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ACTUARIES

REINSURANCE
SECTION

Reinsurance News

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475 N. Martingale Road, Suite 600
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www.soa.org

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Programs Committee Coordinator

Katrina Spillane, FSA, MAAA
2018 Life & Annuity Symposium, Health Spring Meeting, Annual Meeting & Exhibit, Valuation Actuary Symposium Coordinator, and Life & Annuity Symposium Coordinator

SOA Staff

Jim Miles, Staff Partner
jmiles@soa.org

Jessica Boyke, Section Specialist
jboyke@soa.org

Sam Phillips, Staff Newsletter Editor
sphillips@soa.org

Ronora Stryker, Staff Research Actuary
rstryker@soa.org

Erin Pierce, Senior Graphic Designer
epierce@soa.org

Call for articles for next issue of *Reinsurance News*.

While all articles are welcome, we would especially like to receive articles on topics that would be of particular interest to Reinsurance Section members.

Please email your articles to
Ronald Poon-Affat (rpoonaffat@rgare.com) or
Dirk Nieder (nieder@genre.com).

Some articles may be edited or reduced in length for publication purposes.

Publication Schedule
Publication Month: July 2018
Articles Due: May 1, 2018

Chairperson's Corner

By Mike Kaster

It's the middle of January as I write this article, and much of the United States and Canada has been frigidly cold now for over a month. Did someone say "global warming"? I know right now many of us would like to be in other parts of the globe where the weather is much warmer. And in today's world of reinsurance, that is something that is quite possible.

Not only do we have a global macro economy in 2018, we have a very global insurance economy. Many multinational insurers and reinsurers are actively looking for ways to grow and expand both locally and outside their own borders. Are the U.S. federal government and other regulators working to find ways to help, or are they just putting up new obstacles? For example, with changes to the rules for insurers in the United States and European Union to work together on reinsurance (the "Covered Agreement"), the intent is certainly to open up borders. However, with recent changes to the U.S. federal tax rules, companies may not have as much freedom as they have had in the past.

As I begin my year with the privilege of serving as the chair of the Reinsurance Section Council, I look forward to working with some amazing volunteers on these issues and many more. Next week, the Reinsurance Section Council will be gathering in New York City to contemplate our priorities for the upcoming year and working to find ways to continue to provide our members with the quality education and research they have been used to receiving from their membership in the section. The council members are just volunteers, but for many of them, supporting the continuing development of the reinsurance world is an ongoing passion. Three of those amazing individuals are moving on after completing three years on the section council. George Hrischenko did an outstanding job as our research coordinator, helping to advance our research agenda. Ronald Poon-Affat took on the role of newsletter editor, and has truly embraced this role with passion and enthusiasm. And of course the council would not have accomplished all of the great work we did in 2017 without the enthusiastic leadership provided by Mary Broesch as chair. We will miss all three of them, and hope that they continue to help us go forward as friends of the section council.

Of course, we get to welcome three new members this year. I'm looking forward to working with Kyle Bauer, Jean-Marc Fix and Laura Muse. Along with our other returning council



members (Jeremy Lane, Tim Paris, Emily Roman, Katrina Spillane and David Vnenchak), we all look forward to serving you, our membership.

I have already challenged the council to think more broadly, and not just focus on each individual role that they play as a member of the council. I believe the membership elected each of them to help bring their thought leadership to our efforts. With that in mind, there are two things we are working on right now to help broaden our view as a council. The first is to work together to identify and prioritize the most important "hot topics" of interest to our Reinsurance Section members. While we are still gathering input, these will likely include topics like:

- Principle-based reserves (PBR) and the impact to reinsurance
- U.S. federal tax reform
- Accelerated underwriting
- Regulatory changes—risk transfer, covered agreement
- Longevity, mortality and other issues

These are just a few topics we have already identified. Are there others? Please feel free to drop a note to any one of the section council members with your input, so that we can be sure to focus our efforts on addressing the topics that are most important to you, our members.

The second key initiative the council and friends are undertaking is specific outreach to other professional organizations, sections and special interest areas. For example, while the vast majority of the council members focus on U.S. life and annuity reinsurance, we need to make sure to still consider issues of concern for our Canadian members, our health insurance members and our International members, just to name a few. As such, one council member or friend will be charged with specifically overseeing the needs of each of these areas. Other areas where our council members will be addressing some special attention include several other sections, like Risk Management, Financial Reporting, Product Development and Smaller Insurance

Company. And there are a couple of non-actuarial organizations where we hope to establish a better working rapport, including Reinsurance Administration Professionals Association (RAPA) and Association of Home Office Underwriters (AHO). I'm sure there are other areas and organizations, and we would welcome your suggestions.

This is where you, as a reader of *Reinsurance News*, can play a part. Do you have an idea on a hot topic that you believe needs further research? Or do you have some suggestions or ideas for other services that the section council should be working on? I would welcome any of you dropping me a quick email. I promise I will respond to each of you individually if you drop me a note!

Finally, I hope you take the time to read the other educational and informative articles in this newsletter. The 2018 newsletters will be including some new features that we hope you will enjoy. For example, we will be including articles on property and casualty (P&C) in every edition. Swiss Re actuaries Jing Lang and Peter Liebwein have started off this series with a contribution

that explores the characteristics of natural catastrophes. We will also be including a three-part article that deals with a single topic in great depth. Readers will be treated to Kai Kaufhold discourse on survival analysis and predictive modelling in our three 2018 editions. Finally, we will also be extending the scope of the newsletter to look at reinsurance trends in global markets. In this edition, Neill Muller updates us on what's happening in Asia. A special thank you to the hard work and effort that our newsletter editor and new co-editor (Dirk Nieder) put in to create this outstanding publication.

It's a brand new year, and I'm thrilled for the opportunity that being chair of the section brings for me and our membership. ■



Mike Kaster, FSA, MAAA, is EVP—Life Solutions Group, Willis Re. He can be contacted at mike.kaster@willistowerswatson.com.

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Another Year Goes by Without an Invite to the World Economic Forum . . .

By Ronald Poon-Affat

Consider, if you will, these two lists of diverse risk items:

TOP GLOBAL RISKS IN TERMS OF IMPACT		
	2007	2017
1	Asset price collapse	Weapons of mass destruction
2	Retrenchment from globalization	Extreme weather events
3	Interstate and civil wars	Water crises
4	Pandemics	Major natural disasters
5	Oil price shock	Failure of climate change mitigation and adaptation

Source: World Economic Forum, The Global Risks Report 2017, 12th Edition

Sounds relevant in today’s uncertain world, right? Perhaps . . .

The columns list the top five global risks in terms of impact in 2007 and in 2017, according to The Global Risks Report 2017, 12th Edition, published by the World Economic Forum (WEF).

As in past years, the WEF surveyed a sizable and diverse group of thought leaders for the report on which, in their opinions, are the top five global risks in terms of likelihood and impact. The risks are organized into five categories: economic, environmental, geopolitical, societal and technological.

On 2007’s impact list, Risks 1 and 5 were economic, Risks 2 and 3 were geopolitical, and Risk 4 (pandemics) was societal. In 2017, however, the list looked completely different: None of the year’s top 5 risks were economic and only one risk—Risk 1 (weapons of mass destruction)—was geopolitical, and only one—Risk 4 (water crises)—was societal. Meanwhile, three of the top 5 risks—Risks 2, 3 and 5—were environmental—a category that was not part of the top 5 in 2007.

The report also provided an analysis of each risk factor, with some interesting insights, considering the interconnectivity of the various risks and the impact and tendency of each risk.

It is interesting that not one risk factor survived over the 10-year period. Indeed, environmental risk didn’t make the list until 2011. There may be several possible explanations for the shifts:

- All of the 2007 risks may have been resolved, hence new risks are being battled in 2017.
- We may be a tad fickle—likely to change our minds depending on what 24-hour cable news is streaming (or screaming) at us.
- We don’t appreciate the concept of risk management vs. risk measurement.
- A combination of all of the above.

I have to admire the audacity of the WEF report. It clearly states its position on the likelihood, impact, trend and the correlation of each major risk without really having a lot of data to back up its findings.

I am reminded of this quote: “Most decisions should probably be made with somewhere around 70% of the information you wish you had,” Amazon CEO Jeff Bezos said in his 2016 Letter to Shareholders. “If you wait for 90%, in most cases, you’re probably being slow.”

In this editorial, I want to review some of what were, for me, the report’s notable highlights. Ideally, I would like to try to motivate as many readers to read the paper and perhaps to provoke the actuarial profession to broaden how it views risk.

SOCIAL PROTECTION SYSTEMS

The report dates the first three Industrial Revolutions as beginning in 1784, 1870, and 1969. Each of these revolutions has specific characteristics. The first, which began in Great Britain and spread throughout Europe and to North America, moved economies from rural, agrarian bases to ones more urban and, yes, industrial. The rise of iron production, machine tools, and steam power enabled the development of factories that could mass-produce textiles and other basic necessities, and spurred tremendous economic growth. In the second revolution, existing industries as well as new ones such as steel production expanded, and new energy sources such as oil and electricity powered a rise in mass production capabilities as well as tangible technological advances (e.g., the telephone, the elevator, mass urban transportation).



The third industrial revolution, which is truly global, consists of the explosion of information and the digital capabilities making it possible. It is considered to be still ongoing, yet is also being subsumed by what is being termed the “Fourth Industrial Revolution.”

This fourth revolution (which some see as a continuation of the third and others see as a separate revolution) is already yielding several outcomes that have a high probability of changing civilizations around the world, both economically and socially. Today’s ease of remote connectivity is enabling more and more thought-based workers to be untethered from needing to go into an office. Many jobs that before required human labor are increasingly being supplemented or even taken over by technology (e.g., automation, robotics, artificial intelligence).

These outcomes have already been spurring enormous changes in employment, long one of the main sources of insurance customers. With more individuals now part of the gig (or “Hollywood hiring”) economy, workers are not only experiencing more personal financial volatility; most are also without the social protection benefits—that is, traditional life insurance, health insurance, pensions and savings benefits—generally provided by employers.

Could this trend increase demand by individuals for these insurance products?

According to the United Nations Research Institute for Social Development, social protection consists of policies and programs designed to promote efficient labor markets, diminish people’s exposure to risks, and enhance their capability to manage economic and social risks, including unemployment, sickness and old age.

I recently attended a presentation by the CEO of a leading global insurer, who generously shared his vision regarding how his company sought to accompany its customers through various life cycle stages by offering products and services that would provide social protection and add value through each stage of the life journey.

Once, adult life stages were seen only as signposts: first job, purchase of first home, first child, subsequent children, their educations, retirement planning and retirement. All of these things today come under the umbrella of “social protection.” Today, according to Mercer’s whole-of-life approach to social protection, there are no fewer than 22 lifecycle mileposts, each of which has specific age brackets and within those brackets, specific social protection needs.

Leveraging this holistic ideal of traveling with clients, the report also suggests how an individual’s social protection needs might look as the Fourth Industrial Revolution progresses. Benefits, it says, will need to be untethered from employment, structured to accommodate greater longevity and older-age morbidity, and to equalize benefits for both employees and the self-employed. Clearly, insurers, reinsurers and distribution channels need to transform how we perceive life stages as well as how we design and sell products in order to enable us to travel with the client of the future. And it is imperative that we gain both an awareness and an understanding of this need.

AI, EMERGING TECHNOLOGIES AND GOVERNANCE

Of the 12 key emerging technologies identified by the report as hallmarks of the Fourth Industrial Revolution, artificial intelligence (AI) is one that has been advancing at breakneck speed.

According to PitchBook, a provider of private market data for venture capitalists, by early December 2017, the industry was on track to see just shy of US\$24 billion in completed AI merger and acquisition deals. This number reflects an extraordinary surge in this activity, as in 2015, the dollar amount of global M&A activity related to AI totaled approximately \$6 billion—a fourfold increase in just two years. The number of deals has risen even more strongly, with 2015 deals numbering approximately 30, and 2017 deals on track to number close to 120.

How to govern these rapidly emerging technologies, according to the WEF report, is still a conundrum: Rules and laws need to be flexible enough to enable investment and development and adapt as technologies change, but still firm enough to be able to mitigate risk. Currently, governance, the report says, is “patchy,” with some aspects regulated heavily and others hardly at all, because they don’t fit under the authority of any existing regulatory body.

AI, the WEF report continues, will have several benefits as it integrates more into daily life. Businesses will be able to use it to provide digital interfaces and services that will increase efficiencies and lower costs. Good AI governance, “would require multiple layers that include ethical standards, normative expectations of AI applications, implementation scenarios, and assessments of responsibility and accountability for actions taken by or on behalf of an autonomous AI system.”

To me, AI might have had this exponential growth precisely because of the “patchy” regulation described in the WEF report. Both countries and insurers would do well to explore the 12 emerging key technologies, but should do so judiciously, balancing market needs with market risks and being flexible enough to adjust as regulations and market needs evolve.

Actuaries are often challenged to accept a wider role to serve the greater society. I can think of no better global initiative for us than saving the planet we have.

THE DIVERSITY BONUS: RISK EXPERTS OF THE WORLD, UNITE!

At the most recent Society of Actuaries (SOA) Annual Meeting & Exhibit (October 2017), Scott E. Page, keynote speaker at the Presidential Luncheon and author of the books *The Difference* and *The Diversity Bonus*, gave an illuminating talk about the value of team diversity. Page, the Leonid Hurwicz Professor of Complex Systems, Political Science and Economics at the University of Michigan in Ann Arbor, is an economist by trade and a game theorist by inclination. He is best known for having made the initial finding that diverse groups of problem-solvers will consistently outperform groups composed of high performers, because among diverse groups there will generally be a greater diversity of cognitive tools, resulting in more effective performance and better decision-making.

The team diversity example he cited was Netflix. Netflix saw one main value of its service was providing spot-on recommendations of a new film and/or TV series to existing clients, leading to higher persistency. Netflix had an algorithm to predict customers’ tastes based on past viewings but it wanted to do better. In 2006 Netflix offered a prize of US\$1 million to anyone who could improve its recommendations by more than 10 percent. Many teams vied for the prize, but the eventual winners, named in 2009, were mega-teams composed of several of the original competing teams. With so many diverse tools and capabilities, these teams were able to create collections of diverse models that successfully improved the existing predictive model by 10 percent. Essentially, the aggrupation of certain teams provided a “diversity bonus,” enabling the delivery of a superior result.

FOR THE FUTURE

Could a group of actuaries, working together with risk experts from, say, the WEF, be able to create a team sufficiently diverse to provide an enhanced and superior assessment of global risk? An ambitious goal for actuarial professionals would be to obtain a seat at the table at the Forum in order to contribute to the discussion of risk trends.

Actuaries are often challenged to accept a wider role to serve the greater society. I can think of no better global initiative for us than saving the planet we have.

