SOCIETY OF ACTUARIES

Article from:

Product Development News

June 1998 – Issue No. 46

Pricing
continued from page 10

interest, persistency, and mortality. However, this may not be achievable on all plans, especially if a company is moving from a heaped scale that varied by plan. Allowances may be made for this; a single-commission scale for all products could be desirable because it eliminates biases of agents toward a certain product based on differences in compensation.

A levelized-commission program may alter the pattern of profit emergence. The acquisition expense is less than under a heaped-commission scale. This generally results in less surplus strain associated with the sale of a product (assuming no other changes are made to the product design) and, therefore, less of an investment in the product. The relative importance of different profit objectives may change when moving from a heaped-commission scale to a levelized-commission scale.

Conclusion

A levelized-commission scale should have an impact on a number of different profit-test assumptions: commissions, persistency, and expenses. However, the impact of a move to levelized commissions on pricing and product design is such that it may be difficult to simply change profit-test assumptions.

It is generally accepted that the current career agency distribution system is not sufficiently meeting all the needs of its customers. Also, it is anticipated that the career agency distribution system will be challenged by other more cost-effective distribution channels. Levelized commissions may provide the industry with a partial solution to these challenges. Levelized-commission programs offer companies opportunities to address these challenges through:

- Increased incentive to provide more frequent and improved customer service
- Reduced distribution system expenses
- Increases in the in-force block of business, which in turn may provide improved financial results.

However, successful implementation of levelized-commission programs requires companies to make significant investments in administrative systems and transition program costs. It also requires effective communication with the agency force and programs that address the many concerns of the agency force.

Are levelized commissions for every company? Those companies that have implemented levelized commissions have had success with their programs in improved agent retention and better policy persistency. However, these companies also expended a significant amount of capital implementing their programs. Levelized commissions can be part of the solution to improving overall financial results but cannot be the only solution.

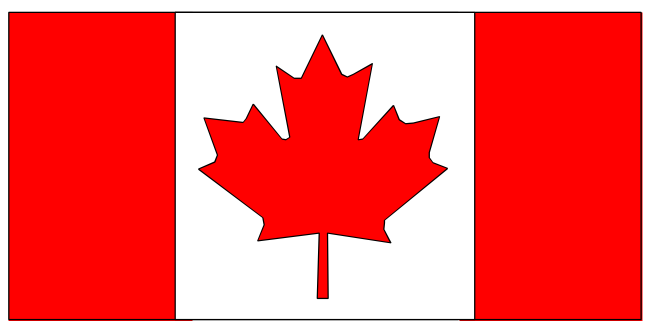
Michael S. Taht, FSA, is with Tillinghast-Towers Perrin in Atlanta, Georgia.

Canadian Corner: Part I. Segregated Funds—"No Loss" Proposition

by Boris Brizeli

Editor's Note: *The following is the first of two articles on segregated funds guarantees in Canada. Part II will appear in the next edition of* Product Development News.

This article briefly describes the guarantees available within the segregated fund products sold in Canada along with the various associated risks and cost factors. Part II will discuss the various methodologies for pricing these guarantees and ways of managing the resulting risks. I will strive for an intuitive exposition here and will introduce more rigor in Part II of the article.



Introduction

Segregated funds (SFs) are variable annuity contracts distributed by Canadian insurance companies. As such, they are defined very similarly to mutual funds—pools of investments in which an investor can acquire an interest by purchasing units. Like mutual funds, SFs charge a management fee for provision of their management services. Unlike mutual funds, SFs must provide two guarantees:

- ***Mortality Guarantee.*** Payment of at least 75% of deposits, less withdrawals, at time of death, and
- ***Maturity Guarantee.*** Payment of at least 75% of deposits, less withdrawals, on maturity. Maturity is defined to be at least 10 years and at most the time of annuitization.

By virtue of these guarantees and a guarantee to provide specified future annuity payments (if annuitized with issuer),

continued on page 12, column 1

Canadian Corner
continued from page 11

segregated funds are classified as insurance products and avoid securities regulation. Some other important ancillary benefits are a significant degree of creditor protection and exemption from probate fees, two benefits not typically available within mutual funds. This article focuses solely on the maturity and mortality guarantee of SFs.

