The Messenger

Transamerica Reinsurance Risk Management Newsletter

Term Life:
Understanding Post-Level Experience

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The life insurance industry is beginning to experience the effects of the so-called "shock lapse" as level-premium term products transition into their post-level periods. To understand the mortality implications of these extreme lapse scenarios, it seems appropriate to review the selective lapsation theory presented in the ground-breaking 1980 article "Pricing a Select and Ultimate Renewable Term Product," by Jeffery Dukes and Andrew MacDonald. This will provide good context for analyzing emerging post-level lapse and mortality experience.

Selective Lapsation Theory

The Dukes-MacDonald selective lapsation model assumes that policy lapsation in excess of a baseline set of rates is anti-selective. The total of the expected deaths from the cohort in the excess lapse group (the "reverters") and the expected deaths from the cohort continuing their insurance (the "persisters") must equal the expected deaths arising from the original cohort using the baseline lapses. This is the conservation of death principle.

Dukes-MacDonald assumes that the mortality for the reverters follows the select mortality of a newly underwritten attained-issue-age group. Then, conservation of deaths is used to mathematically solve for the mortality of the persisters. As long as there are excess lapse rates, this process is repeated year after year as the persisting cohort continues to be divided into new reverters and new persisters.

The theory allows for only some portion ("effectiveness rate") of the reverters to follow attained-issue-age mortality. The remainder, while still lapsing, follow the point-in-scale mortality of the original cohort. For example, if the effectiveness rate is 50 percent, then only half of the reverters exhibit attained-issue-age mortality. The other half continue to exhibit the original point-in-scale mortality. The sum of the attained-issue-age deaths plus the point-in-scale deaths plus the persister anti-selective deaths must equal the original cohort deaths.

Transamerica Reinsurance Tests Dukes-MacDonald

To test the Dukes-MacDonald theory, we use the proprietary Transamerica Experience Database (TED) on a closed block of 10-year term policies. Since we are only interested in measuring the shock experience for policies entering their post-level period, we limit the issue years to 1993 through 1997. Exposures run from January 1, 2004 through June 30, 2008.

As seen in Table 1, results of the lapse study indicate that the rates (by amount) in durations 10 and 11 are approximately 64 percent and 52 percent respectively, compared to a base rate of around 10 percent for earlier durations. A closer inspection shows that

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nearly all of the excess lapses in duration 10 occur at the end of the policy year, while the excess lapses in duration 11 occur in the first few policy months after renewal. To simplify the Dukes-MacDonald analysis, we will use a heaped lapse rate of 83 percent [1-(1-0.64)*(1-0.52)] at the end of policy year 10. With the Society of Actuaries 2001 Valuation Basic Table (VBT) as our expected basis, mortality results (by amount) for the same block of 10-year term policies indicate that mortality immediately prior to the shock is running at around 55 percent of the VBT, while mortality in the durations following the shock are at 126 percent of the VBT. Using Dukes-MacDonald terminology, this means that mortality for the persisters is approximately 230 percent of the mortality for the original cohort.

Table 1

Duration	Lapse Count	Lapse Rate by Amt
7	3,173	12%
8	6,091	9%
9	7,091	9%
10	59,666	64%
11	18,251	52%
12	2,721	22%
13	875	17%
14	356	14%
15	132	12%
16	12	7%

Lapse study results by count and amount for 10-year level-premium term policies.

Table 2

Effectiveness Rate	Average Mortality Multiple
45%	190%
55%	210%
65%	230%
75%	250%
85%	270%

Mortality results are sensitive to the "effectiveness rate" or how selective policyholders behave given an understanding of their own mortality (and ability to replace coverage).

Dukes-MacDonald Predictions

Using the 2001 VBT, we can derive the Dukes-MacDonald predicted increase in mortality that should result from a tenth-duration lapse rate of 83 percent with an underlying base rate of 10 percent. To simplify the calculations, we will use the mortality for a male nonsmoker cohort with an original issue age of 40 (male nonsmokers represent nearly 75 percent of the exposures in our mortality study). At the end of policy year 10, this group is now at attained age 50. We use the VBT mortality rates for issue ages 40 and 50 in our calculations.