The views expressed in this article are solely those of the author and do not reflect the views of either his employer or the Society of Actuaries. ■



Ronald Poon-Affat, FSA, CFA, FIA, MAAA, is co-editor of the Society of Actuaries’ *Reinsurance News* newsletter. He can be contacted at rpoonaffat@rgare.com.

This editorial’s inspiration came from *The World Economic Forum Global Risks Report 2017 12th Edition*. http://www3.weforum.org/docs/GRR17_Report_web.pdf

Interview with Canada Life Re's CEO Jeff Poulin

By Katrina Spillane

Jeff Poulin is the CEO of Canada Life Re, a division of Great West Life Assurance Company. He was appointed CEO in May 2017, but he has been working for the reinsurance company since 1991. He has worked in the reinsurance offices of Canada Life Re in Canada, Barbados, Ireland and the United States. Canada Life Re provides structured solutions, traditional risk and catastrophe retrocession covers to clients in both the United States and Europe. Jeff is an actuary and the proud father of four children.

KS: Jeff, you were appointed as CEO of Canada Life Re a few months ago. How do you see your position and what will be your influence on the division?

JP: I have come in at a very turbulent yet exciting time. We have a catastrophe retrocession business, and it has been a very busy year with three hurricanes hitting the United States, two earthquakes in Mexico and the California fires. I'm happy to see how our reinsurance agreements offered clients valuable protection against these losses. Reinsurers are in the business of paying claims in difficult times.

On the life reinsurance side I am actively involved with the American Council of Life Insurers. This past year was by far the most exciting the life and health industry has seen in years. Our clients are increasingly looking for support to optimize the risk, capital and return profile of their business in order to support changes to regulatory capital rules such as principle-based reserving (PBR), but even more importantly to support investment in new customer propositions such as accelerated underwriting.

Canada Life Re has always been at the forefront of developing risk and capital solutions for clients, so I view my role as keeping the Canada Life Re team focused on these evolving needs and developing the most effective solutions for each client's individual need. We will not change this basic customer-focused principle, which is based on a win-win relationship with our clients. We have developed very strong partnerships and will continue to build on those and develop new ones. We offer both

conventional reinsurance and structured solution reinsurance, and are increasingly seeing situations where the right solution is actually a blend of the two. While we have historically concentrated our efforts in the United States and Europe, we are also starting to help our existing clients with solutions in other parts of the world and with non-life insurance products.

KS: Canada Life Re has experienced rapid growth over the last 10 years. To what do you attribute this growth?

JP: I see four major reasons for our growth. First, the main factor for our success is our ability to adapt to changes. We have seen new regulations, taxes, products and technologies. These changes usually disrupt your business, but we also see them as opportunities for new business. Adapting quickly to a changing world is key to any business's success.

Secondly, we have focused on what we are very good at: bespoke solutions for our clients. Trying to anticipate what our clients will want and offer proper solutions to these needs is key. We have avoided trying to offer everything to everyone, especially in lines of business that other reinsurers are already serving well. As an example of this, when we looked at continental Europe 15 years ago, we noticed that insurance companies were not strong buyers of financial solutions via reinsurance. We made developing this market a priority using the principles we were using in the United States, with very positive results for us and our clients. We also look at emerging markets with large potential growth. The longevity market is a good example where we were one of the first reinsurers involved in a longevity swap. We also closed the very first large multibillion annuity quota share reinsurance transaction in the U.K. in the early 2000s. This willingness to be amongst the first to look at new risks has been a great strength.

Third, we have remained diversified, which is critical because all markets do not always go well at the same time. We have approximately half of our earnings coming out of European clients and half coming out of the United States. We also have a variety of products in different lines.

Finally we benefit from the support of a very strong parent with excellent ratings and a large capital base. While the financial market's memory may be fading, the financial crisis of 2008 provided a sharp reminder as to the importance of prudent and strong business partners.

KS: What is your outlook on the life business in the United States?

JP: The U.S. market is very mature and relies on thorough but cumbersome underwriting for a new policy to be issued. I suspect

we are on the verge of a major change in the market that could reshuffle who the main players are. The trend is away from this heavy underwriting and toward a more simplified underwriting process. This creates potential for anti-selection as the same products are sold with and without full underwriting. It may still take some time before some of the big-data-based underwriting systems are as efficient and reliable as drawing blood. Everything else consumers buy today is easy, even car insurance. It makes it very difficult for the life industry to survive if we do not adapt and make it easy to sell our products. I think we may need a disruptor to help show us how to do it better than we currently do. We have had success offering our products on the internet and simplifying our underwriting, but our products are still too complicated and not universally marketed the way consumers expect today. It is important that we continue to change our offering so it is more consumer-focused. If we called a “premium” a “payment” and borrowed from our European colleagues and called “life insurance” “protection,” it may be a step in the right direction as even the dialect we use is complicated for the end consumer. My sense is that the next generation is less aware, if not completely unaware, of the importance of the protection we offer and will not tolerate an agent coming into their home to explain the concept. So, the first companies to simplify, educate and market their products to the younger customers will be the next winners.

Canada Life Re continues to monitor the InsurTech world to see the key innovations that could have an effect on our industry, and we are ready for this next wave to come. Insurers will need strong partners over the next few years as companies will go through a trial-and-error process before the “new way” is fully implemented. At the base, life insurance is a product that is very important and that every family should buy, so I am optimistic that we will find a way to market it to the next generations.

Canada Life Re continues to monitor the InsurTech world to see the key innovations that could have an affect on our industry. . . .

KS: Will PBR affect reinsurance?

JP: Yes. I think as cedants get more familiar with the reserving methodology and adapt their products to it, PBR will create a certain impact. I can see right away less demand for reinsurance solutions on AXXX and XXX reserves because there will be less redundancy in the statutory reserves under PBR. Another aspect

of PBR that may be interesting for our clients is whether or not they need rate guarantees on their reinsurance treaties, at least for a period longer than one year. Reserve credit under reinsurance ceded will also need to be looked at because regulators will find out that insurers and reinsurers may not hold the same prescribed reserves on a given block of business.

KS: Is Canada Life Re involved in the health industry?

JP: The health market in the United States and Europe is a key market for Canada Life Re given the size of this market and current demographic trends in those areas. Health insurance should have a bright future. While in the United States there is more talk about a single-payer or government system, in Europe and even in Canada the discussions are promoting private systems. Health insurance premiums have grown tremendously in the developed world recently, and we see that trend continue. The individual mandate under the Affordable Care Act has not worked very well but despite that we feel the health market is healthy in the United States. As such we have focused heavily on developing risk and capital solutions that help optimize our clients’ balance sheets by reducing their risk and capital needs while allowing them to retain their hard-earned returns.

KS: How do you see the development in genetic testing affecting our market?

JP: It is both a threat and an opportunity. In the next few years, I think we will be able to get full genome testing with DNA sequencing that will provide us valuable health information like the propensity for certain cancers or diabetes for a cost of approximately \$500 per individual. This could drastically change our underwriting. However, our industry would need to have access to that information as part of the normal medical file. If we do not have access to it, it could create significant anti-selection. If it becomes part of the medical information that we have access to, it will require us to become better at developing the expertise to translate the DNA information into a mortality or morbidity assumption. So, we have some work to do on this front.

On the positive side, we could be opportunistic and use this as a way to develop a closer relationship with our customers by offering them prevention tools to explain how to prevent the diseases they are more prone to get. Whether the insurance industry gets involved in prevention or not, the information associated with genetic testing could result in more preventive measures and better behaviors, which could result in lower mortality and morbidity overall. As a reinsurer, any medical development has an impact on what we do and on our assumptions. We have to be ready to help our clients face these challenges.

KS: You mentioned the longevity market. What is your involvement and do you see it developing in the United States?

JP: We have been pricing longevity transactions in Europe since the late 1990s, and we have a very strong team of experts looking at this in our Dublin, Ireland office. As a group, we also write this risk directly in the U.K., Ireland and Canada. We started writing this risk on U.K. annuities that were mandatory at retirement in the U.K. Many insurers had written large books of payout annuities, and, in retrospect, we can now say that the U.K. regulators became a little too conservative in their required assumptions. This created large basis change losses for annuity writers. These insurers started to reinsure their block to avoid further assumption adjustments. This fueled the market originally but then came the pension plans that wanted to de-risk their portfolios, which continued to feed the demand for longevity reinsurance. This happened not only in the U.K. but also in continental Europe. We have been offering solutions to help with longevity covers for 20 years and continue to be a major player in that market. We continue to see strong demand for both “at the money” reinsurance and structured solutions on longevity books in Europe. The U.S. market is less developed and, despite some significant transactions being done between pension plans and insurers, very little has ended up in the reinsurance market. We expect this to change and that market to expand over the next 10 years. We plan on using our existing expertise to help our U.S. clients manage this risk.

KS: What impact do you think the new U.S. tax reform will have on reinsurance?

JP: International reinsurers are usually organized in a way where they keep most of their capital in a central place. They then have subsidiaries and branches in various jurisdictions to serve their clients and retrocede a large portion of the risk to that centralized reinsurer. This allows them to quickly send money when and where it is needed to pay claims and, at the same time, benefit from this global diversification in their capital in this central location. The base erosion tax has essentially forbidden the retrocession out of the United States for foreign reinsurers by taxing gross payments out of the country to an affiliate. This tax does not allow the netting of claims or reserves and is very punitive. This will require foreign reinsurers to restructure their business in the United States. As a result, foreign-based reinsurers may have to offer clients to reinsure directly to entities outside the United States.

The increased exemption in the estate tax will have the effect of reducing the number of policies purchased for tax planning

reasons and should reduce the amount of large policies issued in the industry. This could reduce the amount of reinsurance ceded since most reinsurance treaties are on an excess-of-retention basis.

Another effect is the potential impact on insurers of the lower corporate tax rate, which could result in loss of capital through tax asset recoverable on prior losses or through the second-order effect that the lower tax rate has on the risk-based capital formula. We expect that some companies will be looking for solutions to keep their capital the same pre- and post-reform if they are negatively impacted by it.

KS: Finally how do you see the future of our industry?

JP: If I could tell the future, I would guarantee that Canada Life Re would be the largest reinsurer in the world! Unfortunately, I often remark that I thought it was foolish to put a camera on a phone. The one thing I am certain about is that our industry sells very valuable services to consumers. Therefore, we should do well in the future because offering a good and valuable product is the basis for our success. I do believe things will continue to change at a very fast pace. We may sell our products online and even on cellphones. We may have instant access to more information than we ever dreamed of about our customers. We will be more focused on what the end consumer wants rather than what our distribution force wants. As actuaries, we will have to keep the complexities that we tend to like so much in the background—i.e., in the data handling and underwriting process—and keep our products simpler in the eyes of our clients. We need to listen and make room for the next generations of employees and listen to their ideas. They know what their peers want. Reinsurance will become more about risk sharing again because companies will take on more risk to sell these new products in an ever-changing world. I am certain the future is bright for both the life and health industry, and for the reinsurance industry. It will continue to be a fun ride! ■



Jeff Poulin, CEO, Canada Life Re.

Katrina Spillane, FSA, MAAA, is VP, Pricing, for Canada Life Re. She can be contacted at katrina.spillane@canadalifere.com.

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Best Article of 2017

By Ronald Poon-Affat

The 2017 *Reinsurance News* prize was awarded to Mick James, business development director, UK—Alternative Distribution at RGA for his article titled, “Long-Term Care—Are We Fishing in the Wrong Waters?” The article appeared in the November 2017 issue. The article challenged thinking regarding current solutions that provide lump sums, or income streams, in order to help elderly people who need nursing care.

The winning article was voted upon by three sitting members of the Reinsurance Section Council.

This year offered an additional prize for the most downloaded podcast of a *Reinsurance News* article. The winner was Anthony Asher, associate professor at the School of Risk & Actuarial Studies, of New South Wales. His article, “The Social Impact of the Actuarial Profession,” describes some of the opportunities we face and suggests that we each need “passion to right a particular wrong or create a particular value.” There were in excess of 1,000 downloads of his article.



Anthony Asher (left) and Mick James (right).

Why the prizes? To recognize the tremendous effort of our volunteer authors, without whom it would be impossible to publish three information-packed editions per year.

Please feel free to contact Ronald Poon-Affat at rpoonaffat@rgare.com and/or Dirk Nieder at nieder@genre.com if you are interested in submitting an article for 2018. We are always looking for interesting articles on a range of actuarial and related topics, and who knows? You might become one of our prizewinners! ■



Ronald Poon-Affat, FSA, CFA, FIA, MAAA, is co-editor of the Society of Actuaries' *Reinsurance News* newsletter. He can be contacted at rpoonaffat@rgare.com.



The Reinsurance Section Council and friends prepare for another successful year during their meeting held at the 2017 SOA Annual Meeting & Exhibit.

Top Row (Left to Right): George Hrischenko, Katrina Spillane, Mike Kaster, James Christou, Emily Roman, Ronald Poon-Affat, Jeremy Lane
Bottom Row (Left to Right): Jim Miles, Jean-Marc Fix, Kyle Bauer, Jessica Boyke, Mary Broesch, Laura Muse, Larry Stern

Unblocking Blockchain

By Ingemar Svensson and Ross Campbell

When technology is baked into a device we rarely give it much thought. We buy a smartphone for its utility not its operating system. Sometimes a new technology changes dramatically how everyone does things; the internet is a good example. Some plausibly great innovations, say 3-D television, just never gain traction. Which of these is blockchain?

Recently, blockchain has emerged as a technology that potentially will transform industries in a similar way the internet did a couple of decades ago. Still a nascent technology, many of the use cases and applications have not yet been discovered and explored.

Most people know a little about blockchain: that it lets multiple parties agree on a common record of data and control who has access to it; that its platform makes cryptocurrencies like bitcoin possible; that movement of cryptocurrency verified by blockchain allows peer-to-peer cash transfers without involving banks; and that blockchain is a permanent, auditable record and any tampering with it obvious.

Some people hold the view it will transform security in financial services, and fundamentally reshape how we deal with and trust complex transactions. This could be a response to hype or a fear of missing out because many other people are asking why and how they should use it.

On the face of it, using a shared ledger to process multiple transactions doesn't seem so revolutionary. Blockchain is essentially a recordkeeping system. Perhaps it's cryptocurrency like bitcoin that lends it a darker, more enigmatic edge than the software used traditionally? One way or another insurers face pressure to update antique systems with new ones that can compete with the demands of a digital world.

A DISTRIBUTED, SECURE AND IMMUTABLE LEDGER OF TRANSACTIONS

A blockchain can be seen as an ever-growing list of data records, or blocks, which can be easily verified since each block is linked to the previous one, forming a chain. This chain of transactions is stored on a network of computers. In order for a record to be

added to the chain, it typically needs to be validated by a majority of the computers in the network. Importantly, no single entity either runs the network or stores the data. Blockchain may be used in any form of asset registry, inventory and exchange. This includes transactions of finance, money, physical property and intangible assets, including health information.