Over the last few years, several developments have made SFs a very hot topic in the Canadian financial services world. While a 75% guarantee on invested principal may not have had a lot of marketing appeal, when some companies introduced a mortality guarantee of 100%, some agents took notice. Other companies eventually upped the ante by going to a 100% maturity guarantee at the earliest legal maturity date of 10 years. The next round of innovation saw the introduction of the reset feature, enabling the policyholder to reset the guarantee level and the corresponding maturity date. Some companies even offered resets without reinitializing the maturity date. The most significant development (and perhaps the one that triggered this product's recent popularity) occurred when a company, in association with several mutual fund companies, offered a product that, for an additional fee, wrapped the legal structure of SFs around these funds. This product offered a 100% guarantee on both death and maturity, together with a reset feature. The enormous marketing success of this venture precipitated several events, notably:

- Two mutual fund companies, in association with insurance carriers, have recently introduced segregated funds by wrapping the necessary legal structure around their existing mutual fund products. One of the top three mutual fund companies is reportedly in the process of introducing its SFs and several other mutual fund companies and insurers are in different stages of developing partnerships.
- Office of the Superintendent of Financial Institutions and the Canadian Institute of Actuaries are now working on developing the necessary surplus and reserving requirements (now practically nonexistent).

In order not to repeat history or "reinvent the wheel," we should consider the experience of similar products in other countries. The GMDB feature of variable annuities in the U.S. and its pricing (see Bernard [1], Brennan and Schwartz [2], Gootzeit et al. [3], Mitchell [4], and Ravindran and Edelist [5]) should serve as a valuable guide in pricing the mortality guaranty of SFs. The work of the Maturity Guarantees Working Party of the Institute of Actuaries in England (see Report of the Maturity Guarantees Working Party [6]) and its impact on the marketing of the associated products can teach us some valuable lessons.

Guarantee Description

To properly price and subsequently manage the guarantee liability, we need to first define it. We will consider some of the common definitions being marketed today. Assuming that the 100% guarantee is on one fund only and in absence of management fees, the value of the fund at maturity or at the time of death T is:

$$F = \max\,(S_T, S_0) = S_T + \max\,(0, S_0 - S_T),$$

where S_0 and S_T are the values of the assets underlying the SF at time 0 and at T. The guarantee payoff is equal to the value of the asset and the payoff from a vanilla put option. If several funds are present, each with its own guarantee, the guarantee payoff is simply the sum of the payoffs for each fund. Let us call this the type I guarantee:

$$F = \sum_i \max(S_{i0}, S_{iT}) = \sum_i S_{iT} + \sum_i \max(0, S_{i0} - S_{iT})$$

where i is the index for the different funds under the guarantee. The situation changes if the guarantee applies to the total of the funds in a family of funds; let us call this the type II guarantee. Now the guarantee payoff is:

$$F = \max\left(\sum_i S_{i0}, \sum_i S_{iT}\right) = \sum_i S_{iT} + \max\left[0, \sum_i \left(S_{i0} - S_{iT}\right)\right]$$

The most obvious difference between the guarantees is that under the type I guarantee, a fund transfer is basically a lapse from one fund and a deposit into another, and under the type II guarantee a fund transfer maintains the ultimate amount guaranteed and the associated maturity date. Consequently, the form of the guarantee is likely to have an impact on the associated policyholder behavior in different ways. Using simplistic modeling, we can model the account value as a single fund, reducing the type II guarantee to type I. This simplification may come at the cost of ignoring the dynamics of fund transfers and interactive behavior of funds within the account. While other types of guarantees exist in the Canadian market (modified "high watermark" or guarantees that do not set a new maturity date for each deposit), the type II guarantee is the most popular one.

Including discretionary resets in the guarantee does not allow for a simple description of the payoff because of the recursive and path-dependent nature of the optionality. One can observe that a reset (in absence of back-end load) can be thought of as an instantaneous lapse and redeposit. It is worthwhile to describe the potential impact of the option to reset on the policyholders' behavior. Consider the following simple analysis of the reset impact on the maturity guarantee.