In determining the theoretical mortality of the persisters, the initial increase immediately following the shock lapse at the end of duration 10 begins to decline in subsequent durations. This is due to the very different pattern of mortality followed by the persisters as compared to the reverters. However, for our analysis we will focus on the post-level mortality averaged over durations 11-16. This is consistent with the methodology used to calculate the 230 percent from our mortality study.

The Dukes-MacDonald mortality prediction is somewhat sensitive to the effectiveness rate assumption. Table 2 shows the predicted results for our group of male nonsmoker 10-year term policyholders. Scanning the Mortality column reveals that our study result of 230 percent corresponds to an effectiveness rate of 65 percent. This means that although there is selective behavior in the reverters, only 65 percent of the attained age 50 lapsing policies have the mortality of a freshly underwritten issue age 50 cohort. If policyholders were 100 percent efficient in assessing their health status to determine whether to lapse, mortality for the persisters would be over 300 percent. That is, if every policyholder had perfect information about their health and behaved rationally, mortality associated with the persisting business would more than triple.

The Dukes-MacDonald selective lapsation model provides useful insights into the effects of post-level period policyholder behavior. While there are undoubtedly additional factors (e.g., the size of the impending premium increase) that determine lapse and mortality patterns during this period, the theory presents reasonable boundaries for prudent pricing assumptions.

What should be clear, however, is that shock lapse and expected mortality are closely related. As a result, it is unadvisable to price shock lapse and expected mortality increases independently – setting the assumption for one will lead to the predicted outcome of the other. ■

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Non-Traditional Mortality Studies

Using the Social Security Administration's Death Master File (DMF) provides the opportunity to perform non-traditional mortality studies – non-traditional in that they are not subject to the constraints of policy issue and policy administration. Non-traditional mortality studies can provide important information about underwriting decisions, the predictive value of laboratory tests, the accuracy of life expectancy (LE) estimation or post-lapse mortality.

In many situations, there will be repeated encounters: Multiple underwriting decisions at different points in time with changing medical history; multiple lab tests at different points in time with different results; multiple LE estimations. The multiplicity of encounters begs the question: Which encounter should be used to define the onset of exposure to risk – the first, last or every?

By David Wesley, MD
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When It's about People, not Policies

The question does not arise in traditional experience studies. These are policy-centric with both actual and expected mortality measured in dollars and based on face amounts. Exposure is defined by policy anniversaries. Were the question asked here, the answer would be "every," because every policy counts, no matter how many apply to a single policyholder.

The author would like to thank Hugh Cox, Biostatistician, and Jeff Prescott, Actuary, for their contributions to this article.

However, traditional experience methods pose problems, especially if the interest is in the quality of underwriting decisions, the predictive ability of lab tests or patients in clinical settings. In the case of life insurance, not all applicants are made an offer and not all offers are placed. Lapsation of those that are placed rapidly erodes the exposure available for study.

Using the DMF for mortality follow-up sidesteps these issues but raises a new one: Which of multiple underwriting (or other) encounters should be used for mortality study? We know of one applicant who was underwritten more than 50 times in less than a decade, but only three or four policies were placed. This large number is uncommon but two, three, six or ten are not. Similarly, if the study interest is lab tests, many individuals get multiple lab tests over the years.

Figure 1

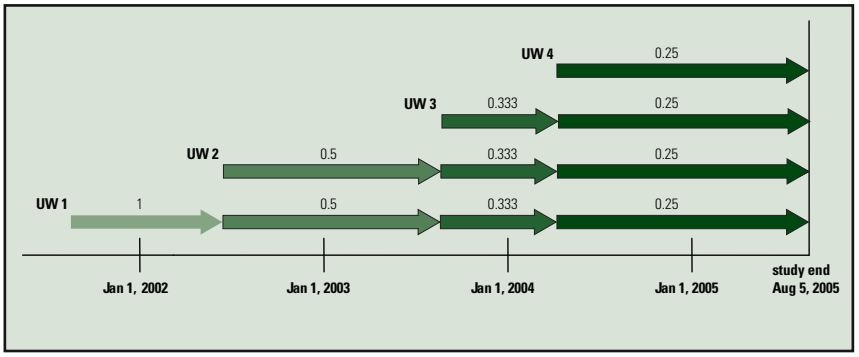

Figure 1 displays the weighted average of the four discrete underwriting encounters.