Since the blockchain networks consist of thousands of computers it makes it extremely difficult to add invalid records. Every transaction is secured using a random cryptographic hash, a digital fingerprint that prevents them being misused. Every participant has a complete history of the transactions, helping reduce the chance of them being corrupted. Simply put then, a blockchain is a resilient, tamper-proof and decentralized store of transactions.

COMPLEX PROCESSING AND AUTOMATION WITH SMART CONTRACTS

Blockchain ecosystems enable large numbers of organizations to come together as peers to offer services, data or transactions that serve specific customers or complex transaction workflows transparently. It can automatically process and settle transactions via smart contracts that encapsulate the logic for the terms and triggers that enable a transaction.

Smart contracts are created on the blockchain and are immutably recorded on the network to execute transactions based on the software-encoded logic. Transparency through workflows recorded on the blockchain facilitates auditability. Peers and partners within a blockchain ecosystem independently control their business models and the economics without the need to use intermediaries.

Self-executing smart contracts can be used to automate insurance policies with the potential to reduce friction and fraud at claim stage. A policy could be coded to pay when the conditions are undeniably reached and verified by decentralized data feeds as an event that has certainly occurred. Blockchain offers enhanced transparency and measurable risk to this scenario.

Parametric insurance through smart contracts with triggers based on measurable events can facilitate immediate payments while decreasing the administrative efforts and time. Effectively the decision to pay a claim is taken out of the insurer's hands. Other possible models are completely technology-based without the need for an actual insurance company. The decentralized blockchain model lends itself well to crowdsourced types of insurance where premiums and claims are managed with smart contracts.

BLOCKCHAIN-BASED INSURANCE

New insurers using blockchain are emerging to offer increased transparency and faster claims resolution. Peer-to-peer property



and casualty insurer Lemonade uses an algorithm to pay claims when conditions in blockchain-based smart contracts are met. Start-up Teambrella also leverages blockchain in a peer-to-peer concept that allows insured members to vote on claims and then settles amounts with bitcoin. Dynamis provides unemployment insurance on a blockchain-based smart contract platform. Travel delay insurer insurETH automatically pays claims when delays are detected and verified in a blockchain data ledger. Etherisc is another new company building decentralized insurance applications on blockchain that can pay valid claims autonomously.

Traditional insurance companies, such as AXA and Generali, have also begun investment in blockchain applications. Allianz has announced the successful pilot of a blockchain-based smart contract solution to simplify annual renewals, premium payments and claims submission and settlement.

Blockchain has potential to improve premium, claim and policy processing between multiple parties. The consultancy EY and data security firm Guardtime announced a blockchain platform to transact marine insurance. It pulls together the numerous transactional actions required within a highly complex global trade made up of shipping companies, brokers, insurers and other suppliers.

A consortium of insurers and reinsurers, the Blockchain Insurance Industry Initiative (B3i), has piloted distributed ledger technology to develop standards and procedures for risk transfer that are cross-market compatible. Whether or not the outcome is adopted industry-wide, it seems important for digital solutions to be created with this transparency and inclusiveness in mind.

There is clear potential for blockchain in reinsurance where large amounts of data are moved between reinsurers, brokers

and clients, which requires multiple data entry and individual reconciliation. Evaluating alternative ways of conducting business is one reason for the collaboration of Gen Re with iXledger, which can explore ideas while remaining independent.

HANDLING OF MEDICAL DATA AND OTHER PRIVATE OR SENSITIVE INFORMATION

Individuals generate increasing amounts of personal data, actively and passively, from using phones and “internet of things” devices, and processing digital health care solutions. Increasingly consumers will want control of this scattered mass of digital data and share it with whomever they choose in exchange for services. This move aligns perfectly with the concept of a “personal data economy.” Think information as currency and using blockchain to secure private data and reveal it in a secure and trusted manner to selected parties, in exchange for something.

Electronic health records are now common. Several countries use blockchain to secure patient data held digitally. This helps counter legitimate concerns about how sensitive personal data can be kept secure from theft or cyberattack. Code representing each digital entry to the patient record is added to the blockchain, validated and time-stamped. A consortium of insurers in India is using blockchain to cut the costs of medical tests and evaluations, and to ensure the data collected is kept secure, with other benefits including identification of potential claims fraud.

Innovative engagement insurance propositions that look to leverage the data economy will rely on shared data, but people may be put off fearing a loss of control over their personal information. This poses a huge challenge for an industry seeking to improve its reputation for trust. Blockchain may help insurers to reassure customers the digital data they share with them is safe.

VERIFICATION OF DOCUMENTS

Verification of the existence and purpose documents in banks and insurance companies relies on storage, retrieval and access to data. Blockchain simplifies these with its open ledger, cryptographic hash keys and date-stamped transactions. Actual copies of documents are not stored but instead the hash represents the exact content in a form of scrambled letters and numbers. If a document is changed these will not match. The effect is an immutability that proves the status of the data at an exact moment and beyond doubt.

Blockchain is a “trustless” system since the network of users acts together to vouch for the accuracy of the record. Examples of blockchain protecting patient records demonstrate its potential to implement other trusted and secure transactions with less bureaucracy.

Other opportunities are open to transition insurers to a digitized paradigm and catalyze efficiency gains. Blockchain need not be reserved for cross-industry platforms or useful only in multiparty markets with high transaction volumes and significant levels of reconciliation. Smaller-scale solutions can bring benefit, too.

It's not just about driving efficiencies either. Agreed standards for data care also make sense to reduce vulnerabilities. Digital connectivity creates a mass of sensitive data all very fallible to security breaches. Blockchain has other features that enhance privacy and data security. Transactions are not directly associated with the individual, and personal information is not stored in a centralized database vulnerable to cyberattack. Technology companies are accountable to their users for the security of their devices, services and software. Insurers are accountable, too, and hackers are more likely to target enterprises with lax security.

MULTIPLE PARTICIPANTS AND THE REMOVAL OF A CENTRAL AUTHORITY

Transparency, auditability and speed are standard requirements for any organization to successfully compete and transact in an increasingly complex global economy. Data is a valuable key catalyst, and is complemented by blockchain's ability to organize, access and transact efficiently and compliantly.

Trusted transactions require access to valuable data, and blockchain facilitates efficient access across multiple organizations. The economics for data usage will drive new business models fueled by micropayments, which will require efficiencies to scale. Business models based on data aggregation by third parties in centralized repositories, with total control and limited transparency, will be replaced by distributed blockchain-enabled data exchanges where data providers are peers within the ecosystem.

Decentralized peer organizations can utilize the blockchain for permission access and to facilitate payments to provide total control of their economic models without a centralized authority. Data access and transactions are controlled directly by each member of the ecosystem with complete transparency and immediate compensation.

TOKEN ECONOMIES

Ecosystems supporting peer organizations that transact or share data will require an effective mechanism for micropayments. These business models require efficiency, with less overhead than traditional account-payable and account-receivable workflows. Event triggers, cryptlets and oracles will execute based on predetermined criteria as token payments occur simultaneously. Counterparty agreements may initially define the relationships between parties on the network, but payments are executed within the smart contract transactions.

The elimination of a time delay in payments acts as a stimulant for economies since tokens earned can immediately be spent, therefore increasing the speed at which organizations will earn and spend. Traditional delays and fees that occur throughout accounting workflows and through intermediary banks that process payments can be eliminated.

CROSS-BORDER PROCESSING

Global payments involving foreign exchange introduce complexities in addition to time delays. Economic indicators and political events dramatically affect the exchange rates and profitability of transactions. Cross-border payments require access to the required currencies by intermediary banks, which can cause additional delays beyond the internal accounting workflows.

Utilizing a token-enabled economic layer simplifies the payments to support micropayment efficiencies. Participants on the network will be able to efficiently utilize the preferred fiat currencies to acquire or sell tokens without utilizing intermediaries' banks or currencies.

MERGING BLOCKCHAIN AND DATA

Today, there are more connected internet of things devices than there are people on the planet, and the data generated is growing at an exponential rate. Various sources have predicted that the number of internet of things connected devices will grow to over 70 billion by 2025; the numbers are almost irrelevant.

Internet of things devices are used in homes, transportation, communities, urban planning, environment, consumer packaged goods, services and soon in human bodies. A number of insurance companies use these devices to assess driver habits and usage. Autonomous cars and changing ownership and usage models are

creating a new generation of insurance products that can be facilitated through internet of things data. Home devices can detect leaks, theft and fire damage, which reduce risk. Shipping companies use internet of things for fuel and cargo management, which offers operating efficiencies, transparency and loss prevention.

Merging the mass of internet of things data with the blockchain is not without challenges, but this is a combination that can provide a completely new way of creating an insurance model that is far more efficient and faster where data flows directly from policyholders to the insurer.

SUMMARY

Interest in the trinity of bitcoin, blockchain and distributed ledger technology has significant momentum. However, the technology is not magic or a panacea for every corporate woe. It has disadvantages and limitations, and there are situations where

it would even be the wrong solution. Yet there is enough about it to merit continued closer investigation—the many emerging use cases bear testament to that—but in place of hype we still need answers. ■



Ingemar Svensson is founder and CEO of iXledger, a provider of blockchain-based insurance solutions. He can be contacted at ingemar.svensson@insurex.co.



Ross Campbell is chief underwriter, Research and Development, in Gen Re's London office. He can be contacted at ross_campbell@genre.com.



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The Robots Are Here: What That Means for Insurers

By Jane A. Mandigo and Robert Weireter

Have you read the news about robots lately? It's hard to ignore the avalanche of headlines about the impact of transformative technology and robotics on business, industry, insurance, society and our personal lives. The onset of robotic capabilities and artificial intelligence (AI) is not a future issue; it is one to address now. In this article, we will take a brief tour of the impact of these changes from the perspective of the insurance world.

THE BIG PICTURE

In 1932, Aldous Huxley took a pessimistic view of unchecked scientific and technologic innovation in his famous book *Brave New World*. Since then, we have largely embraced technological advances as positive, helpful and fascinating—but also challenging. Few people would say they do not want the advantages of new technologies, but one issue that always seems left on the shoulders of insurers is how to navigate through uncertain exposures with little or no historical risk data. It is up to us to contemplate underwriting and coverage issues, using our crystal balls to think about how these risks and exposures will evolve.

Collectively, we are facing myriad technological transformations, including the “internet of things,” smart homes, autonomous cars and, of course, robots. New technology consistently rates as a top global business risk, and it has been estimated that “advanced robotics is going to thrust upon insurers a world that is extremely different from the one they sought to indemnify in the 20th century.”¹ Other commentators have stated that new technology, including AI, is going to “unleash a new industrial revolution [that] is likely to leave no stratum of society untouched.”² In response, roughly 30 percent of leading organizations will create a chief robotics officer role or a similar role for their business in the next two years.³ Ready or not: The robots are here and more are coming.

Shipments of industrial robots have been steadily increasing the past few years. Growth is across all regions, but is most

pronounced in Asia-Pacific. Note that the data in Figure 1 only applies to industrial robots, as they are easier to count. The many classes of non-industrial robots not easily captured by these types of industry statistics are also of interest to insurers.

The automotive industry continues to be the leading user of robots, followed closely by electronics. This is not surprising considering the assembly line operations common in these industries—tasks that robots are well-suited to perform. We also find the growth in “Other” and “Unspecified” to be interesting; as robotic technology becomes both less expensive and more advanced, we expect to see it penetrate industry groups not normally associated with robots. The message for those of us in insurance is that we need to look for robots in places we may not initially expect, such as health care, security, food and beverage operations, child care, hotels, human resources and more.

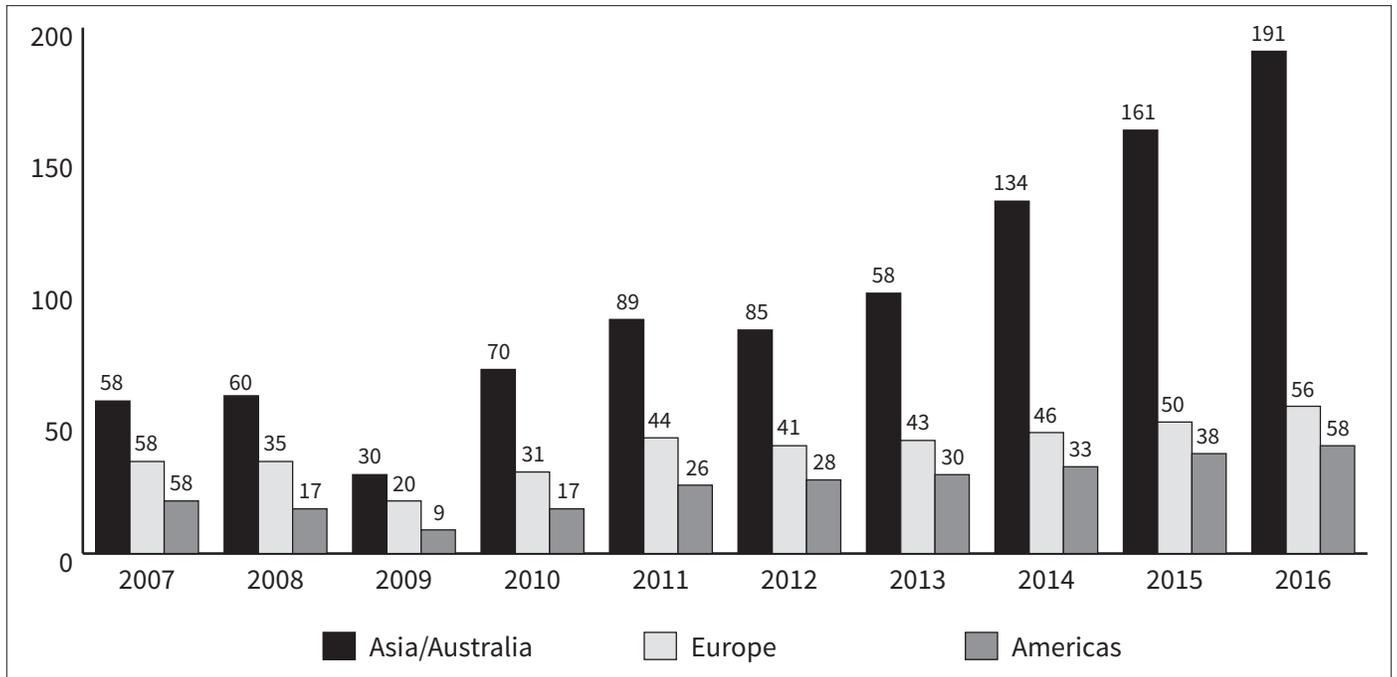
WHAT LINES OF BUSINESS ARE AFFECTED?