Decompose the value of a single SF into the value of the underlying assets, the put option, and the option to reset. Ignore, for now, the surrender charges and management fees. If the whole value of the put option is charged as a front-end load, the option to reset has no value because if the market is up at the point of reset, a lapse results in leaving behind any remaining value of the option and the corresponding potential payoff (we are assuming that the new guarantee is again charged for in full). If, on the other hand, the cost of the put is charged via some kind of periodic amortized cost at the end of each year, when the policyholder resets the guaranteed amount, he or she is essentially forcing the insurer to give up

continued on page 13, column 1

Canadian Corner
continued from page 12

on any future payments for the put. In addition, the put value is very likely to be worth less now than at the point of purchase. Essentially, the policyholder at time of reset can put the cost of the put back to the insurer at its book value, a disintermediation situation. This suggests that policyholders' persistency is likely to be high since they have a "no loss" proposition: protection from the downside of market movement and ability to lock in the upside.

One last observation is needed in defining the guarantee—the impact of management fees and of fees for the guarantee. One simplified way to think about these items, assuming that the guarantee cost is recovered via some periodic basis points charge, is to present them as a negative interest rate. Thus in any modeling of the S_{iT}, the management fee and the guarantee charge would act as a negative return. The fact that the fee for the guarantee has an impact on performance implies a circular relationship. This implies that a numerical technique needs to be used if an exact cost is desired.

Description of Risks and Cost Factors

Since it has been shown that offering SFs guarantees is equivalent to writing put options, we can now analyze the risk associated with the guarantees in the capital market framework. We can observe from analyzing the historical data of North American markets that long-dated puts would rarely trigger a payoff. If markets are modeled in a Black-Scholes-Merton framework, we can see that there is a high-severity/ low-frequency risk combination that cannot be pooled. This is because the volatility of the underlying assets does not decrease if more exposure is created. Diversification among correlated asset classes can, however, provide some limited reduction benefits. The nature of this reduction is one of the most challenging elements to model in pricing and hedging of the guarantee. While VAR-like techniques can be used for shorter term modeling issues, longer time frames pose some challenges but may also carry some reward.

The usual factors that have an impact on values of options, such as interest rates, underlying volatility, strike, market price, and time to option maturity, will affect the cost of SFs' guarantees.

Other significant risk and cost factors include:

Mortality. The assumed age distribution and the corresponding levels of mortality can be misestimated. This is very risky if the same asset-based charge is used at all ages. Even the slope of the mortality can have an adverse impact on the cost of the GMDB. Given that underwriting is minimal or absent, an appropriate assumption needs to be constructed.

Persistency. The policyholder's lapses are likely to vary depending on the market scenario. If the SF has experienced a large decline following a series of large increases locked in through resets, the policyholders are likely to exhibit high persistency. If the SF has experienced a moderate growth with low or no declines, then policyholder lapses are more likely. Both scenarios may lead to the same fund level in the SF, but to entirely different behaviors. To summarize, we can say that persistency is directly related to the amount that the maturity or mortality puts are "in-the-money." This is similar to the situation of the term-to-100 lapse supported product, and SFs' guarantees are clearly very lapse supported—a 5% lapse rate can cut the ultimate maturity liability in half. The increased proximity of the maturity date or deterioration in the state of health are also likely to increase policyholder persistency. Since older policyholders may prefer a more passive approach to wealth management, persistency may also increase with age. This may in turn compound the risk of misestimation of age distribution.

Fund Transfer Risk. It is prudent to assume that policyholders will transfer money between funds based on the SFs' performance and level of resets since purchase. If we are faced with the type II guarantee, the impact of transfers can be significant. Also, the basis of deposit transfers (LIFO or FIFO) will influence the guarantee differently.

Reset Risk. The option to reset carries a cost that is similar to the cost of unamortized expenses and disintermediation in more traditional products. The impact of resets will be rather pronounced on the death-benefit guarantee, because a reset immediately increases the exposure for all the puts associated with mortality. To properly handle this risk, we need to find out what constitutes optimal resetting behavior and then decide how much inefficiency to introduce into the actual policyholder behavior. These inefficiencies are likely to exhibit variation by duration and market activity. For example, resets are less likely after a year of flat performance than after a year of significant fund performance and reset activity. The technique used to evaluate so-called "shout" options can allow us to calculate the value of the reset feature.

Pipeline Risk. Because new funds come at an unknown rate and sometimes in small amounts, the execution of appropriate risk management can be problematic.

