationship of the financial and strategic risks would result in an unintended “workforce management risk,” that is, retaining senior employees planning to retire at their respective retirement ages but who do not have the financial resources to retire now. In this case, the employer will have to establish a strategic workforce plan to retain these senior employees until such time that these employees will be able to retire. It is imperative that plan sponsors are aware of such interrelationships when managing and quantifying these risks.

RETROSPECTIVE VIEW—DETERMINISTIC DC RISK RESERVING

The Deterministic DC Risk reserving concept is analogous to an actuarial valuation of a Defined Benefit (DB) plan. DB actuaries compare the assets and liabilities of a DB Plan to determine the actuarial surplus, or unfunded liability; this determination is done on either a going-concern basis, or solvency basis. Under a DC Plan, there is no concept of an actuarial valuation; the prevalent view is that once an employer contributes towards an employee DC account, then the employee is entitled to the “surplus,” or responsible for the “shortfall.”

The DC Risk reserving concept is based on the premise that in designing a DC plan¹ (1), employers have a well defined target retirement income objective; such an objective could be expressed as follows: “the employer will provide a retirement pension of x percent of pre-retirement earnings for a career employee with y years of service at retirement age of z years based on a target investment return of i percent per year.” The value of this well defined retirement target (liabilities) provides a benchmark against which the assets (actual account balances) can be measured. The surplus or shortfall for each employee is calculated by comparing the actual account balance (assets) and expected target account balance (liabilities) at the valuation date.

Table 2: Sample Employee Data

Age Group	Employee Count	Average Salary	Average Years of Service	Actual Initial Account Balance as of Dec 31, 2006
<20	2	\$25,821	2	\$5,572
20-24	243	32,715	3	1,349,381
25-29	819	41,187	4	8,014,537
30-34	890	47,598	4	10,064,984
35-39	719	50,645	5	11,151,600
40-44	652	59,590	7	16,723,973
45-49	536	59,324	9	18,081,260
50-54	338	51,978	10	11,409,005
55-59	166	57,691	11	7,122,817
60-64	76	66,293	10	3,271,845
65+	7	31,267	4	52,002
Total	4448	\$50,261	6	\$87,246,977

The sample employee data as of Dec. 31, 2006 in Table 2 was used for all the analysis in this article. The DC plan used for the analysis was established in 1996 with a few hundred DC members; the DC plan membership grew significantly to about 4,500 employees at Dec. 31, 2006. The DC plan has a level contribution of five percent per year.

FOOTNOTES:

¹ Canadian Institute of Actuaries Bulletin, Volume 18, Number 1, Sept. 2007: The Role of Actuaries in Defined Contribution Plan Design by Minaz H. Lalani.

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The deterministic target investment return was set at six percent per year. The effective actual return from the period 1999 to 2006 was 7.6 percent. The actual returns for the aggregated plan assets for each year were as follows:

Year	1999	2000	2001	2002	2003	2004	2005	2006
Actual Return	14.5%	7.1%	-5.5%	-5.1%	16.0%	9.8%	15.8%	11.4%

In aggregate the plan assets were allocated 40 percent in Canadian Equities, 20 percent in U.S. Equities, 35 percent in Canadian Bonds and five percent in Cash.

The difference or gap at the valuation date between the actual account balance (based on actual historical rate of return) and the target account balance (based on the target investment return) is the “surplus,” or “deficit”/“shortfall.” This is shown graphically in Chart A. Table 3 summarizes the result of the deterministic valuation.

Chart A:
Retrospective View—Deterministic Valuation

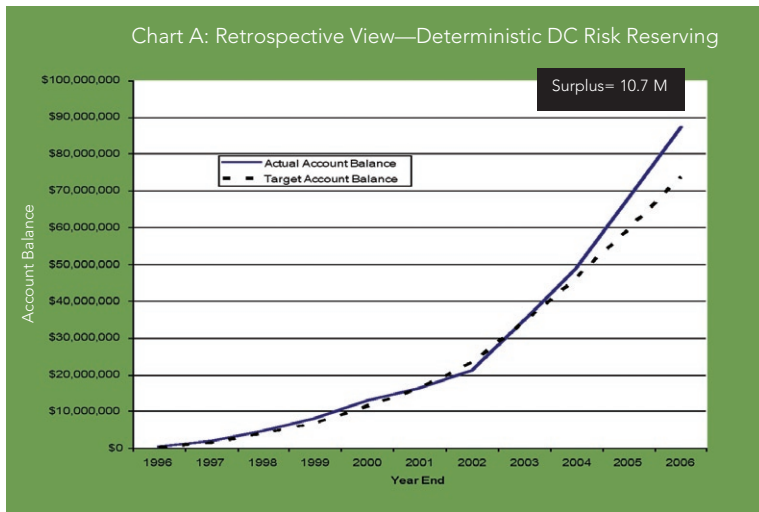


Table 3 :
Retrospective View—Deterministic Valuation

Age Group	Target Account Balance (Liabilities)	Actual Account Balance (Assets)	Deterministic Surplus / (Deficit)
<20	\$5,235	\$5,572	\$337
20-24	1,226,088	1,349,381	123,292
25-29	7,036,545	8,014,537	977,992
30-34	8,836,781	10,064,984	1,228,202
35-39	9,632,246	11,151,600	1,519,354
40-44	14,810,519	16,723,973	1,913,455
45-49	16,045,839	18,081,260	2,035,421
50-54	9,996,329	11,409,005	1,412,676
55-59	6,083,047	7,122,817	1,039,770
60-64	2,866,722	3,271,845	405,124
65+	45,656	52,002	6,346
Total	\$76,585,008	\$87,246,977	\$10,661,969

The deterministic valuation provides a retrospective view of the employee’s actual investment performance versus the target deterministic investment return; the sum of the shortfall for all employees could provide an employer with an indication of investment risk, that is, risk of employees selecting investment options that did not attain the target return. Since the deterministic valuation is based on historical information, it does not provide a complete measure of the potential investment risk, that is, the risk of not attaining the target returns in future years (market risk), or meeting the defined target retirement income level (design risk).

PROSPECTIVE VIEW—STOCHASTIC DC VALUATION

The stochastic valuation is an extension of the DC Risk reserving concept; this is analogous to stochastic projections done for an asset liability study in respect of a DB Plan. Under the DC approach, employee’s account balance with the underlying asset mix is projected to the target retirement age using stochastic investment returns, with internally consistent salary growth and other relevant

“...the shortfall using a stochastic valuation provides a better measure of potential DC risk...”

assumptions, using a capital market model. For the stochastic analysis in this article, the asset allocation at the employee level was assumed to remain the same during the employee’s working lifetime.

The actuarial present value of the projected account balance (analogous to the present value of future benefits under a DB Plan) is determined as the average of the stochastically projected account balances at retirement age discounted back to the valuation date using deflators (weighted stochastic returns that generated the specific projected account balance refer to Deflators).

For a DB Plan, the projected credit unit method attributes the present value of future benefits using the ratio of service to total service to retirement age. A similar service prorate approach is used for DC plans. Other attribution approaches can be used, for example, the attribution can be based on ratio of the target account balance at the valuation date to the projected target account balance at retirement age. For the analysis, a service prorate was used.

The surplus or shortfall for each employee is calculated by comparing the attributed account balance (assets) and expected target account balance (liabilities) at the determination date.

Table 4 summarizes the results of the stochastic valuation. Each employee’s account balance was stochastically simulated using 500 generated economic scenarios (investment return and internally consistent salary growth assumptions) projected to retirement age of 65. The stochastic account balance is equal to present value of the attributed account balance for service to date (based on service prorate to age 65).

DEFLATORS

Deflators provide a means by which stochastically projected account balances can be converted into present values which are consistent with the market values while still allowing for any differences in volatility of returns between asset classes.

Table 4:
Prospective View—Stochastic DC Valuation

Age Group	Target Account Balance (Liabilities)	Stochastic Account Balance (Assets)	Stochastic Surplus / (Deficit)
<20	\$5,235	\$3,528	(\$1,707)
20-24	1,226,088	850,419	(375,669)
25-29	7,036,545	5,182,391	(1,854,154)
30-34	8,836,781	6,770,303	(2,066,478)
35-39	9,632,246	7,825,749	(1,806,496)
40-44	14,810,519	12,684,065	(2,126,454)
45-49	16,045,839	14,740,351	(1,305,489)
50-54	9,996,329	9,822,394	(173,935)
55-59	6,083,047	6,535,332	452,285
60-64	2,866,722	3,287,338	420,616
65+	45,656	55,459	9,803
Total	\$76,585,008	\$67,757,329	(\$8,827,678)

The stochastic analysis requires a significant number of computations and computer resources; therefore, it is highly recommend that active employee data be grouped to reduce the computations and expedite the analysis.

From an employer perspective, the shortfall using a stochastic valuation provides a better measure of potential DC risk due to the lack of employer’s well defined retirement income objective (design risk), shortfall due to market conditions (market risk), or potential risk of litigation due to non-performance of the DC Plan (litigation risk).

RETIREMENT VALUE AT RISK

The Value at Risk (VaR) or risk dollar concept is a well-understood risk measure and is used extensively by risk managers; it is also used by DB actuaries to understand the tail (downside) risks of specific DB measures (solvency deficits, funding ratios). As yet, the use of VaR for DC Plan has not been articulated in literature.

