JOINT RISK MANAGEMENT SECTION

Canadian Institute of Actuaries
Casualty Actuarial Society
Society of Actuaries

Risk management

ISSUE 31 ■ DECEMBER 2014

Actuaries
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Risk management

Issue Number 31 • DECEMBER 2014

Published by the Joint Risk Management Section Council of Canadian Institute of Actuaries, Casualty Actuarial Society and Society of Actuaries.

This newsletter is free to section members. Current issues are available on the SOA website (www.soa.org).

To join the section, SOA members and non-members can locate a membership form on the Joint Risk Management Section Web page at http://www.soa.org/jrm

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 David Schraub, JRMS Staff Partner, at *dschraub@soa.org*. The next issues of *Risk Management* will be published:

PUBLICATION DATES	SUBMISSION DEADLINES
March 2015	December 1, 2014
August 2015	May 1, 2015

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 Baker, 847.706.3501, at the Society of Actuaries for help.

Members Speak!

Love an article or strongly disagree with the opinion developed in another paper? Please share any comments or feedback on the JRMS newsletter with David Schraub at dschraub@soa.org.

Do you have a Risk Management question?

Ask us! Please send us your questions (dschraub@soa.org) and we will publish the questions and answers for everyone's benefit.

Chairperson's Corner

By Lloyd Milani

AS THE INCOMING CHAIRPERSON OF THE JOINT RISK MANAGEMENT SECTION (JRMS), I would like to thank Barry Franklin (chairperson), Susan Cleaver (secretary/treasurer), Louise Francis and Gene Connell for their leadership and hard work over the past year. The 2014 council, with the strong support of CAS, CIA and SOA staff members, has been able to accomplish a number of important objectives set out a year ago. Thank you to David Core, Les Dandridge, David Schraub and Leslie Smith for your support.

Earlier this year the JRMS launched the Digital library in partnership with EBSCO. The library contains approximately one hundred electronic books on various topics within the risk management field. As a member of the JRMS you have the opportunity to "borrow" these e-books for a period of up to two weeks at a time. We will be hosting a webcast over the next six months that will guide you through the process of "checking out" an e-book. I would like to encourage each of our members to try this new feature out and let us know what you think.

The section has recently published its fifth essay e-book, "How to Review an ORSA," available on the JRMS website. This is quite timely as companies in Canada are required to complete an ORSA by end of 2014 and U.S. companies will need to complete their ORSAs by 2015. We also put on two successful webcasts. One on ORSA in Canada and the other on stress testing. Both were well attended and provided participants with valuable information and insight.

I would like to congratulate Rebecca Scotchie, the chair of the organizing committee for the 2014 ERM Symposium, which was recently held in Chicago, from September 29 to October 1. The meeting not only provided valuable information on various risk management topics and issues, it was also an opportunity for over 400 risk management professionals within the financial services industry to exchange ideas on many leading edge risk management topics. Interesting perspectives were also provided by each of the keynote speakers during the luncheons. Didier Sornette laid out a framework to identify market "bubbles" and Felix Salmon presented imagery of the burning platform, relating it to risk management in a non-technical but very pragmatic approach.

I also had the opportunity to personally congratulate the winner of the JRMS call for papers on Practical Risk Management Applications. Damon Levine's paper on "Growth in Stock Price as the ERM Linchpin" was awarded a prize of $5,000. Congratulations, Damon.

Damon Levine receives award for JRMS call for papers on Practical Risk Management Applications.

Please stay tuned for details about the 2015 ERM Symposium to be held in Washington, DC, in June.
I look forward to 2015 and working with the new council and I am excited about the projects and initiatives we are considering for next year. As usual we will continue to support various research activities. We have $51,000 in funds committed to a number of research projects, including an Emerging Risk Survey, Unemployment and Under-employment, Advancing ERM in Canada and many more.
We will continue to provide support to various conferences' organizing committees. As part of our support we coordinate sessions that focus on risk management. This includes finding moderators and speakers for each of these sessions. If you are interested in speaking at any of the actuarial meetings please contact David Schraub at the SOA (*dschraub@soa.org*) and he will put you in contact with the appropriate person on the council.

Finally, this is your section, and you have the ability to make things happen. Consider writing an article for the newsletter, get involved with a conference, either by coordinating a session or being a presenter. Run for council, or just send us a note and let us know what you would like the section to do for you. ■

Lloyd Milani, FSA, FCIA, MAAA, is SVP & chief risk officer at Munich Reinsurance Co in Toronto, ON. He can be reached at *lmilani@munichre.ca.*

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Letter from the Editors

By Jared Forman and Cheryl Liu

THIS EDITION INCLUDES ARTICLES COVERING A WIDE VARIETY OF TOPICS WHICH DEMONSTRATES THE REACH OF RISK MANAGEMENT IN TODAY'S BUSINESS WORLD. Risk management has become such an integral part of the way companies do business and operate in the competitive marketplace. The marriage of risk management processes with other key business processes is increasingly becoming leading practice in the industry. We hope you enjoy this diverse set of articles and gain new insights into managing risks within your organization.

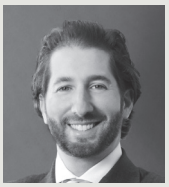
In "Trading places," Tom Herget and Evan Inglis present a case study on pension benefit projection from life company actuaries and pension actuaries prospective. By trading places, it forms a foundation future comparative and analytic work.

Jay Vadiveloo and his team describe how to develop a risk management tool to track, monitor and adjust a wide variety of actuarial assumptions like mortality, lapse or morbidity embedded in the pricing and reserving for any insurance product in "Tracking and Monitoring Claims Experience: A Practical Application of Risk Management."

"To Complexity and Beyond: A Guided Tour" by Dave Sandberg and Tom Herget introduces a current initiative by IAA—a new reference that will highlight and clarify the increased role and value of the actuary in managing the processes needed for the sustainable development of pooled risk.

Chief Risk Officers contribute their thoughts about the role of the CRO, regulation, organization, risk quantification and future outlook in "Increasing Authority and Higher Organizational Profiles: 2014 Insurance CRO Survey." Chad Runchey and Bill Spinard highlight the ongoing evolution of the role and confirm the increasing impacts of regulations that resulted from the financial crisis.