The greater question is: What lines aren't affected? Robots introduce new insurance coverage and/or liability issues for nearly every line of business in insurance. Key examples include: commercial general liability, product liability, employment practices liability, technology errors and omissions, workers' compensation, cyber coverage, professional liability, directors' and officers' liability, and, of course, stand-alone robotics policies. Bundled or hybrid policies that include many component coverages are attractive as one-stop offerings because insureds often prefer broad coverages (vs. numerous stand-alone policies). Bundled offerings can simplify purchasing and help reduce an insured's risk of insurance gaps.

WHAT DO WE MEAN WHEN WE TALK ABOUT ROBOTS?

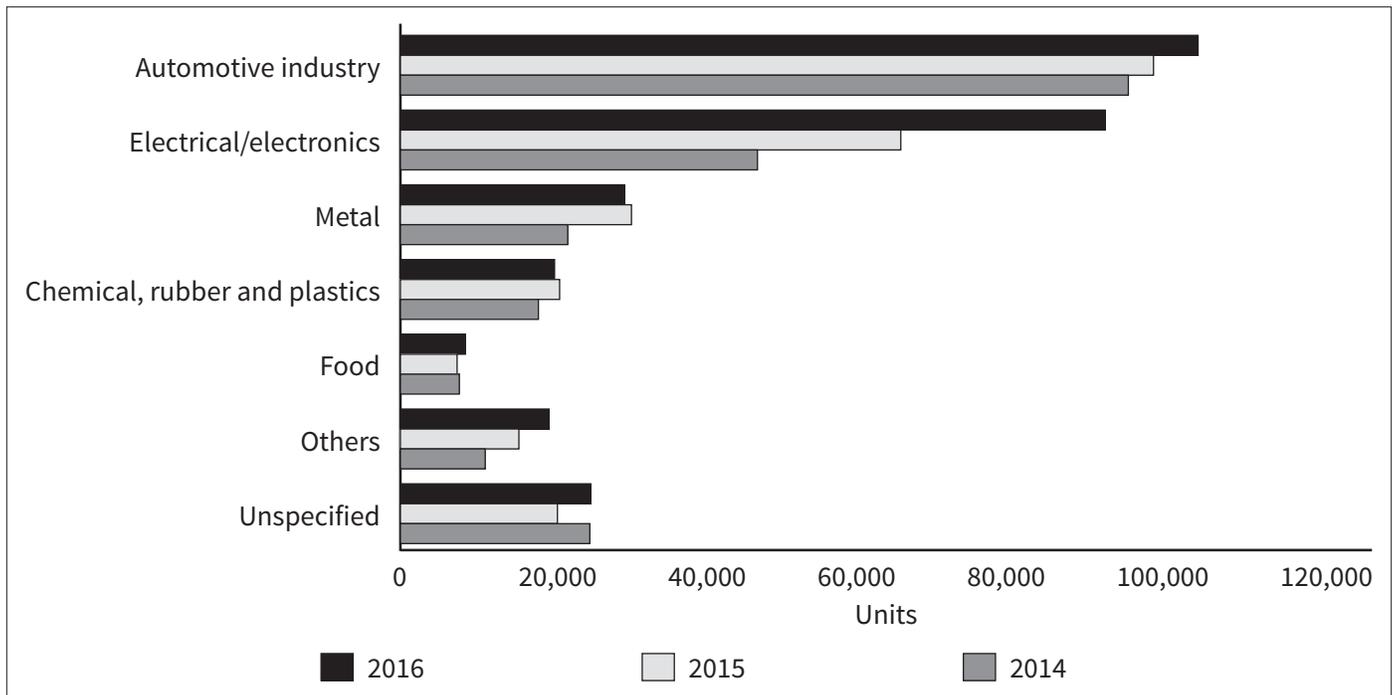
Robots come in many different shapes and sizes and can do lots of different things, but for the sake of simplicity, we can put them in two key categories: machine-based, non-collaborative robots, which often work in traditional industrial or retail settings (think of a modern-day car factory or an Amazon warehouse), and collaborative open robots (also called “cobots”), which use AI and can learn and interact with humans. Most of us can picture traditional industrial robots in the workplace, but robots are advancing to work alongside humans—or on their own. Robots are being used to make deliveries and investment decisions, interview job candidates, administer medical care and even run hotels.⁴ A hotel in Tokyo now uses life-like robots to check in guests and deliver room service. Robots are also being programmed to detect (or cause) cyber breaches. The wide scope of “what is a robot?” is one of our basic challenges and requires insurers to reconsider policy language that has not yet contemplated robotic exposures.

Figure 1
Estimated Worldwide Annual Shipments of Industrial Robots By Regions



Source: IFR/World Robotics 2017

Figure 2
Estimated Annual Supply Of Industrial Robots At Year-End By Industries Worldwide 2014–2016



Source: IFR/World Robotics 2017

DEFINITIONS ARE CRITICAL

How do you define “robot”? It is impossible to use a single definition—and definitions will vary widely depending on the type of robot, its function, the insurance product at issue, and the intended coverage. Examples from the marketplace demonstrate that definitions may include reference to what the robot can do (and by implication, what can go wrong). A real challenge will be deciding whether the introduction of complex automated functions may be considered “robots” for purposes of robotic coverage. For example, is an autonomous car, drone or other advanced device a robot? Is a complex industrial machine a robot—or part of an automated process? The distinction between automation and robotics is murky, and will likely remain unclear. Policy language will be one of the first reference points for disputing parties to turn to for guidance about coverage. Moving forward, insurers do have an opportunity to shape the marketplace for robotic definition, intent and exposure.

Another concern is how multiple contributors to a robot (manufacturers, software designers, operators, etc.) may be sued separately as liable entities. Contractual arrangements may clarify (or complicate) legal responsibilities. Currently, the plaintiff’s bar can be expected to file litigation in a wide swath in order to capture all potentially liable parties; this might include suing the manufacturer, the software developer, the robot owner or employer, the data-service provider, and technology and design professionals.⁵ There will be increased coverage and liability litigation, and likely more defense costs.

STANDARDS AND REGULATION MAY HELP

The introduction of standards and regulations may help provide manufacturers and employers with protection from liability that could help in the defense of a robotic accident. A number of organizations are actively working on standards and guidelines regarding the use of robots. Proposals are originating from the International Standards Organization (ISO), as well as the American National Standards for Industrial Robots (ANSI) and the Robotic Industries Association (RIA). It remains to be seen what legal requirements and regulations will be promulgated by governments at all levels. These will help in the long term, but for the near future, the pace of technology will continue to outrun the ability of regulators to respond.

THE CURRENT CHALLENGES

“Robots are the technology of the future, but the current legal system is incapable of handling them.”⁶ This emphatic statement highlights an active debate about how the law should treat robots. Should robots with AI be held responsible for their own actions? Experts, academics and legal theorists are weighing

many liability concepts, including owner liability, agency theories and corporate “legal entity” theories.

A key concern for insurers is the lack of legal precedents with respect to how robotic liability will be handled by courts. This places even more pressure on insurers to identify what they intend to cover (or what they do not intend to cover) through policy language. Outside of the United States, Europe has discussed whether robots should be considered “electronic persons,” including whether robots should be required to be insured, and whether they should even be possibly taxed.⁷ These discussions recognize that unilateral robotic actions fall into uncharted legal territory.

WHAT CAN WE LEARN FROM EXISTING ROBOTICS CASES?

We have already seen several legal cases involving robotics. Many of these are in the industrial and medical arenas. In one case, a worker died in an Alabama auto parts manufacturing plant, where “[t]he robot restarted abruptly, crushing the young woman inside the machine,” as described by the Occupational Safety and Health Administration.⁸ The worker had entered the robotic station to clear a sensor fault that had stopped an assembly line. The case presents an argument that the robot should have been programmed not to start if a person was inside the station. The manufacturing plant, as well as the designer, manufacturer, marketer and seller of the robot, have all been named as defendants. There are other similar cases of fatal industrial accidents that remind us of the severity of personal injury exposures presented by robots.

A common liability inquiry is whether an employee put himself or herself in the way of harm, thereby creating a fault argument against the employee. Another liability question is whether the employer correctly followed instructions for the installation and operation of a robot. These are areas where workers’ compensation policies have traditionally been available to address workplace injuries. However, products liability claims may be filed in instances where there are allegations that a robot was defective in terms of design or operation. Consistent with traditional workplace exposures, employers’ liability claims might also be filed where there is a failure to address workplace safety.

In less severe cases, there have been incidents of security robots knocking someone down as well as robotic vacuum cleaners “attacking” someone sleeping on the floor. As the price of technology reduces over time and robotics are used in a wider variety of products, we expect to see a broader array of claim scenarios. Robotics are often designed for human interaction (think, for example, of security robots, health and child care aids,

cleaning systems, restaurant service, etc.) and the potential for bodily injury is clear.

ACTUARIAL CONSIDERATIONS

As robots become more common in the workplace, it will be imperative to revise our thinking about workers' compensation exposure. On one hand, it is positive for robots to replace humans to perform high-hazard operations. This could lead to fewer human injuries in these classes. However, new occupations and exposure classes will emerge. For example, "robot technician" could be a new class, and as the cases above illustrate, that occupation can clearly be dangerous. It may be appropriate to develop new class codes for these new occupations and exposures. Currently, they are likely contained within existing manufacturing codes that do not accurately reflect the true exposure.

As robots become more common in various types of workplaces, not just industrial settings, we should also think about the relevance of payroll as an exposure base. Revenue may increase due to productivity gains while payroll goes down. In these cases, we need to be careful to not blindly associate decreased payroll with decreased exposure. These possibilities raise the importance of attention to changes in our risks.

ARE WE PAYING ENOUGH ATTENTION TO THE IMPACT OF DISRUPTIVE TECHNOLOGY?

One concern about the onset of advanced robotics may be the lack of attention to the technology risk. Fifty-five percent of organizations have not conducted risk assessments to understand the impact of disruptive technologies, according to a Marsh/RIMS 2017 study.⁹ This is unsettling because it shows many companies have not thought about disruptive technology, much less begun to deal with it. For these disruptive technologies, there is often little, if any, experience or loss information to provide guidance about traditional underwriting, pricing and claims-handling models. It will be increasingly imperative for insurers to devote time and resources to the assessment of risk issues presented by new technology. Insurers also need to consider the possible lack of risk assessment within their insureds' operations. Existing insurance policy terms and conditions may be outdated and inadequate because they don't contemplate robotic risks and exposures. As robotics and AI become pervasive, insurers have the opportunity to take a lead role in steering coverage through definitions.

CONCLUSION

Whether insurers are paying sufficient attention to the topic of robotics can be debated. Nevertheless, insurers do recognize the gravity of the expected impact of AI and robotics: "Seventy-five

percent of insurance executives believe that AI will either significantly alter or completely transform the overall insurance industry within the next three years."¹⁰ Insurers must ask themselves if they want to be innovators or followers with respect to robotic coverages.

Assessments of robotic risk should include understanding insureds' current and future use of robots, and engaging in dialogue with insureds regarding safety, responsibility, supervision protocols and loss. Insurers need to pay attention to the current state of technology, and emerging case law and regulations.

A dedicated and iterative commitment will lead interested insurers to more successful underwriting and claims management. Insurers will need to revise policy language to keep up with evolving exposure and coverage issues. The rapid expansion of robots will force insurers to be agile in their recognition of the impact of new technology—and to thoughtfully assess and control risk on a line-by-line basis. ■



Jane A. Mandigo is currently a senior vice president with the Swiss Re P&C Business Management Claims division, holding the title of senior claims expert. She is a member of the Missouri Bar. Jane can be contacted at jane_mandigo@swissre.com.



Bob Weireter, CPCU, ARe, RPLU, CRIS, is a vice president, senior treaty underwriter at Swiss Re, specializing in environmental, energy and construction liability, as well as general casualty, with a special interest in emerging risks. He can be contacted at robert_weireter@swissre.com.

ENDNOTES

- 1 <http://insurancethoughtleadership.com/what-liabilities-do-robots-create/>
- 2 <http://www.bbc.com/news/technology-38583360>
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The Internet of Things: Key Considerations for Life Insurers

Five Questions with Julianne Callaway

As strategic research actuary for RGA's Global Research and Data Analytics (GRDA) team, Julianne Callaway researches emerging areas of interest to the insurance industry. Her insights on wellness, wearable technology, genetics and other strategic research initiatives are shared with clients in presentations, white papers and articles.

We sat down with Julianne to discuss the “internet of things” and its implications for insurers, a subject on which she presented at the Second Annual Internet of Insurance Conference.

1. IN WHAT WAYS IS THE INTERNET OF THINGS IMPACTING THE LIFE INSURANCE INDUSTRY?

Smart homes, telematics devices, autonomous cars—it is clear the internet of things is having a big impact on the property casualty insurance industry. The internet of things has enabled insurance products that incentivize consumers to prevent losses, and that provide value to consumers beyond payment of claims. But the internet of things has impacted life insurance as well, in large part because technological advancements have changed consumers' expectations regarding how they interact with businesses.

Internet of things technology has facilitated the development of more personalized insurance products. For example, many life insurers are interested in offering wellness-related discounts to consumers who engage in healthy activities. Wearable technology allows for these discounts on insurance products by quantifying and verifying the activity associated with healthy lifestyles.

Digital solutions are increasing the number of life insurance policies that are sold online and through mobile technology. Online insurance sales are enabled by faster life insurance policy approval, often without the need for lab work or medical exams. Advanced analytics and the use of additional data sources, potentially including data from internet of things devices, have made a triaged approach to underwriting possible, allowing for an accelerated underwriting decision while maintaining approximately the same level of risk assessment the insurer requires. The ability

to “pre-qualify” an applicant based on additional data sources brings the underwriting decision earlier in the purchasing process and satisfies consumer demand for a quick transaction.

Consumer expectations have changed as connected technology has become ubiquitous, which has affected an industry as slow to change as insurance. Connected devices have allowed insurers to evolve their offerings to meet these expectations through loss prevention, personalization of the insurance product, and the ability to purchase an insurance product digitally.

2. HOW ARE LIFE AND HEALTH INSURERS APPLYING THE NEW DATA MADE AVAILABLE BY THE INTERNET OF THINGS TO IMPROVE RISK ASSESSMENT?

Just as telematics devices have made it possible for auto insurers to provide “pay as you drive” insurance products, life insurers have explored using wearable device technology to enable activity-based insurance discounts. But activity rewards are not limited to the fit and healthy population. Fitness devices also have the potential to expand insurability to people who are demonstrating active management of chronic diseases such as diabetes.

