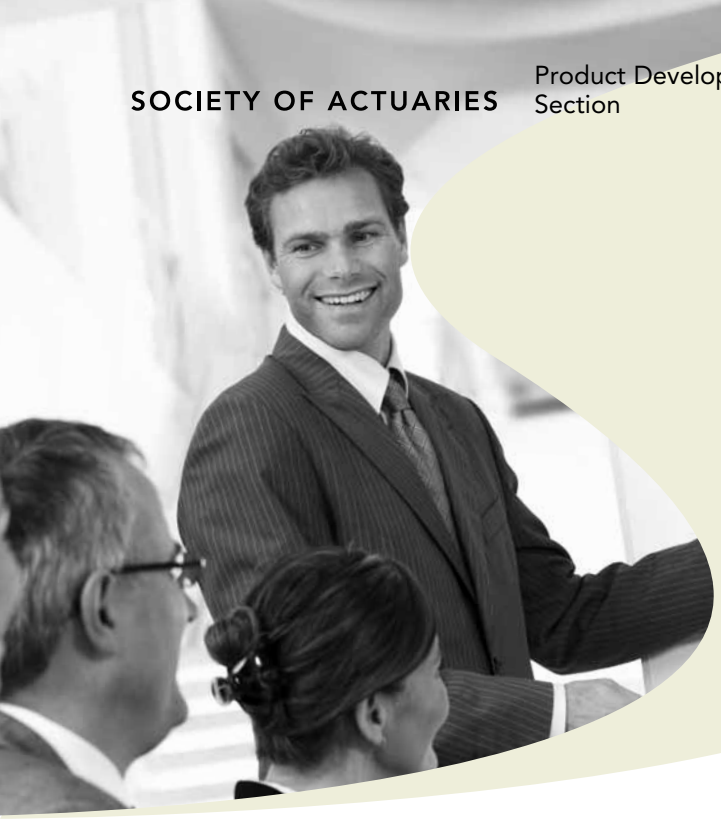
SOCIETY OF ACTUARIES Product Development Section



Product Matters!

ISSUE 83 | JUNE 2012

1 **Term Conversions – A Reinsurer's Perspective**
By Tony Zajac

3 **Chairperson's Corner: News You Can Use**
By Donna Megregian

8 **Around The World – India How simple can it get?**
By Greg Becker

10 **Co-Editors' Commentary**
By Jim Filmore, Paul Fedchak and Kurt Guske

10 **Interesting Challenges for Insurers**
By John Fenton, Mark Scanlon and Jaidev Iyer

17 **Alzheimer's Disease as a Critical Illness Trigger: Does it Really Make Sense?**
By Stephen Rowley and Cyriac Kottoor

21 **Individualized Mortality Projection and Product Pricing with Laboratory and Physical Measurement Data**
By Brian Lanzrath, Jim Palmier and Ammon Dixon

26 **A Primer on Reinsurance Pricing Strategy "A Checklist for Optimizing Reinsurance Negotiation"**
By Larry Warren

Term Conversions – **A Reinsurer's Perspective**

By Tony Zajac

The right to convert a term life policy to a permanent plan has been a key component of term products for many years. This valuable option allows term policyholders, with certain restrictions, to switch to a permanent plan without new underwriting. At the point of sale, the conversion privilege can alleviate concerns about either losing coverage at the maturity of the term product or having to pay rapidly escalating premiums to keep coverage in place after any level-premium period. As with any valuable option, term conversions have a material cost; one that could easily be underestimated if not carefully evaluated.

Direct Writer Term Conversion Considerations

Because conversions are an option, policyholders will decide whether or not to exercise them based on their situation during the conversion period. Mortality anti-selection will occur for those choosing to convert to a permanent plan, since conversions include insured individuals who need to continue coverage and cannot qualify for a new policy at standard rates.

Estimating the impact of conversion mortality anti-selection has been difficult.

- Administrative systems have not always been programmed to contemplate tracking term conversions. Systems may not have identified converted policies separate from original issue permanent policies. Even if they did, they may not have tracked from which term policy or plan it was converted.
- Level term products often allow conversions up to the end of the level period. In most cases, it would make sense for the insured to wait as late as possible to convert to a permanent product, since the term premiums will generally be less expensive than perma-

CONTINUED ON **PAGE 5**

Actuaries
Risk is Opportunity.®

Product Matters!

ISSUE 83 | JUNE 2012

Published by the Product Development Section Council of the Society of Actuaries

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

To join the section, SOA members and non-members can locate a membership form on the Product Development Section Web page at *www.soa.org/product-development.*

2012 SECTION LEADERSHIP

Articles Needed for the Next Issue of *Product Matters!*

While all articles are welcome, we would especially like to receive articles on topics that would be of interest to Product Development Section members based outside of the United States.

Please e-mail your articles to Jim Filmore, Kurt Guske or Paul Fedchak by 7/20/12.

Chairperson's Corner

News You Can Use

By Donna Megregian

Donna Megregian, FSA, MAAA, is a consulting actuary with Milliman, Inc. She can be contacted at donna.megregian@milliman.com.

Your section council has been hard at work evaluating the recently held Life and Annuity Symposium and planning the upcoming Annual Meeting. We have taken the responses from the survey we sent in February and shaped some professional development opportunities including a webcast(s?), sessions and research. We send out a big "Thank You!" to everyone who participated in the survey. We hope that we can continue to increase the value you see in your membership in the Product Development section.

Once again, it is election time ... for the country and for your section council. The section council slate will likely be finalized by the time this article is published. Although you don't have to be a section council member to participate in the section council meetings and events, being on the council allows you to join with your peers in shaping professional development opportunities and decide strategic directions for the section as a voting council member. We thank all those who have volunteered to put their names on the ballot for this year's elections. We have a talented group and the council will benefit from any of the candidates that will fill the three open slots.

Very soon, two research projects that the section has sponsored will be published if they have not been already. First, there is a research project that focuses on Market Consistent Embedded Value (MCEV) and comparing MCEV to profit measures that actuaries may be familiar with already, such as IRR. MCEV has gained popularity in recent years. The report compares MCEV to various profit measures for select life and annuity products and delivers the pros and cons on using this profit measure. We may also sponsor a webcast on this research. **Please look for that opportunity and use your $25 coupon for being a section member!**

The other research project results from a survey on premium persistency assumptions for flexible premium products. With the development of new products and the possibility of principal-based reserves coming, various assumptions are in need of some industry data to help support them. Premium persistency is an area that most have little outside experience to validate their assumptions. The research from this project can be leveraged to validate and benchmark premium persistency.

As many of you know, we have launched a LinkedIn group to help facilitate discussions on topics of interest from our members. Please join the discussion and post questions through your LinkedIn pages. Some of the topics that have been discussed include:

- How would you feel about section benefits being restricted to section members only?
- What type of life insurance do you own?
- Discussion related to transparent lifetime income annuity features.
- What is your comfort level with principal-based reserves?

If you have any ideas or questions, please contact a member of the section council or send a message to Christy Cook at cccok@soa.org.

I've tried to use this corner to provide you with some transparency in regard to what the section council is doing. I hope you can find it useful, and if you wish to be more directly involved, become a friend of the council and join the monthly meetings to help plan and discuss topics pertinent to the section. Again, if you are interested contact ccook@soa.org or fill out a volunteer form on the SOA website. □

nent plan premiums for the same attained age. This means historical experience may understate the potential total number of conversions from more recently issued term plans, where policies are still far from the end of the level period.

Sparse experience data, when combined with vigorous price competition, gives just the right set of conditions for the market to under price the true cost of term conversions.

Conversion Privilege Restrictions

Typically, conversions are permitted only for a specified number of policy years, usually with a maximum attained age. For example, a level term product may restrict conversions to the level premium period or attained age 70, whichever is the earliest. These restrictions reflect the fact that the likelihood of an insured developing an "uninsurable" condition increases with both time since issue (as the benefit of underwriting wears off) and with higher attained age (as a greater percentage of deaths occur from chronic conditions).

Conversion privileges may also vary depending on product design and features. For example, products may not allow conversion privilege while a policy is being paid by a waiver of premium rider during a qualifying disability. Some insurers have different portfolios of term products, with one having more restrictive conversion privileges than the other. Several insurers use an annual renewable term (ART) or other short-guarantee design as a means to attract younger buyers at a low cost. The goal of these designs is converting them to a profitable permanent plan once the policyholder can better afford the premiums. For these plans, conversions are actively encouraged, and conversion credits are often provided for the insured (as a first-year premium discount) while commissions on conversion are given to the agent.

Pricing Impacts

There are two primary ways to cover the additional cost of anti-selective mortality due to term conversions.

1. **Include excess mortality in permanent product pricing.** This choice is popular because level-period term is very price sensitive, and places the anti-selective mortality into the product that is directly affected by the actual increased claims. There are two key difficulties with this approach.

   First, it is difficult to predict exactly what the conversion utilization rate will be on the term product, especially if the conversion privilege extends for many years. Second, it is even more difficult to estimate the volume of permanent product sales that would absorb the excess mortality from these conversions.

   As a result, even with a good estimate of the excess mortality per converting policy, it would be difficult to estimate an actual load. To safely cover this risk, insurers can apply a conservative load to the permanent plans at the risk of affecting their own competitiveness. Using optimistic assumptions to price the conversion mortality load would risk harming the financial performance of the permanent block. Even worse, ignoring conversion mortality in the permanent pricing altogether would risk needing to raise COI rates or cut dividends if excess mortality is extreme. One other option is to develop a conversions-only product. Be mindful that this option may make the conversion alternative less than attractive.

2. **Include excess mortality in the term pricing as part of a cost of conversion.** This has the advantage of aligning the cost of the conversion option to the term product that created the option. This option may include other costs, such as agent compensation for conversions or conversion credits given to policyholders; allowing a proper comparison of profitability across products.

Term products are often price competitive with lower profit margins. In this case it may be difficult to develop a competitive term product that fully absorbs the realistic cost of conversion mortality. This may require the insurer to scale back the availability of the conversion option. One example would be to limit conversions to the first 10 policy years instead of allowing conversions throughout the level period. Another idea is to have two term products, where one

has lower premiums but also more restrictive conversion provisions.

Reinsurer Term Conversion Considerations

Reinsurance treaties cover term conversions in one of two ways. A common method is to keep any term conversions in the original treaty at a point-in-scale yearly renewable term (YRT) rate. If this is the case, the reinsurer needs to allow for a higher mortality rate for the conversions than would be used in pricing if the conversions were not reinsured at all. This can show up in rates in a different manner, depending upon whether the treaty is coinsurance or YRT.

- If the treaty is coinsurance, the YRT rates would apply only to the conversions. These YRT rates can fully reflect the extra mortality due to conversions.
- If the treaty is YRT, the extra mortality must be reflected either by increasing the overall YRT rates or using a separate set of YRT rates to be applied point-in-scale to converted policies.

In either case, the extra mortality assigned to conversions may have been underpriced by reinsurers in the past. Like direct writers, reinsurers have had a lack of useable conversion experience data. Reinsurance transaction files in the past had less than perfect indicators about conversion status, whether the treaty was a term treaty keeping conversions or a permanent treaty covering converted policies. As a result, reinsurers, like direct insurers, often priced for conversion mortality without the benefit of solid experience data.

Another common method to reinsure conversions is to cover converted policies as part of the permanent treaty covering the permanent plan to which the policies convert. This becomes problematic for the reinsurer if the cedant has a material amount of term conversions. If the reinsurer already covers all the term products that can convert into the covered permanent plan, it may be sufficient for the reinsurer to review and compare the YRT rates in the permanent pool with the expected mortality used to price the originating term pool(s). If the YRT rates adequately cover the expected mortality including anti-selection upon conversion, then pricing should be adequate.

