

Risk Managing Equity-Based Products

Recent events are challenging the traditional view of the risk associated with investment guarantees. Hedging may be the best strategy most insurers have for managing this risk.

By Charles L. Gilbert and K. Ravindran, Ph.D.



Charles L. Gilbert is a consultant in the Toronto office of Tillinghast – Towers Perrin. He specializes in asset/liability management and the valuation, pricing and financial management of investment products. A graduate of York University, Mr. Gilbert is a fellow of the Canadian Institute of Actuaries and of the Society of Actuaries and is also a Chartered Financial Analyst.

Insurance products that offer investment guarantees carry unique risks that cannot be managed using the standard “pooling” concept. Such products primarily include variable and equity-indexed annuities in the U.S., segregated funds in Canada and unit-linked products in Europe.

Insurers diversify the risk of most traditional insurance products by aggregating the exposures and applying the law of large numbers. Aggregating the exposures associated with investment guarantees, however, increases the concentration of risk so that the potential payout could be catastrophic. Yet the nature of this risk is such that insurers have rarely expected to pay out on the investment guarantees.

The traditional actuarial method of valuing this risk — assigning best-estimate probabilities to possible future scenarios — may lead one to conclude that the average benefit cost associated with these guarantees is negligible. Why, then, would an insurer pay a substantially higher amount for reinsurance or hedge the exposure?

Times Have Changed. Several factors have combined to focus greater attention on the risk associated with equity-based products:

■ **Enriched Guarantees.** Sales of equity-based products, and the assets under management for these products, have soared in recent years, attracting more players to the market and increasing competition. (See ALM article in *Emphasis* 2001/1.) Competition in the industry has forced insurers to offer enriched guarantees and to take on more risk. These guarantees involve complex optionality, which is difficult to model. The risk inherent in these guarantees is often not well understood. Furthermore, insurers have not always passed on to policyholders the cost related to the increased risk.

■ **More Volatile Capital Markets.** The market downturn in early 2001 has tested insurers’ risk tolerances (whether implied or explicitly stated). When the major market indices fell 22% to 68% from their all-time highs, guarantees, for the first time, became a significant factor, raising issuers’ concerns about the potential payouts under these guarantees. Thus, volatility in the equity markets has increased the cost of these guarantees and reduced earnings stability for companies offering equity-based products.

■ **Greater Awareness of the Risk.** Insurers now have a greater awareness of their risk exposure, thanks to advances in stochastic modeling and a better understanding of the risk profile of this business. Managers want to avoid the catastrophic results of potentially adverse scenarios, even if these scenarios have a low probability of occurring.

Insurers are also exposed to the risks of both revenue loss due to lower fund balances and declining sales due to bad market conditions. *Exhibit 1* summarizes the risks associated with equity-based products. For many insurance executives, managing revenue volatility is the greater priority and the one for which they are held to task. Therefore, any risk management strategy must address this key risk by ensuring that the economic exposure is properly mitigated and the accounting results are simultaneously managed.

A *comprehensive* risk management solution will apply to all these risks. And in jurisdictions where regulators have introduced capital requirements, the strategy must take into account capital volatility.

■ **Decreasing Availability of Reinsurance.** Increased exposure to the financial markets has forced reinsurers to look more closely at the risks they underwrite. As a result, many rein-

Exhibit 1 The Risks Associated With Equity-Based Products

Type of Risk	Risk Exposure
Economic	<ul style="list-style-type: none"> ■ Payout under guarantees on: <ul style="list-style-type: none"> — Death — Maturity — Living benefit ■ Revenue loss from fee income collected on lower fund balances ■ Revenue loss from lower sales
Accounting	<ul style="list-style-type: none"> ■ Earnings volatility due to real economic losses ■ Earnings volatility due to accounting treatment (e.g., one side of balance sheet marked to market while other is fixed at book)
Regulatory	<ul style="list-style-type: none"> ■ Capital volatility in jurisdictions where capital requirements have been introduced by regulators
Operational	<ul style="list-style-type: none"> ■ Losses from lack of adequate control procedures, system unable to administer product features, product design flaws and inadequate pricing

urers have come to the conclusion that they do not have infinite capacity for this risk exposure and have begun to leave the marketplace. Existing reinsurance treaties were not renewed or extended, and direct writers found themselves with no reinsurance coverage for the new business they were writing. This has left many insurers with the options of running the risk “naked,” managing the risk themselves or pulling out of the market altogether.

■ Regulatory and Rating Agency Scrutiny.

At the same time that reinsurers began to exit the market, U.S. and Canadian regulators and rating agencies intensified their scrutiny of products offering investment guarantees. Regulators and rating agencies had become increasingly concerned about the risk exposure assumed by issuers of these products and wanted to ensure that these companies had sound risk management strategies.

In Canada, for example, the Office of the Superintendent of Financial Institutions introduced, in 2000, new capital requirements for segregated fund products, causing insurers to reevaluate their risk management and pricing strategies. Consequently, in Canada, companies running the risk must now put aside a significant amount of capital to cover potential future insufficiencies.

