

Pricing Variable Annuity

Guaranteed Minimum Withdrawal Benefit Features

in a Challenging Market

insights

The variable annuity (VA) market has experienced a rough ride over the past year. The economic crisis — marked by large drops in the equity markets (now partially recovered) and volatile market conditions — has created serious challenges for VA writers. Many guarantees on existing living (and death) benefit riders are significantly in the money, requiring increased reserve and capital levels.

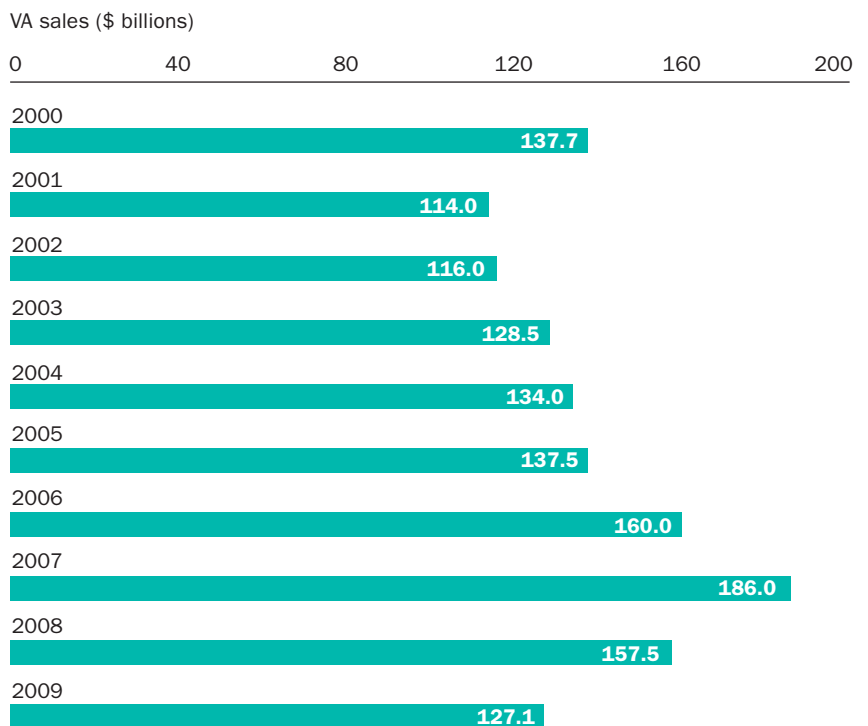
These economic conditions have also led to major challenges in the pricing of new business. Implied volatility levels have been near historic highs, and risk-free rates at very low levels, both of which drive up the cost of hedging living benefit features. Spurred by adverse experience with their in-force block of business, companies are in the midst of repricing their products to “de-risk” them and charge for the higher level of anticipated costs. This is causing companies to rethink the historical approaches they have used to price living benefit features.

To help VA writers navigate this evolving market, we have prepared this broad overview of the pricing methodology used on VA living benefit riders, with particular focus on the Guaranteed Minimum Withdrawal Benefit (GMWB) feature. Also included are findings from Towers Watson’s recently completed 2009 Variable Annuity GMWB Rider Pricing Methodology Survey (GMWB Survey), as well as the Life Insurance CFO Survey #23, addressing recent reactions in pricing during the economic turmoil.

Impact of Current Market Conditions on GMWB Riders

U.S. VA gross sales had been increasing steadily from 2001 to 2007. By 2005, VA gross sales had rebounded virtually to 2000 levels (a historic high). In 2007, U.S. VA gross sales totaled \$186 billion, again the highest in history. *Exhibit 1* illustrates the trends in VA gross sales over time.

Exhibit 01. U.S. VA Gross Sales



The financial market crisis of 2008 led to a downturn in VA sales in the latter part of 2008. Total gross VA sales in 2008 were \$157.5 billion, representing a 15% decrease in sales from 2007. VA sales have shown a further decline in 2009, with 2009 sales of \$127.1 billion, representing a 19% decrease from 2008 sales. However, there is some evidence that VA sales are stabilizing: Gross sales have generally held level throughout 2009. One can also see from the prior market correction in 2000 that sales growth does return, although it can take a year or two to get going.