Model Risk. Any pricing and risk management approach that uses models of fund progression and policyholder behavior runs the risk that the actual behavior of the specified processes is significantly different. For example, using the Black-Scholes-Merton dynamic or the Wilkie model can yield similar results, but GARCH or jump diffusion models can produce an entirely different set of costs (higher!). If multiple funds are modeled and their correlations are part of the model, the amount of model risk increases because more parameters need to be estimated. Balancing complexity and practicality is no small task given the magnitude of the risk involved.

Regulatory Risk. OSFI and CIA may promulgate required surplus and reserving requirements that significantly increase the cost of the SF guarantee.

Basis Risk. This risk arises in any risk management program that assumes a correlation between an asset being modeled and some other capital market variable. The difference and

continued on page 14, column 1

Canadian Corner
continued from page 13

its evolution through time between actual correlation and the one assumed is the basis risk. The source of the underlying statistics and the period over which the correlation is measured are paramount in establishing the correlation relationship. Some funds can exhibit a high degree of positive correlation over short periods (0.5 to 3 years) to a given market index, but over longer periods (5 to 10 years) this correlation is in fact negative.

Active Fund Management. The complicating factor of active management compounds the basis risk. While, locally in time, any fund can be thought to follow a passive investment policy and its risk managed accordingly, the correlation to a market index will drift (sometimes significantly) over time due to active management. For some funds (for example, hedge funds) seeking index correlation can be a meaningless task. It is worthwhile to note that most mutual funds under-perform market indices against which they are benchmarked. This brings in an additional downside risk factor.

Policyholder Investment Strategy. Policyholders are typically poor market timers and transfers between funds within an account can have an impact on the ultimate value of the type II guarantee. First, transfers may produce more volatility. Second, a poorly timed transfer from one fund to another may trigger a guarantee payout, whereas in the absence of transfer no such payout would occur. In addition, the very presence of the guarantee may lead policyholders to invest more aggressively, thus leading to higher volatility and costs.

Price Risk. The extent to which the premiums for the guarantees can increase will have a large impact on the cost level. If an increase in the premium is possible, the choice between including the cost of the guarantee in the management fee or expressing it separately will imply different marketing impact and different limitations on the fee increase.

Several other types of risks arise, depending on the risk management approach used to address these guarantees. These approaches and the associated risks will be addressed in Part II of this article.

Boris Brizeli, FSA, is a Principal with Insource Limited in Toronto, Canada and a member of the Individual Life Insurance and Annuity Product Development Section Council.

REFERENCES

1. Bernard, G.A. "A Direct Approach to Pricing Death Benefit Guarantees in Variable Annuity Products," *Product Development News*, Issue No. 34, June 1993, pp. 6–8.
2. Brennan, M.J., and Schwartz, E.S., "The Pricing of the Equity-Linked Life Insurance Policies with an Asset Value Guarantee," *Journal of Financial Economics*, Vol. 3, pp.195–213.
3. Gootzeit, A., et al. "Guaranteed Minimum Death Benefit Provisions—How Much Variable Annuity Risk Do We Want?" *Product Development News*, Issue No. 36, June 1994, pp. 3–7.
4. Mitchell G.T. "Variable Annuity Minimum Death Benefits—A Monte Carlo Pricing Approach," *Product Development News*, Issue No. 35, February 1994, pp. 11–13.
5. Ravindran K., and Edelist A.W. "Valuing Minimum Death Benefits and other Innovative Variable Annuities," *Product Development News*, Issue No. 37, December 1994, pp. 13–16.
6. "Report of The Maturity Guarantees Working Party," *Journal of the Institute of Actuaries*, Vol. 107, Part II, pp. 103–209.

Product Development Sessions at the Annual Meeting

October 18–21, 1998
New York, New York

Planning for the 1998 Annual Meeting program is well under way. The Product Development Section is sponsoring a number of interesting and informative sessions. Below is a preview of the tentative program.

Monday, October 19

10:30 a.m.–12:00 noon

PD **MILLENNIUM UNDERWRITING**

Moderator: Rick Bergstrom
Panel: Hank George*
Mike Gaines*

This session will focus on how life and disability risk assessment and management might be directed in the first decade of the 21st century. Specifically, the three panelists will address:

- Designing and implementing a virtual insurance company using today's technology, expert systems, and outsourcing services
- Understanding the "insurability profile" concept and how it applies to the concepts of "fast, accurate, and cost-effective"

continued on page 15, column 1