Risk Management Strategies.

To avoid having to pull out of the investment guarantee market, many insurers are looking for alternative risk management solutions. Companies have had three main risk management strategies:

■ **Reinsurance.** Once the most popular risk management strategy, reinsurance is now either hard to find or very expensive.

■ Running the Risk Without Capital Protection.

This can be a legitimate strategy if the exposure is properly quantified and monitored at all times, and sufficient capital is set aside to support the risk. After all, insurance companies are in the business of assuming risk. And on an *expected* basis,

running the risk without reinsurance will usually yield the highest profits with the most variability.

■ **Hedging.** Hedging is often the only option available to companies to manage this risk within acceptable tolerance levels. Hedging involves either static or dynamic strategies and can be partial or complete. Many insurers are quite comfortable assuming the risk up to a 95% (or 99%) confidence level but are not keen on retaining the 5% (or 1%) tail risks. Companies can also use hedging as a tool to deal with earnings volatility.

By combining these hedging techniques with appropriate securitization and product development strategies, insurers can manage risks more efficiently. When compared to either the cost of capital or the cost of reinsurance, hedging may be a more efficient risk management solution for many companies. Furthermore, for companies that cannot afford to assume risks on a gross basis or are unable to secure reinsurance, hedging offers the *only* solution.

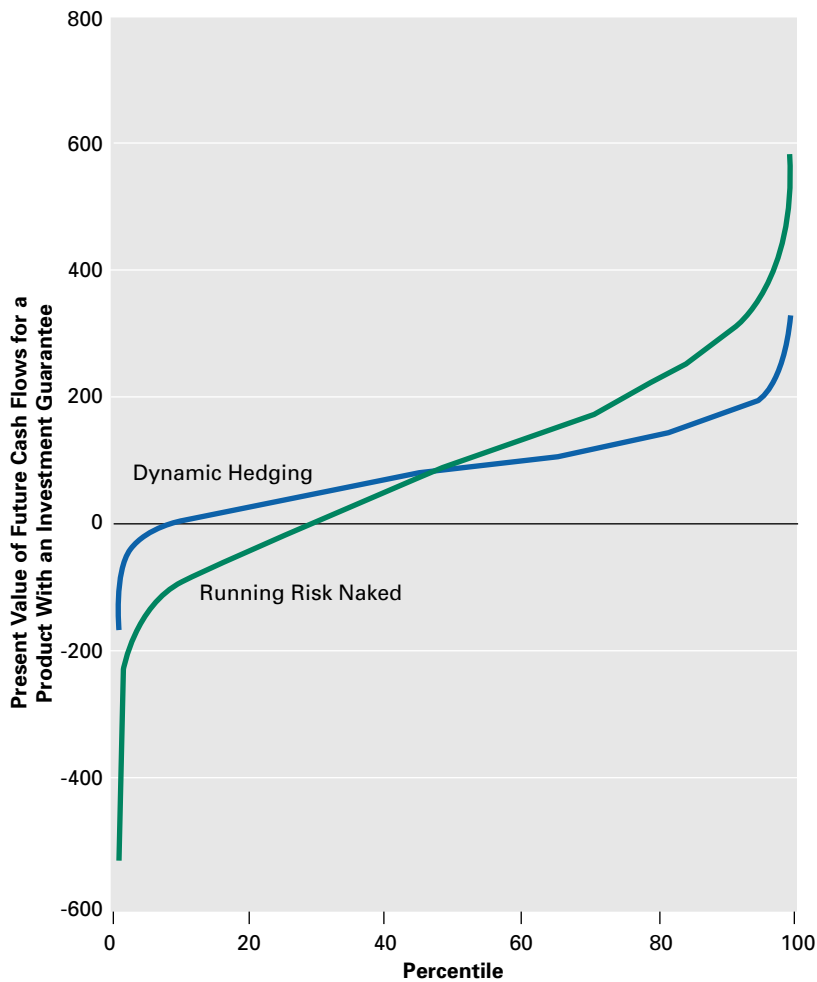
Seeking the Optimal Risk Management Solution.

Many in the industry have concluded that insurers and reinsurers must manage the risk by hedging the investment guarantees



K. Ravindran, Ph.D., is the founder of Annuity Systems Inc. He has extensive hands-on experience managing risks holistically for multi-billion-dollar equity-based annuity portfolios. The author of *Customized Derivatives*, Dr. Ravindran has traded derivatives and exotic derivatives in virtually every asset class on both physical and financial contracts as a market maker and hedger.

Exhibit 2 Dynamic Hedging Can Mitigate Most of the Risk



themselves. While hedging is the best available solution for many companies, sophisticated systems and analytical tools are crucial for monitoring the exposure while executing the hedging strategy. The risk profile curve in *Exhibit 2* shows how dynamic hedging can mitigate much of the risk at the left tail but not completely eliminate it.