Another example is technology that can help seniors to live independently in their homes for longer, thus potentially providing insights and value for insurance coverage, such as long-term care. RGA has a strategic partnership with K4Connect, which developed a system that connects electronic devices and appliances in the home as well as monitors the activity of the user. These devices have the ability to identify patterns of behavior and can inform users of potential issues, thus preventing accidents in the home and possible further physical decline. Data from wearable fitness devices as well as smart home technology can help life and health insurers better understand the policyholder risk. These devices can also encourage healthy behavior that will not only extend life, but improve the quality of life. In addition, by understanding patterns of normal behavior, the devices can help improve the users' quality of life as well as the safety of their surroundings.

3. WHAT ARE THE BIGGEST CHALLENGES INSURERS FACE IN EMBRACING THE INTERNET OF THINGS?

Perhaps the most fundamental challenge to adopting the internet of things is regulation. Insurance regulators must balance the desire for products that meet changing consumer expectations while maintaining the financial stability of the insurance provider and protecting consumer privacy. Reliance on new technology and new data streams can be difficult for regulators to evaluate as there is no strong historical record of data to support changes to rates and products.

Further, as insurers come to depend on additional data sources, data security becomes increasingly important. Data breaches

and improper treatment of data pose substantial reputational risk to companies, which is certainly not unique to the insurance industry. Beyond the security needs, there are requirements to store, process and connect data sets to achieve the most value from the data. Insurance companies must have sophisticated computer systems in place to use these new data sets effectively. Large insurers with legacy systems dating back many decades face significant challenges to adapt to changing environments.

The insurance industry provides protection to its customers and must safeguard that trust through financial stability as well as the protection of data assets. This duty has historically contributed to a measured and slow response to change. However, insurers must consider the influence technology and data will have on their ability to maintain relevance in a digital world.

Insurers must consider the influence technology and data will have on their ability to maintain relevance in a digital world.

4. IN WHAT WAYS DO YOU THINK THE INTERNET OF THINGS WILL IMPACT THE INSURER-CUSTOMER RELATIONSHIP MOVING FORWARD?

The insurance relationship of the future will involve a different consumer as well as an expanded ability on the part of the insurer to educate, inform and engage with customers.

Changing demographics have heavily influenced the insurance customer profile. The millennial generation is a growing consumer segment that has very different buying expectations than previous generations. This generation is the first group of digitally native consumers—they research and purchase products online, benchmark a company's products against those of its competitors, and trust the advice of their peers rather than industry professionals. They will bring these same values and practices to the insurance buying process.

However, digital capabilities have impacted the insurance industry beyond efforts to satisfy the expectations of millennials. Consumers who are confused by insurance products or have coverage questions can communicate with insurers through robo-advisors and chat bots. These tools let consumers engage with insurers on demand, with the convenience the internet offers.

In order to communicate with consumers, insurers will need to expand their communication methods to reach consumers digitally, as well as adapt their message to a new generation.

5. HOW CAN INSURERS STAY UP TO DATE AMID THE INTERNET OF THINGS' ACCELERATING EVOLUTION?

The speed of technological change has made it imperative for insurance to innovate the business model. However, the pace of change also brings risk if the industry responds too slowly or adopts a specific technology that becomes outdated.

Insurance companies can safeguard against obsolescence by creating programs that utilize a wide range of technologies. For example, a life insurance wellness program may utilize wearable technology to verify activity. However, the program should be device-agnostic. By allowing for customer usage of several devices, the insurance program will continue to function even as technology evolves. Insurers must create robust frameworks that will enable technology-agnostic insurance products that can more easily adapt over time.

Companies must manage risk posed by technological advances by expecting continual technological improvements. Research departments can help to stay ahead of trends and inform company strategy so that insurance products change with advancements in technology.

Additionally, leveraging technological advances will require strategic partnerships with smaller, more nimble companies with expertise in different areas than the traditional insurance business. As new technologies lead to opportunities to innovate traditional insurance product offerings, the industry can partner with the companies that are at the forefront. In order to stay relevant in a changing technological environment, insurers will need to establish a network of diverse partnerships.

Insurers can guard against investing in obsolete technology by anticipating and expecting continued rapid advancements. Allowing research teams to inform strategic decisions, designing programs that are not dependent on specific technologies, and establishing a robust portfolio of partnerships are ways insurers can adapt to a changing technological environment. ■



Julianne Callaway, FSA, ACAS, MAAA, is a strategic research actuary for Global Research and Data Analytics. She can be contacted at jcallaway@rgare.com.

A Glance into General Insurance: Some Characteristics of Natural Catastrophes and Management Thereof

By Jing Lang and Peter Liebwein

Looking back, 2017 was an inauspicious year for natural catastrophes globally. In the United States alone, there were three category 4+ hurricanes—Harvey, Irma and Maria (HIM)—making landfall, followed by a series of major fire events in Northern and Southern California. Outside the United States, much of the Caribbean was heavily affected by HIM, two powerful earthquakes struck Mexico, and devastating floods impacted Southeast Asia. These were not all.

The estimated total economic loss in 2017 from natural catastrophes was US\$300 billion, of which only US\$131 billion were insured losses.¹

The goal of this article is to provide a rudimentary introduction on natural catastrophes: perils, characteristics and management of such risks. It is written in a way such that actuaries with a focus on life insurance can get a high-level understanding and can explore some aspects of further interest.

PERILS AND CHARACTERISTICS OF NATURAL CATASTROPHES

Natural catastrophes are disasters resulting from natural forces of the Earth. They can be broadly categorized into three perils: geophysical (earthquake, volcanic eruption), meteorological (hurricane, winter storm, thunderstorm and tornado) and other (fire, mass movement and flood).

In some cases, when a single peril triggers other damage-inducing events and results in direct and indirect economic losses exceeding \$50 billion, a disaster is known as mega-catastrophe. Clash

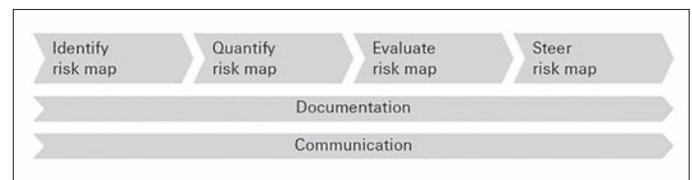
losses often accompany a mega-catastrophe, impacting several areas of insurable risk simultaneously—direct losses related to property and life, and indirect losses related to liability, business interruption, workers' compensation and health.

HIM this year is a prime example. Once it made landfall on the Texas coast, Hurricane Harvey brought extreme rainfall to the densely populated Houston area, causing significant flood damage. Puerto Rico experienced extended power outages for up to two months after Hurricane Maria hit, resulting in significant liability and business interruption ramifications. Aggregate destruction from the three hurricanes is estimated at almost US\$93 billion for insured loss, the bulk of the 2017 insured loss worldwide. Economic losses from the three events will be much higher, given much of the loss was uninsured.²

MANAGEMENT OF NATURAL CATASTROPHES

Key components of managing natural catastrophes as a critical part of risk management of general insurers (Figure 1)³ can be characterized as follows:

Figure 1
Risk Management Process as Basis for Management of Natural Catastrophes



A pivotal aspect of **identifying** natural catastrophes is to enhance risk awareness, within the insurance industry and in the general public. Statistics continue to show that there is a substantial “protection gap,” i.e., a major difference between the total economic loss and the insured loss. This typically triggers two consequences:

- In an event, only a portion will be covered by the insurance industry, which would have the global network to diversify local exposure to natural catastrophes. The remaining part falls back to the society, and ultimately the taxpayer.
- The protection gap offers potential for insurers to make the world more resilient. This potential could be addressed through regular insurance covers or through simpler, e.g., parametric, covers, or through a combination.

commercial), regions (ZIP codes, states, areas, countries and continents), or perils and exposures (e.g., earthquake California and windstorm Europe).

- Complementing the above items, **holding capital** is also a tool to manage exposures to natural catastrophes; rating agencies and regulators encourage reasonable capital adequacy and address exposure to natural catastrophes specifically.⁴

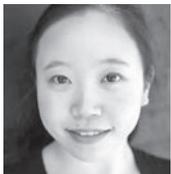
Typically it is about a smart combination of risk transfer and risk financing.

CLOSING REMARKS

Natural catastrophes are a major threat for societies. Management of natural catastrophes contributes to making our world more resilient. General insurers are a pivotal component in enhancing transparency of exposure, allocating costs for exposure in a risk-adjusted way, and providing peace of mind—plus providing protection in case a disaster strikes.

Understanding and modeling natural catastrophes is a very rich field for mathematicians and actuaries around the globe. Management of natural catastrophe exposure for general insurers in turn is pivotal in the context of capital adequacy and sustainability as well as economic capital modeling and earnings volatility.

And our understanding is probably just at the beginning. Hence, we are looking forward to shaping and enhancing our understanding further. ■



Jing Lang, FSA, FCIA, is capital management and initiatives originator at Swiss Re. She can be contacted at Jing_Lang@swissre.com.



Peter Liebwein is transaction executive for structured reinsurance at Swiss Re. He can be contacted at Peter_Liebwein@swissre.com.

ENDNOTES

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- 4 See stochastic capital requirements for, e.g., A.M. Best (2016). See also the upcoming changes of U.S. risk-based capital (RBC) in Brown & Garber (2017).

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The Diverse Markets of Asia: The Growth Engine For Today's Life Insurers

By Neill Muller

Most, if not all multinational companies' current growth strategies are centering around expanding and growing their Asian operations. When sales in Asia for companies such as Apple exceed 30 percent of total sales numbers—more than from Europe and almost the same as the Americas—at growth rates of three to four times that of the other markets, you realize the importance of the Asian markets on the world stage.

The life insurance market is no exception to these rapid growth trends. Indeed, the many and varied dynamics of the market and region have made it, and are continuing to make it, extraordinarily attractive for life insurers and reinsurers alike. In this

article, we will explore some of the Asian market's dynamics and key trends, and how insurers are repositioning for the future.

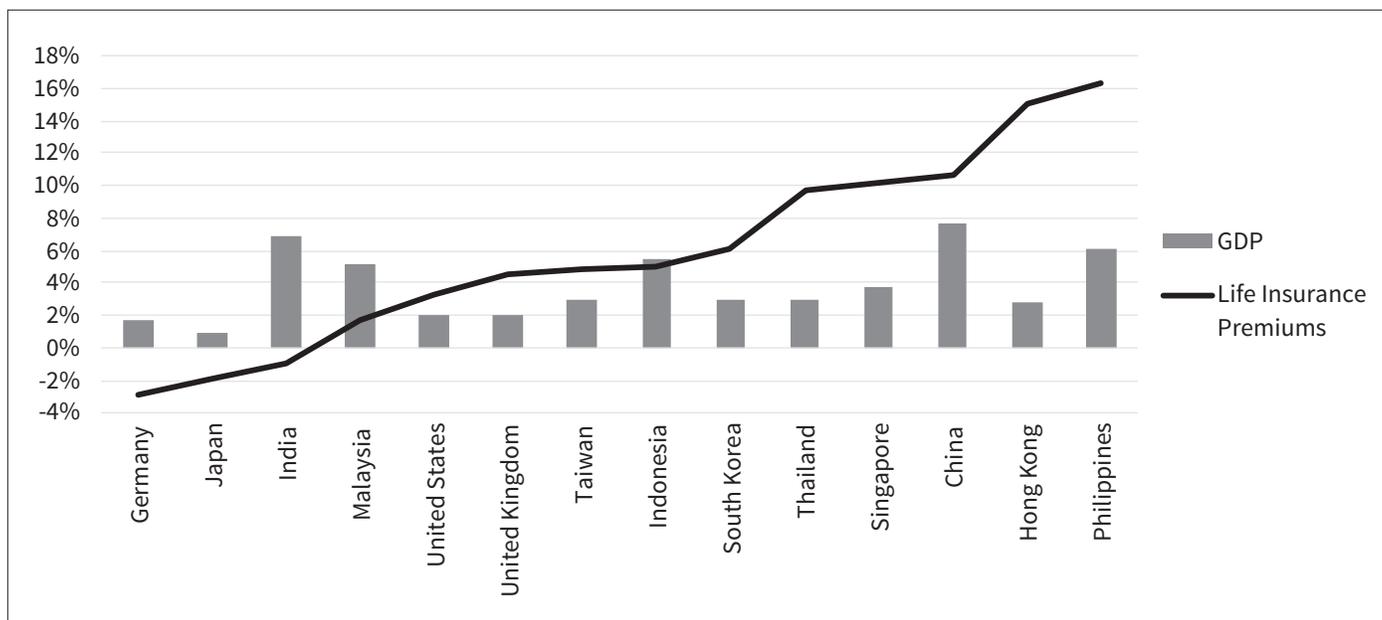
SNAPSHOT: ASIA'S INSURANCE MARKET

Asian countries comprise five of the top 10 life insurance markets worldwide. As Figure 1 shows, life insurance sales in most of the developing and emerging economies have been outpacing their GDP growth since 2010. In constant 2010 USD terms, GDP growth for these countries has been between 3 percent and 8 percent. Life insurance sales, meanwhile, have been growing at a rate of between 5 percent and 16 percent—much faster than in many developed countries worldwide.

Figure 2 lists the 10 largest life insurance markets by life insurance premium and subsequent life insurance penetration rates. It highlights not only the size of some of the Asian markets (considering also that Hong Kong is currently in 11th place), but also the significant growth opportunities, especially for China and India. Exploring this further by overlaying the size of the life insurance market on population sizes of the respective countries (Figure 3), it further highlights the potential growth for the Asian markets.