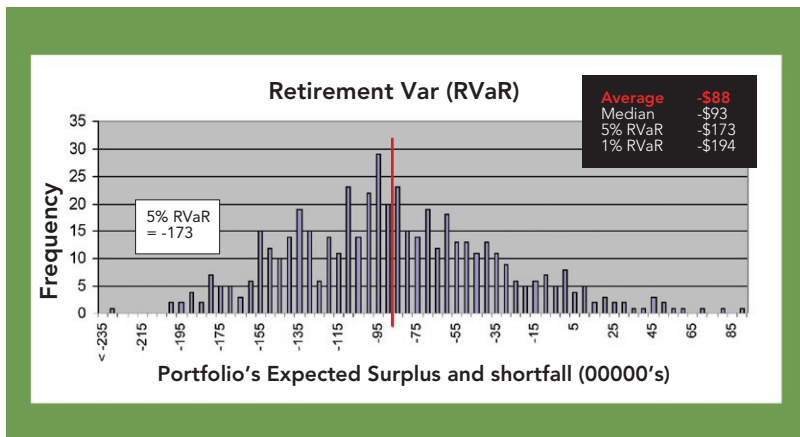
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For our analysis, the Retirement Value at Risk (RVaR) is an extension of the Stochastic DC Valuation. The DC VaR or RVaR is a measure of risk in respect of active employees in a DC plan. For example, a DC Plan with an RVaR of \$17.3 million at a confidence level of 95 percent will have a 5 in 100 chance that the DC Plan will have a shortfall of at least \$17.3 million over the employee's working lifetime (accumulation period) as measured at the Valuation date.

The RVaR is determined from the statistical distribution generated from stochastic valuation of the DC Plan (refer to Prospective View—Stochastic DC Valuation). The results are used to create 500 potential portfolios with surpluses and shortfalls. This is shown graphically in Chart B.

Chart B: DC Retirement Value at Risk



Note: The x-axis scale is in 100,000; therefore, "88" is equivalent to \$8,800,000

Again, from an employer perspective, the probability of a shortfall at a given confidence level is more meaningful as it provides an estimate of the potential shortfall risk which could translate into a potential litigation risk; the degree of risk is depended on clarity and quality of the employer's communication to their employees regarding the employer's commitment in respect of the DC Plan.

RISK MITIGATION

Over the next 10-15 years, plan members will retire in increasing numbers from DC plans; most DC practitioners believe that inadequate management of DC plans due to ineffective DC plan design or lower than expected investment returns, will result in litigation as DC plan members begin reaching retirement age with less than adequate retirement funds.

Below is a short list of possible actuarial involvement to mitigate DC risks:

- Collaborate with the DC plan sponsor in defining the plan sponsor's retirement objectives clearly outlining the level of retirement pension to be delivered based on an expected target return
- Communicate the retirement objectives to employees ensuring there is clear articulation of the intended portion that the employer was expecting to deliver as a percentage of the total retirement income as a percentage of salary
- Prepare illustrations and projections of retirement income that are based on sound and acceptable assumptions for investment returns, mortality and retirement ages
- Develop web-based retirement modelling tools that provide a more sophisticated and complete picture of expected range of total retirement income using internally consistent actuarial assumptions
- Assist DC plan sponsors in developing alternative scenarios (including stochastic analyses) to better understand investment and longevity risks for pre-retirement (accumulation phase) and post-retirement (withdrawal phase)
- Quantify DC risks to better inform the plan sponsor of their potential liability, or risk due to ineffective plan design, or inadequate DC plan performance.

THE FUTURE

Currently, there is little work being undertaken by stakeholders, including actuaries, in managing and quantifying DC risks. Plan sponsors believe that there are no DC risks; also, in countries (e.g., United States) where there are 'safe harbor' rules, plan sponsors believe that they are protected from litigation risks. Before further progress can be made in this emerging field of practice, stakeholders

“...quantifying DC risk may require employers with DC plans to include the shortfall/liability on their financial statements...”

have to embrace the fact that DC plans have inherent risks that need to be managed and quantified. The consequence of quantifying DC risk may require employers with DC plans to include the shortfall/liability on their financial statements. It is hoped that this article will spark some discussion and DC practitioners will develop additional and new techniques to quantify DC risks.

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An ERM Approach to Income Tax Risk

By John Manistre

THIS ARTICLE is intended to overview a number of Enterprise Risk Management (ERM) issues that arise when one considers the impact of income tax on a fair value accounting system. The article starts by developing a high level three step model of an income tax structure that can be used to understand a number of risk issues. Among the questions we use this model to address are



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1. How do we decide if one tax jurisdiction is better or worse than another? The jurisdiction with the lowest tax rate may, or may not, be the best answer.
2. How should income tax affect economic capital? We'll argue that an income tax structure effectively shares risk between a company and the tax man. This leads to a reduction in economic required capital.
3. Which income tax issues should impact the fair value of individual assets or liabilities on a fair value balance sheet? We'll get different answers depending on whether we take an "exit value" or a "going concern" point of view.
4. Are there any new balance sheet items that should appear in a fair value accounting system other than those with which we are already familiar? The current IFRS balance sheet is roughly consistent with an "exit value" point of view. A number of additional line items would be needed to make the balance sheet consistent with the "going concern" point of view taken the by European CFO Forum's approach to Market Consistent Embedded Value (MCEV).

The article concludes by arguing that the risk management community needs to decide whether it wants to manage tax related issues using the going concern model or an exit value approach.

Most of this article is written from the perspective of a stock company with shareholders but the main risk conclusions apply to other types of ownership structures as well.

HIGH LEVEL MODEL OF AN INCOME TAX STRUCTURE

Imagine a world with no income tax at all. We have an insurance entity XYZ Corp. that has determined that it needs \$10 of economic capital. XYZ Corp.'s economic balance sheet looks like this:

Assets		Liabilities
MVA = 100		MVL = 90
		EC = 10
Total = 100		Total = 100

XYZ's actuaries have engineered the insurance products so that \$1 of profit margin is released each year to pay for the cost of capital which we assume is 10 percent. If the interest rate earned on surplus assets is i then the expected return to shareholders on economic capital is

$$\frac{10i + 1}{10} = i + 10\%.$$

STEP 1: A VERY SIMPLE TAX STRUCTURE

To start, assume the tax man takes 35 percent of all economic income (plus or minus). At this stage in our model we allow negative income taxes so there is complete risk sharing with the tax man. What are the consequences? The first consequence is that we no longer need to hold \$10 of economic capital. Due to the risk sharing \$6.50 is now sufficient so \$3.50 can be paid out immediately to the shareholder. Assuming this has been done, and the insurance product has not been re-priced, the expected return to shareholders is now

$$\frac{(6.5i + 1) * .65}{6.5} = .65i + 10\%.$$

The shareholder is, almost, neutral. The impact of the assumed tax structure is to reduce the shareholder's return by 35 percent of the interest earned on the pre tax capital. In the MCEV literature this is referred to as frictional cost.

In order to fully compensate the shareholder for this frictional cost the actuaries would have to increase the product's profit margin by the interest forgone on the capital which the tax man has implicitly contributed i.e., $3.5i$. Assuming $i =$ five percent the new margin is $1.18 = 1 + .05 \times 3.5$. Note that this is not the same as grossing up the pre tax profit margin to $1/(1-.35) = 1.54$ as might seem intuitive.

“The lower tax rate is offset by higher economic capital.”

Two high level conclusions at this stage of the argument are

- Income taxes are somewhat like shareholder dividends in that they compensate the tax man for implicitly contributing 35 percent of the economic capital. For the remainder of this article it will be useful to think of the tax man as a special class of investor.
- The frictional cost issue is an example of a bias that favors the tax man at the expense of the common shareholder, unless the company passes the cost through to the policyholder.

STEP 2: THE TAX MAN INTRODUCES HIS OWN ACCOUNTING SYSTEM (but we still allow negative income tax)

In most tax jurisdictions companies must put together tax balance sheets and tax income statements that can be very different from their economic or accounting financial statements. However, in most jurisdictions it is still possible to understand the difference between taxable income and economic income as a combination of temporary differences and permanent differences. A little bit of algebra may help here.

Let's assume we can calculate income tax as follows (we'll pick up any shortcomings of this assumption in Step 3 of our tax model).

$$\text{Income Tax} = \text{Tax Rate} [(ACF - \Delta A^{\text{Tax}} - PD^A) - (LCF - \Delta V^{\text{Tax}} + PD^L)]$$

Here ACF is the Asset Cash Flow received from invested assets and ΔA^{Tax} is the change in tax base of the company's assets. These two terms add up to the taxable investment income generated by the assets. The term $-PD^A$ represents a permanent difference¹ to taxable investment income arising from the assets.

The taxable investment income is offset by an analogous term coming from the liability side of the balance sheet which one could think of as the tax deductible interest along with any relevant liability related permanent differences.

The details of how tax values are determined, and what qualifies as a permanent difference, vary greatly by tax juris-

diction and the legal status of the tax payer. Fortunately, we won't need to know most of these details but some life insurance examples may help to clarify the discussion. The last example in this list will be important later.

- For many jurisdictions a bond asset is valued at amortized cost for tax purposes. In the United States this rule is used unless the bond was bought at a discount. The U.S. tax regime does not recognize any amortization of purchase discount as taxable income until the bond is sold or matures.
- In most jurisdictions the tax base of an asset resets to market value when the asset is sold.
- In the United States, an example of a favorable permanent difference is the Dividend Received Deduction or DRD which allows a portion of the dividends received from assets to be deducted from taxable income.
- In Canada, life insurers must pay a federal investment income tax on behalf of their policyholders. This tax is not deductible when computing the company's corporate income tax in the province of Quebec. This is an example of an unfavorable permanent difference.
- In the United States, equity investments are generally valued at cost for tax purposes. In Canada they are valued at market on the tax balance sheet.
- In most European jurisdictions the tax base of an insurance liability resets to market if sold from one insurer to another. This is not true in the United States where the tax base of an insurance liability is effectively fixed by a formula defined in the tax code.

How does this impact the company's relationship with the tax man? One way to analyze the situation is to break the income tax payments into three pieces that we will call asset taxes, economic taxes and liability taxes in this article.

FOOTNOTES:

¹ Our sign convention for permanent differences is that a positive amount is favorable to the company.