When performing exposure-based mortality analysis, it may not be desirable to use every encounter. Over-representation of repeaters can bias both the exposure and the actual death count when a repeater dies. The easiest thing to do is to choose just one encounter – but which one? Some argue for using the most recent (last), but the desire to maximize exposure leads us to prefer the first.

If we choose "every," we first eliminate what we consider to be redundant encounters. Facultative underwriting provides an example of redundancies in what can be called rubberstamping. We frequently see identical requirements from more than one company and we strive to make identical offers to each. Clearly, this should count as a single encounter not as several. In fact, we ignore any event where there is no substantive change in the evidence of insurability, even if separated by a long period of time. The resulting set of non-redundant

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Underwriting Technologies

Focusing on Strategic Business Benefits

By Joanne Collins
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New life underwriting technologies have gained ground during the last decade. Recent surveys sponsored by the Society of Actuaries and other industry groups show strong inroads and increased confidence in these new tools. More significantly, the focus of underwriting technology is moving beyond speed, ease of case submission and sales support to strategic business benefits, including product design, pricing and capital considerations. As we enter a new decade, the goal will be to take advantage of what's available to improve efficiencies without losing sight of the big picture – risk management – and the analysis and understanding that is required to manage risk.

The Value of Data

Maximizing the value of data will be front and center as companies execute growth strategies and prepare to do business in a demanding regulatory environment. To understand and demonstrate portfolio risk, management will demand detailed information on underwriting and claims results. Technology that supports this growing need will look increasingly attractive, even in a cautious expense environment.

Tele-Interviewing. Tele-interviewing may be the most popular trend in life underwriting. Research shows that the practice has grown significantly and that the benefits – most notably, improved disclosure – are highly favorable. What began as a way to verify information on an application has evolved into an efficient and effective way to capture medical and family history information. However, execution varies widely from company to company.

In its optimal state, tele-interviewing is a component of a fully integrated new business acquisition process. It utilizes an application with carefully developed questions and drill downs that guide the interviewer. Answers, too, are captured in a structured format, making the information far more valuable than free text data. Rules can be applied to the responses, and the data is available for future mortality studies.

Independent third parties are best suited to perform the interviews: They are not tied to the sale, they are trained to hear hesitation in responses, among other things, and there is no risk of disclosing confidential medical details to a personal acquaintance.

In reality, tele-interviewing is rarely conducted in the ideal state described above. Very often, it is an individual function within the policy acquisition process. Questions may be well crafted, but responses are not captured in an electronic data format, which means they drop out of the process and cannot be used for later mortality analytics. So, while tele-interviewing holds important potential for life insurers, there's much room for improvement.

Rules-Based Underwriting Engines. This is another technology driven tool that is gaining traction in life companies. These systems, which require a high degree of customization, apply company-specific underwriting rules against incoming policy applications (often fed into the engine via the tele-interviewing process) and third party vendor requirements. Underwriting engines are especially well suited for preferred risk products where risk criteria are data-driven factors (e.g., cholesterol).

Companies need to understand the capabilities and limitations of underwriting engines, especially if they are partnering with a software provider who does not offer expertise in new business processes and mortality risk. All too often, these systems are dropped into existing

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new business processes with minimal process redesign, which limits the mortality benefits that the technology can provide. Underwriting engines also require continuous refinement to keep the moving parts in sync and the underlying risk assessment logic up to date. There's also the downside risk that a poorly designed system may increase efficiency but decrease effectiveness – because technology can place poorly underwritten cases just as quickly as it can place properly assessed cases.

In a best practice environment, rules-based underwriting engines serve as the hub for the straight through processing of new business.

Prescription Drug Records. A recent development in underwriting is the use of prescription drug databases to gain additional data or to replace information that is expensive and time intensive. Prescription drug databases have been used most often in the assessment of simplified issue business. Initial protective value studies have supported such use. However, a recent study has shown that prescription drug histories may also offer protective value in a fully underwritten environment. While most current prescription drug products are simplistic and require underwriter intervention, we anticipate increased focus on improving this tool.

As insurers explore the use of drug records, they are justifiably concerned about how this information gets interpreted. Interpretation is highly consequential, with far more impact to the bottom line than, say, reducing per unit costs in the underwriting department.