> “Term conversions have been around for quite some time, yet their impact on product profitability remains a mystery …”

If the permanent pool covers conversions from term plans not already ceded to the reinsurer, there are three areas of uncertainty in determining the correct load for conversion anti-selection:

- Uncertain mortality from the originating term block of business, both before and after reflecting an adjustment for anti-selection.
- Uncertain volume of term conversions coming from these plans.
- Uncertain volume of originally issued permanent products relative to term conversion volume.

The interaction of these three unknowns can produce a great deal of uncertainty on conversion mortality. If reinsurers can quote a separate YRT scale for converted policies, the risk is confined to the uncertainty on the level of mortality from the originating term plan. If cedants require a single YRT scale covering both original-issue and conversion policies, it may be necessary to put a substantial load on the YRT scale.

Conclusion

Term conversions have been around for quite some time, yet their impact on product profitability remains a mystery for many in life product development. Uncertainty has come from the gaps in experience data, driven by sub-optimal tracking of conversions in years past. Since a substantial amount of conversion experience occurs in later policy years near the end of the level term period, only now are trends emerging on credible company data. It may take several more years for this data to be of sufficient use for an industry-wide study that could be helpful to better benchmark conversion mortality. In the meantime, experience should be gleaned from the best available sources.

For insurers with relatively credible and robust conversion experience, company-specific data should be

CONTINUED ON **PAGE 6**

Tony Zajac, FSA, MAAA, is 2nd Vice President, Individual Life with Munich American Reassurance Company. He can be contacted at: tzajac@munichre.com

reviewed. Even if not credible at a granular level, this experience can validate conversion mortality assumptions used.

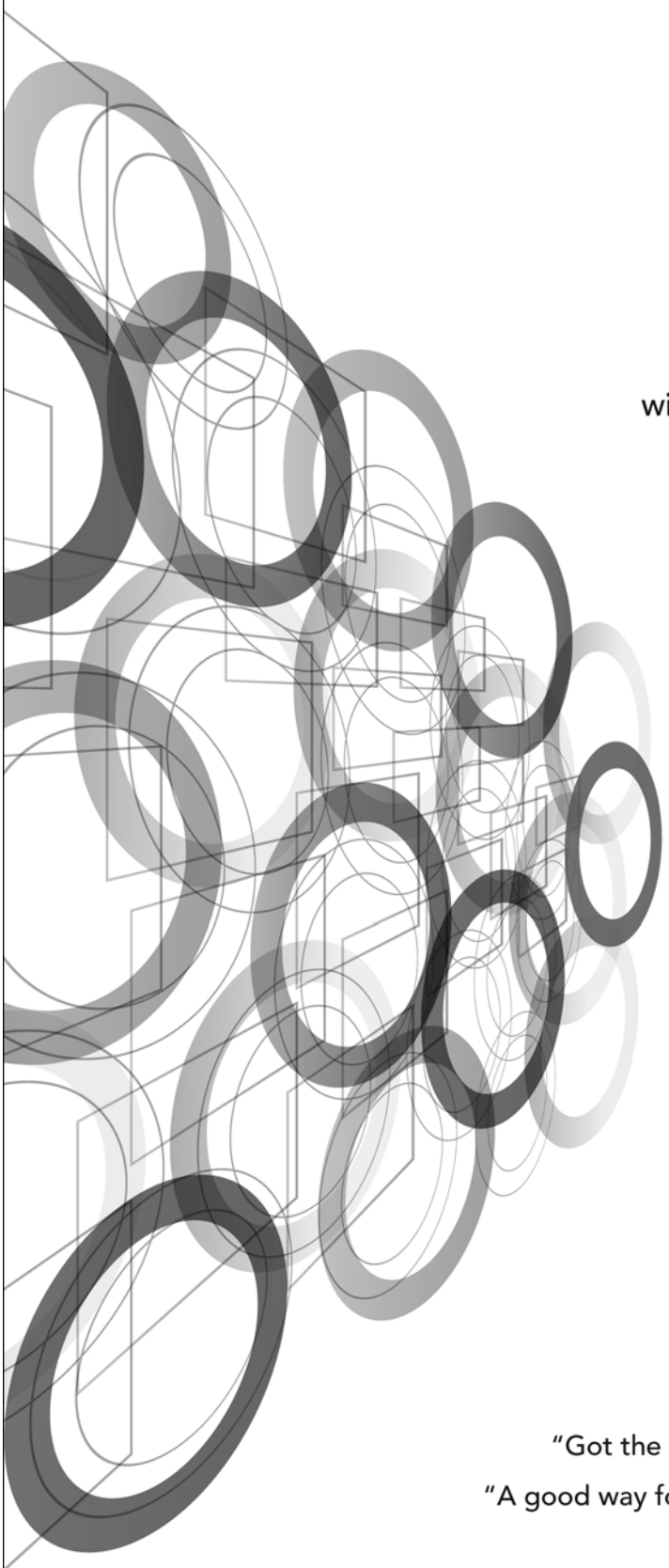
For insurers selling term life insurance with conversion options, reinsurers can provide objective feedback on assumptions settings based on the experience they have internally. If the direct writing company has even rudimentary conversion experience to share, the reinsurer can compare this experience with their own more credible base, and provide meaningful insight to the direct writer.

Direct insurers and reinsurers have a vested interest in understanding the risks and financial impact of term conversions on their blocks of business. We can expect the knowledge base on conversions to grow as the industry puts proper focus on their impact on product performance. □

Model Efficiency Study Results Report Now Posted

The report summarizes the findings of a stochastic modeling efficiency study.

View the report at *SOA.org*—click on research, completed research projects and life insurance.



Connection. Community.

Join our SOA Annual Meeting community. Unite with peers. Make new connections. Revive old ones. Connect with speakers during our more than 100 sessions—and get loads of CPD credit.

SOA 2012

ANNUAL MEETING & EXHIBIT

Washington, DC
Oct. 14-17

"Got the opportunity to learn from very knowledgeable actuaries"

"A good way for actuaries to meet people from a variety of companies"

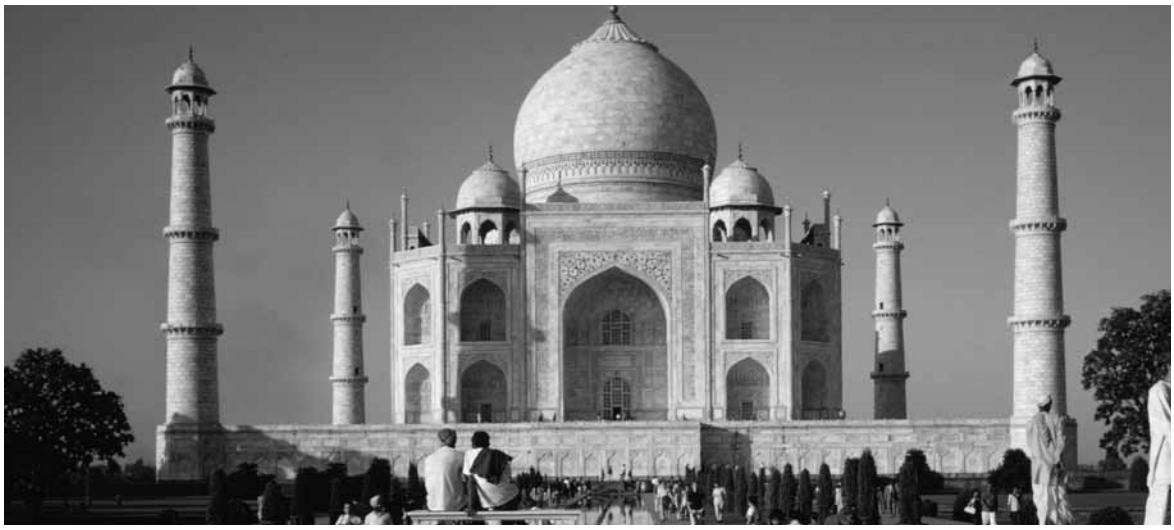
"I attended for the networking opportunities!"

—Past Attendees

Ready to connect? Head to **SOAAnnualMeeting.org**.

Around The World – India
How simple can it get?

By Greg Becker



Greg Becker is a Product Development Actuary at the Reinsurance Group of America, in a role that covers Europe, the Middle East and Africa. He can be contacted at: gbecker@rgare.com

This is the first article in a series titled "Around The World." Each issue will focus on the protection market of a different country or region, looking at interesting product developments, new distribution ideas, regulatory responses, industry initiatives and so on. Simple financial products can meet the needs of many. What can we learn from India?

Our story begins with a personal accident policy that has been sold to more than eight million Indian farmers.

The product, *Sankat Haran Bima Yojana (SBY)*, is sold by IFFCO Tokio General Insurance Co. Ltd. (ITGI), where IFFCO is an acronym for The Indian Farmers Fertiliser Cooperative Limited[1]. IFFCO is the largest fertilizer distributor in the world. With every bag of SBY fertilizer they sell, the purchaser automatically receives Rs4000 ($80) of personal accident cover, Rs2000 ($40) in the event of total and permanent disability or on loss of two eyes or limbs, and Rs1000 ($20) on the loss of one eye or limb.

A person who buys multiple bags of fertilizer can be covered for up to Rs100,000 ($2,000), which can be realized by purchasing 25 bags.[2] The coverage lasts for one year, which naturally aligns with a fertilizing cycle. This useful product differentiation contributes to helping sell fertilizer the following year.

> "What makes this product special is that it has neither an explicit premium nor a policy form."

What makes this product special is that it has neither an explicit premium nor a policy form. The policy document is "the empty fertilizer bag" with the policyholder's name and the date purchased (which locks in the term) written on it. With over 8,800 claims paid, substantial goodwill has been created, and customers who may lack financial astuteness have reaped a positive insurance experience.

IFFCO bears the benefit cost, a mere Rs1 ($0.02). IFFCO uses this partly as a branding initiative to help sell more fertilizer, as well as insurance products. ITGI has developed explicitly-priced cattle insurance and weather-related insurance products and sold them to the same group of customers.

With many Indians having little exposure to insurance products, or a positive buying experience, these types of interesting initiatives are needed, as well as others.

In terms of product, there are some protection products that can best be described as bank accounts that provide insurance coverage in lieu of crediting interest on their customers' account balance. In terms of distribution, there have been some interesting banking initiatives to broaden the access to this bank insurance product.

Mobile phones have been used to enable people to become trusted agents for these banking products. The company, A Little World, sells a kit for $450 that enables one to set up an online bank branch to distribute the bank account insurance coverage.

Some of these initiatives have been made possible due to incredibly low administrative costs. Max Vijay, a partnership between New York Life and Max Vijay has launched an Insurance Savings Box. This is a savings product that provides some protection benefits. The product has flexible contributions and accepts contributions as low as Rs10 ($0.20). It returns a substantial portion of premiums on lapse, 90 percent of recurring premiums.[3] This is only possible with very modest administrative costs.

Turning our attention to the United States, many would argue that the potential for simple financial products is not only being held back by product differentiation strategies that confuse the customer, but also by process complexity that raises the barriers to sale. This Indian Personal Accident product is an example of one with no underwriting and no exclusions. While an underwriter could easily and rightly argue that short-term personal accident protection requires less underwriting than almost any other product, we should be questioning the extent to which precautions could be preventing innovative products from being developed. The first world has exported insurance expertise to the developing world. It could be argued that the innovations in the future may be imported! IBM is Max Vijay's technology partner—when are they going to be bringing these systems and that cost structure to the United States?[4]

END NOTES

1 http://www.iffco.nic.in/applications/iffcowebr5.nsf/?Open

2 *http://www.thehindubusinessline.com/todays-paper/tp-agri-biz-and-commodity/article999830.ece*

3 *http://www.maxvijay.com/products_rajat.aspx*

4 *http://www-03.ibm.com/press/us/en/pressrelease/24781.wss*

Interesting Challenges **for Insurers**

By John Fenton, Mark Scanlon and Jaidev Iyer

Co-Editors' Commentary

By Jim Filmore, Paul Fedchak and Kurt Guske

Since the original release of "Interesting Challenges for Insurers" in March 2011, interest rates have acted like an incessant game of low limbo. Just when you thought the bar couldn't get any lower, it does.