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This is done by adding and subtracting the Economic Investment Income (*Econ II*) and Economic Required Interest (*Econ Req'd I*) from the basic tax equation. We then write

$$\begin{aligned} \text{Income Tax} = & \text{Tax Rate } \{[(ACF - \Delta A^{Tax} - PD^A) - Econ II] \text{ Asset Tax} \\ & + [Econ II - Econ Req'd I] \text{ Economic Tax} \\ & + [Econ Req'd I - (LCF - \Delta V^{Tax} + PD^L)] \} \text{ Liability Tax} \end{aligned}$$

The middle term in this equation is, roughly, the income tax payable in Step 1 of our tax model while the first and last terms clearly reflect the impact of timing differences and permanent differences coming from the assets and liabilities respectively.

STEP 3: THE "TAX MAN'S PUT" OPTION

No doubt most readers of this article are ready to point out that the first two steps of the tax model outlined here have missed a significant element. In terms of the tax man as shareholder concept he not only defines his own dividend mechanism (Step 2) but he is usually able to limit his downside participation in the company's fortunes. Again, the details of how this works vary greatly from one tax jurisdiction to another. We will refer to this limit on the ability of the company to pass risk through to the tax man as the "Tax Man's Put" option.

Some specific examples of the "Tax Man's Put" at work are

- Most tax codes do not allow negative taxes per se. Tax losses can often be carried back to prior years or carried forward to future years. There are usually well defined limits on how much of this can be done.
- In Canada, non-capital tax losses can be carried back three years and forward indefinitely. Capital losses can be carried back three years and forward indefinitely but can only be applied against capital gains.
- In the United States capital losses on some asset sales can only be used to offset capital gains on similar assets.

This kind of rule puts some constraints on a company's ability to manage the asset taxes described in Step 2.

Interestingly this is not entirely a one way street. It is the author's experience that tax specialists in many tax jurisdictions are fully aware of tools and transactions that can manage the potential impact of the "Tax Man's Put." This is often a significant activity within a company's tax department.

TAX MODEL SUMMARY

While short on detail the three step model developed so far does go a long way toward explaining the economic relationship between the company and the tax man. Because risk is being shared with the tax man he can be thought of as a special class of investor. From a risk perspective income tax payments are therefore more like shareholder dividends than expenses.

It is quite possible that a tax structure of this type can work to the shareholder's advantage. In a jurisdiction, such as the United States, the company has some freedom to manage the asset taxes while a conservative liability tax valuation basis can create a negative liability tax. The net result could well be that the present value of actual taxes is less than the present value of economic taxes.

Since the economic taxes are essentially the "right" taxes for the risk being transferred (remember the shareholder was paid \$3.50 in Step 1), this could mean that the tax man is being paid less than he should be paid relative to the risk he is taking. If this is, in fact, the case then the tax structure is working to the advantage of the actual shareholders even though income taxes are being paid.

In terms of the first question posed at the beginning of this article we see that an enterprise wide perspective needs to be taken when considering an issue such as moving business from one tax jurisdiction to another. If we move business into a lower tax rate jurisdiction a large part of the benefit of the lower tax rate is offset by the cost of holding higher amounts of economic capital. Additional issues such as frictional cost, timing differences, permanent differences and the "Tax Man's Put" therefore need to be considered before drawing a conclusion.

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Once this picture is appreciated arbitrage arguments show that the total *MVL* must be the risk neutral present value of liability cash flows, distributable earnings and future liability² income taxes. The transfer price of the liability is then determined from the relation $MVL = V + \tau[V^{tax} - V]$ since this is the price at which an insurer is indifferent between manufacturing the liability itself or paying a third party to do it.

In this article I will refer to this valuation model as the “going concern” approach since this is also the value we would put on the liability (or asset) if we were selling it to ourselves. In general this is different from the standard valuation approach which I will call the “exit value” model. The reason the two values are different is that a market transaction usually changes the present value of taxes payable to the tax man and that change in value must work its way through to the transacting parties.

If we work through all the algebra we find that to calculate the transfer price in the “going concern” model we need to do the following calculation:

$$V = E_t^Q \frac{CF_{t+1} - i_t \tau(V^{tax} - V) + \frac{DE_{t+1} - \tau PD_{t+1}^L}{1 - \tau} + {}_{t+1}V}{1 + i_t}$$

In this formula *CF* represents the cash flow being valued, *DE* is a distributable earnings term and E_t^Q is the risk neutral expectation operator. The key new feature to emerge here is the term $-i_t \tau(V^{tax} - V) = -i_t DTOL$. What the analysis has told us is that when the tax base of a financial instrument does not reset to market on sale then the transfer price should be reduced by the present value of interest earnings on the *DTOL*. This effectively turns the *DTOL* into an interest bearing liability.

An intuitive way to understand this result is to think of the *DTOL* as an interest free loan from the Tax Man to the company. If positive, this creates an economic benefit and if negative this creates an economic drag. Since this benefit or cost is the same for all relevant holders of the insurance liability it makes sense that the markets would recognize³ it in an arm’s length transaction. In this article we will call this transfer price adjustment the Value of Liability Timing Differences (*VLTD*).

A short summary of the above discussion is that tax issues can affect the prices at which financial instruments trade in the market place. Two simple rules have emerged:

- Permanent differences are reflected in transfer prices.
- Temporary differences are generally not reflected in transfer prices. U.S. insurance liabilities are an important exception.

ENTITY SPECIFIC TAX ISSUES

The discussion so far has ignored a number a number of tax issues that are entity specific in the sense that we cannot look to an external market to put a value on them. Four examples that will be briefly discussed here are

- The Value of Asset Timing Differences (*VATD*) and the Value of Liability Timing Differences in jurisdictions where the tax base resets to market on sale.
- Tax Loss Carry Forwards
- Frictional Cost on non-hedgeable risk capital
- The “Tax Man’s Put”

One thing all of these issues have in common is that they have value to an insurer when viewed from a going concern perspective but may have no value at all, or a very different value, when an exit value perspective is taken. We can’t finalize the balance sheet until we take a position.

The *VATD* arises from the idea that an asset could be worth more, or less, to an insurer than it is to an external party. If an asset has a large unrealized gain then selling the asset immediately accelerates the payment of income taxes that would otherwise be paid at some point in the future. The asset is therefore worth more to the current owner than it is to an external third party. The reverse could also be true.

FOOTNOTES:

² As defined in Step 2 of the simple tax model.

³ Note that we aren’t really saying anything new here. Traditional actuarial appraisal methods recognize these tax issues, and others, since they are based on “going concern” principles.

If we knew how long we were going to keep each asset then we could put a value on the timing differences by using the “going concern” valuation model described earlier for U.S. insurance liabilities. This would give us a new going concern adjusted transfer price $GCA = A + VATD$ and a new deferred tax item $DToA = \tau[A^{Tax} - GCA]$.

The $VATD$ issue is not part of most⁴ accounting models at this time which makes the issue almost invisible from a risk management perspective. In the author’s opinion this is not good ERM practice.

Tax Loss Carry Forwards are considered by most current accounting models. In terms of our simple tax model we can value a tax loss carry forward as a sequence of future permanent differences. There is a practical issue of estimating how quickly the losses can be used.

In Step 1 of our tax model we introduced the idea of frictional cost equal to the tax on the interest earned on economic capital. To the extent this capital is required for non-hedgeable risk then the frictional cost can be covered off by adjusting the insurer’s profit margins as indicated earlier. However, if the capital is there because the insurer is taking credit risk or mismatch risk, risks that could in theory be hedged away, then the insurer must absorb the frictional cost loss. A true going concern approach to the balance sheet would present value this frictional cost and establish an appropriate liability.

The “Tax Man’s Put” liability can thought of as the final item needed to get a going concern balance sheet right after all of the other items have been valued in isolation. In practice this would require some modeling to see if the other balance sheet items are over or under providing for future taxes.

A model going concern balance sheet is illustrated in the table above. It should be compared to the exit value model presented earlier.

	Assets	Liabilities
Transfer Price	A	V^5
Tax Timing Differences	$VATD$	$VLTD$ (<i>0 in the United States</i>)
Going Concern Value	$GCA = A + VATD$	$GCV = V + VLTD$
Deferred Tax	$DToA$	$DToL$
Market Consistent Value	$MVA = GCA + DToA$	$MVL = GCV + DToL$
		<i>Frictional Cost etc.</i>
		<i>Tax Man’s Put</i>
		<i>Capital = MCEV</i>
Total Balance Sheet	$MVA = GCA + DToA$	<i>Total Liabilities & MCEV</i>

If someone asks whether all relevant taxes have been included somewhere in the balance sheet we can answer in the affirmative. Going back to the tax model introduced earlier we can are now in a position to make the following statements

1. All asset related taxes are captured on the asset side of the balance sheet. Permanent differences are reflected in the transfer price while timing differences are captured through a combination of the $VATD$ and $DToA$.
2. All liability related taxes are captured in the same way as above.
3. Economic Taxes are in a number of different places. If the liabilities have been valued using the cost of capital approach to setting fair value margins then most of the economic taxes are already captured in the transfer price of the liability. One exception is the frictional cost tax on any economic capital which was not contemplated in the liability valuation. An example could be the frictional cost associated with holding hedgeable risk.

FOOTNOTES:

⁴ One exception is Canadian GAAP. For the past decade Canadian actuaries have been putting a value on the timing differences, for assets backing actuarial liabilities, and then presenting them as an adjustment to the actuarial liabilities.

⁵ The $VLTD$ is included in the transfer price V in the United States.

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Compared to IFRS this is a very strange looking balance sheet but it can be shown that this is what the balance sheet must look like if we want to comply with the European CFO Forum's Market Consistent Embedded Value (MCEV) principles. A key difference between MCEV and IFRS is that MCEV takes the going concern philosophy to heart whereas IFRS is largely, but not completely, on an exit value basis.

The table below compares IFRS and MCEV to theoretically "pure" implementations of the exit value and going concern concepts for the entity specific issues discussed in this article.