Straight Through Processing (STP). STP systems electronically connect all steps in the new business acquisition process, capturing relevant data along the way for immediate use and longer term analytics. STP means that data remains consistent and electronic throughout the entire value chain and is accessible throughout the organization. For most companies, STP is still on the drawing board, but the value-creating potential of such an environment is too big to ignore. In the short run, a company gains operational efficiencies. In the long run, a company gains access to information that can yield the insight needed to stay competitive in the market and meet evolving regulatory demands.

Conclusion

Today's life insurance market, driven by continued competitiveness and impending regulatory change, is a challenging place to do business. There is a growing demand for detailed understanding of how blocks of business are performing. This demand for information is coming from senior management, regulators, rating agencies, capital markets and those responsible for pricing products and setting reserves. Underwriting and product managers must respond quickly and accurately when asked to provide information on underwriting results.

Life insurers who take advantage of what's available to improve the risk assessment and risk management process will have a competitive advantage in the market. If you would like information about Transamerica Reinsurance's automated underwriting services for both fully underwritten and non-medical life products, contact your account executive.■

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The Messenger is produced by the Marketing Communications department of Transamerica Reinsurance. Matthew Hughes and Christian Kendrick are the editors. If you have questions or would like to be added to or removed from the mailing list for *The Messenger*, please send your inquiries with name, company name and mailing address to Matthew.Hughes@Transamerica.com or Christian.Kendrick@Transamerica.com.

Variable Annuities: The Lessons of 2009

By Simpa Baiye
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The credit crisis of 2008, coupled with the ensuing downturn in global markets, now appears to have stabilized. Governments and central banks have employed various measures to restore calm to financial markets. Financial services firms have experienced a rebound in profits, with the partial recovery in financial markets. Insurers, aided by regulatory capital relief measures, have begun the process of rebuilding balance sheets and redefining product priorities.

In the US annuity insurance sector, 2009 could be described as a year of product "de-risking." Many carriers took a more defensive posture in their fixed-income portfolios, lowered crediting rates and/or launched fixed annuity products that pass more risk to retail customers. More importantly, variable annuity carriers significantly reduced the complexity of and risks associated with their rider guarantees. Given this ground-breaking shift to insurer sustainability in the marketplace for variable annuity guarantees, it is important to review the lessons that have served as a backdrop for the changes witnessed in 2009.

Lesson 1: Simplicity Matters

Much of the growth in variable annuity gross sales between 2002 and 2007 was fueled by elaborate promises embedded in new, complex annuity guarantees. These guarantees offered a variety of bells and whistles that were meant to differentiate carriers from their competitors. They generally increased insurer risk profiles but did not uniformly achieve the much-desired penetration at distributor firms. Indeed, net industry sales (i.e. new annuity premiums) showed little or no improvement, even as gross industry sales increased significantly. Consistent feedback from independent financial advisers – the most promising and most elusive sales growth channel for variable annuities – was that the new guarantees were too complex to understand and sell to clients. A winning simplicity proposition will need benefits that balance easier risk management, simpler illustrations and a variety of investment fund choices against real income promises.

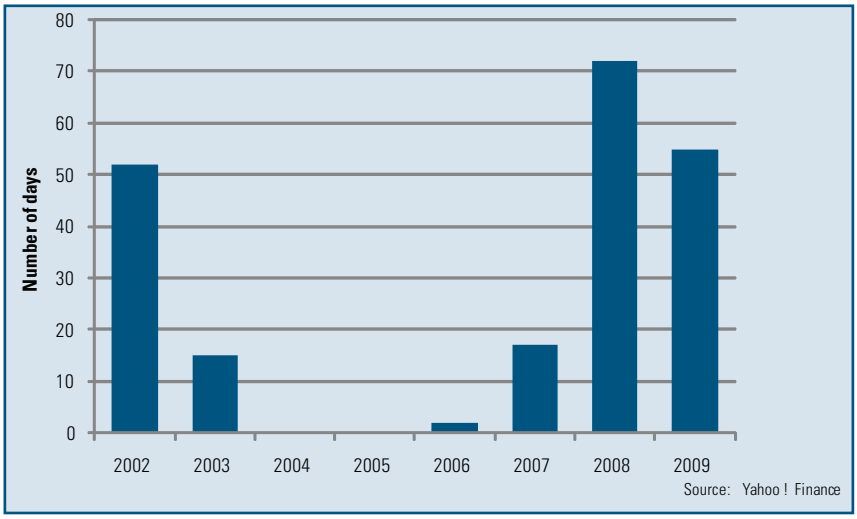
Lesson 2: More Risk Does Not Always Mean More Value