The mature and stable markets of Japan, Korea and Taiwan with their aging populations, slower overall economic growth, and plethora of regulations, are presenting unique opportunities for the insurance industry—opportunities to provide innovative

Figure 1
Compound annual GDP and life insurance premium growth rates 2010–2016



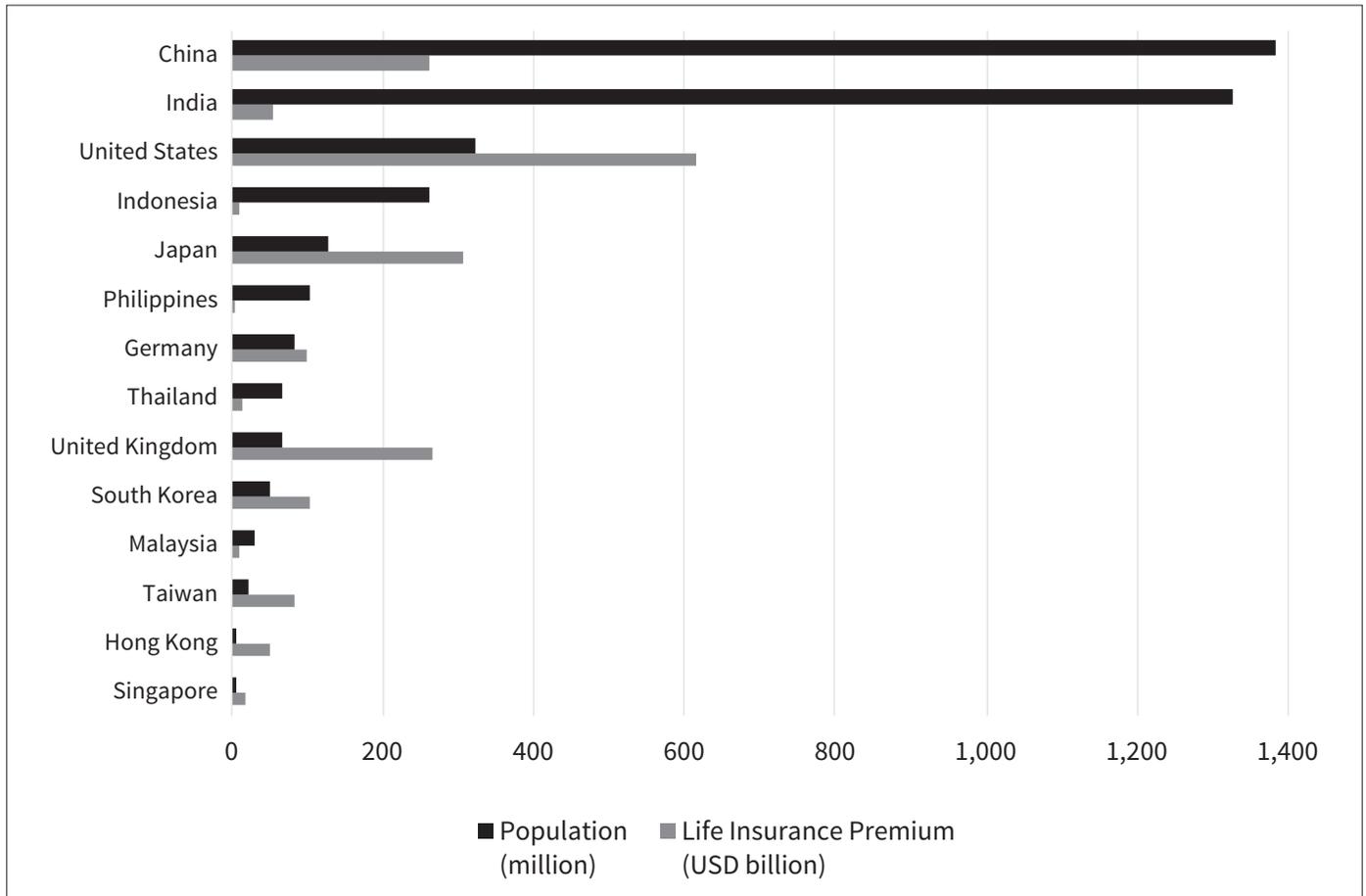
Sources: Axco Insurance Information Services, The World Bank

Figure 2
Life Insurance market size and penetration rates, 2016

Ranking	Country	Life Insurance Premium (USD billion)	Life Insurance penetration rate (Premium/GDP)
1	United States	616	3.6%
2	Japan	307	5.1%
3	United Kingdom	265	9.6%
4	China	263	2.8%
5	France	149	5.3%
6	Italy	113	5.4%
7	South Korea	103	7.9%
8	Germany	100	2.7%
9	Taiwan	85	15.9%
10	India	55	2.2%

Sources: Axco Insurance Information Services, The World Bank

Figure 3
Life insurance markets vs population sizes, 2016



Source: Axco Insurance Information Services

protection and cover for elders and families as well as a wide range of financial and capital solutions.

Hong Kong and Singapore, with very favorable market, economic and regulatory environments are sparking significant innovation, as insurers seek new ways to protect individuals who have traditionally lacked cover as well as provide protection to their fast-growing high net worth and elder markets. Meanwhile, Indonesia, Malaysia, Thailand and the Philippines are experiencing very different trends—mainly, rapid population growth and urbanization—which are yielding different sets of protection needs.

Then there is China, currently the most populous country in Asia. Its economic and demographic trends have characteristics in common with many of Asia's varied markets: rapid aging, urbanization, population growth, and slowing GDP growth . . . and all are advancing at breakneck speed.

Asia's current economic and demographic dynamics indicate excellent opportunities, especially in developing and emerging markets, for life insurers and reinsurers in the next 10 years. However, like much of the world, Asian countries are facing not just rapidly aging populations and a fast-growing middle class, but also the effects of nearly 10 years of low interest rates and increased regulatory scrutiny stemming from the implementation of International Financial Reporting Standards, and of Solvency II and other risk-based capital regimes. These are presenting Asia with many new financial challenges while opening

up the potential for a diversity of new financial and capital solutions.

We are currently observing four key trends in Asia:

- Rapid pace of product development, especially for critical illness and health insurance products, with a focus on aging populations;
- focus on innovative underwriting solutions;
- wellness, with a focus on covering impaired lives; and
- the rise of InsurTech, health care startups and other third-party service providers such as disease management providers.

RAPID PRODUCT DEVELOPMENT

Although life insurance in Asia is still dominated by savings and investments products, protection benefits are increasingly becoming an even more integral part of all insurance portfolios and solutions. Providing more flexible and reliable solutions to address the challenges and opportunities presented by aging populations is becoming imperative.

Product development, especially in critical illness, is occurring at a blistering pace. Hong Kong insurers alone have launched more than 30 new critical illness products in the last two years, ranging from simpler policies that cover only the four traditional critical illnesses (heart attack, cancer, stroke and coronary artery bypass surgery) to complex multi-pay products that cover more than 100 conditions.

Several factors are creating the financial pressures driving this rapid development:

- Better screening tests, diagnostics, treatments and other medical advances are lengthening lives, which is resulting both in higher populations and more older Asians living with age-related chronic and critical illnesses.
- Government-driven wellness initiatives, such as Singapore's diabetes awareness campaign and Korea's thyroid screening program, are yielding both more discovery of disease conditions and greater health awareness.
- More adults are caring for their parents, which is showing them the financial impact of critical illnesses and making them more inclined to buy critical illness for themselves.
- High and rising long-term care costs of diseases such as stroke and cancer, coupled with the impact of loss of





income on survivors and their spouses, are generating severe consequences:

- Non-direct medical and non-medical needs costs are much higher than medical costs;
- cancer survival rates are high and rising (five- and 10-year rates are now 70 percent and almost 50 percent, respectively); and
- stroke is a leading cause of long-term disability, especially in survivors over age 65, and up to 80 percent of its long-term costs are non-direct medical and non-medical

All of these factors are significantly raising the financial pressures associated with dealing with critical illnesses and protecting individual's current and future standard of living, both in terms of direct and indirect medical costs and the lifestyle impact of loss of income. Some new treatments and tests are still expensive but reducing quickly, but as novel treatments emerge and lifespans continue to increase, overall costs are unlikely to drop soon.

Asian insurers are introducing critical illness policies as well as riders on savings policies that offer greater flexibility for comprehensive protection and wealth management. New policy features and options include cover for continuous cancer, reimbursement of medical costs for diabetes, cancer and stroke, and a whole life long-term care benefit that does not require medical underwriting.

They are also investigating ways to expand the ability to sell critical illness to impaired individuals who, in the past, might have been turned down due to health status, age or past claims history. For example, in Singapore, diagnosed pre-diabetics and Type 2 diabetics between ages 30 and 65 can now buy targeted

critical illness policies that replace medical examinations with five questions, simplifying their access to cover.

INNOVATIVE UNDERWRITING SOLUTIONS

Approximately 15 years ago, innovations around financial underwriting led to the creation of one of the most successful new markets in the region, i.e., the high net worth customer markets in Hong Kong and Singapore. Similarly, the focus in all the Asian markets is on enhancing the customer journey and value proposition through new and innovative underwriting solutions and looking to create similar and just as successful business and customer solutions.

Although the current market distribution model is still dominated by the agency channel, companies are making significant moves to expand distribution into other channels, such as bancassurance and digital. Bancassurance solutions, specifically, are gaining significant traction and importance. Some of the more traditional distribution and business models are costly and sometimes inefficient, especially in emerging Southeast Asian countries, given their large populations and geographical dispersions. Leveraging off banking and other distribution relationships, the focus is on making the underwriting process as simple as possible, resulting in the increasing use of banking, financial and lifestyle behavioral factors to simplify underwriting processes and enhancing the customer journey even further.

Innovative thinking is also being applied to combating fraud. In India especially, fraud has been a severe challenge. The Indian fraud research firm Indiaforensic Research estimates that India's insurance sector loses US\$4.5 billion annually due to fraud. India recently went live with a new risk-scoring model integrated with an e-underwriting platform developed specifically to identify potentially fraudulent applicant behavior based on historical industry claim experience. This solution is expected to generate significant savings for the Indian insurance industry in the future.

WELLNESS, IMPAIRED LIVES AND OTHER LIFESTYLE SOLUTIONS

The challenges presented by populations of all ages have placed more emphasis on health insurance protection. As in the West, Asians are increasingly subject to the deleterious health impact of high-stress work environments and sedentary lifestyles, and much of the health care focus is still primarily on "sick care"—finding and fixing illnesses—rather than on prediction and prevention.

Many Asians are entering their senior years without sufficient cover, and several insurers in the region are integrating wellness concepts into their policies. Developing innovative wellness solutions that specifically address impaired lives is also gaining

significant traction. Many insurers are currently looking at ways to leverage medical advances, new data sources, and new technologies for this market, developing unique underwriting rules for products that can reduce the risk of covering impaired lives, and designing pre-approved life, health and critical illness solutions targeted for customers who in the past might have been uninsurable due to past health and claims experience.

Still, innovations that expand insurance coverage to customers who previously could not purchase insurance may no longer be enough. We, as an insurance industry, have to ensure that insurance solutions can both protect and improve customer health as well as financial and emotional wellness. Combining insurance solutions with traditional wellness programs, disease management protocols, third-party service providers and InsurTech could permit holistic solutions in the impaired lives wellness space.

DISRUPTION IS NOT A DIRTY WORD: INSURTECH, HEALTH CARE STARTUPS AND OTHER THIRD PARTY SERVICE PROVIDERS

InsurTech is bringing new, more innovative and more customer-focused insurance, service and business solutions. FinTech investment in Asia, like the rest of the world, has been growing by leaps and bounds: in 2016 it reached \$5.4 billion, just shy of the U.S.'s \$5.5 billion, and today accounts for nearly one-fourth of all global financing activity (up from just 6 percent in 2010). In the 12 months ending June 2017, health care startups alone in Asia totaled 240 deals and \$3.8 billion raised.

India was No. 1 in the number of health care startup deals in 2015, and many of those entities are successfully raising higher amounts in their current funding rounds as they become more mature. They are also actively seeking opportunities to collaborate with enterprises in order to scale further. Instead of seeing them as disruptions, many insurers and reinsurers are

planning to embrace InsurTech in order to seize opportunities and challenges.

In China, technology, social media and consumer product companies are coming together with insurers to leverage their vast customer bases for product marketing. Tencent Holdings, for example, owner of WeChat, recently received approval from regulators to permit its 58 percent owned Weimin Insurance unit to sell policies to WeChat's 900 million users.

Given the populations of both China and India, the current relatively low insurance penetration rates and the role InsurTech and other innovative insurance solutions are starting to play, an explosion in these markets may not be far away.

CONCLUSION

From both an economic and demographic perspective, Asia's insurance markets present significant opportunity for growth and innovation. Innovative critical illness and medical insurance products are still center stage in Asia, but insurers are focusing more and more on holistic insurance solutions combining traditional products with wellness programs, disease management protocols, and third-party service providers, to provide for the changing needs of the different segments of the population, including the previously uninsured and ageing populations.

Embracing InsurTech, data analytics and other technological advances to improve protection and underwriting solutions will increase engagement and enhance the customer journey. This is where insurers in Asia are focused. Stay tuned . . . ■



Neill Muller, FIA, FASSA, is chief marketing actuary—Asian Markets with RGA. He can be contacted at neill.muller@rgare.com.

International Congress of Actuaries 2018 in Berlin—It’s Getting Closer

By Michael Steinmetz



From June 4–8, 2018, the cream of actuarial expertise from around the world will meet in Berlin. The German Association of Actuaries, in conjunction with the International Actuarial Association, will host the 31st International Congress of Actuaries (ICA) with an expected 2,000 international participants. Located within the ESTREL Convention Center, the ICA 2018 features a high-class congress program with daily plenary sessions, around 50 invited speakers, over 280 contributed presentations for practitioners and academics coupled with an entertaining social program in the vibrant and historical capital of Germany. The registration for the ICA 2018 opened on 1 December 2017. Only 8 weeks after registration started, 2,250 delegates and accompanying persons have signed up to attend the ICA 2018 – the number of expected participants for the whole registration period. The ICA 2018 will therefore be the best attended world congress in the history of the ICA so far.

HIGH-QUALITY CONGRESS PROGRAM

In **daily plenary sessions**, internationally renowned representatives from insurance and regulation discuss the latest topics that will move the actuarial profession forward in the year 2018 and beyond. Where are we heading, and what impact will, for example, demographic developments, new concepts of mobility

and an ongoing period of low-interest rates have for insurers? Among other international experts, Winfried Heinen, chairman of the board of executive directors of Gen Re; Scott Cochran, executive vice president of RGA; Peter Praet, member of the ECB’s executive board; Gabriel Bernardino, chairman of the European Insurance and Occupational Pensions Authority; and Alexander Sixt, member of the board of directors of Sixt, will talk about the future of demography, insurance, the low interest rate environment, mobility and regulation.

Additionally, more than **30 invited speaker sessions** with well-known guest speakers from both academia and practice will cover topics from one or more of the program strands. As experts in their fields, the invited speakers—such as Paul Glasserman (Columbia University), Gunther Kraut (Munich Re) and Jürgen Huschens (IBM)—will focus on relevant actuarial and financial topics. Invited speaker sessions are offered in every section and will take place on each day of the ICA 2018.

The wide variety of topics facing the actuarial world will be covered in around **280 contributed presentations**, selected from the record number of almost 600 submitted abstracts as part of the call for papers. Section-specific talks as well as numerous interdisciplinary presentations can be found throughout the program—every day various sessions in each section will be offered. The program, taking place in 12 parallel lecture halls, will meet the needs of all actuaries: practitioners as well as academics, newly qualified actuaries, and those who can look back on many years of professional experience.

To create such a high-quality program, the Scientific Committee defined a broad set of actuarial topics prior to the call for papers. As a result, the presentations in Berlin will deal with many different aspects of those congress topics spanning all fields of actuarial science. For example, many speakers—especially from the reinsurance industry—will address innovative approaches to new life & health insurance products and the latest study results for mortality and morbidity from large data sources as well as how actuarial data science can affect risk transfer





instruments and what impact current and future medical innovations will have.