Last, we provide a list of recent articles and papers that may be of interest to the members. These pieces can provide further information on a broad range of topics. As always, we would like to thank David Schraub and Kathryn Baker for their support in pulling together what we hope is a thought provoking and insightful newsletter for our readers. ■



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Trading Places

LIFE AND PENSION ACTUARIES FIND COMOM GROUND TO EXPRESS FUNDING CONCEPTS

By Tom Herget and Evan Inglis

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Evan Inglis, FSA, MAAA, is a pension actuary and principal with the Terry Group. He can be reached at *evan.inglis@terrygroup.com.*

From Tom: Living in the state of Illinois, funding levels of public pension plans are always in the headlines—and it's never good news. At an actuarial club speech a few years ago, the speaker lamented that if life actuaries used pension rules to establish insurance company reserves they would be in jail. Still living in my hometown, I'm friends with many of my schoolmates who became firefighters, policemen and teachers. I'm a well-qualified life actuary, but found myself unable to find the prose to express to these pension fund members the gravity of their situation.

So, I searched for a colleague who had the same passion for this issue and who could translate the life terms into pension ones. My first two attempts fell flat. Then, at a dinner party, I was seated next to Evan Inglis and was amazed to discover that, after happy hour, communications went so well. To that, I should credit techniques championed by Raj Koothrappali.[1]

From Evan: Tom, public pension plans are in the news in Illinois, but everywhere else too! I've been following the issue and working and thinking about it for many years. While some systems are in reasonable shape, there are many city and state plans around the country that are heading for disaster. I know it's a complicated issue when even other actuaries like Tom don't fully understand it. Of course, I've always wondered about the actuarial numbers behind life insurance products, so when he described his idea to translate pension information into life insurance terms and vice versa, I said, "Sign me up!"

OBJECTIVE OF THE PAPER

Here's what we want to do:

- Help life actuaries to understand pension funding mechanics and to help pension actuaries to understand life valuation fundamentals,
- Enable life company actuaries to better grasp the issues surrounding public (state and local government) pension funding,
- Give pension actuaries a look at the funding requirements for life companies, and
- Form a foundation for future comparative and analytic work.

THE METHOD

Translating pension terminology into the life insurance vernacular is as fun and rewarding as translating British English into American. After some less than successful endeavors to grasp the similarities and differences with words, it appeared the only way out was with numbers. A case study. A very simple case study.

U.S. life companies prepare between three and five sets of financial statements. These accounting methods are statutory, GAAP, tax and perhaps economic value or a foreign parent's shareholder accounting. For this study, we selected U.S. statutory (regulatory) accounting (as opposed to U.S. GAAP) to display life company treatment since required capital calculations are tied to statutory accounting. Also, the resulting liabilities would

Table 1

Age	Salary	Spiked Salary Last Day of Year	Unspiked Cumulative Retirement Benefit	Spiked Cumulative Retirement Benefit
60	50,000	50,000	1,000	1,000
61	51,875	51,875	2,075	2,075
62	53,820	53,820	3,229	3,229
63	55,839	55,839	4,467	4,467
64	57,933	67,933	5,793	6,793

"The pension actuary and life actuary can now gauge standard practices in each other's world where the objective is essentially the same: to make good on promises to pay benefits in the future."

not be materially different between statutory and GAAP. Pension valuations are typically of two varieties—accounting and funding. In the world of government pensions, the Government Accounting Standards Board (GASB) recently changed pension accounting rules, but conceptually they are still quite similar to the way plans are funded. In this article we will illustrate the pension approach using typical funding techniques to determine contributions made up of a normal cost plus an amount to amortize deficits or surplus.

PENSION BENEFITS

Our illustration will focus on a single employee, Kim, who enters the workforce at age 60 then retires at age 65 with a lifetime benefit.

Kim receives annual salary increases, and the employer allows the inclusion of a final payment for unpaid sick and vacation days in the final year of salary. This pushes up the benefit amount and will allow us to illustrate the effect of amortization of deficits in the pension calculations. Kim's annual retirement benefit is based on years of service and pay, like this:

Ben65 = FAP x YOS x 2%

- Ben65 is the benefit payable at the normal retirement age of 65.
- FAP is final average pay; in this case we use one year of pay only and the last year will include extra pay for unpaid sick and vacation days.
- YOS is years of service.

KEY ASSUMPTIONS

The pricing (not accounting) interest environment is 4.5% level—a 4.5% return on assets (equal to the yield after defaults on a high-quality fixed income instrument) is assumed for the entire pricing period. Since life companies don't put equities into their general accounts, this reflects a high-grade corporate bond type of investing. In the pension world, the typical asset allocation is about 50% to equities, 25% to fixed income and 25% to real estate, private equity and other alternative investments. However, in our example, we assume a 4.5% return on the assets to facilitate comparison with the insurance company world.

We assume that mortality is also the same in the different environments, although government pension plans would generally use less conservative mortality rates than insurance companies. This study uses the RP2014 healthy table. Mortality improvements of 2% are projected annually for 10 years.

This is an extremely efficient enterprise, so there are no acquisition costs and no maintenance costs on the insurance side. The tax rate in this jurisdiction is 0%.

So far, we have created an environment where insurance and pensions are on even ground.

Now, let's take a look at the differences!

THE INSURANCE COMPANY GROSS PREMIUM

An annuity factor at age 65 using the interest and mortality assumptions described above is 13.08. Multiplying this by the annual benefit (with spiked pay) of $6,793 generates a single premium of $88,851, which generates a present value of benefits equal to $68,174 at age 60.

Most life insurance products are developed anticipating the policyholder will pay a level dollar premium. The level premium over five years for these benefits is $15,098. This premium is then loaded by 12% to cover risk, the cost of capital and to provide a provision for profits. (Please don't ask how the 12% was developed—our proprietary methods cannot be divulged). This generates a gross annual premium of $16,910. We expect Kim to pay five of these.