According to www.federalreserve.gov, 10-year Treasury constant maturities dropped below 2 percent on Sept. 6, 2011 and have hovered around 2 percent through mid-March 2012. The article's subject matter and helpful tips are even more relevant today than they were a year ago when the article was originally published in the March 2011 issue of Towers Watson's Insights publication. Thus, we thought it would be useful to publish this article again.

Enjoy reading and we hope the article provides insights that you can apply to your business!
Jim, Paul and Kurt

This article first appeared in the March 2011 issue of *Insights*, a Towers Watson publication.

Market interest rates and bond yields dropped in response to the global financial crisis in late 2008, and they have struggled to return to their prior levels, in part because the Federal Reserve has made efforts to spur growth and lending in a sluggish U.S. economy. The yield on 10-year Treasury notes fell in the second half of 2010 to around 2.5% (compared with 3.5% a year ago and more than 4.0% in mid-2008), before recovering to 3.3% at year-end. The recovery occurred even as the Fed announced a second round of quantitative easing (QEII, as markets call it) to buy $600 billion of U.S. through the second quarter of 2011, a move aimed at keeping bond yields low. Markets, on the other hand, worry about inflationary consequences of such new stimulus and rushed to hedge or eliminate exposures for year-end.

Despite some recent good performance in other market sectors, life insurers continue to be concerned by continuing low interest rates, as well as by the significant uncertainty about their direction. Numerous recent analyst calls have cited lower profitability due to squeezed interest margins. The current economic environment and associated uncertainties about the future pose a number of challenges for life insurers. Much of the business currently on life insurers' books stands to perform very poorly under either very low or very high interest rate environments. Thus, for many, the ideal situation from an interest rate perspective would be for rates to increase gradually back to more "normal" levels. However, it is not at that this scenario will play out, and insurers need to be prepared for any alternate reality.

In considering these issues, life insurers benefit tremendously by having a robust risk management framework in place. Defining risk appetite is key; companies should have a clearly articulated top-down enterprise risk appetite statement that incorporates clearly defined risk metrics.

While the impact of very low interest rates is easy for many to see, these risk metrics can be used to help identify and evaluate impacts of interest rate risk that are not necessarily intuitive—things such as the relative steepening of the curve and timing of movements, both of which can adversely affect insurers through the interplay of assets and liabilities.

One thing should be clear in the face of the current and uncertain future interest rate environment: Doing nothing and waiting for things to return to "normal" is not a defensible strategy.

Scenarios—The Bad and the Ugly

The last 20 years have seen U.S. interest rates fall steadily (Figure 1). Many economists and market gurus suggest that the future interest rate environment is unlikely to follow a clear secular trend. Fat tail risk seems to have gone up dramatically so that previously extreme scenarios now appear to be more likely to occur. Even in the very short term, the direction of rates is completely uncertain; volatility rather than trend is the order of the day. The most frequently mentioned plausible adverse scenarios for U.S. rates are these two:

- A Japan-type very low rate environment persisting for a long period of time amid a disinflation or possibly even deflation economic prognosis. This is one of the Fed's concerns, which it is trying to with its quantitative easing program.

• An inflationary environment with a rapid resurgence in the economy (similar to what occurred in the late 1970s), forcing the Fed to reverse course in a hurry as it tries to undo the stimulus now being pumped in. This is what has concerned the market recently.

Either of these might severely test insurance company portfolios (even ignoring, for the purpose of this article, market impact in other sectors, such as credit risk, foreign exchange and equity prices).

Regardless of the forecasts (and there are probably as many forecasts out in the market as there are forecasters), it has become increasingly necessary for insurers to look at these types of extreme scenarios and to plan their portfolios for optimization under either case. To reiterate, these are:

• Interest rates stay at their relatively low level—and we may see another drop if the economic recovery falters—and remain low for a long period of time.
• Interest rates spike up suddenly across the board in line with rampant inflationary expectations.

In either of these scenarios, we may also see the shape/slope of the U.S. yield curves become dramatically tilted/bent (i.e., nonparallel shifts).

Low interest rates

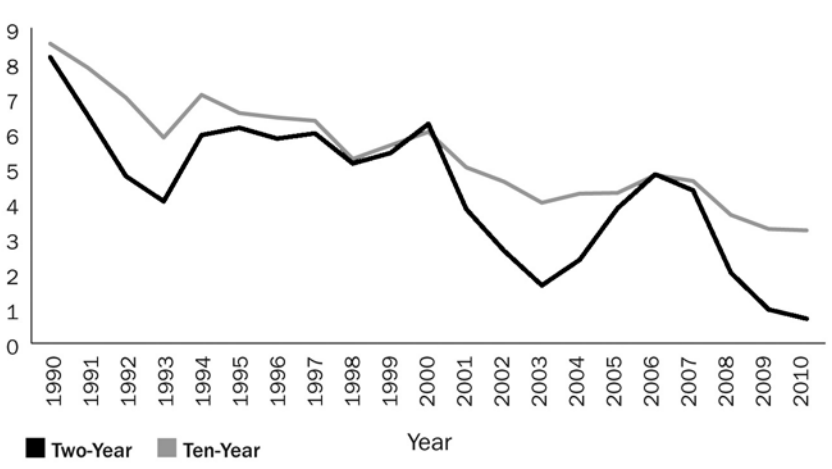
Low interest rates hit insurance companies at several levels.

• They reduce the returns from the bonds that insurers buy and significantly curtail their ability to earn attractive rates, with associated impact on profitability. This is of particular concern for products where the liabilities are "locked in," either explicitly—such as on nonparticipating whole life, universal life with secondary guarantees and long-term care—or implicitly, such as universal life and fixed deferred annuity products where the credited rates are currently at the minimum guaranteed rate. Even on fixed products where credited rates are still above the minimum, a low sustained interest rate environment will likely lead to credited rates hitting the minimum guarantee rate in the not-too-distant future. (These issues are mitigated somewhat on existing business if assets have been closely matched with liabilities.)

> "Life insurers continue to be concerned by continuing low interest rates, as well as by the significant uncertainty about their direction. Recent analyst calls have cited lower profitability due to squeezed interest margins. The current economic environment and associated uncertainties about the future pose a number of challenges for life insurers."

• They increase the cost of hedging equity exposures, including that of living benefit guarantees on variable annuities (VAs). Pricing of products with such guarantees generally makes provision for the cost of hedging, which fluctuates with interest rate levels. However, since these living benefit features are effectively locked in, many writers don't have a good mechanism in place to vary prices/features with the cost of hedging. The drop in interest rates means that the fees charged for offering guarantees may be inadequate for a number of companies, leading to subpar profitability.

Figure 1. Historical Two-Year and 10-Year Treasury Rates



CONTINUED ON **PAGE 12**

The first point above relates to the fact that, at a fundamental level, a life insurance company (or at least many of the products that they commonly sell) is an extremely leveraged investment vehicle. Funds are borrowed from policyholders at rates explicitly or implicitly baked into product premium and benefit guarantees; these funds are then invested in a portfolio of assets with the aim of earning a return for shareholders that exceeds the cost of borrowing. The lower returns implied by a sustained period of low interest rates mean that, unless insurers are able to reduce their cost of borrowing, profit margins will decrease or erode completely, resulting in significant losses.

With the very real possibility of sustained low rates and bond yields, the choice that companies face on the sale of new products under this scenario is either to accept lower profits or redesign products. Insurers have, of course, dealt with low bond yields in previous economic cycles, and some have financial hedges in place at a macro level to compensate somewhat.

It is true that falling interest rates have also benefited insurers in some ways. Since yields and bond prices move in opposite directions, bond investments in insurers' portfolios have risen in value, strengthening companies' balance sheets on a market-value basis. However, this is usually of minor consolation, if at all. In most instances, the corresponding market values of liabilities would have increased by at least as much as any increase of the assets. In the broad financial competitive landscape, it is also true that insurers are not the only ones that lose from persistently low interest rates. With short-term rates hovering near zero, low-risk money market mutual funds have trouble generating adequate returns to cover their own fees and expenses. Banks are earning low or no returns on their cash holdings. Pension funds with shortfalls between their assets and future liabilities may be in a huge hole in a few years if bond yields stay low.

High interest rates

Sharp upward spikes in interest rates can be equally damaging to life insurers. Faced with a large increase in interest rates, writers of fixed products using a credited rate concept must often increase their credited rates or face having their business fly off the books. Increasing the credited rate leads to lower interest spreads (because earned rates typically do not move up as quickly unless the duration of assets has been kept unusually short). The alternative often leads to negative cash flows, with the potential for market value losses on sale of assets. Companies that are more closely duration matched are less vulnerable to interest rate increases, although convexity risk changes the matching position (i.e., as interest rates change, the prices of assets and liabilities don't move in a linear manner), leaving companies exposed to these risks.

Even for product lines where the liabilities are locked in, the presence of negative cash flows can have an equally adverse impact; companies will have to sell assets at depressed market prices to meet cashflow needs.

Scenario Analysis Is an Important Tool

Establish Risk Management Framework

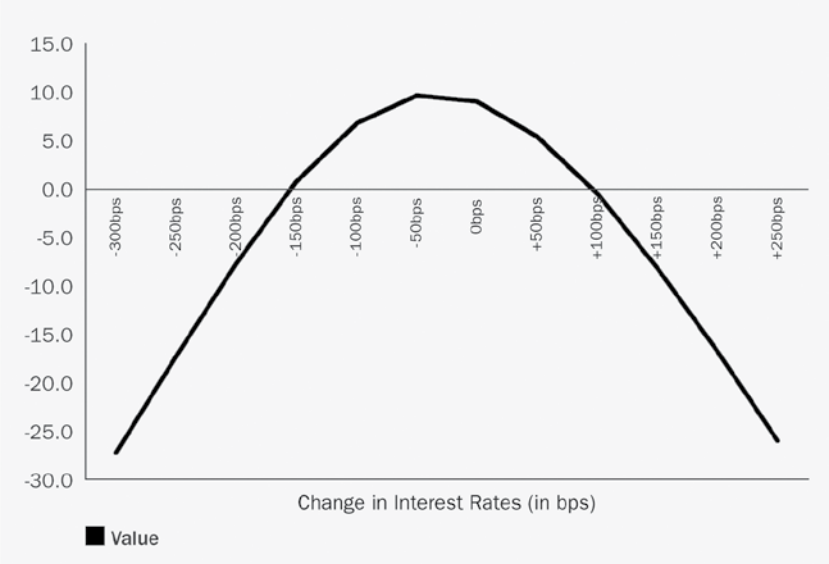
Companies that have an established robust enterprise risk management framework are better placed to assess the impact of interest rate movements and examine strategies they can undertake. There are some important considerations in developing such a framework:

- The company needs an enterprise-wide view on risk. This encompasses both how risk is interpreted (e.g., which metrics are the most important in driving decisions) and how the company's risk appetite is defined.
- For many insurers, interest rate risk limit decisions at the top of the house should include both value at risk (driving the economic value perspective) and earnings at risk (driving the accounting, book value or earnings perspective). These can then be suballocated in the form of interest rate economic risk on metrics such as duration, and interest rate earnings limits such as sensitivity to parallel shifts, nonparallel shifts, spreads and convexity. Increasingly, companies are beginning to realize that the top-level limits should be expressed not just at the high-confidence levels such as 99th or 99.95th percentiles but also at the, say, one-in-10-year earnings (90% confidence) and one-in-100-year earnings (99.9% confidence).
- Companies should determine acceptable levels of credit risk. Although not technically part of interest rate risk, credit risk is often directly linked to it. North American life insurers have historically taken on credit risk via investments in corporate bonds and commercial mortgages, supplementing this with other credit-risky asset classes, such as nonagency mortgage-backed securities. Once the real cost of credit risk is factored in, including increased risk capital levels, the risk-adjusted returns of these credit-risky asset classes may not be as high as originally anticipated.
- Determine risk capital on an aggregated and allocated basis. Examine the role that interest rate risk plays in setting capital levels. It is important to understand both how interest rate risk affects the insurer on a stand-alone basis and how it interacts with other risks, typically including credit, currency, equity and insurance risks.
- Insurers need the ability to measure and report on actual and potential risk exposures in a manner consistent with how risk is viewed and risk appetite expressed within the organization.
- Insurers should establish, equip and empower a robust risk management organization that stands independently of pricing actuaries and portfolio managers to test the compatibility of the risks they assume.