Issue	"exit value"	"going concern"	IFRS	MCEV
Timing Differences	No, if tax base resets on sale	Yes	No	Yes
Tax Loss Carry Fwd	No	Yes	Yes	Yes
Frictional Costs	No	Yes	No	Yes
Tax Man's Put	No	Yes	Yes	Yes

CONCLUSIONS

This article has surveyed a wide range of tax and risk related issues. One very clear ERM issue to emerge is that we have to decide whether we want to manage risk using the "exit value" model implicit in IFRS or adopt the "going concern" model that is consistent with MCEV. Both points of view have merit but they can lead to different risk management conclusions.

For example, going concern actuarial liabilities are typically longer than their exit value counter parts. This has A/L M implications.

The going concern model is broadly consistent with the traditional actuarial appraisal approach to valuing an insurance enterprise. Unfortunately, fully implementing this approach would require a number of modifications to the IFRS balance sheet. In the author's opinion this is what the risk management community should lobby for. If we don't, then we could end up working with financial statements that don't reflect all of the relevant economics. This would not be good for ERM practice as most managements will likely focus on risk as measured by those financial statements.

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Risk Intelligence

By Shaun Wang

STANDING AT THE BEGINNING OF 2009, I dare to make a statement: “The financial world as we knew has ended in year 2008. We are in a forever-changed world with a set of new mega events that will exhibit explosive risk dynamics with a very different set of risk parameters. Laggards who are slow to recognize this new reality will be unpleasantly shocked by the shaking and unprepared for the new opportunities.”

A year ago, very few anticipated the collapse of Wall Street titans such as Leman Brothers, AIG and Fannie Mae. Sophisticated risk models failed to predict the severity of credit crunch due to massive asset write downs. It begs the question: what could have been done differently with risk modeling? The answer lies in risk intelligence. The recent subprime mortgage crisis underscores the need for better risk intelligence. I would even say that for the risk management profession, the biggest lesson from the subprime mortgage crisis is an over-reliance on risk models, while ignoring the art and practice of risk intelligence.

All models are wrong; some are more useful than others. Our economic system has too many interacting variables and complex dynamics. After witnessing the recent financial crisis, Dr. Alan Greenspan offered his wisdom: “we will never have a perfect model of risk.” Actuaries and financial engineers should recognize this reality and not put too much faith in models. Here is my advice: Stop searching for a perfect model; start using risk intelligence to complement your risk models.

Risk models, in the conventional sense, need to be based on sound mathematical frameworks; this noble “scientific requirement” also brings a curse of inherent limitation (that is, where one is constrained within a box). In contrast, risk intelligence is not limited to any fixed methodological framework. While risk models often fit data to a sound mathematical theory at the surface, risk intelligence takes an in-depth approach by examining structures underneath the data. As an example, if we fit house price data during the 2002-2007 time period to mathematical curves, we may project the upward trend well into future years. However, if we look at the large U.S. trade deficits, reliance on foreign money to fund escalating U.S. national and household debts, and the sloppy underwriting and

speculative buying in the housing sector, we could find many clues for a housing bubble. Some fund managers took a hard look at the structure of the economy and anticipated that this bubbling trend was not sustainable. They were the first to smell “fish” when signs of stress with subprime mortgages and Alt “A” mortgages were revealed.

Risk intelligence requires curious minds that proactively pick out bits and pieces of signals from noises. Here I give a success story. Mr. Hongbin Song

was working in the United States for Fannie Mae in 2007. One day he went to get coffee from the office lounge, as part of his daily routine. He suddenly realized that the coffee was no longer free. With an alert mind, he immediately called some colleagues within Fannie Mae to find out what was going on. He smelled “fish” and soon he resigned and returned to China where he gave his predictions that U.S. Financial Crisis was coming. Indeed. A few months later, Fannie Mae collapsed. Mr. Song is now one of the best known economists in China.

Risk Intelligence Requires a Bigger Framework: This point was articulated well by Todd Davies: “Most managers feel well equipped to understand and respond to the regular crises that emerge day to day. Risk management processes have permeated most organizations which give middle management a sense of comfort that they have things broadly under control. But those who read the financial press will be aware that there are a series of emerging state changes which are not picked up by their normal risk management processes. As such, directors and chief executives reviewing their risk profiles often feel that all of this effort in risk management is missing the big picture. Business managers are too busy in day to day routines and don’t have a framework to personally develop a cohesive understanding of key events that need to be watched, and how to frame the emergence of such events. Without the capability to frame these events they



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are at risk of being out of touch and time to act appropriately, and open to losing the initiative to leverage potential opportunity.” It is my observation that most senior managers can benefit from broad-based training on the various economic big pictures.

Data and Information: Conceptually, we need to differentiate data and information. Actuarial and financial risk models are based on past events within a fairly static set of parameters. In a fast changing world, these parameters have changed and therefore their predictive capabilities have also changed. Similarly, past financial market data reflects an old regime, and would not necessarily be indicative of new regimes. As put it by Tom Freeman (CRO of Suntrust): “I learned that you can scrub the data all you want, but as soon as you’re done scrubbing, the data is out of date. You have to have a process that ensures the data is updated upon origination and modification.” Recognizing the fast pace of changes and the new regime we are in, it is imperative to rely more on fresh field data to calibrate risk models.

Precision and Accuracy: Consider all risks facing an enterprise, there may be only 30 percent of the risks are readily quantifiable. It is not logical to spend all efforts to get more precise answers on this 30 percent of the risks, while forgetting about the other 70 percent of the risks or leaving them to clueless guesses. A precise answer may only give the appearance of the more accurate knowledge about the risk. This is my main criticism of the superficially high Value-at-Risk thresholds. While Bear Sterns, Lehmann brothers and AIG all had capitalization beyond the 99.9 percent Value-at-Risk, it did not stop them from failing, it just masked reality by false metrics.

In the same way, mathematical sophistication does not necessarily make a model more accurate. One mathematical model that has gained popularity lately is the “regime switching” model, with built-in probabilities of switching from one regime to another. The model does not live up to its name, since it does not give any guidance on when regime switching is going to take place. It is only through good risk intelligence that we can be the first to recognize a new regime.

Potential Risk in Our Attitude: It is essential for us to maintain an objective state of mind which is not polluted by our desires, incentives or preferences. People tend to be attracted to signals that confirm to their established beliefs, and tend to ignore signals or predictions they dislike. Some criticized the “sloppiness” of rating agencies in rating structured products. When easy rating was generating handsome revenues, people turned a blind eye on a simple question: “What if the house price increase turns to negative?” Risk Intelligence does not require a rigorous scientific methodology, but it requires a scientific attitude—be objective.

Based on my risk intelligence, I expect another major wave of market downturns in the first half of 2009 (asset write downs, wild swings in stock prices, and massive corporate bankruptcies). While it is difficult to predict the specific timing and outcome of various events, one thing is quite certain: the next wave of downturns (and rebounds) will be “fast and furious.” Nevertheless, when I talked to some of my fund manager friends, my message was not welcome because this is not what they want to hear.

HOW TO BUILD A RISK INTELLIGENCE SYSTEM

Here are some steps to follow:

1. Perform broad environment scanning, review firm’s business model, and select key indicators to look out for emerging risks of strategic importance to the firm. Such indicators should be updated periodically given the fast changes in the economic environment.
2. Develop a system information gathering process, from front-end risk origination and back-office monitoring, with the appropriate feedback loops.
3. Establish a broad conceptual framework to integrate both quantitative and qualitative data.
4. Offer a channel that encourages and rewards independent and out-of-box risk intelligence from employees and external parties.

Implications in Regulatory Framework: The current regulatory framework is based on compliance-type model

“ Stop searching for a perfect model; start using risk intelligence to complement your risk models. ”

validations, rather than based on risk intelligence. This is a major shortcoming, since most existing metrics consist of lagging indicators. Without proactively relying risk intelligence, regulatory metrics may be too slow to anticipate emerging risks. New regulation should adopt risk intelligence as a major tool.

Emerging Risks: As I said above, I expect that the next wave of economic downturns in the first half of 2009 to be fast and furious. This is based a study of several impending forces. Many insurance companies are monitoring their investment portfolios, only realizing that not only stocks, but the once safe investments (high grade corporate bonds, Muni, MBS, etc.) are now subject to huge swings in value. Unfortunately companies are already locked in for a bumpy ride from the burst of the housing bubble (where they were too late to get off the train). However, now we do have a precious time window to prepare for the next emerging bubble. In the medium term, I see the next emerging bubble as the U.S. dollar itself (in the medium term I do not forecast a total collapse of the U.S. dollar, but there will be significant

devaluations along with wild volatilities). The burst of the U.S. dollar bubble could well bring hyper-inflation. Insurance companies should begin carefully evaluate their risks associated with U.S. Treasury, and stress test for potential losses due to dramatic interest rate hikes along with foreign exchange volatilities. Insurance companies also need to carefully review any asset-liability mismatches. For property-casualty companies, there may be significant cost inflation associated with their insurance liabilities. As a hedge for hyper-inflation, insurance companies should consider investing in inflation-resistant asset classes, including various commodities, currency baskets, and TIPS. TIPS is an inflation-indexed treasury bond, it hedges against inflation risk, but does not fully hedge currency risk. Regulators should allow insurance companies to use more current tools to hedge inflation risk. For example, regulators could allow for baskets of currencies and commodities within the asset portfolio of insurance companies. ♦

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Risk Appetite

By Stephen P. D'Arcy

RISK APPETITE IS a relatively new term that has arisen as the fields of financial and enterprise risk management have developed. Although sometimes equated with risk tolerance or risk threshold (Chapman 2006), risk appetite is much more complex than these alternatives. Risk tolerance and threshold imply that risk has only a negative or painful aspect and that there is a certain amount of risk that can be borne, and no more. Risk appetite recognizes that risk has a positive element as well, and not just a downside, so the decision about assuming risk involves much more than simply measuring potential negative results.