Please note that the insurance company insisted on recognizing the retirement benefit based on the expected "spiked" salary average.[2] While the pension plan provisions may or may not guarantee this, it has been the practice at Kim's employer for over a decade. Had not the life company understood this at contract inception, it still would have been required to establish similar reserves using the expected level of benefit payments based on best estimate assumptions used for cash flow testing in statutory accounting and for loss recognition testing dictated by U.S. GAAP accounting. For U.S. life companies, a liability using best estimate assumptions

CONTINUED ON PAGE 8

prevails over the often locked-in assumptions used as of policy issue date.

CASH FLOWS

The first 10 years' expected cash flow pattern, for the insurer, excluding interest, is:

Table 2

Age	Cash Flows
60	16,910
61	16,779
62	16,640
63	16,492
64	16,336
65	(6,496)
66	(6,424)
67	(6,347)
68	(6,265)
69	(6,177)

The cash outflows starting age 65 would be the same for the public pension plan but the cash inflows will be different, as we will get to in a moment.

INSURER FINANCIAL STATEMENT

Assets accumulate from cash flows. Benefit payments draw down the assets. For the insurer, there is an additional source of cash drain: dividends paid to shareholders. Before a shareholder dividend can be paid, the insurer needs to be sure it is retaining an amount of capital adequate to satisfy regulators and to receive a satisfactory evaluation from rating agencies.

In our example, required capital is established as 5% of reserves—in other words, additional funds are set aside to ensure the insurance company's viability, even in adverse circumstances. A key component of this cushion will be to provide for interest rate risk.

A major insurer concern is an unexpected demand by policyholders to cash in their policies in a rising interest rate environment—aka disintermediation. Policyholders take their cash value and run—to seek out higher-yielding policies. This would force an insurer to sell assets at a loss while the policyholder's cash value experiences no loss. As the accumulation period winds down, and the policyholder transfers to income-paying status, the option to cash in the policy disappears and this interest rate risk diminishes. Consequently, at the retirement age of 65, the required capital drops to 3% since this disintermediation risk is no longer a possibility.

Statutory reserves are calculated using assumptions that are conservative for the environment at the time the policy is issued. Interest has been lowered to 3.5%, and mortality has assumed an additional 3% annual improvement forever.

Table 3 shows excerpts from the insurance company financial statements.

Note the distributable earnings (shareholder dividend) column. The negative numbers in the first years indicate that shareholders (often a holding company) will need to provide additional funds—in other words, overall dividends from the company will be reduced in order to maintain a resilient balance sheet while this new business develops. The ability to distribute earnings from this policy improves as the required surplus drops to 3% of liabilities.

Life insurers are often owned by holding companies. These holding companies will periodically provide their subsidiaries with fresh capital to either support new business like Kim's policy or to shore up a weakened position.

How funded is this? In year 1, the ratio of assets to liabilities for the company is 105%; in year 10, 103%. Further, the liabilities use conservative valuation assumptions, which provide for adverse deviation and cushion for solvency.

Table 3

Age	Distributable Earnings	Ending Balance Assets	Liabilities	Surplus
60	(1,322)	18,993	18,089	904
61	(1,038)	38,420	36,590	1,830
62	(468)	58,005	55,508	2,498
63	14	77,836	74,842	2,994
64	505	97,905	94,594	3,311
65	1,652	93,871	91,137	2,734
66	1,122	90,260	87,631	2,629
67	1,085	86,604	84,081	2,522
68	1,048	82,905	80,491	2,415
69	1,012	79,169	76,864	2,306

Surplus actually held by companies is dictated by what the market and rating agencies demand. Actual surplus being held will be notably higher than what we illustrate here.

Kim is sleeping well.

PUT ON THE PENSION HAT

Now that we have seen how a life company would determine then fund for its liabilities, let's see how the public pension world differs.

First, the funding would be based not on a level dollar amount, but on a level percentage of salary because the pension is a component of pay. In the real world, this difference is more significant than in our five-year example.

Second, the funding, in practice, has been based on a benefit that doesn't anticipate any surge of annual salary a moment before retirement. This additional benefit has not been accrued during the active working period but is recognized the moment Kim retires. With a typical pension funding approach, any newly observed liabilities are not immediately funded but instead are incrementally recognized evenly over a 30-year period. The term for this delayed recognition is called amortization, a term life company actuaries use for adjusting asset values.

BUT WAIT

Before we proceed, let's look at terminology. The concepts are very much the same, but the names and numbers are different.

Life Insurance	Pension Actuarial
Gross premium	Normal cost
Reserve	Actuarial accrued liability (AAL)
Paid premium	Contribution

THE LIABILITY SIDE UNVEILED

For pension calculations, we will use the entry age normal, level percent of pay method for allocating costs. Table 4 shows the actuarial liability using this method.

Table 4

Age	AAL (EOY)
60	12,211
61	25,520
62	39,970
63	55,567
64	88,851
65	85,751
66	82,587
67	79,363
68	76,082
69	72,748

CONTINUED ON PAGE 10

Notice that the liability is pushed up substantially when the actual benefit based on final salary is determined in year 5. Below we describe how this change in liability is paid off gradually over a 30-year period. Here are the amounts that the insurance approach requires to be set aside compared to the pension liability.

The insurer provision (column 4) is significantly higher than its pension counterpart (column 6) for several reasons:

- Use of level, not increasing, funding premiums in the accumulation period,
- Immediate and full recognition of the anticipated benefit,
- Use of conservative interest and mortality assumptions, and
- The requirement to hold capital to support uncertainty.

BUT WAIT, THERE'S MORE

The prior section dealt only with the liability. What about the assets supporting these commitments?

In the insurer world, the policyholder remits the gross premium. The insurer holds it and invests it. It only relinquishes earnings to shareholders after benefits have been paid and when certain risk thresholds have been surpassed.