> "With the very real possibility of sustained low rates and bond yields, the choice that companies face on the sale of new products under this scenario is either to accept lower profits or redesign products."

Life insurance as a short straddle?

Because of the guarantees and policyholder optionality inherent in many of the products they sell, life insurers are adversely affected by very low and very high interest rates (or at least a sharp spike in rates). Fixed products that use a credited rate concept, in particular, have been designed so that, for moderate movements in interest rates, management can take action to maintain a reasonable level of profitability, but for sustained very low or very high interest rates, losses will result. In this sense, shareholders are in a short straddle position—having sold both a call and a put on the level of interest rates. In summary, life insurers have taken a bet that interest rates might move by a little, but not by a lot.



CONTINUED ON **PAGE 14**

Need for Scenario Analysis

Virtually all life insurers perform some basic scenario analysis on interest rates through their asset-liability management (ALM) analyses and cash-flow testing. However, we suggest they extend their scenario analysis to include a wider range of possible interest rate scenarios and to examine the resultant potential impact on earnings as well as value.

- For many life insurers, earnings volatility is a significant concern, yet their risk analytics (whether on the asset or liability side) tend to be focused more on balance sheet measures such as economic value (with risk to this value being measured by required economic capital or value at risk). In these cases, there is a need to expand current analysis to measure earnings risk. One good method for this purpose is repricing gap analysis, focused on "rate maturities" of assets and liabilities, and the resultant exposures revealed as positive gaps (asset sensitive) or negative gaps (liability sensitive). At its simplest, the analysis will spread out cumulative asset liability maturity repricing gaps, adjusted for behavioral considerations and for embedded optionality, and varying credit quality in the products and hedges. These gaps must then be stressed with various scenarios for interest rates and the consequent impact on current and future period income. Specifically, analysis must be done of the "cost to close" asset-liability maturity gaps against limits on the same.

- When companies perform interest rate stress and scenario analysis, they often examine only parallel movements in curves, leaving them unaware of significant aspects of their interest rate risk exposure. Interest rate risk analysis should also look at nonparallel rate shifts that arise through tilts and bends in the yield curve, basis or spread risks that arise due to mismatches in the credit curve references across, say, Treasury, London Bank Offered Rate (LIBOR) and corporate bond curves, and convexity in the portfolios due to embedded option features.

"Companies that have an established robust enterprise risk management framework are better placed to assess the impact of interest rate movements and examine strategies they can undertake."

For economic value purposes, a detailed perspective on these risks can be obtained by extending duration measures to include key rate duration and spread duration analysis. For earnings risk, this implies using the rate maturity gap modeling metric noted above to include parallel, nonparallel, spread and options analysis under different scenarios of rising and falling rates.

For earnings risk purposes, repricing gap analysis using rate maturities offers a complete, but arguably cumbersome, solution. Rate maturity gaps are different from liquidity-based maturity gaps. As a simple example of differences in maturity, consider a five-year floating rate bond tied to six months LIBOR; for purposes of liquidity analysis, this bond has a five-year maturity. However, for considerations of interest rate repricing/risk, the maturity is six months. The purpose of repricing gap analysis is first to capture an instantaneous view of where asset-liability maturity gaps exist in the future, and second to consider the earnings impact of interest rate shocks given such gaps. Four key scenario considerations need to be incorporated into such interest rate shocks:

- Parallel shifts in rates, up and down, representing one-in-10-year, one-in-100-year and five-in-10,000-year risks (i.e., corresponding to 90%, 99% and 99.95% confidence levels, and allowing for systematic comparison with economic value analysis at the same levels of confidence), as opposed to simply picking 100 bp and 200 bp.
- Nonparallel shifts in rates, of similar sizes as above, due to tilts and bends in the yield curve(s) such that asset-liability gaps at various maturities (spread out, say, quarterly for the early years and annually thereafter to full life) may be exposed to different shocks and "risk concentrations" may be exposed.
- Basis or spread risks due to different yield curves (e.g., Treasury, corporate or swap/money market) moving differently or by different amounts across maturities. The size of such shocks may be standardized to, say, 50 basis points divergence or convergence.
- Optionality/convexity effects both on the liability side (e.g., minimum interest rate guarantees) and on the asset side (e.g., mortgage-backed securities [MBS] or callable bonds). Minimum scenarios here would include the embedded options being exercised or not. Also, convexity effects may be captured

through a direct earnings impact or in other cases through an adjustment to the effective interest rate.

Benefits of, and Actions Pursuant to, Scenario Analysis

A disciplined, systematic scenario stress-testing regime will reveal a possible range of decisions/actions. At the least, the following can be easily established:

- Exposures across the time horizon ideally can be compared with limits both on size of gaps and on potential earnings impact.
- The cost of hedging away interest rate risks can be easily established, both in future earnings and in present-value terms.
- Optimal hedging and product gap tactics can be established by taking into account all considerations.

Taking Strategic Business Action

The degree to which management can take steps to manage interest rate risk varies by type of business, depending, for example, on the extent to which policyholders share in the risk through nonguaranteed premiums or adjustable credited rates. At a fundamental level, life insurers have only a few levers available to them to manage the risks and rewards associated with interest rates. The first is in product design and new business strategy (i.e., managing the risk before it is even on the books). Once the business has been sold, the main levers available to management are the investment strategy as well as—where possible—sharing risk with policyholders through the crediting strategy. All of these should be evaluated under a coherent, well-defined risk management framework.

Product design strategies. The industry should consider making the following revisions to product design:

- Reduce the minimum guaranteed rates on fixed products, particularly on universal life contracts currently at 3% per annum or higher.
- While products with a higher minimum guaranteed rate can offer competitive advantages, the risk of a sustained period of low interest rates means that companies that do not take this step are opening themselves up to significant exposure to squeezed interest rate margins. Companies will still retain flexibility via the current credited rate mechanism to offer higher rates if interest rates rise. Also, if assessed appropriately, the lower cost of interest rate risk could be passed on to policyholders via enhancement of other features.
- Move products that contain locked-in features to a design that allows them to change product features based on movements in interest rates (and/or other factors).
- Examples of this include products with living benefit features. These features could link or index certain aspects of design (such as the roll-up rate or the percentage payout) to the level of interest rates, changing on a periodic basis, either annually or quarterly. Even if rates stay at their slightly higher recent levels relative to near-term lows, insurers should consider moving to a linked/indexed feature; arguably a good time to introduce this is when interest rates have risen a bit and the resulting benefit level is more attractive.
- Revising other products with features not as closely connected to interest rates may be more challenging. Products with interest rate risk in the form of future renewal premiums (e.g., long-term care, nonparticipating whole life and universal life) may be better addressed via asset-based strategies, such as locking in interest rates on future cash flows via derivative contracts. For universal life products with secondary guarantees, this would likely necessitate significant revisions to guaranteed premium levels, making them less attractive. On other products, creativity will be required (perhaps leveraging off the linkage seen in participating whole life products).
- Fixed immediate annuities also have locked in designs. Here, typical industry practice is to match assets fairly closely with liabilities, although finding assets with sufficiently long maturities can be an issue. Thus the issue of low interest rates arises more on the consumer side, where purchase rates can be viewed as unattractive. Consumers may be better served in this case by using a dollar-cost-averaging approach for their purchases (i.e., buying over time).
- Consider emphasizing products that offer a greater potential for consumer return in a low interest rate environment. For example, a company could focus on indexed annuities over pure fixed annuity products.
- Current credited rates on fixed annuities are not much in excess of the guaranteed minimum rates on indexed annuities. With the potential for upside participation

CONTINUED ON **PAGE 16**

via the equity markets, indexed annuities arguably offer a better return to consumers in the current interest rate environment (particularly if both contain the same level of distribution cost—an emerging trend).

Crediting strategies. Companies will need to maintain flexibility with their crediting strategies on inforce business so they can react to various interest rate environments. In a low or falling interest rate environment, companies will naturally look to reduce their current credited rates. This is subject to the floors imposed by the minimum guaranteed rate (hence the suggestion to lower these guarantees).

The situation in a rising interest rate environment is more nuanced because companies walk a fine line between losing their earned interest spread and having their business move off the books (with the resulting potential of negative cash flows). Consequently, it's very important to understand the impacts of changes in interest rates. A rising interest rate environment makes it even more critical to understand what drives policyholder behavior and puts pressure on insurers' ability to capture this accurately through dynamic models. We have found that (with some notable exceptions) dynamic lapse formulas employed by the industry on fixed products tend to be relatively simplistic; many don't capture available industry experience and knowledge on how policyholders will likely react in varying interest rate environments. Given the current uncertainties about the interest rate environment, we believe more attention needs to be paid to these models on the fixed product side.

Asset Strategies

Insurers commonly mismatch their asset and liability repricing maturities, implicitly or explicitly. In effect they are betting on rates, although they are less ready to acknowledge such bets compared with credit, where bets seem somehow more "respectable" and easier to acknowledge, and where many insurers claim credit expertise. It is not easy to understand why insurers would be more proactive on the interest rate side as well. Be that as it may, the repricing gap analysis described earlier can at least help to pinpoint the concentration of these bets so a company can establish limits and boundaries to reconcile them to the company's overall risk appetite.

Another possible asset strategy would be to specifically seek structured assets that hedge the liability profile. More interestingly, insurers could look for pools of assets that directly reduce the gaps exposed in the repricing gap analysis so that earnings risk can be specifically hedged.

As noted earlier, insurers need to consider not only the impact of interest rate risk in isolation, but also how it interacts with other risks. To see how this can affect an insurer's asset strategy, let's consider an insurer with a sizable block of immediate annuity business. If the insurer minimizes interest rate risk by investing to match its best-estimate liability payments, it could still face an adverse balance sheet impact if interest rates change. This is due to the required capital, which — due to the adverse mortality improvements assumed in the capital calculation — usually has a longer duration than the best-estimate liabilities. Consequently, in practice we find a number of insurers lengthening the duration of their assets so that they are mismatched from their best-estimate liabilities, but the overall balance sheet impact (i.e., solvency ratio) is neutral. This highlights how important it is that insurers think carefully about the objectives for their hedging and ALM, and consider the impact of the interaction of different risks.

The Bottom Line

History may suggest that interest rates will not stay low forever, but the speed at which rates rise and how far they climb is difficult to predict. Markets are clearly uncertain about the direction of rates, especially in the near term.