While VA sales have declined since 2007 — largely due to economic conditions — the presence of the GMWB rider is becoming more critical to VA sales. In the GMWB Survey, companies responded that an average of 67% of new VA policies (by premium) contained a GMWB rider.

GMWB Pricing Practices

Overall Pricing Approach

An important issue that companies face is how to reflect provision for hedging the GMWB rider in pricing. Based on our experience and survey results, nearly all companies now make a provision for the cost of hedging in the pricing of their GMWB riders.

The general approach used in pricing the GMWB rider is to first calculate the hedge cost for the rider using risk-neutral scenarios (also referred to as market-consistent scenarios). The rider cost is then incorporated into base product pricing, which is generally undertaken using real-world scenarios. There are different approaches used to reflect the hedging cost — the most common is to express the hedge cost on an annual basis (as either a percentage of the benefit base or account value), although a few companies attempt to more closely reflect the actual incidence of hedge timing.

Hedging is assumed to cover all or most of the projected claims associated with the rider in the base product pricing. This can be reflected as one, minus the assumed hedge effectiveness percentage, multiplied by the claims generated under real-world scenarios.

There are different ways to approach this. Some companies try to mimic the impact of hedging on specific adverse scenarios (see page 4, Hedge Effectiveness Assumptions). The strategy of using a mix of risk-neutral and real-world scenarios can be described as a hybrid market-consistent approach.

We have also observed that a few companies fully price the product using risk-neutral scenarios. This is generally done by companies that adhere to a market-consistent framework for managing their business. We are seeing more interest in this approach in product pricing, including undertaking sensitivity tests on this basis.

Type of Hedging

In the GMWB Survey, the majority of companies responded that they were pricing assuming three-Greek hedging (*delta*, *rho* and *vega*).

In general, companies price for hedging based on the actual hedging strategy being employed. For example, companies that responded that they priced assuming full three-Greek hedging often execute a full three-Greek hedging strategy. There are some exceptions, particularly in cases where companies hedge fewer than three Greeks where they price, assuming more Greeks will be hedged in the future. (A discussion of GMWB hedging practices, including information from the GMWB Survey, is provided on page 5.)

Assumptions in Risk-Neutral Scenarios

A key consideration in risk-neutral approaches is the derivation of assumptions supporting the calculation. While the business can be priced at today's market conditions, the product could be sold for up to two years. Adding to the uncertainty, business issued today generally does not lock in the hedging costs over the lifetime of the product. Therefore, profitability results for business priced today are, by definition, already stale tomorrow. Therefore, companies need to understand the impact of changing market conditions on profitability. This is generally done by performing multiple sensitivity tests under various market conditions.

In generating risk-neutral scenarios, we've observed two primary approaches being used in the industry:

- Use current market conditions to develop risk-neutral scenarios to calculate the GMWB rider cost.
- Use long-term estimates to generate risk-neutral scenarios to calculate the GMWB rider cost.

Other methods also exist, including a blend of these two methods. Half of the companies in the GMWB Survey indicated they are setting their pricing assumptions based on "then current" market conditions. The other half use either long-term estimates or a blend of the two approaches, which can entail calculating hedge costs on current assumptions and long-term estimates, then taking an average, or assessing on both bases. Regardless of approach, almost all companies indicate that they run a series of sensitivity tests that they use to assess the impact of changing market conditions on profitability.

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When analyzing the basis for setting risk-neutral assumptions, *Exhibit 2* illustrates historical market data with respect to risk-free rates and the S&P 500 implied volatility. A comparison of the risk-free rates and implied volatilities ranging from 6/30/06 to 9/30/09 (those shown for 3/31/09 represent current market conditions in the GMWB survey) shows stark differences.

The significant differences in the level of swap rates and implied volatility give rise to arguably the biggest pricing assumption that companies are currently facing. Using market conditions in the October 2008 to March 2009 time frame would result in severely higher hedge costs that, if assumed in the pricing, ultimately need to be passed on to the policyholder to make writing the GMWB rider a profitable venture.

