Milliman Research Report

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Milliman

The VA Industry: An Analysis of Recent Activities

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EXECUTIVE SUMMARY

Since Milliman published its last report on the performance of hedging programs in December, the market environments have seen significant changes, and market players have reacted with different measures.

In December 2008, Milliman published the research report *Performance of Insurance Company Hedging Programs During the Recent Market Crisis*. That report was well received by the variable annuity (VA) industry. Since then, the market environments have seen significant changes, and market players have reacted with different measures. This paper analyzes the interactions in the recent market in the following areas:

- Based on Milliman's study of VA writers with hedging programs, the hedging programs have been about 94% effective in achieving their designed goals during the November 2008 through March 2009 period.
- Significant refinements and expansions of existing hedging programs have been explored and implemented. These changes enhance the earnings of VA writers through better management of basis mismatch, interest rate hedging strategy, volatility assumptions, and investment strategy of hedge assets.
- The *arms race* in richness of product features has ceased as a result of the financial crisis. Simpler product designs with higher fees are becoming the new product trend.
- There was a flurry of mergers and acquisitions (M&A) activities, with no successful transactions. That dynamic is bound to change. The financial crisis stands to weed out weaker players in the market, and leave stronger and bigger surviving VA writers with viable products and robust hedging programs.
- Reinsurance and structured derivative solutions became less available again as a result of the financial crisis. This has prompted VA writers to reevaluate their entire risk management strategies to be more self-reliant.

HEDGE PERFORMANCE

Recent capital market movements have substantially increased VA guarantee liabilities. The major drivers are equity levels, interest rates, volatility, and exchange rates.

Since our study of the period of September and October 2008, the capital market has further declined, with continued high volatility.

To mitigate the risks from capital market movements, nearly all major VA writers have implemented hedging programs. There are many forms of hedging programs aimed at protecting different risk exposures. The most common are:

- **Delta/Rho hedging**, which protect against equity and interest rate movements
- **Delta/Vega/Rho hedging**, which protect against equity, interest rate, and implied-volatility movements

To mitigate the risks from capital market movements, nearly all major VA writers have implemented hedging programs.

We have focused our study on the aggregate profits and losses (P&L) for the companies within the period between November 2008 and March 2009. We found that hedging has been on average about 94% effective in recouping the capital market losses that hedging programs were designed to protect during this period. Together with payoffs from earlier months in 2008, the hedging programs have helped VA writers avoid the need for federal rescue.

The study considers only those risk factors that an insurer deliberately hedged. As we will discuss in the remainder of the report, insurers did not fully hedge their market risk exposures, and unhedged risk exposures will generate losses in a market decline. The challenge of insurers is to continue to identify areas of risks that are not currently hedged and expand hedging programs to protect their bottom line.

Senior management often focuses on how much a hedging program has recovered total losses experienced by a company. There are two parts to this question: first, how effective is the hedging program in recovering losses it is designed to cover; second, how much loss is not covered by a hedging program. Our study answers the first question and not the second, which varies widely from company to company.

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One can reach totally opposite conclusions if these two questions are not fully explored. Suppose a company incurs a loss of $1,000, of which $400 is supposed to be covered by its hedging program, and the balance of $600 is unhedged. Assuming the hedging program pays off $360, one would say that the hedging program has been 90% effective (360/400) in achieving its goals. The question would be how to expand the success of the hedging program to the $600 that is unhedged, therefore improving the overall financial results.

Without distinguishing these two questions, however, one could argue that the hedging program is not very effective because it only recovers $360 of $1,000, and the company still suffers $640 of loss. One may further decide to shut down the hedging program, which would even take away whatever existing protection the company currently has.

Fortunately, almost all major VA writers now begin to realize the bifurcation of the hedge effectiveness measurement, resulting in expansion and refinements of existing hedging programs.

HEDGING STRATEGIES

While hedging programs have been quite effective in achieving their goals, there is no protection for exposures that have not been hedged. The recent financial market crisis is multi-faceted, and there have been areas where VA writers did not place a hedge and suffered losses.

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The financial crisis has served as a great learning opportunity for many VA writers, who have tightened their hedging programs since the crisis hit. The most notable areas of improvements are in the management of:

- Basis mismatch
- Interest rate risk
- Valuation volatility assumption
- Hedging asset investment

Refinements in these areas further tighten hedging programs for significant areas that were not hedged before. With clever interest rate risk and hedging investment asset management, prudent VA writers with robust hedging programs also stand to receive gains beyond what the conventional risk-neutral valuation framework would have anticipated.