Risk is generated whenever there is uncertainty concerning an outcome. The range of potential outcomes in a risky situation can

- encompass only positive values (an unknown rate of return on an investment with a minimum guarantee),
- be only neutral or negative (the possibility of a liability claim),
- or be positive or negative (the return on an equity investment).

As long as the outcome is not known with certainty, risk is involved.



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Risk appetite functions much the same as your appetite for food. Right now you may be hungry for one type of food, but not another. You could never imagine eating much salt, mustard, Worcestershire sauce or other condiment separately, but in combination with other foods these seasonings make a dish much more appetizing. Taste is an important factor affecting your appetite for a particular food; some people enjoy certain tastes, whereas others cannot tolerate those same tastes. There are also negative elements of food that affect your interest in eating them—calories, cholesterol, transfat, additives. What you want to eat reflects your appetite as well as constraints on consumption.



Risk appetite reflects the multiple dimensions of risk in a very similar way. Companies have a taste for certain types of risk that others may avoid. This can be due to past favorable experience, specialized expertise or how a risk fits with other aspects of their operations. Few companies would be willing to accept the unlikely but possible loss of \$1 million in the event of liability claim to an individual in return for a payment of only a few hundred dollars, but to an insurance company with a large book of personal umbrella policies this risk could be welcome. A contract based on the future value of sugar would be avoided by most organizations, but large bakeries or other food processors might find this to be an effective way to reduce the uncertainty of future production costs, and sugarcane and sugar beet growers can find this contract an equally useful tool for hedging profits.

Risk appetite considers the entire probability density function (PDF) of a potential endeavor, as well as its effect on the shape of the PDF the organization. Consider a risk in which an organization pays \$3 million each year and loses it entirely 37 out of 38 years (approximately 97.4 percent of the time). However, there is a 1 in 38 chance that the organization will receive \$108 million as a payoff. The expected value of this investment is a negative \$157,895, or approximately -5.3 percent. This doesn't appear to be a very attractive investment opportunity for an organiza-

“There is no single value that can be used to determine a firm’s risk appetite.”

tion. In fact, this is equivalent to playing roulette with 38 numbers (1-36 plus 0 and 00) and betting a single number with a payoff of 35 to 1, not something most organizations would do with their capital. However, the same odds could also apply to a catastrophe reinsurance treaty that pays off approximately once every 38 years. In this event an insurer may very well purchase this contract for \$3 million, despite its negative expected return and the 97.4 percent chance that it will receive nothing in return. By reducing the effect of a catastrophe on the company in the unlikely event that a major disaster occurs, this could be a useful investment.

Therefore, an organization’s risk appetite is based on the distribution of aggregate results of the organization considering all risks the organization faces—hazard, financial, operational and strategic. However, just as an appetite is not based on any one single factor, risk appetite is a function of multiple characteristics relating to this distribution. Some stockholders (such as hedge funds with their asymmetric compensation structure), and most option holders view the possibility of a large payoff that would significantly increase the stock price very positively, even if the expected value of the investment that may generate this large payoff is lower than alternative investments. Stockholders are also concerned about the expected value of the stock price, and that is influenced, at least in the short term, by whether reported earnings meet or exceed expectations. Some stockholders focus on the stock price in the short term (for example, mutual funds that report returns quarterly). Therefore, any risk that could impact earnings by enough to cause the stock price to drop in the short term would be a concern. Thus, a company might have a constraint on risk such as the chance of a decline in earnings of more than five cents a share has to be less than 10 percent. Other stockholders are more concerned with the long term outlook for the stock. For these investors, stock price volatility in the short run is acceptable if it improves the long term prospects. Other factors that go into the risk appetite from the point of view of stockholders would be the chance of a ratings downgrade, the chance of breaching bond covenants and the chance of bankruptcy.

Other stakeholders in a company would have additional considerations regarding risk appetite. In addition to the

chance of bankruptcy, bondholders are concerned about the extent of their losses in the event of a bankruptcy. They would be concerned about the chance of losing more than, for example, 20 percent of their investment or the chance of receiving nothing. Other creditors of a firm may only be concerned about the company’s short term viability so that payments for services rendered can be made. Salaried employees may not be concerned about the stock price, unless they hold company stock as part of a 401(k) plan, but they would be concerned about the possibility of layoffs at the firm. Employees who receive bonuses would be concerned about financial results impacting the level of bonuses. Long-term employees in companies with defined benefit pension plans would be concerned about any outcome that would lead the company to terminate this plan, preventing them from continuing to accrue benefits and increase their salary on which their pension will be based. Society at large could also be concerned about the risk appetite of an organization if a bankruptcy could shake confidence in an entire industry (such as a bank), has so much counterparty risk that bankruptcy could cause a domino effect (Bear Stearns), or could impact employment at many suppliers (General Motors).

There is no single value that can be used to determine a firm’s risk appetite. If it were, then stochastic dominance could be used to decide which risks to accept and which to avoid.¹ Risk appetite must consider the income statement for measuring the effect of a risk on earnings, the balance sheet for determining the impact of risk on key financial ratios, and even off balance sheet items that could affect an organization’s financial position.² Thus, risk appetite has multiple dimensions that are based on multiple sets of financial data.

Responsibility for sorting out all of the competing interests relating to the risk appetite nominally falls to the board of directors. However, the board faces significant hurdles in making this determination. The first hurdle

FOOTNOTES:

¹ See Bawa (1975) for a full explanation of stochastic dominance and D’Arcy and Gorvett (2004) for an insurance application.

² Off balance sheet items caused significant losses for Enron on energy futures and Citigroup and Merrill Lynch on collateralized debt obligations.

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would be a lack of expertise in making complex decisions under the level of uncertainty the risk appetite entails. As Enterprise Risk Management is an emerging field, there are no clear guidelines for making this determination, and the types of risks organizations face can be unfamiliar to many, if not all, directors. For example, Citigroup's foray into complex credit derivatives generated risks that evidently no directors fully understood. A second hurdle is that the board typically includes some inside directors who hold significant stock options. Based on the asymmetric payoffs of options, it would be in their best interest to accept investments that could produce large payoffs, even if that increased the risk of significant losses. A third hurdle is that the distribution of outcomes the firm faces cannot be displayed by a single distribution of any one of the financial documents that affects risk appetite. Even if a firm had a model that integrated all aspects of risk into a single measure, and then produced a distribution function for a particular financial variable based on multiple stochastic simulations using that model, the resulting pdf would not provide enough information for a board to use to determine the risk appetite. The model would produce results based on a single set of assumptions for a large number of parameters. For example, assumptions about interest rates, likelihood of default on bonds, expected growth in markets, loss frequency, and many other factors. However, if the expected values or the volatility of each were to change, such as interest rates were to become more volatile than the base case parameters indicated, then the results could be significantly different.

Given the complexity of the entire process and the potential conflicts of interest that board members reflect, there is a critical need for transparency about a firm's risk appetite. The optimal process for dealing with risk appetite would be for each organization to include the firm's selected risk appetite in published financial documents. Key elements that should be included in this report include what factors are used to determine the organization's risk appetite, what target levels apply and details about key parameters that go into the model.

Although some firms may object to providing this information to the public, either for competitive reasons or to prevent shareholders from knowing the risks the company is assuming, this reluctance could be dealt with in two

ways. Either regulators could require that this information be provided, or it could be optional. If optional, then companies failing to disclose this information may find their value adversely affected if shareholders consider this information to be important. Given recent events and the level of risk aversion investors are currently displaying, it is likely that failure to disclose a firm's risk appetite could lead to a significant market penalty.

An example of the information that should be disclosed is listed below. Use of a consistent format, by regulation or standards of practice, would be necessary to allow for meaningful comparisons to be made.

Our firm used a stochastic model to incorporate all of the significant measurable risks that we face. The key variables that affect results include interest rates, equity returns, GDP growth in the United States and Canada, and housing prices. The equations used to simulate these variables and the base case parameters are ...

Based on base case estimates for expected values and volatilities of key parameters, our risk appetite is as follows:

- 1. Expected return on capital is to exceed 10 percent over the risk free rate*
- 2. Chance of an increase in earnings per share of more than 50 percent is at least 10 percent*
- 3. Chance of a reduction in earnings more five cents a share is less than 25 percent*
- 4. Chance of a ratings downgrade is less than 10 percent*
- 5. Chance of failing to meet all current bond covenants is less than five percent*
- 6. Chance of bankruptcy is less than 0.5 percent*

Sensitivity analysis has been performed on all variables to determine the impact of deviations from the expected values. For those variables having a significant impact on results, a Delphi approach has been used to determine the highest likely values for those parameters, and the model has been rerun. The highest likely values for the parameters for which the model is most sensitive are...