Table 5

Life Company					
Age	Company Liabilities	Company Capital	Assets (Liabilities plus Capital)	Pension Actuarial Accrued Liability	Targeted Level of Funding (Assets) Using 30-Year Amortization
60	18,089	904	18,993	12,211	12,211
61	36,590	1,830	38,420	25,520	25,520
62	55,508	2,498	58,005	39,970	39,970
63	74,842	2,994	77,836	55,567	55,567
64	94,594	3,311	97,905	88,851	72,169
65	91,137	2,734	93,871	85,751	68,988
66	87,631	2,629	90,260	82,587	65,743
67	84,081	2,522	86,604	79,363	62,437
68	80,491	2,415	82,905	76,082	59,074
69	76,864	2,306	79,169	72,748	55,657

In the public pension world, contributions are determined as the normal cost plus an amortization amount to pay down the deficit or reduce surplus—the target is for the plan to eventually be 100% funded. The normal cost pays for benefits during the current year. The amortization is designed, theoretically, to pay off the entire deficit over a certain period of time—often 30 years. The amortization payment is usually backloaded by assuming that it will increase each year with pay and be a constant percentage of the payroll. The amortization is frequently "open," meaning that a new 30-year amortization is calculated every year and the prior year's 30-year amortization schedule is wiped out.

Table 6 illustrates how a typical open amortization approach to paying off the unanticipated increase in liability due to spiked salary would work. This information is compared to the insurance company funding. The pension information in column 3 can be compared to the higher level of insurance company funding in column 5.

Note how the amortization of unanticipated increases in the liability for pensions defers funding well into the future, resulting in low levels of assets relative to the AAL.

IN CONCLUSION

So what have you learned? The pension actuary and life actuary can now gauge standard practices in each other's world where the objective is essentially the same: to make good on promises to pay benefits in the future. The life company actuary can now better anticipate his conversation in the supermarket when the talk turns to public pension funding.

It seems ironic that the same legislators who pass such strict laws for insurers don't provide the same level of security for employees of their own jurisdictions. Why can't legislation be passed or accounting rules changed to recognize obligations to safeguard the retirement of its employees? ■

ENDNOTES

[1] See any episode of "The Big Bang Theory."

[2] "Spiking" has been well-publicized and still exists, but is less common today than it was in the past. In this article, we use spiking as a convenient way to illustrate an unanticipated change in cost for the pension plan to illustrate how pension methods deal with deficits."

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SOCIETY OF ACTUARIES

Tracking and Monitoring Claims Experience: A Practical Application of Risk Management

By Jay Vadiveloo, Gao Niu, Justin Xu, Xiaoying Shen and Tianyi Song

BACKGROUND

This paper describes how to develop a risk management tool to track, monitor and adjust a wide variety of actuarial assumptions like mortality, lapse or morbidity embedded in the pricing and reserving for any insurance product. This is one of the most important controllable and actionable risk management tasks that a company should undertake and it will help companies reduce financial risks. This paper has been motivated by an article, "Building a Nervous System for Insurance Products" that Mark Griffin, Executive VP and CRO, Phoenix, shared with the Goldenson Center. Our paper builds on Mark's article and develops the statistical basis for identifying significant deviations in experience and determining whether it is a one-time occurrence or a trend.

Jay Vadiveloo, FSA, MAAA, is professor & director of the Goldenson Center for Actuarial Research at the University of Connecticut in Storrs, Conn. He can be reached at *vadiveloo@math.uconn.edu.*

Gao Niu is a graduate student in actuarial science at the University of Connecticut.

Justin Xu is a graduate student in actuarial science at the University of Connecticut.

A TWO-STEP STATISTICAL PROCESS

The risk management technique we have developed looks at two steps in the claims tracking process:

- The first step uses confidence bands to identify blocks of business whose actual experience deviates significantly from expected (pricing, reserving or any benchmark measure) in the current measurement period. This can be viewed as an early warning signal for companies.
- The second step uses historical experience and the student's t-test to check if this deviation represents a random fluctuation for the current time period or a fundamental change in actual experience.

Note that the second step is performed only if the first step identifies a block of business which shows a significant deviation from experience in the current period. Any block of business which falls within the confidence band in the first step is not analyzed further. Also, for the second step, the current experience is excluded in the historical analysis.

POTENTIAL ERRORS IN TESTING PROCESS

Based on this methodology, there are two error probabilities which are calculated:

1. The Type 1 error denoted by α for the first test is the probability of concluding that actual experience for a given block is significant in the current measurement period when it is not.
2. The conditional Type 2 error denoted by β is the probability that given the block of business is significant in the current measurement period, the second test concludes that the underlying experience has not changed when it has.

Note: We term this a conditional Type 2 error since we are ignoring the component of the Type 2 error where the first test is not significant but the underlying experience has changed. Our claims tracking and monitoring process only focuses on alerting management on blocks of business showing significant deviations in experience in the current measurement period and whether this significant deviation represents an underlying trend or not.

We will follow the standard approach in statistical hypothesis testing by fixing the confidence bands separately in step one and step two and calculating the various α and β probabilities for different levels of deviation in experience. A company will have to establish the appropriate confidence band parameters

> "Our testing process generates two possible errors that can be measured and calibrated to fit within a company's risk threshold."

for both steps in order that the resultant Type 1 and conditional Type 2 errors are acceptable within a company's risk threshold.

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METHODOLOGY SIMULATION

For a given set of confidence bands, we can simulate different values of α and β for different levels of change in underlying experience. Using mortality experience as an illustration, and denoting $q^* = actual\ mortality\ experience = 1-(1-q)^{(1+c)}$ and $q = expected\ mortality\ experience$, then c = 0 represents no change in the underlying mortality and c > 0 represents an adverse mortality trend. The mortality ratio A/B is the risk metric of interest where A = actual aggregate mortality experience for the current month and B = expected aggregate mortality experience for the current month.

CONSTRUCTION OF CONFIDENCE BANDS

For a two-sided confidence band in step one, it will be constructed as $[1-factor\times SD(A/B), 1+factor\times SD(A/B)]$ where the factor is based on the standard normal distribution for the given confidence band. Since mortality rates are available on each policy and policies are assumed to be independent, expected values and standard deviations are calculated for each policy and aggregated in calculating SD (A/B).

For step two, the corresponding two-sided confidence band is given by $\left[1-factor\times SD\left(A/B\right), 1+factor\times SD\left(A/B\right)\right]$ where $\overline{A/B}$ is the average of the historical aggregate mortality ratios and the factor is based on the t-distribution for the given confidence band where the degrees of freedom is determined by the number of historical periods being analyzed.