Number of sessions (90–120 minutes each) over the full week:

- AFIR/ERM: 25
- ASTIN: 20
- HEALTH: 13
- LIFE: 20
- PENSIONS: 17
- IACA: 10
- PROFESSIONALISM: 5
- EDUCATION: 5

EXCITING SOCIAL PROGRAM IN BERLIN

In addition to numerous scientific sessions, the congress program of the ICA 2018 also includes entertaining social activities. On Tuesday and Thursday afternoon, following the congress program, ICA 2018 delegates are invited to join one of six fascinating **field trips** through Berlin. These guided tours cover Berlin's most famous attractions such as the Brandenburg Gate, the Government Quarter and the Holocaust Memorial, as well as the hidden places in town. All accompanying persons are also welcome to join the **optional tours**. A day trip to Potsdam with its marvelous parks and castles, a shopping tour in Berlin, a guided tour through Germany's largest hotel or a graffiti workshop—with the optional tours there will be no time left for boredom.

Anyone seeking more actuarial content can join the **limited attendance experiences** offered as an attractive alternative to the field trips on Tuesday and Thursday afternoon. The events combine an actuarial talk with an exclusive guided tour through an exceptional venue in Berlin.

And last but not least, three entertaining **evening events** on Sunday, Tuesday and Thursday afternoon await the full-week delegates. The "Welcome Event" on Sunday held under the theme "Gauss meets Humboldt" invites participants to an exclusive night at the Natural History Museum in Berlin, one of the

most important research institutions in the world in the fields of biological and geological evolution and biodiversity. On Tuesday all attendees are welcome to join the "Garden Event" in the Estrel Summer Garden next to the congress center with freshly barbecued food, cold drinks and smooth jazz music. The final evening event will take place on Thursday in the Kalkscheune, a former German machine factory. The traditional funfair with various booth activities and fun games will take delegates back to the old Berlin of the 1920s.

GET THE MOST OUT OF YOUR STAY

Germany has a lot to offer: from Bavaria in the south with its beautiful landscape of mountains, lakes, traditional small villages and breathtaking castles, up to the north to Hamburg, which is considered to be Germany's gateway to the world. The pre- and post-congress tours offer the ideal opportunity to discover Germany and its neighboring countries. From single- to multi-day trips, package deals or individual tours—on the ICA 2018 website a wide selection of tours can be found.

FIRST VIRTUAL ICA

Another highlight of this ICA will be the very first Virtual ICA (VICA). Due to the support of a number of institutional partners from the actuarial community as well as several sections of the IAA, many sessions from the stages in Berlin will be broadcast live online and provided as recorded sessions afterwards. This allows a much broader audience from all over the world to follow the high value content presented during the ICA and helps to secure this knowledge in a sustainable manner. Furthermore, due to the successful call for papers, the VICA will also feature many online presentations of qualified authors that the ICA could not offer a presentation slot in Berlin.

The IAA sections AFIR/ERM, ASTIN, IACA and IAALS (LIFE) have already decided to become a partner of the VICA. This partnership allows the members of the sections to access more than 100 hours of live streams and videos without any further cost. Information on how to become a member of the sections can be found on <http://www.actuaries.org>.

The DAV is not only looking forward to welcoming many colleagues in Berlin, but invites all section members to join the ICA online. All the information on how to participate in the VICA will be provided in April 2018. For regular information, please register for the monthly ICA 2018 newsletter on www.ica2018.org. ■



Michael Steinmetz is project lead ICA 2018 and managing director for the DAV. He can be contacted at michael.steinmetz@aktuar.de.

With Age Comes Wisdom: Understanding Maturity Extension Riders

By Connie Cheng and Anji Li

Living to 100 and beyond is an exciting proposition. However, as this notion becomes a reality for more and more people, it raises questions for universal life policyholders on whether their existing coverage meets their financial needs.

HOW DID IT ALL START?

Prior to the introduction of the modern universal life product, most insurance products sold were whole life products that matured at face value when the policyholder reached a maturity age. Generally, maturity can be thought of as an automatic surrender, where the cash value will be paid out to the policyholder and the contract will terminate. Due to requirements in the tax code, more specifically from Internal Revenue Code 7702 and the Technical and Miscellaneous Revenue Act of 1988 (TAMRA), permanent life contracts were designed to mature at the end of the then-available Commissioners Standard Ordinary (CSO) mortality tables, between ages 95 and 100. For whole life products, as well as rare highly funded universal life products, cash value was prescribed to accumulate to be equal to face amount by maturity. The primary issues of policyholders surviving to and past the maturity age were the tax implications of receiving the full amount while still alive.

Beginning in the 1980s, sales of more nuanced universal life products began to surge in popularity. Compared with other products on the market at the time, new universal life contracts offered a significantly more flexible product design, including flexibility on premium payments, ability to take withdrawals or loans, and ability to tailor coverage periods, all while participating in investment gains from a booming economy and high interest rates. Over the decades, sales of universal life and variable universal life grew rapidly—from \$2 trillion in the 1980s to more than \$8 trillion in the 2000s.

While universal life products do offer more flexible funding and coverage patterns, their design of low cash values upon maturity are likely to pose complications to both insurers and policyholders. As this in-force block of universal life policyholders ages,



nuances from the effect of TAMRA requirements impacting contractual maturity age are surfacing. Consistent with industry mortality tables at the time and safe harbors guidelines put forth from TAMRA, common practice was to offer cost of insurance (COI) rates only up to attained age 100 for most universal life products sold through the 2000s. Myriad efforts were undertaken to extend mortality rates beyond age 100 as life expectancy increased; however, less attention was dedicated toward how to account for business sold during the time when actuarial views of mortality ceased at age 100. Attempts to address this issue began in the late 1990s and early 2000s, when many insurers began adding maturity extension riders (MERs) to their products.

MERs offer policyholders a means to prolong insurance lifetime coverage past maturity age and are generally structured for the policyholder to pay an additional premium for a preset period before reaching maturity age. Following the maturity age, an MER would allow for policyholders to maintain full face amount coverage until death. However, especially at a time when centenarians represented only 1 out of every 5,600 Americans, the features and uses of an MER may not have been fully understood by policyholders, who, despite contract specifications, may have been under the impression that a universal life product provides full coverage for life. To account for products that were issued before MERs were developed, many insurers allowed for policyholders to elect into an MER at any age before MER premiums were due, which may have also lent itself toward later complications for policyholders who may not recall either the specificities of MERs or opting in at all.

This article analyzes the cost of MERs under the current and the original pricing industry mortality views, the different structures of MERs, sufficiency of the premiums collected to cover MER costs, as well as limitations of MERs and how to address them.

HOW MUCH DOES AN MER COST?

In order to quantify the cost of MERs, we evaluated the probability of incurring a claim after the original maturity age given that the policyholder has elected the rider. Since the maturity age was most commonly set to attained age 100 with MER premiums beginning at attained age 90, these ages will serve as the standard for this study. Therefore, the cost of MERs is calculated as the probability of reaching age 100 given that the policyholder survives to pay rider premiums beginning at age 90. Furthermore, for simplicity, our analysis excluded any discounting of the death benefit because most MERs provide insurance coverage for life and guarantee a death benefit payout to the policyholder provided they reach attained age 100.

The sample illustrations were selected based on a representative business mix from the 2000s, which is the decade where MERs were most widely sold in the industry. During this target decade, most policies were sold to insureds between the ages of 30 and 60. Policyholders were more commonly male, and the average issue was approximately 50 years old. However, there was also a significant amount of business that was sold outside of this range, and almost a third of total face amount was sold to policyholders over the age of 60, with a higher concentration of women at older ages.

The cost of MERs is presented under both the current industry mortality view and that at the time of pricing. When MERs were first offered, life insurance mortality tables only included rates up to attained age 100, and a wide range of approaches were used to overcome this issue. A common practice was to use annuity industry mortality tables to extend the tail past age 100, which is why both life and annuity tables have been considered in this analysis. Although underwriting practices differ between life and annuity products, it was assumed that any substantive

underwriting effects are likely to have worn off by attained ages 90 and above.

Pricing life insurance mortality is represented by the 75-80 Society of Actuaries (SOA) Basic Table, commonly used through the 2000s, and the 83 Individual Annuity Mortality (IAM) Basic Table. The current life insurance and annuity mortality views are represented by the adjusted¹ 2015 Valuation Basic Tables (VBT) Basic Table and the 2012 IAM Basic Table. To illustrate the expected exposure at the time MER premiums are due, the probability of reaching attained age 90 for the model points was calculated under both the current and pricing life insurance mortality views.²

As evidenced by the probabilities of reaching age 90, these results indicate that the MER exposure will be applicable to a sizable block of the in-force business that is much higher than expected at the time of pricing, especially for the more common issue ages. Furthermore, for the policyholders who will reach age 90, the current views of mortality suggest a substantive likelihood of incurring claims during the maturity extension period, ranging from 11 to 17 percent, which is a notable increase since the time of pricing. This increase is partially driven by actual-to-expected adjustments made from the 2009-2013 SOA Individual Life Insurance (ILI) Mortality Experience Report in addition to differences in the underlying basic tables, such as more recent claims data and table construction methodology. These MER costs show to be comparable among current life and annuity mortality tables, suggesting that the tail mortality views between life and annuity tables have been relatively aligned with each other within the same era. The only exception for these observations is issue age 85; this is a direct consequence of the 75-80 SOA Basic Table's use of a 15-year select period structure versus the 2015 VBT Basic Table use of a vanishing select period that tapers down to only eight years by issue age 85.

Table 1
Cost of MERs Analysis

Sample Policyholder			Probability of Reaching Attained Age 90		Probability That an MER Claim Is Paid Out			
Gender	Issue Age	Smoker Status	Adjusted 2015 VBT	SOA 75-80	Adjusted 2015 VBT	2012 IAM	SOA 75-80	83 IAM
Male	35	Nonsmoker	35%	12%	12%	11%	6%	9%
Male	50	Nonsmoker	36%	13%	12%	11%	6%	9%
Male	75	Nonsmoker	52%	34%	12%	11%	6%	9%
Male	85	Nonsmoker	84%	72%	13%	11%	13%	9%
Female	55	Nonsmoker	48%	29%	15%	17%	12%	12%
Female	75	Nonsmoker	61%	52%	15%	17%	12%	12%
Female	85	Nonsmoker	88%	84%	17%	17%	25%	12%

HOW ARE MERS CURRENTLY FUNDED?

A selection of large universal life insurers were considered for analysis of premium funding, and it was found that the premiums charged for MERs vary widely in structure and amount. Companies largely fund the MER for a defined number of years prior to the maturity age, most commonly the 10 years between attained ages 90 and 99, as opposed to throughout the life of the policy. Premium payment patterns tend to vary, even amongst different products sold by a single company. Common premium formats include the following:

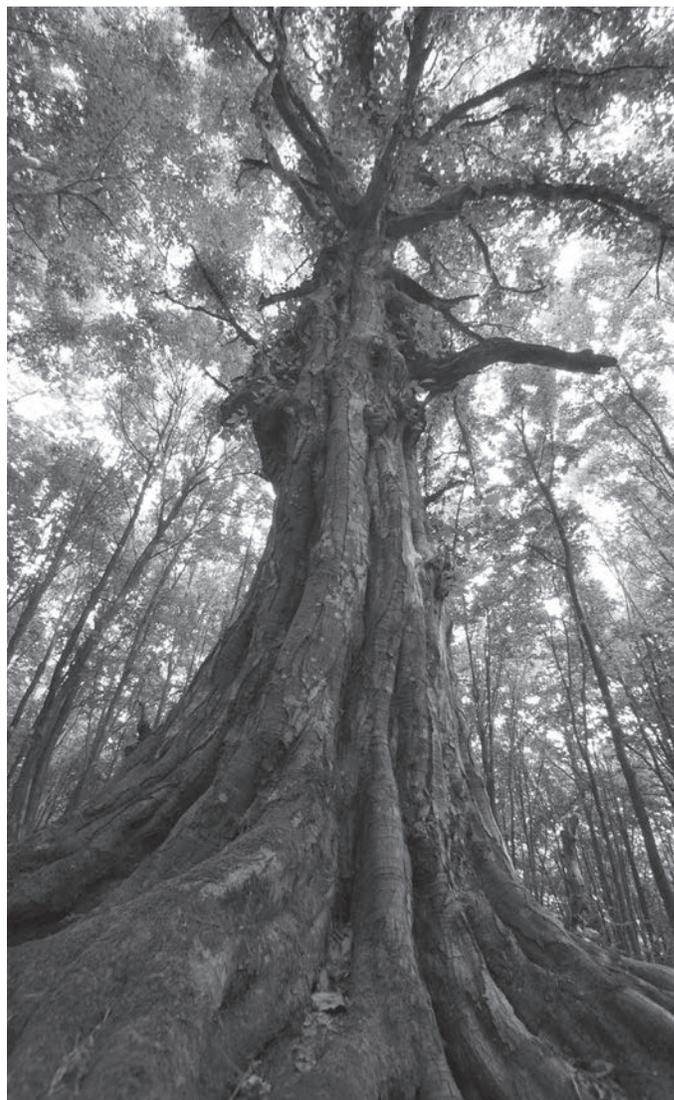
- Level flat extras, with amounts potentially varying by gender and risk class
- Flat extras increasing by attained age, with amounts potentially varying by gender and risk class
- Additional surcharge applied to base premiums during the specified period

Regardless of the premium payment pattern used to pay for the MER, the total amount of MER premium paid over the defined payment period is meant to cover the mortality risk of an insured surviving to age 100. This was assessed by comparing the total premium collected as a percentage of face amount against the probability that an MER claim is paid out, excluding any potential benefits from time value of money from the timing of both claims and premiums for simplicity and conservatism.

Based on the companies included in this analysis, it was found that the total amount of MER premium paid varies significantly across companies. This wide range was driven by differing views on what was expected of old age mortality, where a more aggressive view resulted in lower MER premiums, and conversely, a more conservative view resulted in higher MER premiums. Such a broad array of charges indicates that some products are sufficiently charging adequate premiums to cover claims while a substantive portion are likely insufficient. MERs that were priced to the lower conditional claims probabilities of the 75-80 SOA Basic Table are especially likely to exhibit this insufficiency.

WHAT ARE ALTERNATIVE SOLUTIONS TO MER ISSUES?