Basis mismatch management

Basis risk was a significant problem for many VA writers in 2008, and has continued to be a major challenge in 2009. The majority of invested funds in VA contracts have some active components. However, VA writers need to use widely held indices to hedge risks. This introduces basis mismatch when the actual performance of funds deviates from the expected indices movements. Some big writers had losses in the neighborhood of $100 million because of basis mismatch during 2008.

Historically, several approaches have been available to map the performance of a mutual fund to liquid, hedgeable indices, such as linear regression with constrained optimization, dynamic analysis, credibility weighting returns, and qualitative judgment. These approaches may be deficient in helping VA writers appropriately hedge guarantee exposures associated with a given fund because these approaches are fundamentally based on historical return information. Statistical tools work fine with these backward-looking approaches. However, fund managers can make style changes, and concentrated sector or positional bets, which are difficult to detect from statistical analysis of historical returns. The limitations of the existing fund-mapping approaches contribute to the discrepancy between the expected index movements and the actual fund returns.

The period of 2008 and into the early part of 2009 provides an interesting example of this mismatch. For many active managers, 2008 was a poor year. Fund managers accumulated positions far from their benchmarks. Performance across different sectors varied widely, and the market environment magnified the impact of sector and position bets. High market volatility contributed to high basis volatility. VA guarantees going in-the-money created large liability deltas, which exacerbated the income statement impact of basis mismatch.

The current framework for basis risk management of VA products is inadequate. Funds are chosen independently of hedging considerations, use of historical return data to map funds to hedgeable indices are backward-looking, and fund managers are unaware of the needs of the VA market, which, ironically, is an important source of its business.

A holdings-based approach can solve almost all of the problems associated with the current framework of basis risk management. This approach seeks to analyze the component holdings of mutual funds, and apply the component information to each policyholder. Overall risk is aggregated by block of business, and translated into specific trade recommendations by mapping the aggregated holdings to tradable hedge instruments.

Mutual fund companies are required by law to file their holdings on a quarterly basis with the SEC in the N-Q form. Many mutual funds also provide more frequent updates to commercial data providers. It is also in the best interest of fund companies to provide this data so that their funds have greater chances of acceptance in the VA marketplace. This is a mutually beneficial platform between VA writers and fund managers.

Since the holdings-based approach uses direct information on the fund's composition, important risk dimensions that would have been obscured by aggregate statistics can be identified. Risks such as style shifts, credit exposure, implicit or explicit currency exposure, and positional bets can be identified at an early stage. This improves the VA writer's ability to hedge more precisely, budget risk, assess suitability of specific funds, and react quickly to fund-manager decisions.

Fundamentally, the traditional fund-mapping approach is a backward-looking, black-box approach. The holdings-based approach is forward-looking by understanding the components of the funds in a VA product. The new approach can provide much more insight for the risk management process.

Interest rate risk management

Interest rate exposure is another important aspect of VA guarantees. Particularly with the introduction of lifetime guarantees, the length of guarantee liabilities has become very long, which further increases the interest rate risk exposure. From the beginning of 2008 to the end of the first quarter of 2009, the three-month U.S. Treasury rate has fallen from 3.26% to near zero. This has significantly increased the fair value liabilities of VA guarantees.

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Given the current low interest rate environment, many companies that implemented Rho hedging early on have made an interesting decision: they unwound their Rho hedge positions. The reasoning for this decision is that the current interest rate environment is already very close to a zero interest rate environment. Because nominal interest rates can never be less than zero, the Rho hedging strategy has essentially realized its maximum benefits. This is different from Delta hedging, where the equity market can still decline materially, despite its recent free fall.

For those Rho-hedging companies that have chosen to unwind, it is common to set up a threshold where Rho hedging would be reinstated. A typical threshold is something like "restart Rho hedging positions when the 10-year Treasury rate is above 4%." Any reduction of the guarantee liabilities that is due to the increase of interest rates from current levels to the threshold would be recorded as a gain to the VA writer with this type of strategy.

Companies have also learned other good lessons from the market turmoil in terms of Rho hedging. Refined key-rate Rho hedging has been particularly popular.

The vast majority of VA writers use the swap rates as the risk-free rates in their hedging programs. A total Rho calculated from parallel shifts in the swap rates does not capture the impact of the swap curve twists on the liability valuation. From early on, many companies have recognized this shortcoming of relying on the total Rho. To compensate, companies have also calculated key-rate bucket Rhos. For example, key-rate buckets are calculated by shocking each three-year maturity bucket such as 1-3, 4-6, 7-9, 10-12, 13+, etc. Often the interest rate sensitivity is concentrated in one or two buckets, and only the swaps or interest rate futures in those buckets are traded.