The Type 1 and conditional Type 2 errors have been modelled using 1,000 simulations of monthly deaths over a 24 month time period for 10,000 term insurance policies varying by issue age, duration, face amount, gender and underwriting class.

Table 1

Step 2 CI / Step 1 CI	60%								
	c=0	c=0.01	c=0.03	c=0.05	c=0.07	c=0.09	c=0.1	c=0.15	c=0.2
80%	6.0%	7.4%	5.6%	4.9%	3.1%	1.6%	0.9%	0.2%	0.0%
85%	4.5%	5.9%	4.2%	3.7%	2.6%	1.4%	0.8%	0.2%	0.0%
90%	2.2%	4.2%	3.2%	2.6%	1.6%	0.8%	0.4%	0.2%	0.0%

Table 2

Step 2 CI / Step 1 CI	70%								
	c=0	c=0.01	c=0.03	c=0.05	c=0.07	c=0.09	c=0.1	c=0.15	c=0.2
80%	4.2%	9.7%	7.5%	6.5%	4.3%	2.4%	2.0%	0.3%	0.0%
85%	3.3%	7.8%	5.8%	5.1%	3.5%	1.9%	1.7%	0.2%	0.0%
90%	1.8%	5.3%	4.2%	3.5%	2.2%	1.2%	0.9%	0.2%	0.0%

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Table 3

Step 2 CI / Step 1 CI	80%								
	c=0	c=0.01	c=0.03	c=0.05	c=0.07	c=0.09	c=0.1	c=0.15	c=0.2
80%	2.9%	11.6%	10.4%	8.3%	7.1%	4.6%	3.4%	0.5%	0.1%
85%	2.2%	9.0%	7.9%	6.5%	5.7%	3.6%	2.8%	0.3%	0.1%
90%	1.1%	5.7%	5.5%	4.3%	3.6%	2.5%	1.7%	0.3%	0.1%

RESULTS OF SIMULATION

Tables 1, 2 and 3 show the different values of the Type 1 and conditional Type 2 errors, α and β, for different confidence bands. In our example, we have modeled a one-sided confidence band to only detect adverse mortality experience.

Note:

1. Step 1 uses the standard normal distribution to construct the confidence band denoted in the tables as Step 1 CI.

2. Step 2 uses the t-distribution with 22 degree of freedom to construct the confidence band denoted in the above tables as Step 2 CI.

3. $c = 0$ represents no change in the underlying mortality; $c > 0$ represents adverse underlying mortality.

4. The Type 1 error α represents the proportion of simulations falling outside the confidence band for step 1 and step 2 when $c = 0$.

5. The conditional Type 2 error β represents the proportion of simulations falling outside the confidence band for step 1 and falling within the confidence band for step 2 when $c > 0$.

INFERENCES FROM SIMULATION RESULTS

From the results, we can make the following inferences:

- The lower the confidence limit for the second test, the lower the conditional Type 2 error for a given confidence limit for the first test.
- The higher the confidence level for the first test, the lower the conditional Type 2 error for the second test for a given confidence limit for the second test.
- For a given set of confidence levels for test1 and test 2, the conditional Type 2 error decreases as the adverse mortality factor increases.
- For this example, an appropriate set of confidence parameters to establish could be 90 percent for step 1 and 60 percent for step 2. This generates a Type 1 error of 2.2 percent and a conditional Type 2 error of 4.2 percent for 1 percent adverse mortality, decreasing to a negligible error (zero for 1,000 simulations) for 20 percent adverse mortality.
- Our focus is on the conditional Type 2 error since our tracking and monitoring process only examines the current month's adverse experience. However, a company will have to ensure that the confidence level in step 1 is not too wide since that would reduce the need of going through step 2. This could mask the detection of any historical adverse experience that is not being captured in the current month.

CALIBRATION PROCESS

Prior to establishing a formal claims monitoring and tracking system, a company will have to establish the appropriate confidence band parameters so that the resultant Type 1 and conditional Type 2 errors are acceptable within a company's risk threshold. The Type 1 and conditional Type 2 errors are also impacted by the frequency of the claims tracking (monthly, quarterly, annually etc.) and the number of degrees of freedom in the t-test for step 2. In general, the longer the frequency of the claims tracking and the smaller the degrees of freedom, the greater the Type 1 and conditional Type 2 errors. This should be an important consideration in designing a claims tracking and monitoring process for a company.

> "Claims tracking and monitoring is fundamental risk management and the benefits to a company are immediate and measurable."

TRACKING & MONITORING OUTPUT

Once the confidence band parameters have been determined as well as the tracking frequency and the number of historical periods to be tested in step 2, the claims tracking process we have developed will allow a company to identify blocks of business which show the following characteristics:

1. A significant deviation in experience in the current month and a change in underlying experience.
2. A significant deviation in experience in the current month with no change in underlying experience.
3. No significant deviation in experience in the current month.

CONCLUSION – A PRACTICAL APPLICATION OF COMPANY RISK MANAGEMENT

A disciplined and rigorous claims tracking and monitoring process can benefit a company in several ways:

1. It is an active risk management process since it identifies on a regular basis, blocks of business exhibiting adverse (or favorable) claims experience and whether it is a one-time occurrence or a change in the underlying trend, thus making it easy for a company to take any mitigating action steps.
2. It will better align the pricing, reserving and planning process of a company with the actual emergence of claims experience.
3. The process can help justify current drivers of claims experience and identify some new drivers of claims experience, thus providing a systematic way for a company to refine its claims predictive models.
4. A claims tracking and monitoring system of several actuarial decrements (mortality, morbidity, lapses) for a company could help identify correlations between risks. For example, blocks of business showing adverse lapse experience could also be the same blocks of business demonstrating adverse mortality experience.
5. It is a proactive way of dealing with regulators and analysts to explain earnings volatility arising from claims fluctuations.
6. The consolidation of a claims tracking and monitoring process of several peer companies will help develop industry best practices on how to manage claims experience and benchmark a company's own claims experience against its peers.