Many annuity carriers entered the guarantee "arms race" of years 2002 through 2007 to increase both market share and shareholder value. Indeed, that timeframe provided a great window for risk taking: Market volatility was very low, returns were positive, and interest rates were moderate. The risky underbelly of this stable period was that some carriers became very confident of their ability to dynamically hedge complex annuity guarantees. However, the reality was that dynamic hedging programs are far less successful in preserving shareholder value under volatile market conditions. As markets began to unravel in 2007, investors began to seriously question and adjust for residual market risks that had previously been underestimated in stock valuations and rating agency reports. As a result, third-party annuity distributors began to perceive that some companies were selling guarantees that they could not manage well. This new perception resulted in a drop in annuity sales at these carriers. The growth proposition that guarantees had previously represented to these carriers was replaced by an "unmanageable risk" perception. The consequence of these events was a substantial reduction in carrier shareholder value.

Lesson 3: Dynamic Hedging Does Not Transfer All Market Risks

Annuity insurers set up hedge programs to offload guarantee market risks as living benefits began to lift annuity sales in 2003. Many of these programs addressed just market return risks. Now, hedging is both science and art. It comes with risks and opportunities that vary by the level of operational sophistication. For example, programs that address only market return risks require frequent, costly rebalancing whenever markets become volatile. For insurers with this type of hedge strategy, the market crises of 2008 brought lessons learned on bank derivatives-trading desks to insurance companies: Rebalancing in periods of high volatility can result in massive losses, unless market-volatility protection is pre-purchased or volatility is skillfully managed. Even for annuity carriers that did attempt to pre-purchase volatility protection, hedging instruments did not move in perfect tandem with underlying guarantee values. Mitigating future hedge underperformance risks will involve diversifying hedge strategies to include the use of structured derivatives and reinsurance.

Figure 1: Absolute Daily S&P 500 Index Returns in Excess of 2%



Equity markets, as exemplified through the S&P 500, exhibited minimal volatility during 2004-2006. This helped facilitate an environment of greater risk taking, which later unraveled.

Lesson 4: Capital Management Is Crucial

Statutory and rating agency capital requirements for variable annuity guarantees are pro-cyclical; i.e., they can increase significantly when markets drop. Hedges set up to offset guarantee liabilities should provide some relief in depressed markets, but substantial residual capital requirements still remain. Some insurers had to raise scarce capital, even as their hedge programs performed well in the turbulent months of 2008. It has thus become important to plan for residual capital requirements at the bottom of the economic cycle. This could be achieved through structured derivatives or by setting aside ample capital in reinsurance captives that is well in excess of rating agency requirements.

Many current variable annuity writers are seeking to reduce market risk and to return to simplicity that embodies the key lessons of 2009. These lessons center on understanding the tradeoff between risk and value, adjusting for the limitations of hedging and the importance of capital management. These all come at a time when demand for guaranteed income solutions is at a high. Companies will need to carefully balance the need for insurer sustainability with reasonably priced but meaningful annuity guarantees. The next phase in that challenging mission is already taking shape. ■

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Non-Traditional Mortality Studies (cont.)

encounters is satisfactory for Cox Proportional Hazard modeling and many other uses, but it is not optimal for exposure-based mortality study.

The Weighted Every Approach

For experience-type studies, the best solution is the weighted-every approach. In a nutshell, it works like this:

- Eliminate redundant encounters.
- From the point in time of an individual's first encounter, the weight for exposure (and death, if necessary) is one. If there is a second encounter, the weight for the first is changed to one-half at that point in time and the second starts at one-half. If a third encounter, one-third all around, and so on. If the weight is one-quarter at the time of death, each of the encounters (each being a unique set of attributes) is assigned one-fourth death.
- Thus, a subject only contributes one person-year of exposure for one year of follow-up and a subject who dies contributes only one death – no matter how many encounters!

This can be very complex to follow – and to implement. We offer additional diagrams on our website to help you visualize what is happening, and we offer Stata code to show how weighted-every can be implemented. Please contact us if you have an interest in these issues or you would like assistance with DMF-matching.■

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TMN-0110-2500-04