Based on highest likely levels for expected values and volatilities of the critical parameters, our risk appetite is as follows:

1. *Expected return on capital is to exceed three percent over the risk free rate*
2. *Chance of an increase in earnings per share of more than 25 percent is at least one percent*
3. *Chance of a reduction in earnings more five cents a share is less than 50 percent*
4. *Chance of a ratings downgrade is less than 25 percent*
5. *Chance of failing to meet all bond covenants is less than 15 percent*
6. *Chance of bankruptcy is less than three percent*

Once this information is made public, stakeholders in the organization can either work to change any of the criteria with which they disagree or to terminate their stake in the organization. If any of the parameter estimates seemed unreasonable or were out of line with what other firms were using, then the market value of the firm would likely adjust to reflect a more appropriate level. Two obvious

arguments against providing this information are the complexity and cost. This process, once in place, would be no more complicated than the pension determinations required under ERISA for defined benefit plans. There is substantial literature that supports the beneficial effect for financial markets of disclosing pension obligations. For the cost objection, although it would be costly, it would likely be less costly, and much more beneficial, than the additional auditing requirements established by Sarbanes-Oxley, and, if these reporting requirements had been in place, they would have prevented the credit derivative debacles that investment banks experienced in recent years. Risk appetite is a critical and complex issue, and should not be left to the board of directors to determine in private, given the potential conflicts of interest. Only by full and consistent public disclosure of the choices a firm is making relating to risk, can adequate oversight be provided, and confidence in the financial markets restored. ♦

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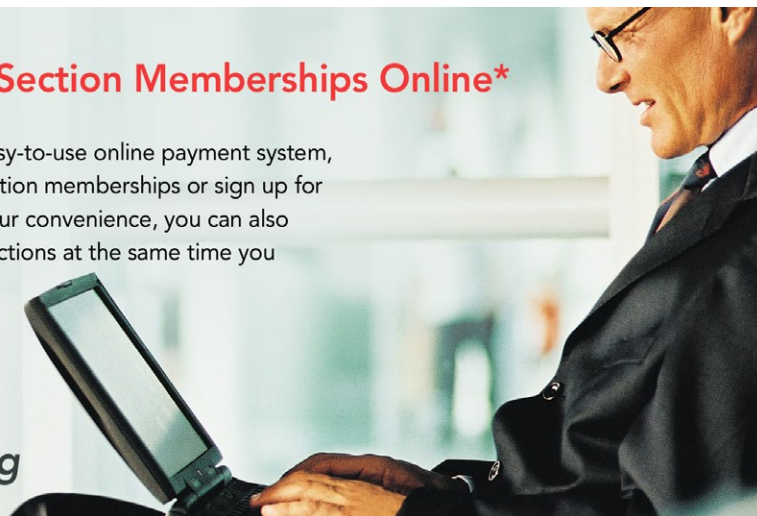
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Solvency II Primer

By Judy Wong

INTRODUCTION

THE MOVEMENT towards fair value accounting and market consistent valuation of assets and insurance liabilities has led to global efforts to revise the current insurance solvency regulation. Solvency II, a new solvency regulation initiated in the European Union, determines capital requirements using a fair value approach as opposed to the formula-driven Risk Based Capital framework that is currently adopted in the U.S. European insurers are required to be in full compliance with Solvency II by 2012. Regulators around the world including the United States are also closely reviewing the Solvency II regime in terms of incorporating elements of it into their own local regulations.

This article serves as a Solvency II primer by first introducing the Solvency II framework and then identifying several implementation issues that are still being resolved. Finally, it provides a discussion on how the credit crisis in 2008 could affect the framework as it continually evolves.

SOLVENCY II FRAMEWORK

Solvency II is based on the concept of fair value of liability and market consistent valuation. It is a dynamic approach of looking at the balance sheet where two points in time are considered: the current balance sheet and the balance sheet at the end of the year. It requires companies to have enough capital to withstand adverse changes to the Fair Value of Liabilities (FVL) over one year at the 99.5th percentile confidence level. The FVL is the sum of two components: the Best Estimate Liability (BEL) and the Market Value Margin (MVM). Figure 1 illustrates the Solvency II balance sheet at the valuation date (Time 0) and one year forward (Time 1).

BEST ESTIMATE LIABILITY

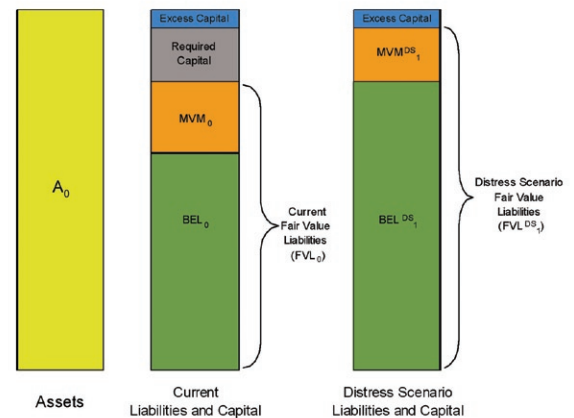
The Best Estimate Liability is the unbiased estimate of the present value of expected future cash flows. In other words, the cash flows are valued using best estimate assumptions with no explicit margins incorporated.

FOOTNOTES:

¹ Ernst & Young, 2007. *Report on Market Value Margins for Insurance Liabilities in Financial Reporting and Solvency Applications.*

FIGURE 1

The Solvency II Balance Sheet¹



*Distress scenario is the 99.5th percentile worst case scenario

MARKET VALUE MARGIN

Since insurance cash flows are not deterministic, simply considering the BEL to be the fair value of liability will underestimate the liability value. The BEL is the outstanding liability on average only. There is the risk that actual experience will be more adverse than expected, or that a catastrophic event could happen, causing the actual outstanding cash flows to be much larger than expected. As a result, there needs to be an additional “risk margin” component built on top of the BEL. This value is referred to as the MVM. The MVM can be interpreted as the cost of putting up capital to assume the risk of experience adversely deviating from best estimate assumptions. Note that the MVM only covers non-hedgeable insurance risks such as mortality and policyholder behavior risks. Hedgeable financial risks such as equity and interest rate risks are not captured in the MVM since these risks can be completely hedged through market transactions.

“Regulators around the world including the U.S. are closely reviewing the Solvency II regime in terms of incorporating elements of it into their own local regulations.”

There are various methods to derive the MVM. Solvency II prescribes that the MVM be calculated using the cost of capital approach as described below:

- 1) Determine the capital base needed to support the liability on the valuation date.
- 2) Project the capital base each year forward until the liability is expected to be paid off.
- 3) For each year, multiply the capital base by the cost of capital rate and take the present value of the product.
- 4) Take the sum of the present values for all years from Step 3 to arrive at the MVM.

SOLVENCY CAPITAL REQUIREMENT

Figure 1 shows that the distress scenario FVL is the sum of BEL^{DS}_1 and MVM^{DS}_1 , i.e., the estimated BEL and MVM at the end of one year following a distress event at the 99.5th percentile determined through simulation. The required capital is the difference between the distress scenario FVL and the current FVL. It can also be expressed as the sum of the changes in the BEL and MVM:

$$\begin{aligned} \text{Required capital} &= FVL^{DS}_1 - FVL_0 \\ &= (BEL^{DS}_1 + MVM^{DS}_1) - (BEL_0 + MVM_0) \\ &= (BEL^{DS}_1 - BEL_0) + (MVM^{DS}_1 - MVM_0) \\ &= (\text{change in BEL}) + (\text{change in MVM}) \end{aligned}$$

The change in MVM is difficult to quantify. It is more straightforward to calculate MVM^{DS}_1 directly rather than separately calculating MVM_0 and the change in MVM. The remaining component of the required capital, i.e., the change in BEL, is defined as the Solvency Capital Requirement (SCR) under Solvency II. It is easy to see from this definition that the SCR is a value-at-risk measure at the 99.5th percentile over a one-year time horizon.

ISSUES

While Solvency II aims to provide a risk-sensitive framework of capital adequacy and move away from the traditional formulaic approach of quantifying capital requirements, there are several implementation issues that are still subject to ongoing discussions.

CALIBRATION OF THE MVM

The Market Value Margin measures a market consistent price to compensate companies for providing capital to assume risks. In order to be market consistent, the components of the MVM, specifically the cost of capital rate, need to be calibrated properly. At the time of writing, the cost of capital rate is prescribed by the Solvency II task force to be a fixed six percent over the risk-free rate. It is questionable whether this is truly the market consistent cost to raise capital and whether the cost should be kept constant regardless of current market conditions. Furthermore, the cost of capital methodology implicitly assumes that companies will always be able to raise capital in the market. The credit turmoil in 2008 provides ample evidence to show that when the market is under stress, not only will the cost of capital skyrocket, but raising capital could be infeasible at these elevated rates. Given the uncertainty around the true cost of capital rate, it would be prudent to conduct thorough stress testing of the MVM to ensure it adequately captures the risk margin even in stressed situations.

USE OF INTERNAL MODELS

Solvency II promotes the use of internal capital models by allowing companies to use their own models to determine the BEL, SCR and MVM, provided the models meet several standards. While the use of internal models may induce companies to take a more rigorous approach in measuring their risk exposure, the sub-prime crisis has brought about a lot of attention and skepticism on the use of sophisticated models. Some argue that market-consistent liability valuations are mark-to-model rather than mark-to-market concepts. Since insurance liabilities have no observable market price, calibrating the capital models becomes a very challenging task. The move away from formula-driven solvency rules will require regulators to possess both superior risk modeling knowledge and common sense, so they can decipher the black-box nature of capital models and at the same time rationally assess whether model results truly make sense.



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This will require the investment in additional resources for model review and validation by insurance regulators in many jurisdictions.

LESSONS FROM BASEL II AND THE CREDIT CRISIS

Basel II, the fair-value based solvency regulation for banks, came into effect in the United States in the beginning of 2008. The Solvency II framework is similar to Basel II in many regards. Examining how Basel II has unfolded in the midst of the credit crisis may offer insights into shaping the future of Solvency II.

SYSTEMIC RISK

In an effort to reign in the economic slump in 2008, governments around the world injected billions of capital into banks and insurance companies. While this promotes liquidity and solvency, it introduces uncertainty into the financial system as there are now subjective decisions being made by the governments to boost the capital of some otherwise would-be insolvent companies. It becomes difficult to gauge just how much risk remains in a company after a government bailout. The credit crisis sparked discussions around the need to allocate capital for systemic risk, i.e., the risk of a total collapse of the financial system. Research is currently underway to determine how systemic risk should best be captured under the Basel II framework. The results of such research could be applicable to Solvency II as it currently does not require companies to put up capital for systemic risk.

PRO-CYCLICALITY

Both Solvency II and Basel II are susceptible to pro-cyclicality as they are market-consistent approaches that prescribe capital requirements sensitive to the risk profile

of companies. In a good economy, the market value of assets is high and adequate to maintain healthy capital ratios. When the economy weakens, asset values fall and capital levels decrease. If the market value of assets decreases enough so that capital levels dip below minimum requirements, companies could be forced to sell risky assets that are capital intensive to lower their capital requirements. The increase of securities for sale in the market further depresses asset values, exacerbating the downturn. Regulators are working to come up with solutions to address pro-cyclicality. One proposed approach under Solvency II suggests mandating periodic stress testing of cyclical effects on capital positions to detect any potential capital shortfall. In cases where future capital inadequacy is deemed possible, regulators can prescribe a capital add-on to the SCR to “prepare for rainy days.” This method of over-collateralization of risks was also used to enhance the credit ratings of sub-prime bonds. In the case of these bonds, over-collateralization has proved inadequate. Capital add-ons need to be clearly defined and frequently reviewed to make them truly useful.