IDEAL FOR UNIVERSITIES WITH STRONG ACTUARIAL PROGRAMS

While many companies may lack the resources or time to develop a claims tracking and monitoring process and actively manage it, the use of actuarial resources at an accredited university which maintains strong relationships with insurance companies could be a cost-effective way to accomplish this. The Goldenson Center for Actuarial Research at the University of Connecticut has a strong actuarial program and a track record of working on actuarial research projects with the insurance industry. The Goldenson Center could undertake this initiative for its Advisory Board company representatives, which is comprised of the major insurance companies in the region. The repetitive and data-intensive nature of this project and its strong emphasis on fundamental actuarial and statistical principles makes this an ideal project to be undertaken by the Goldenson Center. Besides providing students with real-life industry experience, this will be a highly cost-effective way for companies to benefit from the academic rigor and exploratory analysis that students can provide in identifying drivers of claim experience in a disciplined and consistent manner.

Note: This research was sponsored by the Goldenson Center for Actuarial Research at the University of Connecticut.

To Complexity and Beyond: A Guided Tour

By Dave Sandberg and Tom Herget

Note: *In 2014, the Insurance Regulation Committee of the IAA formed a working group to initiate a Risk Book. The main aim of the Risk Book is to provide a high quality resource enabling actuaries and those regulating risk management to reference appropriate materials on the key issues needed for sustainable practices. The work is expected to be completed in 2015.*

OUR PROFESSIONAL PRACTICE HAS DEVELOPED TOOLS AND PROCEDURES TO IMPROVE RISK MANAGEMENT BOTH WITHIN AND OUTSIDE THE INSURANCE INDUSTRY. Because the heart of insurance is the acceptance of risk in a sustainable manner, actuaries have developed many tools and methods to successfully ensure the sustainable acceptance, management and prudent mitigation of risk. These methods help clarify the risk exposures and their sensitivities, and provide needed ongoing management tools. They are as necessary to illuminating the acceptance and transmission of risk as debits and credits are for tracing the acceptance and transmission of cash in an auditable manner.

The challenge is that unlike auditable cash and/or inventory, the quantification of risk has an inherent uncertainty around it. The title of this article alludes to Buzz Lightyear's line in "Toy Story," "To infinity and beyond" and perhaps could have also been titled "To Future Uncertainty and Beyond." We (at the IAA) would like to link the tools our profession has developed to estimate and manage risk to the disclosure and context needed to reveal and/or address the level of uncertainty/volatility that may accompany these estimates.

Fifteen years ago the International Actuarial Association (IAA) applied its efforts to identify emerging best practices and recommended the key principles for the reference *A Global Framework for Insurer Solvency Assessment*. The IAA's new effort intends to add to that previous work through two objectives:

a. Describe the professional developments of the last 15 years as they have been applied to the management and regulation of insurance risk for both established and evolving structures for pooling risk. These tools are often discussed in a silo fashion but much of their value comes from being used in an interconnected or complementary fashion. While each topic has value on its own, it is in realizing their interconnectedness that the more robust value and usage can be understood and applied.

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b. Provide a road map to enhance understanding and navigation of some of the more complex tools and risk structures that have been developed. This allows non insurance experts with an interest in sustainable insurance to ask intelligent questions. It also should help everyone to see the forest of key principles in a way that enables them to drill down to the specific trees that may be of interest to them.

This new reference has a working title of "Risk Management and Regulation – Some Practical Views." Each chapter is targeted to 10-20 pages. The chapters are not meant to be an exhaustive coverage of the topic, but to lay out the key issues and identify already published references on those issues. It will provide a place to start one's education or background seeking (a function similar to one provided by Wikipedia). Current tools and processes that we expect to include as chapters are:

1. Regulatory and management tools beyond reserves and capital for micro and macro purposes across various business models for accepting or generating risk.

2. Internal models – Their effective usage, controls and validation especially in relation to uses for possible

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required capital purposes. This includes the value of having the internal model processes being reviewed and signed off by those who are subject to professional standards.

3. Catastrophe Risk & Models – The causes and implications of catastrophe risk are covered with particular emphasis on the key modeling elements which are constructed and maintained by mostly third party providers.

4. Stress Testing. This chapter will build off the prior IAA work done on this topic and the implications of moving from uses for internal assessments to possible uses to set required capital standards-including either: a) stress testing an audited balance sheet, or b) stress testing a set of cash flows. This also includes the options for addressing correlations in times of stress versus normal times and the implications of one year versus multi year approaches.

5. Issues for groups. This chapter will look at risks arising in groups and explain how they are controlled. This chapter will also address the advantages that can flow from group structures. Other topics include risk limits, capital allocation, intra-group reinsurance counterparty risk, governance, culture, contagion, concentration and fungibility of capital.

6. Non-Proportional Reinsurance. This chapter defines the various types of reinsurance, discusses how pricing is performed, and addresses business effects (e.g., volatility reduction, diversification improvement, risk return enhancement and capacity increase).

7. The role and value of professional Actuarial Standards. Examples of such standards are data quality, communication and required disclosures, ERM, and assumption setting. It will discuss the roles of standards of practice, codes of conduct and practice notes as well as the roles of national vs. international standards.

8. Operational Risk. This chapter will summarize the contents of three recently-issued landmark papers on operational risk (OR). The Canadian Institute of Actuaries paper identifies the location and contents of current leading-edge sources on OR. Milliman's *Operational Risk Modeling Framework* focuses on quantitative assessment. The CRO Forum's *Principles of OR Management and Measurement* highlights the balancing of measurement with the management of people, culture and process issues.

One way we intend to accomplish the desired integration of these topics is by organizing a risk map. Desired functions of this map include:

a. Design and build stress tests (For example, is the purpose an internal or external assessment or to set a capital requirement?)

b. Map results of stress tests to the actions that can be taken to mitigate them–capital, management or regulatory actions, ex ante and ex post.

c. Compare similar risks with the ability to nuance risk profiles and the impact of differing relative risk exposures across business models.

Design issues that will need to be addressed for a useful risk mapping include:

1. A time dimension over which the risk exposure is manifested as well as for the corrective action(s) that can/will be taken. What does risk look like at one month, one year and three to five years into the future?