Alternatively, if one used long-term estimates that produced considerably lower provision for hedge costs, profitability assessed on current market conditions would be very poor. *Exhibit 3* below illustrates the theoretical risk-neutral hedge costs for a typical GMWB rider that would be calculated if economic conditions were calibrated to the pricing dates below.

Companies must determine the assumption for late-tenor volatility (after 10 or 15 years for the S&P generally less for other indices) as liquid and active markets for volatility do not currently exist at the longer tenors. We have seen three methods used to set implied volatility for later tenors (i.e., ultimate volatility):

- Grade from longest-credible market-observable tenor to a target value.
- Hold level at the longest-credible market-observable tenor.
- Use level volatility throughout. (This approach is generally associated with companies that use long-term estimates.)

The majority of companies in the GMWB Survey indicated that they used the first method (i.e., grading to target value). Several different methods of setting the target value were noted, including using an average of historical implied volatilities and historical realized volatility with a margin.

Exhibit 02. Summary of Economic Conditions Over Time

Tenor	Swap Rates								S&P Implied Volatility							
	6/30/06	12/31/07	9/30/08	10/31/08	12/31/08	3/31/09	6/30/09	9/30/09	6/30/06	12/31/07	9/30/08	10/31/08	12/31/08	3/31/09	6/30/09	9/30/09
1	5.69	4.22	3.96	3.17	1.27	1.18	.88	.63	15	22	27	41	35	37	28	27
5	5.65	4.18	4.09	3.84	2.10	2.23	2.97	2.64	16	25	28	36	35	35	30	30
10	5.73	4.67	4.49	4.46	2.49	2.90	3.78	3.44	19	27	30	36	34	34	32	32

Exhibit 03. Risk-Neutral Hedge Costs for Typical GMWB Rider

Theoretical Pricing Data	Hedge Costs (bps)
12/31/07	56
12/31/08	133
3/31/09	105

Towers Watson Perspective

Given that market conditions change frequently, we would set forth the following considerations when pricing living benefit riders:

- Develop a company position for long-term economic assumptions on which risk-neutral scenarios are created. This may consist of a fair amount of margins, perhaps based on a tail level of historical implied volatility. These assumptions should be revisited periodically.
- The product should be priced to meet targeted profitability levels with these long-term estimate assumptions.
- We also recommend that profitability be assessed periodically (e.g., monthly) at current market conditions. The profitability, assuming current market conditions, would inform senior management about the profitability of current sales. It should achieve some minimum level of profitability (as determined by the company, based on its risk tolerance and threshold). This would allow for potential management action if profitability fell below these thresholds for more than a certain period (or by a specified amount), and action could be taken (i.e., raise price, pull product, limit sales). The relationship between target and minimum profitability needs to be carefully delineated.

Approaches to Setting Capital

Methods to calculate capital for pricing GMWB riders are evolving and currently in flux. Common industry practice is to leverage off the C3 Phase II (C3P2) results, either by using a multiple of CTE(90) or the CTE(98) value. Some companies also indicate that they are using their internal economic capital formula. Ideally, companies would use the same methodology for capital that they use for point-in-time valuations. In a pricing context, that would require a stochastic-on-stochastic framework to determine capital for pricing GMWB riders. However, this approach is not yet prevalent; lack of computing power was cited as the primary issue for not determining capital using stochastic-on-stochastic methods.

Therefore, most companies are still employing a factor-based approach to setting capital in pricing, although the factors are often informed by the company's C3P2 results. The level of sophistication varies, with some companies using factors that vary by key drivers: generally duration, "in the money" level and, perhaps, issue age.

Another consideration is whether the capital charge will be based on the stand-alone product, all VA new business issued or, possibly, combining with a larger block of VA business (i.e., all GMWB in force). Finally, one must also consider the degree of diversification benefit versus other risks, particularly when an economic capital approach is employed to set capital levels.