In summary, to more fully protect themselves against interest rate risk, insurance companies have to do one or more of the following:

- Revise product designs to link benefits/fees/premiums (i.e., income and outgo) more directly with capital market conditions.
- Better understand the nature of the interest rate risks they are taking (including having a better handle on their policyholder behavior formulas) and be prepared to take action to bring their asset and liability portfolios in line with acceptable tolerances.
- Pursue asset strategies that are more explicitly linked to hedging interest rate risks exposed in their repricing gap analysis. □

John Fenton is a director with Towers Watson. He can be contacted at john.fenton@towerswatson.com.

Mark Scanlon is a senior consultant with Towers Watson. He can be contacted at mark.scanlon@towerswatson.com.

Jaidev Iyer is president and CEO of J-Risk Advisors (J-Risk). He can be contacted at jaidev.iyer@j-risk.com.

Alzheimer's Disease as a Critical Illness Trigger: **Does it Really Make Sense?**

By Stephen Rowley and Cyriac Kottoor

Gen Re has reinsured Critical Illness since its inception in South Africa in 1983. In the years since its development, we have watched and helped as the product has migrated around the world. Surprisingly, the United States was one of the last of the sophisticated insurance markets to embrace Critical Illness insurance. Perhaps this was reflective of our historically rich medical plans. Fueled in part by the more recent changes such as High Deductable Health Plans, Health Savings Accounts, and ongoing Health Care Reform concerns, the product has recently begun to take hold. The Gen Re/NACII *2011 Critical Illness Market Survey* shows new business premium of more than $220 million for the year 2010. I think we can safely say that the product has finally arrived.

Despite this quiet "arrival," few individuals have yet to be approached to buy this product and fewer yet have actually purchased it. If questioned about it, their more likely response would be, "What is Critical Illness?" As such, this market is rich with opportunity. How often does an insurance agent get the chance to provide real personal value and educate their clientele on something they've never heard of but could truly benefit from?

With more than 700,000 policies or certificates in-force at the end of 2010, it's reasonable to assume that truly competitive situations are rare for this product. Given this, it is rather surprising that nearly every new critical illness product on the street is looking to add more payouts, more benefit eligibility triggers, and more complexity in order to "beat the competition" and avoid being easily "spread sheeted." What competition?

That being said, some of the ingenuity we've seen in critical illness products may add true value. For example, the inclusion of total paralysis as a benefit eligibility trigger, allowing for a subsequent payout, or providing a wellness benefit may make sense for certain markets. But the one that is the most perplexing is the addition of Alzheimer's Disease as a benefit eligibility trigger.

Let's start by reviewing how we select which triggers to include.

Determining Which Benefit Eligibility Triggers to Cover

This can be either the simplest exercise of the product development process or the most complex. Nearly every critical illness policy covers the core benefit eligibility triggers of invasive cancer, heart attack, stroke, end stage renal disease, and major organ transplant. In addition, most policies provide partial payments for carcinoma in-situ, coronary artery angioplasty, and coronary artery bypass grafting.

Beyond that, a number of insurers offer one or two additional triggers that may include such conditions as paralysis, severe burns, loss of vision, etc. Each may make sense depending upon the insurers market. For instance, including paralysis makes perfect conceptual sense when the insurer plans to co-market critical illness with its disability product.

Regardless of the benefit eligibility trigger under consideration, insurers should ask themselves these six important questions before including it in their product:

1. *Is the condition normally "critical"?* Is it a significant medical event that would likely have considerable financial consequences for the insured?
2. *Can the condition be well defined?* Will the consumer understand exactly what they are purchasing and will the insurer have a firm understanding of what it is they are pricing and adjudicating?
3. *Can reliable incidence rates be developed?* Are there good population incidence rates that can be studied in order to help price the risk?
4. *Can the risk be appropriately underwritten?* Do we have the tools to determine if the proposed insured has had the condition or is highly predisposed to it? Can we screen out those who are selecting against us?
5. *Can the benefit eligibility be objectively determined at time of claim?* Will our claims departments be able to properly adjudicate the claim, paying all that should be paid and denying those that don't meet the criteria?
6. *Will inclusion of this benefit likely have a favorable impact on sales?* Will more people purchase the

CONTINUED ON **PAGE 18**

Stephen Rowley, Vice President, Gen Re. He can be contacted at srowley@genre.com.

Cyriac Kottoor, ASA, MAAA, Second Vice President, Gen Re. He can be contacted at Ckottoo@genre.com.

policy because the trigger is included? If so, will these be the right people?

If the answer to all of the above criteria is "Yes," then this may well be a benefit that makes sense to include in a critical illness policy. If any of the above criteria are not met, insurers may want to reassess inclusion of the eligibility trigger.

Alzheimer's Assessment

Of all the unusual benefit eligibility triggers we've been asked to consider, Alzheimer's Disease ranks among the lowest when measured against the above criteria. Sure, whooping cough and rabies seems silly and unnecessary, but fortunately neither has gained any traction in the critical illness market. What raises concern is that Alzheimer's Disease seems to have gained a foothold in this product line.

Let us now analyze Alzheimer's Disease and see how it fits our criteria:

1. **Is the condition normally critical?** Alzheimer's Disease is a horribly debilitating disease that has tremendous emotional and financial consequences.

2. **Can the condition be well defined?** Alzheimer's Disease can be fairly accurately diagnosed by medical professionals today, but the only current way to unequivocally diagnose Alzheimer's Disease is through an autopsy. Some insurers strengthen their criteria by covering only "Severe Alzheimer's Disease." Even this is difficult to define as patients can often exhibit some elements of the mild, moderate, and severe stages and never completely meet all the criteria of a single stage.

   Some would argue that reliance should be placed on the records of the attending physician. This too has its limitations as the accuracy of clinical diagnosis may vary from one physician to another and may be influenced by any number or combination of factors.

3. **Can reliable incidence rates be developed?** Incidence rates of most illnesses are gathered by the government for a number of reasons. All, however, are reliant upon clinicians, insurers, etc., reporting and correctly coding the impairment. This is where historical incidence rates for Alzheimer's Disease (and other forms of dementia) become highly questionable.

   Generally speaking, clinicians are more likely to address, diagnose, and report conditions that they can actually treat than conditions they cannot. Prior to the advent of Aricept (whose clinical efficacy is once again being questioned) there was little if anything a physician could do to treat a patient suffering with a form of dementia. Add the emotional strain and stigma that has far too long accompanied the disease, and it's easy to see why many cases were never formally diagnosed or reported. This problem likely persists, but to a lesser degree, today as effective treatment of the disease remains elusive.

   As such, it is believed that reliance on reported incidence rates would materially underestimate the actual population prevalence. Estimates could be made as to how far off these have been historically and remain today, but there is little basis on which to make an educated estimate for pricing purposes. To the degree that historical rates have any reliability, they would be more suited to all forms of dementia rather than specific to Alzheimer's Disease.

Price determination, however, is based on more than incidence rates alone. As a lapse supported product, like long-term care, our actuaries need to determine if inclusion of a benefit designed for older insureds will cause the product to persist more like LTC than CI. If so, the additional persistency will need to be factored into the price for all of the benefit triggers, not only Alzheimer's Disease, thus increasing the premium beyond the cost of the Alzheimer's Disease incidence alone.

4. **Can the risk be appropriately underwritten?** It is unlikely that an insurer would ever detect early cognitive impairment from a basic application or telephone interview. There are commonly available, but imperfect, cognitive screens utilized for long-term care and some Life underwriting at advanced ages that may offer limited protection. For economic and time service reasons, these test are normally reserved for applicants at age 70 and above and would leave unscreened the 5 percent to 10 percent of individuals who begin experiencing symptoms in their 60s, 50s, or even 40s.

   Records from attending physicians may be of minimal help as well. Most individuals would have progressed well into dementia before any indication of the disease appears in their medical records, and then normally at the behest of family members rather than the patient. For the few who are cognizant of their declining cognitive function, predisposed due to family history, or who have tested genetically positive for the Apolipoprotein E (APOE) marker, detection is highly unlikely. Furthermore, whereas we could assume a high degree of anti-selection for these individuals, actual symptoms are likely years away and the normally protective provisions such as pre-existing condition limitations or contestability clauses are unlikely to be of any value.

5. **Can the benefit eligibility be objectively determined at time of claim?** There are two issues at play here. The first being that of dementia vs. Alzheimer's Disease. The second being diagnostic capabilities.

   Dementia is not a single disease, but a non-specific illness syndrome (a combination of signs and symptoms that are indicative of a particular disease or disorder) which impact areas of cognition. Alzheimer's Disease is only one of many forms of dementia. Other common forms of dementia include vascular dementia, frontotemporal dementia, semantic dementia, dementia with Lewy bodies, and dementia resulting from traumatic brain injury. It would be extremely difficult, if not impossible, for an insurance claims adjudicator to differentiate Alzheimer's dementia from other common forms of dementia at claim time.

   Even if an insurer chooses to charge for and cover all forms of dementia (of which Alzheimer's Disease represents roughly 70 percent) some process would need to be in place to help determine if the claim is valid of not. Some of the more common screens available today are the Abbreviated Mental Test Score, the MiniMental State Examination, the Modified Mini-Mental State Examination, the Cognitive Abilities Screening Instrument, and the Clock Drawing Test. All of these can be problematic for the insurance environment in that the scores must be interpreted in the context of the person's educational and other background which we rarely have available to us.

   The other major drawback, especially for a lump sum payout product, is that all of these tests were designed with the assumption that the individual being tested wants to pass the test. In other words, they have no way of protecting for a person who may choose to deliberately fail the test in order to gain access to the policy proceeds.

   For a more definitive assessment of dementia, insurers may choose to obtain a complete neuropsychological evaluation. These are very expensive tests that normally consist of a full-day marathon of paper-and-pencil tests and address all the domains

"It is unlikely that an insurer would ever detect early cognitive impairment from a basic application or telephone interview."

CONTINUED ON **PAGE 20**

of cognitive function. Even with these, the exact selection of tests and the interpretation fall to a Ph.D. psychologist and psychologists differ on the exact menu of tests to include.

6. **Will inclusion of this benefit likely have a favorable impact on sales?** It's clear that this would not be a topic for discussion if some insurers didn't believe so. But would it really? The average buyer of critical illness insurance is in their early 40s. The average age for a buyer of long-term care insurance today is early to mid 60s. This begs the question of why this benefit would help drive critical illness sales when our target age group has shown little to no historical interest in purchasing similar protection.

   Unless this provision is likely to move the masses, we need to ask ourselves who it will motivate. The lower the interest in the provision, the greater the likelihood that those who understand that they are predisposed to this illness through family history, genetics, or early indications will disproportionately purchase or opt in as a result of this benefit's inclusion. Anti-selection may run very high for this product and with an expected incidence at age 60 (for example) of only two claims per 100,000 lives insured, we have little wiggle room for any anti-selection.

Insurance Need

As with any insurance product, it is important to keep in mind why the product is needed in the first place. In the case of critical illness insurance, it is to help pay for the out-of-pocket costs associated with surviving critical illnesses that are not normally covered by other insurance products. These costs may include such items as paying for high deductibles and co-pays, out-of-network care, travel expenses, and even experimental treatments.

In the case of Alzheimer's Disease, consumers already have the option of purchasing long-term care insurance that has been specifically designed, and is ideally suited, for protecting people who develop Alzheimer's Disease by providing them with the care and supervision often required to prevent harm to themselves or others.