2. The map needs to work across differing business models with different relative risk exposures and time horizons.

3. How to address the reasonableness of the correlations in normal times vs. stressed times.

4. A visual output/representation via network theory tools is needed to reflect the character of the mapping instead of the traditional reliance on spreadsheets, formulas or pages of text. Could the map show a systemic landscape of risks and their current linkages? And, could it also be interactive and show different levels of resolution (e.g., google maps) and serve as a mass collaboration tool to communicate and sense and respond to emerging risks?

5. Instead of cataloging/lumping all risks into frequency/severity to calculate capital, focus on

"A common line heard about internal models is that 'All models are wrong.' While true, it is also misleading as everything we do is a model and subject to limitations including accounting reporting and the 'law' of gravity."

which parts are addressed via capital and which through processes.

6. Could we build a public mapping/database of financial and economic variables that apply to a company's unique risk profile? Could this mapping also reflect all past observed correlations (including regime shifts) plus the ability to dynamically alter them as well?

7. How and when to separate scenario generation from liability valuation.

Coincident to this work by the IAA is the desire from the Financial Stability Board to create a Global International Capital Standard (ICS) for insurance. There are two contrasting methods that can be used in this regard. One is to define a set of factors to be applied to various balance sheet and or other measures (like premiums or face amounts). The other is to use internal models.

Both approaches have important benefits and shortcomings. The simplicity of a factor based approach means that it will always be lacking in capturing changes in risk due to either new products or changed environment (state of the physical world and economic/political conditions). While the internal model may be based on a better mapping/revelation of the risk exposures of the organization, the results are based on what is likely to be complex algorithms with differing governance and validation tools across organizations. The IAA *Risk Book* chapters will be very helpful in suggesting tools, procedures and review processes to address the shortcomings of which ever method(s) are chosen for an ICS.

For example, one important contribution would be to increase the comfort with (and the ability to review and rely on) the results of models. A common line heard about internal models is that "All models are wrong." While true, it is also misleading as everything we do is a model and subject to limitations including accounting reporting and the "law" of gravity.[1] The key is to clarify the limitations and possible variability of the model output.

Twenty five years ago in the United States, two actuarial roles were developed to address this conflict between factors and subjectivity. For life products, the role of the actuary was to write a report (subject to regulatory and actuarial standards) that identified any missing risks that were missed by the factor reserves and increase them, if needed. The other role was for P&C actuaries to define a reasonable range for the reserve instead of being expected to produce a "single" number. We need the actuarial role to further expand on this idea of reasonable ranges for uncertain futures. In both cases, the actuary is being used to provide a more relevant risk context to an accounting number that can take on a too literal implication without that context.

In conclusion, it is the hope that this work will come to fruition during 2015 and will highlight and clarify the increased role and value of the actuary in managing the processes needed for the sustainable development of pooled risk. Traditionally we have been asked to calculate numbers based on the specifications of other professions and have missed important ways to clarify their context and implications for "To Infinity and Beyond." ■

ENDNOTES

[1] The "law" states that all objects fall at the same rate. But it depends on a key assumption of no friction. A piece of paper slowly falling is not an indication that the proposed model for gravity is "wrong" it just shows the limits of the model.

Increasing Authority and Higher Organizational Profiles: 2014 Insurance CRO Survey

By Bill Spinard and Chad Runchey

WHILE THE INSURANCE SECTOR HAS LARGELY RECOVERED FROM THE ECONOMIC IMPACTS OF THE FINANCIAL CRISES OF 2008-09, THE RISK MANAGEMENT LANDSCAPE REMAINS FOREVER CHANGED. This is nowhere more evident than in the changing stature, authority and visibility of chief risk officers (CROs) across the industry.

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The crisis afforded CROs the opportunity to demonstrate their value—an opportunity many seized by helping to de-risk balance sheets and navigate their companies through the turbulence. Today, intensifying and constantly changing regulatory, economic and competitive challenges mean their skills remain in high demand. Indeed, there is a pervasive sense across the industry that risk management (and therefore CROs) have become essential to nearly all aspects of the business.

To understand the changing landscape, EY insurance risk analysts interviewed chief risk officers and senior risk executives from more than 20 North American insurance companies. Collectively, the companies have significant business operations in all major sectors of the insurance industry, including property and casualty and life business. Further, respondents came from both mutual insurance and stock companies and from organizations under different regulatory regimes. We asked these executives questions related to CRO roles, regulation, organization, risk quantification and future outlook.

The survey results highlight the ongoing evolution of the role and confirm the increasing impacts of regulations that resulted from the financial crisis. The events of a few years ago are still shaping the agendas of many CROs, even as their activities focus to a greater extent on the effectiveness of risk management policies and processes. Further, they are spending more time with their boards and senior business leaders—a fact that underscores the increased impact of many CROs on the business and that industry leaders have become more aware of CRO capabilities. That CROs are involved with more types of business issues is testament to the value they have been adding to their organizations in the last several years and a harbinger of the opportunities that lie ahead.

We conducted the survey via interviews from October through December 2013 against the backdrop of increasing calls for coordinated regulatory regimes at national and international levels. As such, the answers reflect many of the mega-trends and major developments that were taking place in the broader sector during that time. It is particularly important to note that the majority of surveys were conducted before the release of the most recent report from the National Association of Insurance Commissioners (NAIC) regarding the content recommended for inclusion in the Own Risk and Solvency Assessment (ORSA) reports. Similarly, the Federal Insurance Office (FIO) released its report about the modernization of insurance regulation after most of the surveys were completed. It is likely that insurance CROs may be rethinking their views on critical regulatory issues.

Several major themes can be seen in this year's results:

1. THE EXPANSION OF CRO AUTHORITY

CROs are spending more time interacting with boards and senior management. This higher organizational profile shows that insurers have on their radars a broader range of issues—including emerging risks such as cyberterrorism and data privacy. More important, it seems that these risks are more clearly perceived and considered more significant by the highest levels of executive leadership. That is certainly true when 2014 survey results are compared with those from previous surveys. This may be evidence of CROs' success in identifying such risks and clarifying their potential impact on the business. There is a growing recognition that CROs bring a forward-looking perspective and a unique set of analytical tools that can help leader-

"Trying to comply with changes in regulatory and accounting/actuarial environments at the same time is impossible. There is no one regulation that presents the biggest challenge, but rather the combination of all at the same time that makes this a hugely challenging process."

ship understand the implications of emerging risks. In other words, CROs have seized the opportunity highlighted in survey results from 2013 and the trend of rising CRO prominence has continued.