In terms of timing, as with most riders, some products require the MER to be elected at policy inception. However, to address older products that were sold before MERs were developed, others allow for election of the MER at any point before the MER premiums are due. For the latter case, simple forgetfulness may be an issue for policyholders who, having purchased coverage over a decade ago, may not recall the details of an MER. Under a more conservative lens for an insurer, policyholders who behave rationally might delay election until their late 80s



when they are most able to gauge their health and remaining life span. Adverse selection then becomes an issue, where those with serious prevailing ailments at that time would be unlikely to elect an MER, resulting in a healthier pool of policyholders who may have a greater chance of surviving past maturity age and incurring claims during their extension period. In light of both the possibility of adverse selection as well as the ongoing development of views of old age mortality, it is important to consider any potential deviations from expectations even for MERs that appear to be sufficiently funded. In these instances, there are several options to remediate the situation.

The most basic solution to fund claims after maturity would be to increase premiums. However, as evidenced by companies that have put forth COI rate increases, such an action is likely to have both legal and reputational ramifications. On the opposite end of the spectrum, an insurer can also opt to absorb all costs

and offer maturity extension at no additional cost to policyholders—a decision that could mitigate any potential reputational damage but come at a substantial cost. As an alternative to the two extremes, companies could also partner with reinsurers to develop tailored excess-of-loss coverage that would extend to cover gaps between the collected premiums and increased experience of longevity beyond maturity.

WHAT IS NEXT?

Since MERs were initially priced up through the 2000s, current industry mortality views show that the insured population is living significantly longer than was expected, consequently leading to higher exposures to policyholders approaching maturity age than expected at the time of pricing. As universal life policyholders continue to age and reach MER premium paying ages, insurers may wish to keep in mind the following considerations:

- For product designs where MER may be elected at any moment before MER premiums are due, insurers may be exposed to adverse selection for healthy policyholders who opt into the rider at very old ages, because they may have a higher probability of surviving past maturity age and incurring claims during the extension period.
- Companies may need to ensure that MERs are appropriately accounted for in administrative systems and clarify procedures to support the capability of providing information to existing policyholders regarding their options upon maturity.

- Solutions involving changes to product design will require consideration of tax consequences and regulatory approvals.
- In all of these considerations, reputational risk should also be kept in mind. As this substantial block of policies continues to age, it is important to proactively address these points before in-force policies achieve their centenarian milestones. ■



Connie Cheng, FSA, CERA, MAAA, is an assistant actuary with Munich Re. She can be contacted at ccheng@munichre.com.



Anji Li is an actuarial associate with Munich Re. She can be contacted at anli@munichre.com.

ENDNOTES

- 1 The 2015 VBT Basic Tables (<https://www.soa.org/experience-studies/2015/2015-valuation-basic-tables/>) were adjusted for actual-to-expected factors by attained ages based on the 2009-2013 SOA ILI Mortality Experience Report (<https://www.soa.org/experience-studies/2017/2009-13-indiv-life-ins-mort-exp/>), both as published by the SOA.
- 2 Mortality tables do not include future mortality improvement for simplicity due to variance in assumptions among companies.

The Laws of Longevity Over Lunch

A practical guide to survival models—Part 1

By Kai Kaufhold

“It is more fun to talk with someone who doesn’t use long, difficult words but rather short, easy words like ‘What about lunch?’”

—A.A. Milne, *Winnie-the-Pooh*¹

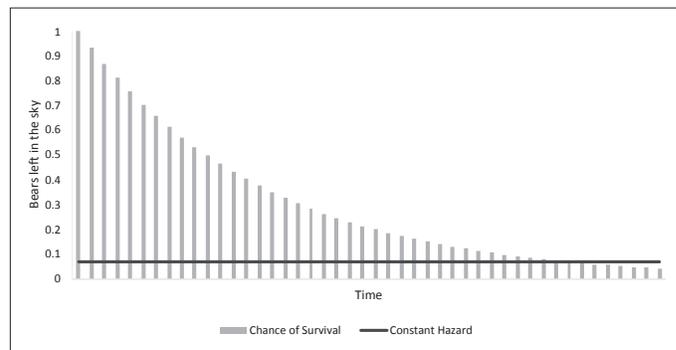
Anyone care to join me for lunch? Apart from taking a light, healthy snack, in keeping with our New Year’s resolutions, wouldn’t it be nice to ponder some fun facts about living long? Being a bear of limited appetite for anything but honey, let’s keep it simple.

Have you ever wondered why life as an actuary has to be so complicated? It seems to me that we may have taken a wrong turn at some point and gotten lost in the woods. How about following the breadcrumbs and sticky pawprints back to the edge of the forest and trying a new path? All we are trying to do is to figure out how long people (and bears) live. It really shouldn’t be that hard. This is the beginning of a series of three articles on the topic of survival analysis and predictive modeling. We’ll find out what that is and why it’s useful in this first part. In Parts 2 and 3 we will talk about examples, where the methods have been applied, and what we found out using survival models, which we wouldn’t know otherwise.

So, you live, and then you die. Hopefully, there is plenty of time in between; let’s call it survival time. Some bears only start worrying about getting old and sick after they already have some gray fur, so we are looking at survival starting from any convenient time, like now for example. The thing about life is, it gets harder as time goes by. Climbing up trees to find honey becomes more and more difficult, not to mention the little tummy that some of us develop as survival time gets longer. That’s why I recently had the idea to use a hot air balloon instead of climbing. That was much more fun, but also a bit riskier. If one of the bees notices that I am about to steal some of her honey, she may get upset and put a hole in the balloon. Ouch!

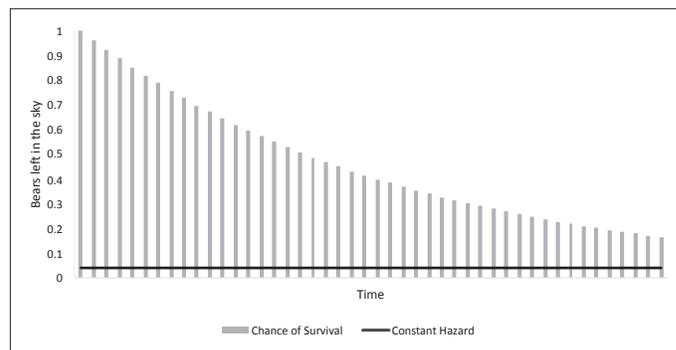
Let’s say, at any point in time, while I am floating up the tree to find honey, a stingy bee might turn up and put a hole in my balloon. It’s a lot easier if we also imagine there are 100 bears floating up 100 trees. Bears like me are simple people and all have the same appetite for honey, and the same problem with gravity without hot air in their balloons.

Figure 1
Simplest Survival Model



Of course, if there are fewer bees around, it wouldn’t be as risky to fly the balloons, and it would take longer for the bears to all fall down. That would be nice.

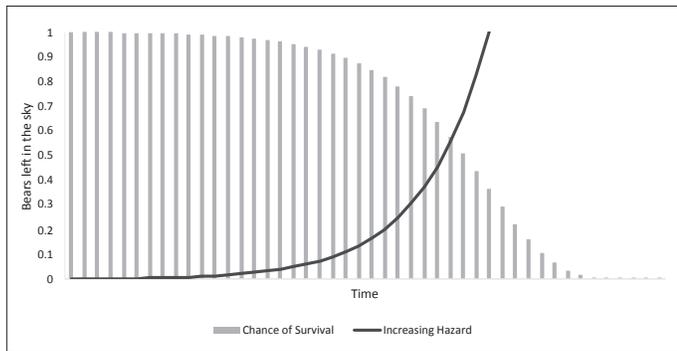
Figure 2
Simplest Survival Model



Another way of worrying about this would be to count how many bears are falling down. Because there were many bears floating around at first, then there would be a lot of bears dropping out of the sky. But after a while, fewer and fewer bears would fall, because there wouldn’t be so many of us left, would there?

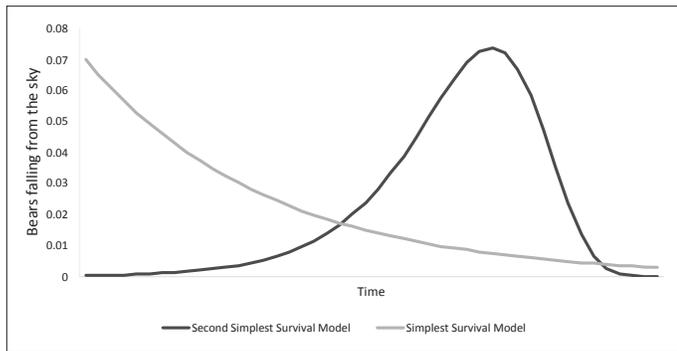
Now we get to the part where things get less comfortable, because there was more than one bee in the hive. Gradually, more and more bees come out of the hive and put holes in my balloon. Even if the holes were very small to begin with so that my balloon didn't burst, after some time, the air goes out quicker and quicker. That means that after a while the air comes rushing out. And we all know what happens then, right? Drop.

Figure 3
Second Simplest Survival Model



How many falling bears do we see now?

Figure 4
Comparing Survival Models



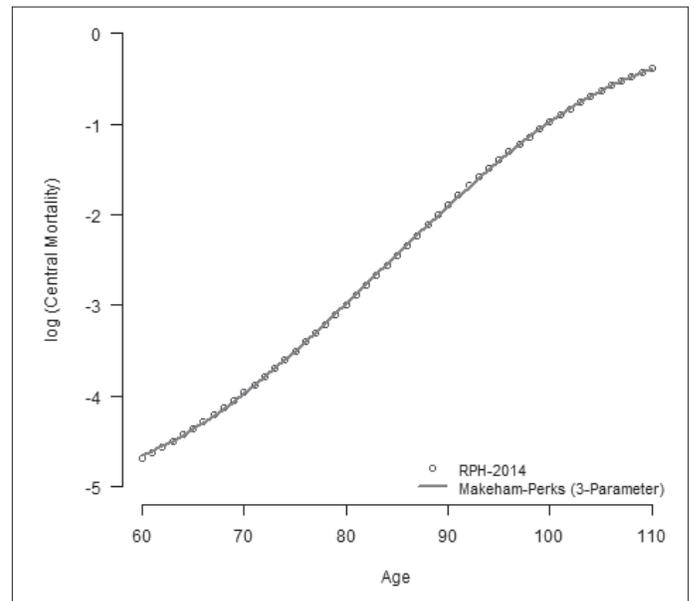
Because in our second example the chance of falling down is low at the beginning, nothing really happens at first. Then, after a while, more and more balloons pop and more bears drop from the sky. In the end, there are only very few bears left floating around, and so the sound of bears bouncing on the forest floor gets less.

The first model we saw—the one with a constant hazard rate, is called exponential decay—and is found in alpha radiation in particle physics, or in policyholder persistency, for example. It can be described with a single parameter, and counting the number of bears dropping in a time interval, or the beeps on the Geiger

counter, will help us guess what the parameter is. The second model is nearly as simple, because it needs only two parameters. And those can be found by counting the deaths by age, if the mortality data is provided for age groups, or by taking the time how long each person survives, if we know about every person. If you work for an insurance company or pension plan, usually you do know about the people whom you are looking after, and that will help us fit models that are very simple and still give us enough information to find many interesting results.

I can hear you scratching your head and thinking, “That sounds too good to be true.” There are many serious, grown-up, hard-working actuaries who spend a lot of time building nice mortality tables, lapse tables and disability incidence rate tables. A friend of mine and I were playing in the forest one day when we found a lovely table that someone had left there.² It was made up of 51 rates for ages 60 to 110, and you could tell that it was done nicely using a very well-mannered smoothing mechanism. My friend decided to try something out and put it into his R script for fitting survival models, like the second simplest model that we used for less dangerous bees. Only this time, we added one more parameter and were able to find a very pretty function that described all the parameters of the serious, grown-up table in one go. We needed nearly all of our fingers and toes, but we figured out that that is 48 fewer parameters than the grown-ups used. You can see my friend's results in the chart with the nice smooth line running through the serious, grown-up mortality rates shown as circles.

Figure 5
Healthy Retired Pensioners



Source: Ramonat and Kaufhold (2018), referring to the SOA tables for healthy retired pensioners published in 2014. The rates are fitted using a Makeham-Perks model with only three parameters.

Nothing really happens at first. Then, after a while, more and more balloons pop and more bears drop from the sky.

We laughed and went for lunch. When we came back, we found out that my friend's function could do even more. It could fit the parameters we found in the table that had *RPH-2014 males* written on it, and it could also fit rates that weren't even there; rates for ages younger than 60 and older than 110. I know the grown-ups worry about such missing rates sometimes, and call it extrapolation. Sounds difficult, but if you have a simple model, sometimes it works better than you would expect.

While we were at lunch, we had another idea, too. How about letting different people float around on balloons? We already had a suspicion that Piglet would not fall down as quickly as a tubby bear with a little tummy, even though he is a lot more scared of falling down. But maybe the red balloons would stay up longer than the blue ones. All we would have to do is call one of the parameters "blue" or "the other color" or "not red," and then we would be able to find out whether it made any difference. It turns out, color doesn't make any difference, but tummy size does. Oh dear!

Toward the end of the afternoon, a couple of grown-ups came by and watched us playing with our models, shaking their heads and muttering, "These kids are having way too much fun. That can't be serious actuarial work." No one had told them that life as an actuary didn't have to be all serious and complicated all the time.

I'll be telling more stories about survival and what can go wrong with it next time. I can't tell you right now, because otherwise you might not want to go back to work. You might want to hang out with us and play with models, too. But I can tell you one thing that we found out while we were trying the models out on different kinds of situations. If you want to know how long you have to look after someone who is really ill there is a really big

chance that you get it wrong. Even if you did everything the right way, wiped your feet and brushed your teeth, chances are that what happens is a lot different from what the grown-ups thought.

There are two more articles coming out in *Reinsurance News* that describe such case studies in which survival models proved themselves to be very useful. You can not only predict when someone is going to lapse their policy, become ill and disabled or die. You can also find out what the chances are that your calculation is not quite right. This error in estimating the parameters of the model is very closely related to how much a company's results will vary and so can be used to predict losses for entire portfolios and even companies. This is extremely helpful if you are trying to convince someone in the regulator's office that you have enough money to buy enough honey for all the bears you promised it to.

And if you can't wait for the next issue of *Reinsurance News* to find out, maybe you would like to visit us at the International Congress of Actuaries in Berlin. We will have a session to talk about these results. But don't have too much fun—otherwise we might be sent to bed without continuing professional development (CPD) credit. See you there! ■



Kai Kaufhold, Aktuar DAV, is partner, Prediction Consulting and Longevity with NMG. He can be contacted at kai.kaufhold@nmg-group.com.

ENDNOTES

- 1 Found at <https://www.goodreads.com/work/quotes/1225592-winnie-the-pooh> on Jan. 9, 2018.
- 2 From the RP-2014 Tables published by the Society of Actuaries (SOA). <https://www.soa.org/experience-studies/2014/research-2014-rp/>

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