Summary

Alzheimer's Disease is a devastating illness with tremendous emotional and financial consequences. There are existing products that are specifically designed to help with the cost of living with it. Unfortunately, when using the aforementioned criteria to assess it, Alzheimer's Disease falls far short of other critical illness benefit triggers offered today. As such, our answer to the subtitle of this article, "Does it Really Make Sense?" is "No." ◻

Individualized Mortality Projection and Product Pricing **with Laboratory and Physical Measurement Data**

By Brian Lanzrath, Jim Palmier and Ammon Dixon

In any underwritten life insurance product, establishing the relationship between underwriting standards and expected mortality experience is the very core of the product design process. Risk stratification criteria, though, tend to be relatively unsystematic, and often consist of little more than simple variations on clinical guidelines as applied to certain well-studied biomarkers (particularly serum cholesterol and the broader lipid panel), supplemented by laboratory-supplied "reference ranges" (usually the middle 95 percent of an analyte's observed distribution) for tests where clinical significance is less well-established. Following an often ad hoc definition of underwriting classes, empirical mortality projections are developed from historical data, or established industry expectations. Credits and debits may sometimes be attached to individual test results on the basis of published clinical studies, virtually none of which will control for the full suite of laboratory and physical data available during insurance underwriting. The final result, of course, is the familiar three to five rate classes (plus table ratings) of most existing preferred underwriting systems.

Recent applications of modern data analytics methods to the extremely large (more than 8 million complete records since 2001) laboratory and physical measurement database of one insurance testing laboratory (ExamOne) have enabled a fully individualized approach to mortality projection—one which could in principle assign a unique pure premium to any given applicant. As might be expected from so granular an appraisement of mortality risk, this method identifies substantial numbers of significantly mispriced policies; including preferred-qualified individuals who represent a greater claims risk than most standard policies, and standard policies that can be confidently projected to perform at least as well as the majority of more favorably underwritten cases.

Analytical Methodology and Outputs

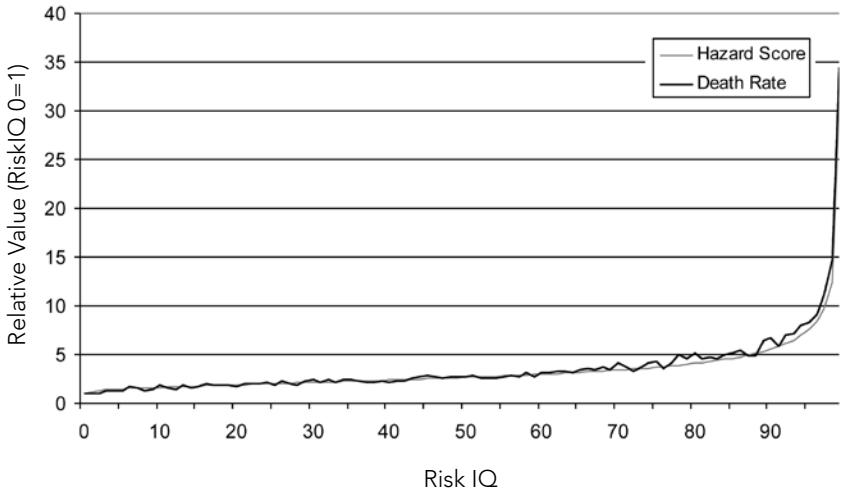
The development process for the mortality risk assessment model used in this study (Risk IQ) has been detailed elsewhere.1 Briefly, it is a multivariate proportional hazards regression model developed from laboratory and physical measurements, as matched to the Social Security death master file (SSDMF). There are two calculated final values: a hazard score, which represents the relative mortality risk of an applicant as normalized to a median value of 100 for the relevant peer group (defined as curtate age, sex, and smoking (cotinine) status), and the Risk IQ, which is simply a percentile ranking of the hazard score, again relative to age, gender, and smoking status. By definition, Risk IQ scores are bounded by 0 and 99, but hazard scores can be arbitrarily high (in very rare cases exceeding 100,000); hazard scores below 25 are uncommon. The hazard score, but not the Risk IQ, is directly proportional to mortality risk; in males 40 – 49, for instance, the mean hazard scores for Risk IQs of 25, 50, and 99 are 76.2, 100.6, and 1359.7, respectively.

Distribution of Mortality Risk in Applicant Populations

A direct comparison of Risk IQ, raw death rates, and hazard scores [Fig. 1] may be the simplest illustration of the risk segregation attained by this approach.

In Figure 1, death rates are not normalized by age or sex, as Risk IQ is itself demographically normalized. In all percentiles, the mean age is 40.65, 54.34 percent of applicants are male, and 9.3 percent are cotinine-positive.

FIGURE 1
Hazard Score and Raw Death Rates by Risk IQ



CONTINUED ON **PAGE 22**

Alternately, we can plot the fraction of all recorded deaths attributable to applicants in a given percentile range [Fig. 2], which highlights the disproportionate concentration of risk (as represented by actual deaths) among the upper quantiles of the ranking system.

Over the study period, fully 10.4 percent of all recorded deaths occurred among the 1 percent of applicants assigned scores of 99, and 31 percent among applicants in the highest Risk IQ decile. Mortality was commensurately represented among lower score ranges, with only 4.6 percent occurring in the zero to nine Risk IQ decile. Again, these results are in excellent accordance with the hazard score projections (the mean all-applicant hazard score for Risk IQ-99 individuals is 1172).

FIGURE 2

All ExamOne Applicants and Deaths by Risk IQ: Non-smoking Applicants, 2001-2008

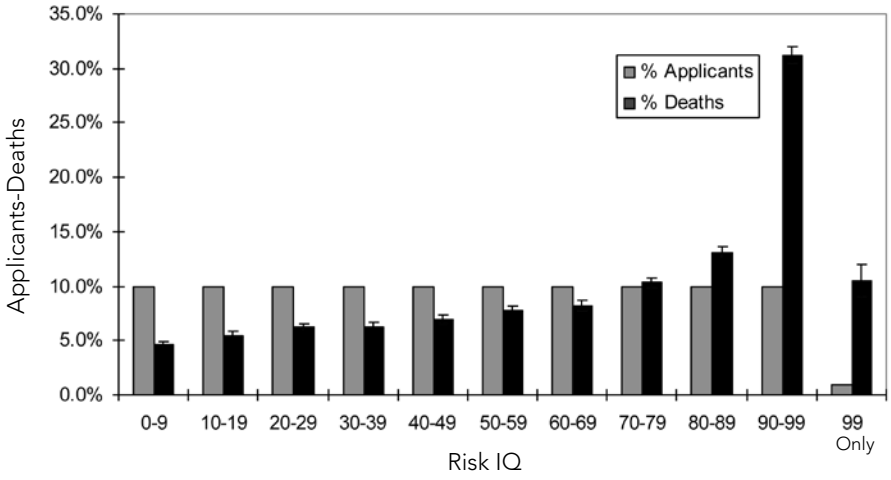
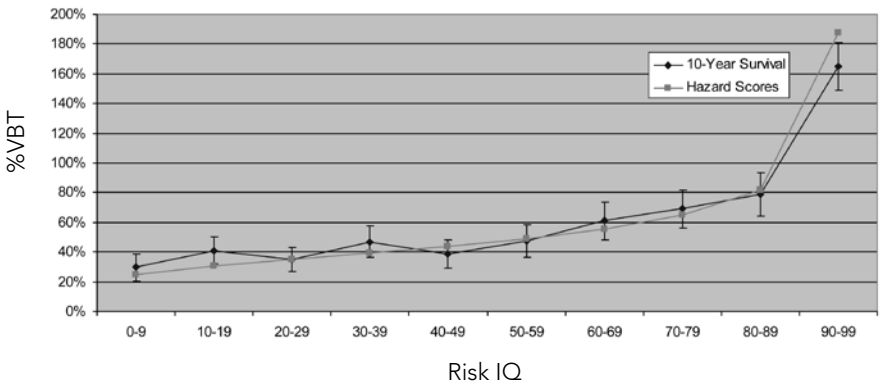


FIGURE 3

10-Year Death Rates: 45-Year Old Male Non-Smokers



Observed Absolute Death Rates by Risk IQ

When stratified by model demographic groups, sample sizes are too small for statistically significant empirical percentile-by-percentile estimates of death rates (as in Fig. 1), but decile-level aggregation remains feasible [Fig. 3 for males 40 – 49].

Death rates and confidence intervals were constructed according to standard life-table methodology using SAS/STAT. For convenience, death rates have been expressed as a percentage of 2001 VBT Select values. It is important to note that the absolute mortality estimates provided in this article are derived from SSDMF data, which is known to be an incomplete record of U.S. deaths. Upward adjustments of as much as 10 percent (assuming a ~90 percent completeness rate for the SSDMF) would be required for product-level implementation. We have little reason to suspect that Social Security record quality would vary with prior mortality risk (particularly among the life insurance applicant population), so relative risk levels should be highly consistent. The precise shape and magnitude of the Risk IQ/mortality curve vary somewhat by age and sex [Figs. 4 & 5 for results from select demographic groups].

A striking characteristic of all of these charts is the very favorable mortality experience among the lowest three Risk IQ quartiles (scores less than ~75). If, as is the case in many products, a preferred applicant is defined as one who's projected death rates fall below 60 – 70 percent of the 2001 Select VBT, then in many demographic groups as much as 75 percent of the applicant pool may qualify, according to this appraisal. Given that, in existing products, it is rare for more than 30 – 35 percent of policies to be issued at the best rate class, the potential for a substantial, actuarially justifiable, expansion of these classes is obvious. In general, low-Risk IQ applicants currently excluded from preferred pools (the hidden healthy) represent 25 – 40 percent of underwritten cases. The most common grounds for relatively unfavorable decisions in these cases are mild

obesity or elevated cholesterol—two conditions that, though undoubtedly correlated with premature claims in a univariate sense, have few to no marginal mortality implications when present in isolation (i.e., in the absence of common co-morbidities such as hypertension or diabetes).

The existence of an identifiably charged population naturally implies the existence of a subsidized high-risk group currently granted relatively favorable rates. This phenomena (cryptic risk) is in fact observed; defined as applicants with scores of 75 or above who are admitted to preferred pools, it represents ~4.5 percent of the total applicant population. In the paradigmatic cryptic risk case, all underwriting variables will lie within established preferred ranges, but several of these values will fall near the extreme upper or lower boundaries; the aggregate effect of several such high- or low-normal results can easily surpass that of a single more overtly abnormal value. As a group, cryptic risk applicants die at approximately twice the rate for which a preferred or preferred-best class is priced, with obvious financial implications. Under reasonable assumptions regarding discount and lapsation rates, the present value of claims in a $300,000 20-year term policy written on a 45-year-old male non-smoker subject to a preferred-level life table is $3,300; if this applicant were a representative cryptic risk case, the actuarial present value would rise to $7,400, a $4,100 expected loss on a present value basis.