In the GMWB Survey, we asked companies to provide the level of capital they were assuming in pricing, expressed on a present-value basis as a percentage of account value. Most companies reported that the average amount of capital they held fell between 1.0% and 1.9%, or 2.0% and 2.9%, of account value in pricing, although there were outliers above and below this range.

Hedge Effectiveness Assumptions

As indicated previously, companies typically make provision for hedge ineffectiveness by allowing a portion of real-world claims to flow through their integrated base product and rider pricing. Different hedge-effectiveness assumptions are generally used for the base pricing (often a mean calculation) and the capital determination (a tail metric). Intuitively, a lower degree of hedge-effectiveness is generally assumed for capital reflecting the lower-expected hedge coverage in the most adverse scenarios.

The level of assumed hedge effectiveness would also be expected to vary depending on the type of hedging program employed. A program only hedging *delta* would be expected to have a lower degree of hedge effectiveness compared to a program that employed full three-Greek dynamic hedging.

Almost half of the companies in our survey assume 100% hedge effectiveness for mean pricing, with a lower number assuming only 75% effectiveness. Assuming 100% effectiveness — that hedging will remove all of the cost — is optimistic in our view. We recommend that hedging effectiveness assumptions be less than 100% (e.g., 85% to 90%, at most). For capital, half of the survey respondents indicated their assumed level of hedge effectiveness was less than 75%; the others ranged between 75% and 100%.

We would expect companies to continue to monitor the level of hedge effectiveness they have achieved in their hedge program and use more recent results to determine whether they should update their assumptions in pricing.

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It is critical for GMWB pricing to reflect actual GMWB hedging practices.

Hedging Strategies for GMWB Riders

In the GMWB Survey, while most companies responded that they were pricing toward supporting full three-Greek hedging, companies also responded that full hedging of Greeks was more common for *delta* and *rho*, while *gamma* and *vega* were not hedged as completely, whether subject to wide trading limits or hedging targets short of full coverage. For *vega* in particular, the majority of companies in the survey did not undertake an active dynamic hedging strategy, but instead obtained *vega* coverage through exposure to one-off transactions in long-dated put options.

In addition, a few companies that responded indicated that they employed a dynamic *gamma* hedging strategy transacted in relatively shorter-dated options to lessen transaction costs.

The GMWB Survey showed that companies transacted in a wide variety of hedging instruments to hedge GMWB riders. The table below lists the major hedging instruments used to obtain primary and secondary exposures to Greeks.

Deep, liquid markets make index futures the primary hedge asset to hedge liability *delta*. A minority of companies used total return equity swaps to gain *delta* exposure. Secondary *delta* exposure was gained through long-dated put option trades, typically encountered in transactions aimed at mitigating *gamma* or *vega* exposures. Interest-rate swaps were the most popular hedging instrument to obtain *rho* exposure, followed by bond futures. Most companies hedged *vega* exposure through long-dated put

options. In the industry, dynamic hedging of *gamma* risk is rare, but when executed, shorter-dated options are traded.

Effectiveness of Hedge Programs

Hedging program effectiveness garnered a lot of attention in the wake of the financial crisis. The crisis created the “perfect storm” for equity risk management departments, with historically high equity volatility rates, a low interest-rate environment and depressed equity prices all occurring at the same time.

One major component of hedge ineffectiveness receiving heightened attention lately is basis risk, in which the selected hedging indices do not effectively track the performance of the funds underlying the VA contract. The relationship between selected hedging indices and underlying fund returns is typically derived by ordinary least-squares regressions, with the strength of the relationships quantified by R² values. A reduction in these R² values can have deleterious effects on VA hedging programs, as the hedging indices can no longer accurately explain movements in the underlying subaccounts. The selected indices are particularly susceptible to tracking error during periods of heightened market volatility, and can warrant more frequent refreshing of the regression analysis.

Another major contributor to hedge ineffectiveness involves the breakdown of fund correlations. The hedgeable equity indices associated with the funds underlying the VA contract exhibit historical correlations that are impounded within VA hedging models. These correlations provide a “benefit of diversification” that reduces the impact of negative market

movements on the fair value of VA contracts. In reality, however, in extreme downward market movements, correlations tend to converge to 100%, thus reducing this diversification benefit. Many VA writers experienced this phenomenon in 2008 and 2009.