CONCLUSION

Solvency II takes on a new approach to regulate capital requirements by quantifying risk on a market consistent basis. One of its stated purposes is to provide incentives for companies to develop good risk management practices. While Solvency II is a big step forward from the traditional formulaic-based solvency approach, its use of mark-to-market valuations increases instability when markets are volatile. Policymakers and the insurance sector will need to continue to work together to resolve outstanding technical issues on the implementation of the Solvency II framework, at the same time learning from the recent experiences of banks and other financial institutions in the credit crisis. ♦

Talking Risk & Capital

By Diane Reynolds

REGULATIONS, HIGH-PROFILE LOSSES, the credit crunch, exchange rate fluctuations, political factors, and a growing appreciation for risk management are driving investors to demand more information from the firms in which they invest. Perhaps hardest hit by many of these factors, and therefore under the greatest pressure to disclose their risks are financial institutions. A series of surveys reveal how banks have adapted their annual reports to include more risk disclosure as they adjusted to new regulations and pushed through the beginning of the credit crunch. Using this experience as a foundation, we examine possible future directions in risk reporting by insurers, as they negotiate turbulent markets and move towards Solvency II compliance.

Can investor relations improve through better risk disclosure? If so, this would constitute an immediate shareholder value add—beyond the information itself. However, the anecdotal results are somewhat mixed. Surveys indicate that investors place significant value on risk information. For example, a recent survey by Price Waterhouse Coopers¹ found that respondents regarded ‘quality of compliance and risk management process’ (41 percent) and ‘transparency’ (41 percent) ahead of ‘performance’ (40 percent) when asked for the main criteria for deselecting investment providers. In contrast, AIG did not fare well in September when its financial products division began racking up large losses. Despite comprehensive risk disclosures in its 2007 annual report, its share price tumbled more than 90 percent in the wake of the losses.

Investors demand not just more information, but comparable information. Is a common disclosure road map possible? Firms and investors alike were looking to regulations such as Basel II and Solvency II for answers. Things have changed and investors are becoming more directly demanding. Ultimately, a compromise that allows the financial industry to continue operations in the short term, while ensuring a longer-term move towards greater capitalization and stability must be reached. Financial institutions are forging ahead, learning from each other to develop appropriate methods of disclosing relevant risk information to stakeholders.

One of the most public ways for a firm to disclose and discuss its risk management practices is through the annual



report. In its annual *Risk Report*,² Algorithmics surveys 100 of the world’s largest banks by reviewing their annual reports to assess how they are discussing their risks with their investors. The most recent survey examined 2007 annual reports, finding that 75 percent of banks chose to provide a separate, usually unaudited ‘risk report’ as part of or adjacent to the annual report.

In contrast, only 49 percent of banks included such a report for 2006. Of the 26 ‘new’ risk reports, many were created by simply increasing the profile of the risk-related information rather than enhancing the disclosure details. For example, by moving it into the core of the annual report as a separate “risk report” section instead of leaving it buried in various, scattered notes to the consolidated financial statements, risk information



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FOOTNOTES:

¹ See the survey, *Transparency versus returns: The institutional investor view of alternative assets*, conducted by the Economist Intelligence Unit on behalf of PriceWaterhouseCoopers (PwC).

² Article available from www.algorithmics.com.

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was consolidated and easier to locate. The consequences of this move from the investor perspective are two-fold: risk information is (1) more readily accessible to investors, but (2) less reliable, since it moves outside of the typical external auditor review process.

The length and level of detail in the risk report varied greatly, with banks dedicating between two and 128 pages to risk disclosure. Still, with an average length of 28 pages, or 11.2 percent of the entire annual report, dedicated to risk, the extent of the information was considerable in many cases. Although a high degree of variability in the content of the risk report was also found, the most common outline for a risk report is shown in the table.

Outline of a Typical Risk Report for 2007

1. Statement of solvency
2. Risk management committee structure
3. Definitions of risk(s) and capital
4. Description of material risks
5. Provisions & loan loss reserves (i.e., amounts already set aside to cover 'known' risks and prior losses yet to materialize)
6. Exposure breakdown: rating, sector, etc.
7. Risk quantified: VaR, CTE, or capital
8. Risk measurement methodologies (e.g., what is VaR?)
9. Risk attribution: business unit, country, etc.

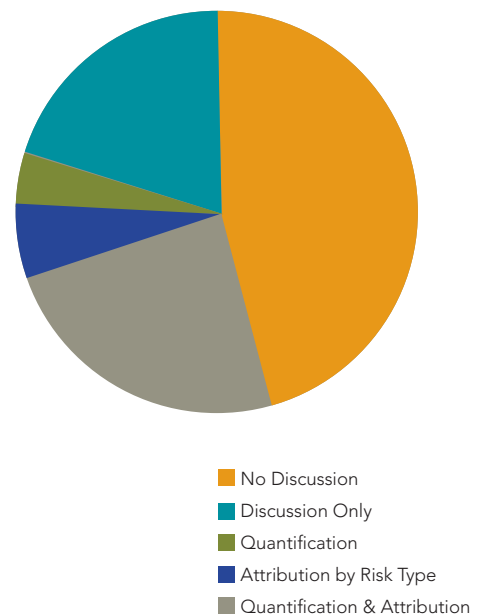
A majority of banks used their risk report to establish the link between capital and risk. About two-thirds of risk reports (54 of 75) used economic capital to describe capital requirements and quantify risks. Although the definition of economic capital varies from one institution to another, most revolve around the same key elements. Specifically, economic capital is:

- The capital required to support the risk-taking by the firm
- Meant to cover a list of particular risks
- Inclusive of diversification benefits
- Based on a confidence interval (with a number provided)—and that this confidence level is related to the rating of the institution
- Measured over a particular time horizon.

Significantly, 30 firms (up from 19 the previous year) went beyond definitions and discussions to actually quantify economic capital. Of those 30, six (five last year) stated an overall capital requirement, four (three last year) provided an attribution of capital across risk types, business lines and/or geographical centers, and 20 (11 last year) provided both types of information.

Not only were more banks discussing economic capital, more detailed information was also provided. For example, Commerzbank not only allocated its economic capital by risk type, it supported the distribution of economic capital with stress tests and scenarios analyses for each risk type, then compared stressed economic capital to available capital. If this seems a sophisticated strategy, keep in mind that AIG also provided stress test information in their 2007 report.

Talking Economic Capital



One area where there was little change was in terms of comparing economic capital requirements to a benchmark of available capital or funds. Unlike measures of regulatory capital which can be compared to shareholder equity, economic capital is a forward-looking measure of risks on an economic basis. It is counter-intuitive to compare

“A standard liquidity-based benchmark for economic capital, such as cash & equivalents, may emerge from the crisis of autumn 2008.”

a book value to an economic measure, leaving the identification of a suitable benchmark in question. As IFRS moves firms inexorably toward mark-to-market of assets, a more suitable benchmark may become available. Given the events of the autumn of 2008, however, one might also consider a more liquidity-based benchmark such as cash & equivalents.

How did insurance firms compare to banks in 2007 reporting? Taking Great-West Life as an example, we found six pages devoted to identifying and defining a wide variety of risks in an easily-identifiable risk report addressed under the management discussion in the annual report. In contrast, Manulife Financial, the parent company of John Hancock, devoted only two pages (of 124) to defining and quantifying interest rate, reinsurance and credit risks in Note 7 to its financial statements. Like many banks, there is of course other risk information available in the report—it is divided across several, variously labeled notes.

Other insurers surveyed included Sun Life (risk report, three pages) and All State (17 pages spanning four separate sections). These examples illustrate the variety in reporting details, methods and locations. Arguably, the variety itself obscures the risk information by making it more difficult for investors to compare firms. This admittedly small sample also showed distinct similarities between insurer reporting in 2007 and bank reporting in 2006.

Looking more closely into the earlier AIG example, we found that AIG dedicated 25 pages to risk in a clearly labeled section; but embedded it in section 7 of their 10-K filing. Rather than addressing risk in the core 50-page report, one had to search through the section-by-section contents to locate it. (Although one must note the standard location of risk in 10-K filings.) More extensive than other insurers reviewed, the risk information included definitions of key risks, an overview of the management processes and even a discussion of economic capital model enhancements (no quantification).

Clearly, the length of the risk report is only a crude metric of the extent to which risks are reported. Other issues such as the scope and quality of the information take precedence. Further, while the concept of ‘gathering together’ all of the risk information into a central location is appealing, it may not be practical. Many accounting standards (e.g., IFRS 7) and regulations reference or require the disclosure of risk measures or practices. Some of the details must be audited and/or impose strict rules on referencing of unaudited information. These competing requirements create complexity in the design of a risk report.

The CRO Forum³ addressed this issue in its November 2008 paper, “Public Risk Disclosure under Solvency II.” In an effort to promote market discipline they proposed a principles-based standard for risk disclosures that would provide harmonized reports to stakeholders, thereby reducing negative surprises and permitting comparisons across firms and across time. The five key principles included (1) group disclosure as a reference, (2) leverage of financial reporting, wherever feasible, (3) materiality, (4) appropriateness of disclosures to the risks faced and audience and (5) comparability of solvency, based on Solvency II standards.

In discussing materiality, the CRO Forum stated “Risk disclosure should include the specific definition of materiality used by the undertaking [firm] and a description of the material risks faced by the undertaking, the governance framework for managing these risks, and the relationship between risk and capital.” In other areas, quantitative disclosure is encouraged, and stress testing deemed essential.