As is evident from figures 1 and 2, mortality risk in Risk IQ 99 applicants is qualitatively different from that of lower scores; in most demographic groups, deaths are more than twice as common in 99s than even among 98s. Studies conducted with carriers in fully underwritten applicants have confirmed that, as might be expected, these individuals are substantially more likely to be declined in the course of conventional underwriting. The final decline rate, however, has not exceeded 50 percent in any study, and analysis of actual claims experiences reveals that issued 99s die at virtually the same disproportionate rates as those who are excluded (in approximate terms, Risk IQ-99 applicants represent 1 percent of the typical carrier's applicants, 0.5 percent of its issued policies, and 5 percent of its paid claims). [Fig. 6 summarizes one carrier study]

"The most common grounds for relatively unfavorable decisions…are mild obesity or elevated cholesterol …"

FIGURE 4
10-Year Death Rates: 35-Year Old Female Non-Smokers

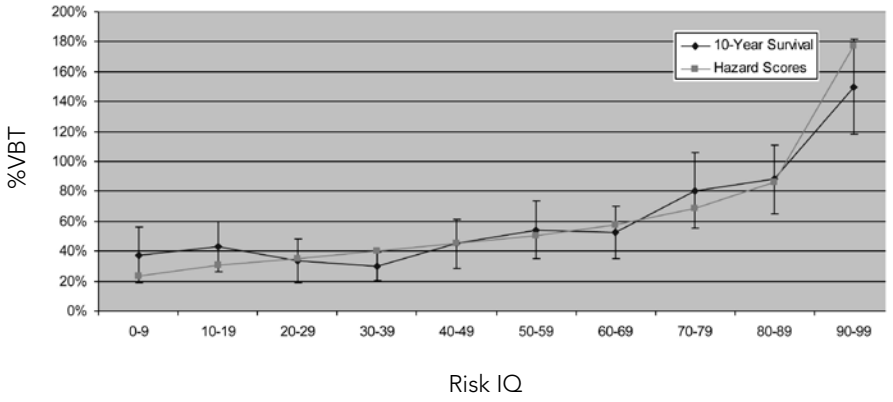
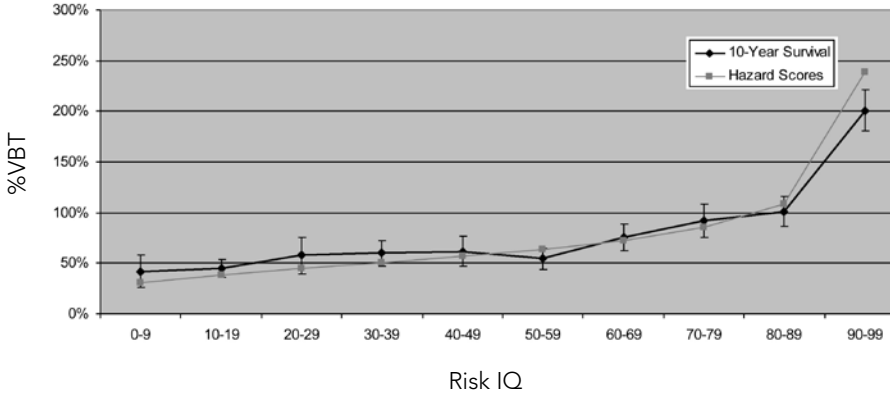


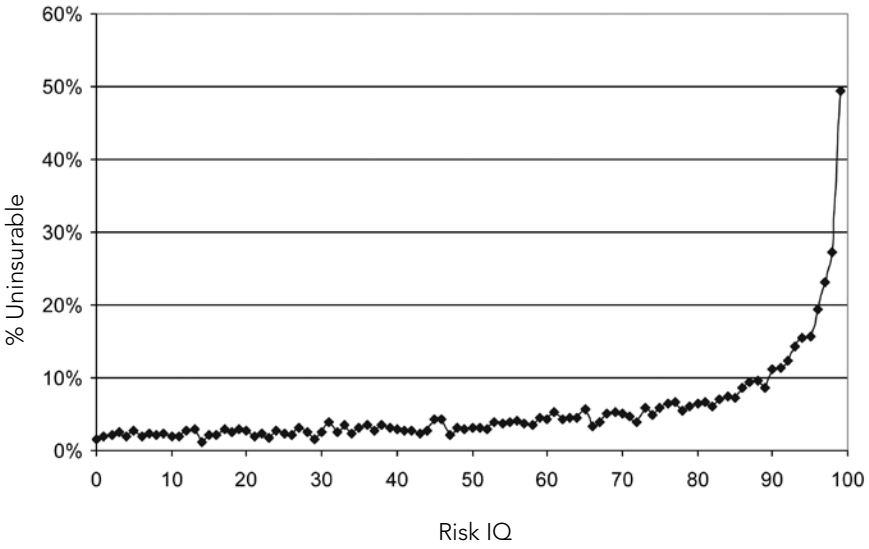
FIGURE 5
10-Year Death Rates: 65-Year Old Male Non-Smokers



CONTINUED ON **PAGE 24**

Although, as mentioned above, individual Risk IQ scores cannot be associated with specific death rates on a strictly empirical basis, decile-level results can be interpolated (using hazard scores are in principle directly proportional to risk) to produce mortality tables specific not only to each Risk IQ score, but potentially to each individual applicant. Fig. 7 provides expected life-table multiples (as percentages of the 2001 Select VBT) for selected scores and demographic groups.

FIGURE 6
'Uninsurability' Rates by Risk IQ: 2009-2010



Implications for Product Design

As with other innovations in risk assessment, the effects of individualized mortality modeling will likely emerge incrementally. Early adopters of this system have devoted most of their efforts to date on the identification and (in most cases) decline of the half of Risk IQ-99 cases not detected by conventional underwriting. In combination with cryptic risk detection, this constitutes the most immediately quantifiable value proposition of scoring algorithms. A more fundamental transformation of product design will require a willingness to offer preferred-level premiums to hidden healthy applicants, which for many carriers will require close coordination with reinsurers. The benefits of this latter approach are highly dependent upon the elasticity of carrier market share relative to preferred placement rates, which creates particularly strong incentives for adoption in the brokered market.

It can be expected that adverse selection will become a progressively more powerful driver of adoption as market penetration progresses (by the end of the second or third quarter of 2012, it is expected that roughly 25 per-

FIGURE 7

Gender	Age	40-49			60-79		
	Risk IQ	Hazard Score	%VBT	UW Class	Hazard Score	%VBT	UW Class
Female	0	42.2	17.8	Preferred or Better	32.7	21.4	Preferred or Better
	50	100.6	42.5	Preferred or Better	101.0	65.9	Preferred or Better
	80	157.2	66.5	Preferred or Better	165.0	107.7	Standard
	90	214.4	90.7	Standard	230.5	150.5	Table 2
	95	296.3	125.4	Table 1	329.4	215.1	Table 5
	99	1332.1	563.6	Table 19	1427.6	932.0	Table 33
Male	0	40.5	17.5	Preferred or Better	35.6	20.7	Preferred or Better
	50	100.6	43.4	Preferred or Better	100.9	58.6	Preferred or Better
	80	156.8	67.6	Preferred or Better	159.8	92.8	Standard
	90	213.3	91.9	Standard	221.0	128.3	Table 1
	95	295.4	127.3	Table 1	309.7	179.8	Table 3
	99	1359.7	586.2	Table 19	1163.9	675.8	Table 23

cent of laboratory panels conducted at North America's largest insurance testing lab will be accompanied by mortality scores). Many cryptic risk applicants denied admission to the preferred pools of early adopters will seek out coverage among non-adopters, and hidden healthy applicants (who constitute the least claim-prone half of existing standard pools) will tend to migrate to carriers able to recognize their comparatively low risk.

In the intermediate term, individual mortality risk scoring should greatly facilitate the transition to straight-through processing, and mitigate the need for the additional requirements (such as attending physician statements, 80 percent of which are requested for applicants generating preferred-level risk scores), which do most to slow and complicate the policy issue process. In one study with a large carrier, Risk IQ proved to be a more accurate predictor of short-duration (two to three year) claims than the actual human-made underwriting classification, despite drawing upon a more restricted set of raw data. In the future, it is possible that rate classes may become obsolete, replaced by applicant-specific premiums calculated from the unique mortality probability vector of individual insureds (as has been the strong tendency in the property and causality fields). □

END NOTES

[1] Lanzrath, Brian, et al. "A Comprehensive Multivariate Approach to the Stratification of Applicant-Level All-Cause Mortality Risk." On the Risk. Vol. 27, No. 1 (March 2011): 56-61.

Brian Lanzrath is Actuarial Biostatistician at ExamOne.

Jim Palmier, MD, MPH is Medical Director at ExamOne

Ammon Dixon, MAOA is Head of Risk Analytics at ExamOne. He can be reached at ammon.j.dixon@examone.com.

A Primer on Reinsurance Pricing Strategy
"A Checklist for Optimizing Reinsurance Negotiation"

By Larry Warren

Editor's Note: *The following article is part one of a two-part series regarding reinsurance quote negotiation.*

Larry Warren, FSA, MAAA, is executive vice president & chief actuary for National Benefit Life Insurance Co. He can be contacted at larry.warren@primerica.com.

This article is written with the idea that both the reinsurer and the direct writer could each benefit from fully exploring all appropriate assumptions and considerations directly and indirectly impacting reinsurance pricing. This article addresses such assumptions and considerations based on my experience on the direct writer side of the negotiation. The reinsurer benefits by being able to offer the lowest YRT rates and the most competitive pricing that it can justify, enabling it to win a share in the pool. The direct writer benefits by giving the reinsurer the additional insights and justification for a lower priced quote, thus reducing their reinsurance premiums and increasing bottom line net income. This "negotiation process" should be looked at as more of a useful educational process. With less information the reinsurers will tend to be more conservative in their pricing. Conversely with more information the reinsurer can use a sharper pen. The more knowledge and insights the reinsurer has about the direct writer's business that may impact current mortality and future mortality patterns, the greater the likelihood that its quote will be more competitive.

Obtaining reinsurance quotes may be a simple matter, but the selection of which reinsurers to participate in the bidding, and the negotiation process that follows, calls for special insights. Product actuaries know that there is often a big disparity in the reinsurance quotes obtained from reinsurers competing for business. It is beneficial to understand the underlying reasons for big disparities in reinsurer pricing. It is helpful to recognize each reinsurer's methodology and assumptions that are driving its pricing. In most of what follows we assume that the direct writer wants a first dollar quota share YRT reinsurance arrangement, but the same concepts are applicable to coinsurance as well.

Below I outline some of the most important assumptions and associated considerations that impact reinsurance pricing. These items are offered as a checklist for careful joint review by the reinsurer and the direct writer.

Assumption A. Choice of Mortality Table

Probably the most important assumption (and certainly the one with the largest financial impact) made in reinsurance pricing is the mortality table believed to have the appropriate slope for the client company's mortality. Reinsurers place the slope consideration at the top of their list as the paramount feature justifying painstaking research as part of the reinsurance pricing negotiation process. Reinsurers nowadays use either the 1975–80 select/ultimate table or the 1990–95 select/ultimate table (2001 VBT) as the basis of their reinsurance rates, often based on the request of the ceding company. The former table models relatively flat durational mortality progression while the latter exhibits the opposite. Mortality rates in this more modern table exhibit marked and steep progression after issue. Once the issue of table suitability has been addressed, the chosen standard mortality table should be fine-tuned to reflect anticipated experience by developing scaling factors to initially assure a perfect fit. The working mortality table to be assumed for pricing purposes will reflect best estimates of the slope of future mortality experience. It may transpire that the table finally adopted is a hybrid table of intermediate slope exhibiting features of more than one standard table.

Considerations in Choosing a Mortality Table with Appropriate Slope

1. Underwriting Rules/Guidelines/Practices

Variations in underwriting rules, guidelines and practices obviously impact future mortality patterns. While underwriting guidelines vary from company to company, the degree to which the underwriters adhere to the guidelines (i.e., the frequency of underwriting exceptions) must certainly be recognized. Special underwriting programs such as table shaving, special credits, etc., must be properly defined and disclosed and can affect the overall slope.