One survey respondent described the evolution this way: "The CRO role is changing from being a 'brake' to being a 'copilot.' More knowledge of capital management and financial management will be required for CROs as they become decision making members of the executive suite."

2. THE SEISMIC SHIFT IN BOTH DOMESTIC AND INTERNATIONAL REGULATIONS

It's difficult to overstate the potential impact of regulatory changes. Survey respondents described their effects as "tsunamis," and are clearly spending a lot of time thinking about the new regulatory regimes. As such concerns move up the corporate agenda, CROs are being asked to lead preparations and organize broad frameworks for the cumulative and interrelated effects of different layers of regulations. Efforts to comply with the ORSA recommendations are ongoing, but most companies are confident they have adequate plans in place and will meet the deadline. There is also a shared belief that the long-discussed international capital standards and group supervision will soon be an everyday reality. On the domestic front, there is a small but growing group of companies that want to upgrade the state-based regulatory system in the United States, perhaps through the adoption of a hybrid model. These themes are being echoed across the industry. For instance, in an August 2013 report, the Financial Stability Board (FSB) criticized the state-based regulatory system and called upon the federal government to assume a greater role. The partial convergence of United States and international regimes is increasing the urgency of finding a common framework.

As one survey participant put it, "Trying to comply with changes in regulatory and accounting/actuarial environments at the same time is impossible. There is no one regulation that presents the biggest challenge, but rather the combination of all at the same time that makes this a hugely challenging process."

3. SHIFTS IN THE CRO FOCUS—FROM SURVIVAL TO EFFECTIVENESS

While low interest rates remain an issue, risk-management dialogues have shifted away from company survival (which was common in the immediate aftermath of the financial crisis) toward a more strategic and longer-term view of risk management effectiveness and decision support. There is a sense that balance sheets have been mostly de-risked to their desired level and investments are performing as expected. Thus, CROs can invest a higher proportion of their time and energy in other areas, such as seeking ways to embed more data- driven and analytics-based practices within their operations. The key question for many CROs has shifted from "are we doing the right things?" to "are we doing things right?" They are also seeking new patterns of engagement with the business. One survey participant commented that "the key is to improve dialogue with the board and key stakeholders on risk, and increase board knowledge of risk management."

Overall, the results make clear that the ongoing "risk journey" has entered an important new phase and that CROs will continue to have a seat at the table as their agendas and charters are aligned to the industry's top concerns. Thus, the evolution of the role of the CRO seems certain to continue. A diversified set of responsibilities and increasing priorities will place a premium on communication and lead to more direct engagement with the board and senior business leadership. Meanwhile, the proliferating risks faced by insurers are likely to fuel further expansion of authority for CROs, as well as influence the ways they interact with the business.

At the same time, it is impossible to overestimate the profound impacts of regulatory change. There can be no doubt that CROs have a larger role to play—as well as more value to add—in shaping the conversation with regulators and in helping their companies prepare for compliance with these new demands. Despite the turbulence and shifts that CROs face in their daily jobs, it is no coincidence that their increased focus on the effectiveness of their efforts resulted in raising the organizational profile of the risk management function and increasing its value contribution to the business. ■

Recent Publications in Risk Management

As an ongoing feature in *Risk Management*, we will provide recent publications we find noteworthy to our readers. Please send suggestions for other publications you find worth reading to d*schraub@soa.org*, or *cheryl.liu@pacificlife.com*.

Principles of Operational Risk Management and Measurement
CFO Forum, September 2014

The 2014 White Paper on operational risk is an update to the 2009 CRO Forum White Paper. The White Paper summarizes the important principles and considerations that should form part of the best practices for the management of operational risk within an insurance company. Additionally, a section dedicated to the measurement of operational risk has been introduced with the notion of providing guidance and considerations to the quantitative aspect of operational risk. The premise of this White Paper is to present principles of operational risk management whilst maintaining focus on the important aspects of the quality of business and risk management processes.
http://www.thecroforum.org/wp-content/uploads/2014/07/Principles-of-Operational-Risk-Management-and-Measurement_Final.pdf

Regulatory Risk and North American Insurance Organizations
Casualty Actuarial Society, Canadian Institute of Actuaries and Society of Actuaries, 2014

The Casualty Actuarial Society, Canadian Institute of Actuaries and Society of Actuaries jointly sponsored a research paper on North American regulatory structures that involve insurers. This report takes a focus on regulatory risk in the North American insurance company environment and strategies to minimize regulatory risk.
https://www.soa.org/Files/Research/research-2014-reg-risk.pdf

Risk Communication
Aligning the Board and C-Suite—Why every executive should care about effective risk communication
Oliver Wyman, Oliver Wyman, 2014

A report produced by Oliver Wyman's Global Risk Center together with the Association for Financial Professionals (AFP) and the National Association of Corporate Directors (NACD), examines what it takes to develop best-in-class risk communication.
http://www.oliverwyman.com/insights/publications/2014/feb/risk-communication-2014.html

Global Risks 2014 report, Ninth Edition
World Economic Forum, 2014

Global Risks 2014 report, Ninth Edition offers a snapshot of how more than 700 industry leaders and experts perceive evolving, interconnected risks that cut across national boundaries, the economy, technology, society, and the environment.
http://www.weforum.org/reports/global-risks-2014-report

Survey on Model Risk Management (MRM) Practices in the Financial Services Industry
KPMG, Summer 2013
https://www.kpmg.com/US/en/services/Advisory/risk-and-compliance/financial-risk-management/Documents/kpmg-model-risk-management-practices-survey.pdf

Exploring Strategic Risk: A global survey
Deloitte, 2013
http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_grc_exploring_strategic_risk_093013.pdf

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