FOOTNOTES:

³ See <http://www.croforum.org/>

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From a practical perspective, the CRO Forum also presented a template for risk disclosures accompanied by an example. These items are well worth examining in detail. As a summary, the outline proposed by the Forum for risk disclosure is presented in the table below.

CRO Forum Risk Report Template

Risk Overview

- Risk Governance Framework—organization, controls, and policy
- Risk Overview—material risks, solvency assessment, mitigation

Risk assessment by risk category

- Quantitatively assessed risks: non-life underwriting, life & health underwriting, market, credit, and operational risks
- Qualitatively assessed risks: liquidity, strategic and reputational risks

Capital adequacy management

- Internal capital adequacy
- Regulatory solvency

Required capital for major solo entities

Generally, this proposed outline tracks well with the more detailed risk reports provided in 2007 annual reports. By

creating a standard template, information will be easier to locate and compare. Within the detailed outline provided in the paper, there are also guidelines as to the measures firms are expected to disclose for quantifiable risks—something that is currently high non-standard.

Certain questions remain open, however. For example, stress testing is not addressed. Rather, there is a statement that Solvency II is expected to produce a common set of standard stress tests to serve as reporting benchmarks. While this might be the case, Basel II regulations do not as yet include standard stress tests, instead leaving it to each institution to tailor stress tests to its own particular circumstances. Perhaps a combination of common and customized stress tests will emerge as a standard, however, some care must be taken not to create too high a burden.

We have already seen some significant changes in the extent of risk reporting amongst large banks and leading insurers. Risk management, already high on the budget agenda based on regulatory compliance considerations and gaining momentum in the popular press through the growing credit crunch, rogue trading, rumors of downgrades & growing spreads, then actual defaults and downgrades, took center stage in September and October 2008 as market turmoil escalated. However, questions remain as to what new standards of best practice for risk disclosure may emerge from this latest market lesson in risk management. The CRO Forum has taken an important step along this path. ♦

Uncertainties, Challenges and Opportunities of Global Insurance Regulatory Convergence

By Matthew Clark

THE GLOBAL INSURANCE INDUSTRY

is experiencing dramatic change as reserve and capital regulations transition from the traditional, prescriptive approach to stochastic, principles-based approaches. This fundamental change most likely portends the gradual global convergence of regulation across countries and insurance products. At the same time, the current economic crisis seems to be creating a multinational appetite for tighter regulation.

Consequently, the industry needs to pay attention to the evolving new standards for reserves and capital. These standards will impact how individual companies deploy their capital within their various jurisdictions and the amount of risk they take on to achieve comparative cost advantage. This will change global industry dynamics. The stakes are high in terms of how well companies use the changes to their competitive advantage.

In the United States, there is a movement toward the principles-based approach which is likely to lead to the outright shift from U.S. generally accepted accounting principles (GAAP) to International Financial Reporting Standards (IFRS). The initial first steps have been Statement of Financial Accounting Standards No. 157 (FAS 157) for fair value or market-consistent valuation, principles-based reserves and capital changes. Similarly, Europe has focused on the principles-based, market-consistent IFRS and Solvency II. Even though the economic crisis has been called into question and, indeed, may delay various implementation timetables and the final drafts of principles and guidance, the eventual convergence of U.S. GAAP, IFRS and Solvency II seems set.

U.S. companies cannot afford to wait until the remaining uncertainties are resolved. The challenge is to understand and anticipate the impacts, particularly on capital management and deployment, and to act on the opportunities the changes introduce. While this article cannot address such specific implications as profit emergence over time and product profitability, it does address the key capital and risk management issues immediately confronting the industry.



EVOLVING AND CONVERGING GLOBAL METHODOLOGIES FOR CAPITAL RESERVES

Across jurisdictions, there has been a steady shift toward principles-based, market-consistent methodologies for setting reserves and capital requirements. In both the U.S. and Europe, the evolving changes resemble and leverage capital-quantification techniques, including stochastic analysis across multiple risk drivers. There has been considerable progress:

- As of 2008, the definition of fair value for U.S. GAAP was clarified with FAS 157. Although fair value for insurance liabilities remains undefined under IFRS Phase II, the definition in FAS 157 resembles the approach currently being proposed under IFRS, namely that fair value is derived using market-consistent techniques.
- The economic crisis is already driving an intensifying dialogue between the International Accounting Standards Board and the Financial Accounting Standards Board, so it is likely that there will be an accelerated convergence



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of principles as all jurisdictions work through the dramatic effects the crisis has had on the equity markets.

- Solvency II, the evolving European capital standard, is currently scheduled to be introduced in 2012, but is still in flux. In rough parallel with FAS 157 and IFRS Phase II, Solvency II employs a market-consistent approach to the valuation of insurance liabilities. At first glance, convergence might seem logical because of this common approach. However, each approach uses a different interpretation of market consistency for insurance liabilities. The Solvency II treatment of capital requirements at group and business unit levels (specifically the amount of credit that can be taken for group support as a means to cover local business unit capital requirements), has recently been tabled for further debate and could change significantly before final adoption.
- Proposed changes to U.S. statutory reserves and capital are being developed and are expected to be in place by year-end 2009. The standards are principles-based, with a run-off of liability cash flows calculated over a set of scenarios. The statutory approach is based on a real-world projection of asset and liability cash flows over the life of the liabilities.

When comparing new U.S. statutory reserves and capital with the prospective new frameworks and regulations of GAAP, IFRS and Solvency II, it is clear that there are similarities and differences among the underlying mechanics. The key variable is to what extent and how the evolving standards will deal with market-consistent valuation of assets and liabilities currently held.

Having said that, it is a virtual certainty that country regulators will ultimately achieve a global transformation—a harmonization—of capital and solvency requirements. At the end of the day, underlying differences in methodologies will not impede the trend toward that global harmonization.

GRAVITATING TO MARKETS OFFERING COMPETITIVE ADVANTAGE

While each of the evolving standards is an improvement over existing regulations, the variances among the standards suggest that formal global convergence may be farther off than expected. Nonetheless, differences in capital requirements will impact the competitive positions

of insurers throughout the global insurance market. The practical marketplace reality is that as new standards are phased in, capital and risk will gravitate to areas that offer companies the lowest overall cost of capital and risk. An efficient market should encourage the evolution of a converged global regulatory framework.

In such a converging, dynamic global market, if the competitive balance shifts toward a particular regulatory basis (all things being equal), one of two actions will occur: (1) the regulations in the jurisdiction at a competitive disadvantage will converge to those requiring less capital; or (2) the insurance liabilities will gravitate toward the jurisdiction that provides the most favorable reserve and capital requirements.

Companies domiciled in a jurisdiction with significantly lower capital requirements should be able to capture greater market share by passing on the lower cost of capital to policyholders through more competitive pricing. There will likely be additional barriers to the movement of risk, or a limitation on the credit taken for capital held across jurisdictions, but the impact will nonetheless be felt throughout the insurance industry. Countries within the European Union have retained control over risk incurred by companies within their boundaries. These country controls will likely continue as the global economy works its way out of the current crisis.

PROPOSED CHANGES PRESENT OPPORTUNITIES AND CHALLENGES

Increasing the understanding of the proposed regulatory reforms and potential convergence will help companies deal with and even embrace the proposed changes. The reserve and capital requirements currently applied to many U.S. products have led the insurance industry to find alternative approaches to capitalization.

Most actuaries would agree that the reserves required for term insurance are excessive. The capital requirement for variable annuities was altered under C3 Phase 2 to align the risk profile at a company level. The proposed changes will produce a reporting basis in which the required reserves and capital reflect the risks inherent in the product design. The key difference from a global perspective is the definition and quantification of risk.

“ Increasing the understanding of the proposed regulatory reforms and potential convergence will help companies deal with and even embrace the proposed changes. ”

As indicated above, the current differences in the proposed bases should converge. If the future brings reserve and capital requirements consistent with the risks taken, pricing methodologies will inevitably change as well. Convergence may present an opportunity, depending on such factors as products, markets and the future regulatory basis.

The timing and potential to alter the financing or change the pricing and marketing focus of an insurer requires insight into the proposed regulatory changes around the globe. It could be catastrophic for an insurer to ignore the cost of the changes outside its current jurisdiction. Likewise, the ability to anticipate the impact of changes on in-force business could prove invaluable.

BUSINESS IMPLICATIONS

The proposed global regulatory changes will have significant implications for the business:

- *Pricing.* The methodologies and metrics used to set product prices will likely adjust to reflect the change in reporting basis.
- *Financial reporting.* Organizations are already working on solutions to meet the increased processing and modeling demands. The challenge will be to produce stochastic results over a short time horizon.
- *Strategic decision-making.* Management will need to climb a steep learning curve to understand the results and movement in capital under a new reporting basis. When results are counterintuitive from the perspective of existing frameworks, actuaries and management will need to have confidence in the new reporting structure.

- *Benchmarking.* The metrics used to compare companies will need to change. This will require adapting the metrics currently used by outside parties, as well as additional disclosures. The goal will be to achieve a balance between information overload and information needed to understand the financial results.

CONCLUSION

Global insurance regulations are converging. Countries are not likely to support regulation or reserving methodologies that place their home-based insurance sectors at competitive disadvantage.

The journey forward will undoubtedly be a bit protracted and uncertain. But, patiently waiting for closure will not likely be rewarded. It is important for insurers to understand how each evolving regulatory change, both in and outside of their countries of domicile, will impact the capital they and their competitors are required to hold. Given the time and investment it will take to develop a stochastic capital framework, it is imperative that companies recognize the urgency and not wait for the regulators to drive them to act. Regardless of the direction regulatory capital requirements take, it would be myopic for insurers to adopt a wait-and-see stance.

The challenge for each company will be to achieve the most effective and efficient balance of capital cost and acceptable risk. This is a familiar challenge, but as the economy moves through the current crisis, the stakes have never been higher. ♦

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