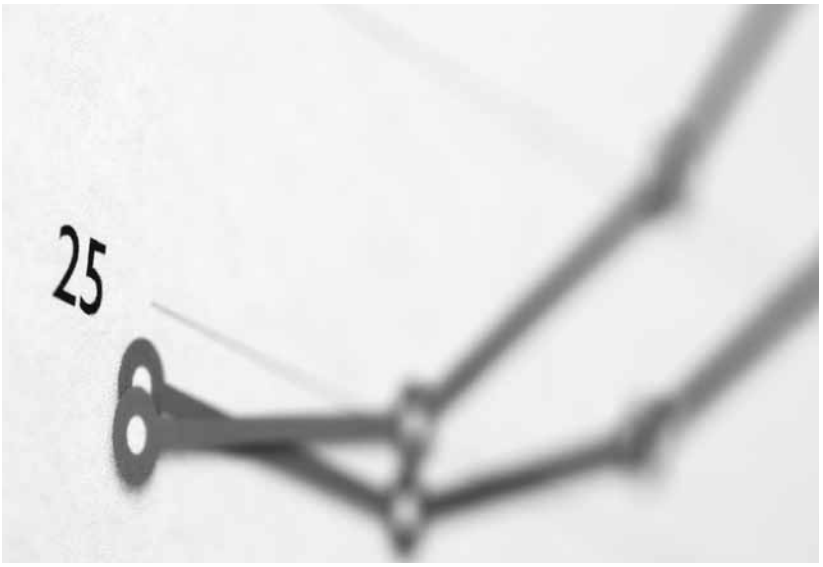
Generally, tighter underwriting requirements and stricter adherence to the underwriting rules and guidelines will produce lower mortality rates on the outset and sharper increments in duration-specific slope.

2. Average Size of Policy (Face Amount)
The average face amount per life insured plays a dramatic role in the overall underwriting screening process. For example, two companies may have identical stringent underwriting guidelines, yet one company (company A) operates in a market where face amounts in excess of $500,000 are the norm while another company (company B) may be issuing policies with face amounts averaging $100,000. Thus, the actual underwriting requirements being obtained by company B would be very limited relative to company A, giving rise to relatively weak selection and an expectation of higher mortality rates with a flatter durational slope.

3. Distribution System
The distribution system of the ceding company or for a particular product can have a significant impact on the degree of potential anti-selection. Anti-selection will likely impact the mortality level and durational slope. Brokers writing for multiple companies could seek out deficiencies in companies' product designs, underwriting or pricing and exploit these to the detriment of the direct writer and its reinsurers. Career agents writing for only one company can produce business with less potential anti-selection.

4. Market Segment (Upscale, Middle America, etc.)
It is that each market segment will exhibit its own variation in mortality patterns resulting from social, economic and cultural differences. Companies underwriting middle market risks with lower average face amounts are likely to experience higher mortality rates, and flatter durational slope.

5. Average issue age distribution
A younger average issue age distribution linked with a low average face amount per life will generally have less stringent underwriting requirements and likely flatter durational slope.



6. Other important Points
It should be noted that studies have shown that the impact of choosing one mortality table or another in projecting the present value of future mortality can produce a swing of up to 20 percent or more in reinsurance YRT rates and hence turn a competitive quote into an uncompetitive one. This impact varies by issue age and gender distribution. For additional information see the author's article "The Relationship of Mortality Projections and the Underlying Mortality Tables Used," in the August 2002 issue of *Product Matters!*

It is therefore of utmost importance that the direct company identify and explain all possible characteristics and aspects of the business including those shown above in Assumption "A" (Choice of Mortality Table) to each quoting reinsurer would tend to justify an assumption of a flatter mortality slope than the 1990–95 (2001 VBT) select/ultimate table. If a reinsurance quote was expressed as a percentage of the 1975–80 select/ultimate table, be sure to understand the underlying slope implications. The reinsurer may have done their pricing on a steeper scale and then quoted the actuarial equivalence in terms of the 1975–80 table. In that case there may still be opportunity to convince the

CONTINUED ON **PAGE 28**

reinsurer that a flatter slope is more appropriate for the business and have them improve their quote.

Techniques exist for generating a hybrid, modified or redesigned table exhibiting a flatter, fairer mortality table resulting in more competitive reinsurance pricing. These are best addressed during the negotiating process. For additional information see the author's article, "Generalized Mortality Table Analysis," in the March 2003 issue of *Reinsurance News*.

If a review of the various aspects of the business fails to find any attributes that could justify a flatter slope, consider raising the following point with the reinsurers to encourage them to assume a flatter slope than the 1990–1995 mortality table (2001 VBT).

"Another very important assumption and special consideration is the reinsurer's end-of-term pricing."

The 1990–1995 mortality table was based on intercompany mortality experience from calendar years 1990 to 1995. It is a known fact that the lapse rates for policies during this period were very high compared to current levels. Therefore one could argue that the slope of this table is artificially high due to the anti-selective lapses that occur when lapse rates are atypically high. Consequently current mortality slopes should be expected to be flatter than the 1990–1995 mortality table.

Assumption B Mortality improvement Factors

Another very important assumption is the extent that mortality improvement is factored into the pricing (i.e., the reinsurer's mortality assumption for the direct business). For example, a 1 percent annual mortality improvement factor over 20 years produces a decrease in the present value of future claims ranging from 7–10 percent depending upon issue age. As a result of the fact that reinsurers commonly build future mortality improvements into their pricing, coupled with the fact that projecting future mortality is an art as well as a science, it is not unusual to find reinsurers who will offer a YRT reinsurance premium rate scale (even after factoring in their expense and profit margins) that is lower than the ceding company's pricing mortality assumption.

The Mortality and Underwriting Survey Committee of the Society of Actuaries will soon be publishing the results of the latest (March/April 2011) survey on mortality improvement. The results of practices of direct writers and reinsurers will be published separately with a comparative analysis.

Assumption C. Reinsurer's Expense Assumptions

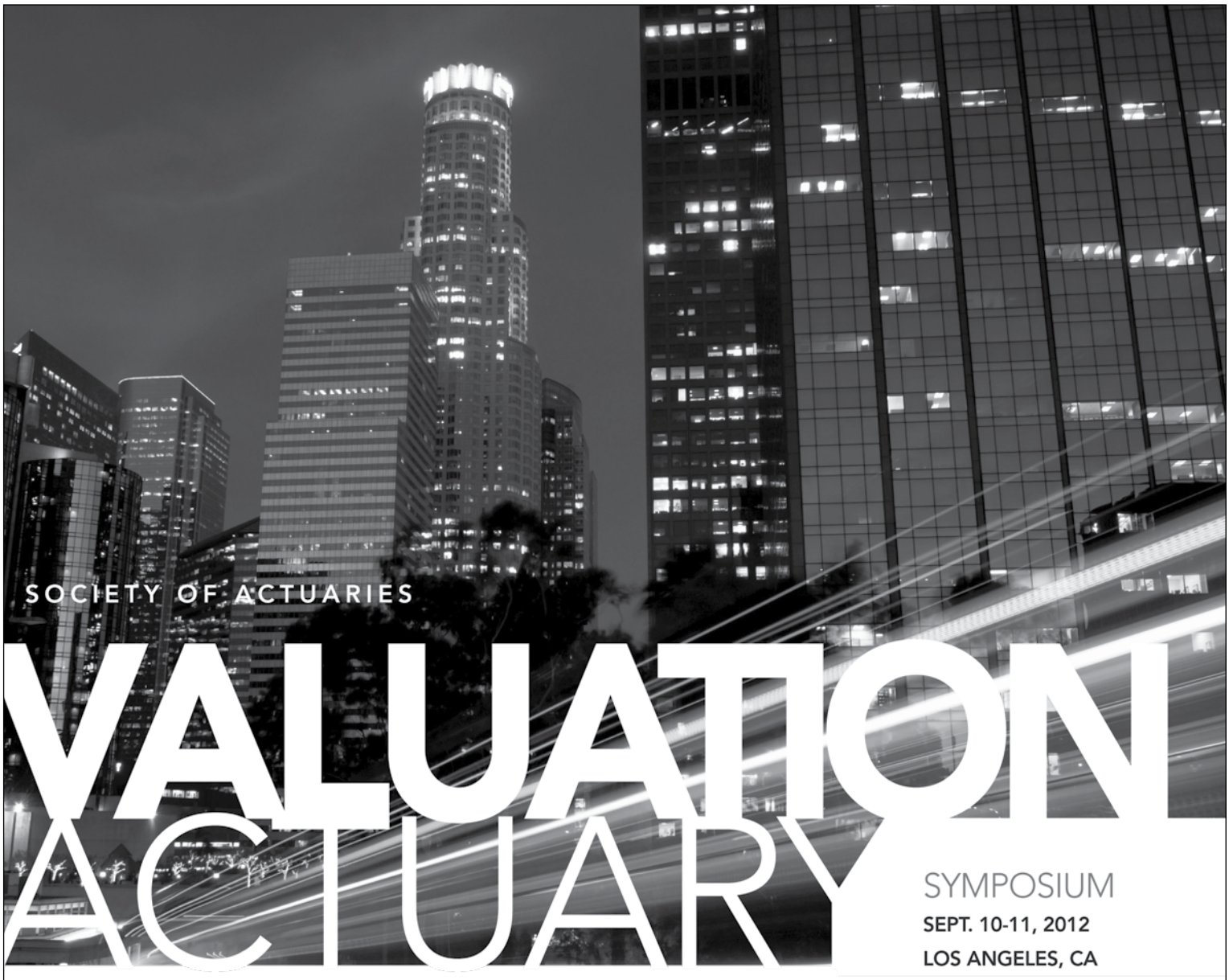
The reinsurer's expense methodology and assumptions (per unit, per policy, percent of premium) can have a significant effect on pricing. For example, the per unit expense that a reinsurer may assume (unless subject to a reasonable cap) could lead to unrealistically high total treaty expenses where large business volumes are involved and can lead to substantially less competitive or even uncompetitive quotes.

Assumption D End of Term Pricing

Another very important assumption and special consideration is the reinsurer's end-of-term pricing. Studies invariably confirm the severe anti-selection process occurring at the end of each level premium paying period. Severity of anti-selection varies from company to company and product to product. Many factors come into play that influence the end of term anti-selective continuation rate and the resulting deterioration in mortality experience of the term portfolio. The magnitude of the direct writer's renewal premium after the initial level term period (typically an annual renewable term premium ranging from 200–300 percent of the 2001 CSO) impacts the degree of the shock lapse rate and resulting anti-selection. The degree of mortality deterioration varies according to a number of factors such as the length of level term period, the magnitude of the renewal premium following the initial level premium term period, issue age, duration, risk class, and gender. Due to the complexity and subjectivity involved in recognizing, measuring and evaluating each of these parameters in pricing post-level term mortality, the reinsurers naturally tend to be very conservative in

pricing for continuation. This can turn what would have otherwise been an attractive quote into one that is less competitive. Technical approaches based on tools such as the Dukes-McDonald Method or the Becker-Kitsos approach are valuable in determining the appropriate end of term mortality assumption and hence in judging whether the reinsurer's end of term pricing is equitable and reasonable. To overcome this problem and enhance the quote, it might be prudent of the ceding company to request each reinsurer to provide a quote predicated on the condition that at the end of the level term period, the reinsurer has the unconditional right to increase premiums and the ceding company has the unconditional right to recapture. (Whether or not the reinsurer actually increases their premium rates.)

There are several additional important considerations to recognize in reinsurance negotiations. These considerations will be addressed in part two of this series in the next issue of Product Matters! ☐



UPGRADE YOUR VALUATION SKILLS. ADVANCE YOUR TECHNICAL KNOWLEDGE.

- Gain insight into principle-based valuation issues, statutory reserves and equity-indexed products.
- Improve your ability to analyze complex data.
- Enhance your creative problem–solving skills and refresh your expertise.
- Engage in comprehensive discussions on economic capital, principle-based reserves and capital, health topics, taxation and more.

Learn more at *SOA.org/ValAct*

Actuaries
Risk is Opportunity.®

SOCIETY OF ACTUARIES
Product Development Section

475 N. Martingale Road, Suite 600
Schaumburg, Illinois 60173
p: 847.706.3500 f: 847.706.3599
w: www.soa.org

Product Matters!

Non Profit Org
U.S. Postage
PAID
Carol Stream, IL
Permit No 475