■ **Static Versus Dynamic Hedging.** Buying customized long-dated options (known as “static hedging”) is one approach used to hedge the exposure associated with investment guarantees on equity-based products. Doing this exactly right requires accurate modeling of the options embedded in the liabilities and proper determination of the hedging strategies once a portfolio replication of the funds offered has been completed.

Some hedging inaccuracies (“slippages”) will occur over time, even in well-designed hedges. Such slippages arise from differences between withdrawal and death rate experience and assumptions used to project the in-force block. Some basis risk will also exist between the actively managed funds and the assets underlying the hedges.

Given that slippage is inevitable, companies must monitor and manage the residual risk exposure periodically. Because of the dynamic nature of rebalancing, a continuum exists between static hedging and dynamic hedging, and it is difficult to separate one from the other. Regardless of the approach, both methods hedge the *option sensitivities* (known as the “Greeks”) of the liabilities to changes in the underlying market values. (See *Box*.)

These sensitivities are simply mathematical derivatives of the option price taken with respect to the variables used to value the option. It is quite easy to go overboard and start computing various cross-derivatives arising from a combination of variables (e.g., volatility and interest rate). The underlying indices and instruments that are available in the capital markets drive the process and, in practice, only a select few of these sensitivities are used for hedging purposes.

What Can Go Wrong? In general, a perfect hedge is unattainable due to such factors as liquidity holes (i.e., the inability to trade in volatile markets when bid/ask spreads widen), basis risk, bulkiness of the hedge instruments and transaction costs. In risk management, practice is quite different from theory, and numerous pitfalls await the uninitiated, for example:

- Inaccurate modeling of the guarantees or inaccurate assumptions (e.g., regarding lapse and mortality) when determining the option value and corresponding sensitivities for the liabilities will lead to under- or over-hedging and can result in substantial unintended gains or losses.
- Simplifying assumptions that do not consider the term structure of volatility or interest rates will expose the insurer to nonparallel shifts in the volatility or interest rate curves.
- Basis risk will result when replicating actively managed funds with a combination of liquid indices, and needs close monitoring.

■ Currency exposure can result when replicating international funds using international indices. This exposure requires separate hedging.

■ Because marked-to-market requirements can result in significant cash outflows (even while the economic exposure is perfectly hedged), companies must understand the potential cash-flow implications of any hedging strategy before it is executed.

■ Counterparty exposure will occur when entering into long-dated contracts, requiring due diligence to ensure that the counterparty can fulfill its obligations.

■ Lack of proper internal procedures and controls can lead to financial disaster (e.g., the Orange County and Barings incidents).

■ Stale data can result in the wrong trades being made at the wrong time.

This last point cannot be overemphasized. Anyone executing a hedging strategy must have current market and liability data and the ability to process the data instantaneously to provide the net exposure and option sensitivities on a real-time basis.

Considerations that must be taken into account when determining the hedge instruments and the hedge portfolio include:

■ How much money is available for implementing the hedges?

■ How much slippage is acceptable before having to rebalance the hedges, taking into account liquidity constraints, bid/offer spreads and market timing?

■ What restrictions exist with respect to hedging instruments? Are writing options allowed?

■ What time horizon should be used?

■ How should trades be executed? And when would a trade execution be in danger of moving the market?

■ What does the exposure surface look like? And what are the historical and assigned probabilities that correspond to this surface?

Before implementing *any* risk mitigation strategy, a company needs to be aware of the pitfalls. Properly executed, hedging is an effective risk management strategy that can mitigate as

It's Greek to Me

A brief description of the “Greeks” follows:

■ **Delta** δ : the relative change in option price for a small change in the price of the underlying asset (analogous to duration in evaluating interest-sensitive assets or liabilities)

■ **Gamma** γ : the relative change in delta for a small change in price of the underlying asset (analogous to convexity in evaluating interest-sensitive assets or liabilities)

■ **Vega** v : the relative change in option price for a small change in volatility of the underlying asset

■ **Theta** θ : the relative change in option price for a small decay in the option maturity

■ **Rho** ρ : the relative change in option price for a small change in the interest rate. **E**

much of (or as little of) the risk exposure as desired.

Two Alternatives. Recent events (e.g., the market correction, earnings volatility, limited reinsurance capacity and greater regulatory and rating agency scrutiny) have called into question the traditional view of the risk exposure associated with equity-based products and how insurers manage this risk. In the absence of reinsurance, insurers have only two alternatives: Run the risk or hedge the exposure.

Insurers deciding to run the risk must put up capital to support the risk and, more than ever before, need to quantify and monitor their exposure frequently. For many companies, dynamic or static hedging represents the only viable alternative to managing the risk within acceptable tolerance levels. Whatever the decision, sophisticated risk management systems and analytical tools are crucial for properly monitoring the exposure and executing a company's risk management strategies. **E**

This is the last in a series of three articles on asset/liability management. The first two discussed ALM best practices in Europe (*Emphasis* 2000/4) and in North America (*Emphasis* 2001/1).