While most VA hedging programs have been plagued by basis risk and the breakdown of correlations, the observed effectiveness of hedging programs has been mixed, as performance has varied across the industry. Companies favoring a multi-Greek program inclusive of second-order Greeks (such as *gamma*) often demonstrated better hedging performance than companies that employed a *delta*-only strategy. A number of companies traditionally engaged in three-Greek hedging made a strategic decision to leave *vega* underhedged, due to the historically high cost of equity options.

Another noteworthy issue is that different companies may be hedging to different targets, such as mitigating GAAP earnings volatility or reducing capital requirements. It is important to observe that hedging GAAP earnings volatility (median) is not necessarily synonymous with hedging “tail” risk.

Through it all, however, as our recent CFO survey reported, only 6% of respondents were dissatisfied with the performance of their hedging programs, post-financial crisis. This indicates that while hedge breakage and ineffectiveness were realized, CFOs continue to value hedging programs as a viable market risk management function for variable annuity guarantees.

Hedging Instruments Employed for GMWB Riders

Greeks	Index Futures	Total Return Swaps	Options	Interest-Rate Swaps	Bond Futures	Interest-Rate “Swaptions”	Variance Swaps	Total
Delta	9	1	5	—	—	—	—	15
Gamma	—	—	5	—	—	—	—	5
Rho	—	—	1	9	4	2	—	16
Vega	—	—	8	—	—	—	1	9

Industry Responses to Economic Conditions

Companies in the industry responded to the recent market conditions in several ways. Some companies pulled back dramatically: dropping riders, removing some of the richest features. Others instituted large fee increases for their products. Over the last few months, we have seen many new product releases that generally involve product de-risking:

- Significant fee increases (it is now not uncommon to see fee levels on riders of 100 bps or more)
- Removing or scaling back costly GMWB features, often the roll-up benefit
- Modifying other features, such as increasing the minimum age for 5% lifetime withdrawals from age 60 to age 65
- Adding or enhancing asset allocation restrictions (although mandatory asset allocation was not uncommon prior to the economic downturn, it is now much more prevalent — also, lower limits on the maximum percentage of equities have been implemented)
- Not allowing allocations to overly volatile funds, or funds that did not track well to selected hedging indices, if the underlying VA contract has the guarantee

Despite the changes, the GMWB features still are fairly rich (e.g., a number of companies continue to offer a 6% roll-up benefit) and continue to present exposure to equity market risk (although the higher fees have helped mitigate this somewhat).

In almost all cases, prices for these product features have been set based on the new pricing paradigm, instituting an assessment of market conditions in the current environment.

About Towers Watson

Towers Watson is a leading global professional services company that helps organizations improve performance through effective people, risk and financial management. With 14,000 associates around the world, we offer solutions in the areas of employee benefits, talent management, rewards, and risk and capital management.

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Industry: What Do We See Going Forward?

Going forward, we see several different areas of activity:

- Continued work on product redesign — carrying on the de-risking theme. This may include adding more index funds that can be more effectively hedged or offering funds that hedge within the fund. We also see greater use of a current and guaranteed rider charge structure (i.e., rider charges not fixed for the lifetime of the product, with the insurance company able to change them periodically, up to a guaranteed maximum). This may be tied to observable economic factors, such as the level of risk-free rates or a volatility index.
- A period of more favorable economic conditions could tempt the industry to move back to richer features, although it does appear the industry will continue de-risking.
- We believe there will be more focus on total fee and charge levels. Although consumers have appeared relatively insensitive to rider fee levels in the recent past, the move of rider charges to the triple-digit range may push total fees outside of market competitiveness. The key is finding the right mix of benefit and cost that works in the marketplace. Insurers may need to consider other ways to reduce fees (for example, lowering fees on the base product) to maintain an attractive product for a broad range of customers.

In general, we believe that companies now are doing more complete and market-based analysis of the key factors underlying their VA rider pricing, thus enabling them to better understand the risk versus reward trade-off.

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