This approach worked quite well in calmer markets. However, the market turmoil experienced since 2008 is anything but calm. Interest rates also moved dramatically during this period. In addition to significant overall drops, the shape of the swap curve also changed drastically. The traditional Rho hedging approach produced noticeable leakage during this period because of this. To contain the risk, companies have taken measures to refine their key-rate Rho hedging strategies.

A typical key-rate Rho hedging refinement works like this. The company has key-rate buckets in 1-3, 4-6, 7-9, 10-12, and 13+ years of maturity. The 10-12 year bucket was determined to have the most sensitivity. In the past, only a 10-year swap was set up for the total Rho. In the refined key-rate Rho hedging strategy, the 10-12 year bucket was further broken down to 10, 11, and 12 years of key-rate Rhos and hedged separately. In addition, key-rate Rho hedges were also set up for the other buckets. Through this refinement, a company could reduce its interest rate hedging errors by over 80%.

Milliman Guarantee Index

Life insurers, subject to U.S. GAAP accounting, are currently valuing VA guarantees using methodologies that do not reflect the lack of liquidity of the guarantees. Also, commonly used methodologies do not reflect the insurers' risk-adjusted expected cost of paying claims associated with the guarantees. Milliman has introduced an improved methodology for VA guarantee valuation under Financial Accounting Standards Board Statement 157 (FAS 157), where Milliman Guarantee Index (MGI) is used as valuation volatility. This methodology follows recently released guidance in the position paper FAS 157-3.

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Today, VA writers commonly use data from the over-the-counter (OTC) options market for volatility parameters when valuing guarantees. However, there is a fundamental disconnect between the OTC options market and VA guarantees. The OTC market is dominated by hedge funds and investment banks that are exposed to forced liquidation. For example, hedge funds, using leverage provided by prime brokers, manage options-based investment strategies. Declines in the mark-to-market value trigger forced liquidation of option positions. Aggregated across the investment bank and hedge fund community, exposure to forced liquidation commonly triggers cycles of volatile option price movements. A particularly severe spike in option prices was observed in September and October 2008 because of these liquidity factors.

VA guarantees have no liquidity. Given that VA guarantees have no cash value, life insurers are not exposed to forced liquidation. There is a substantial liquidity premium built into OTC options prices. Reflecting this premium in VA guarantees distorts the financial condition of life insurers and risks misleading public investors.

In addition, the use of OTC option prices is a structurally inappropriate reference point for VA guarantee valuation for other reasons. VA guarantees are commonly 20- to 30-year options. The OTC options market is generally a one- to five-year market. There is no basis for extrapolating OTC volatilities to such long maturities.

FAS 157-3 appears to provide justification for a new approach to fair valuation of VA guarantees, addressing valuation for instruments when a market is not active. Given that there is no activity in the OTC options market in the 20- to 30-year maturity range, and given that the liquidity characteristics of VA guarantees do not match those in the OTC options market, life insurers are justified in applying the guidance in FAS 157-3 to VA guarantee valuation.

In particular, the paper notes that, "In determining fair value for a financial asset, the use of a reporting entity's own assumptions about future cash flows and appropriately risk-adjusted discount rates is acceptable where relevant observable inputs are not available.... Regardless of the valuation technique used, an entity must include appropriate risk adjustments that market participants would make for nonperformance and liquidity risks."

The MGI provides volatility parameters necessary for VA guarantee valuation on a monthly basis with a risk adjustment that reflects the uncertainty in the ultimate cost for life insurers of funding VA guarantee claims.

To construct the monthly MGI, market data is reflected in an analytical process that produces a one- to 30-year term structure of volatility for the following indices:

- S&P 500
- Russell 2000
- NASDAQ 100
- EAFE
- Lehman Aggregate

In addition, the index includes a correlation matrix developed from the underlying data.

The foundation for the index is a GARCH(1,1) model calibrated to historical data. Additionally, Milliman conducts monthly surveys of MGI subscribers to compile price and volume information on their hedge transactions. The index result reflects both the market data used in the GARCH(1,1) stochastic volatility calibration process and the transactional data from the survey.

Based on the FAS 157-3 guidance, such risk-adjusted term structures are appropriate for financial reporting of illiquid financial instruments for which there is no corresponding liquid asset market. The term structures created follow from the current volatility level, the volatility of volatility, the mean reversion rate, and the long-term target volatility.

Another key benefit of the MGI is that it provides a platform on which the financial results of all VA writers can be compared. As the chart in Figure 1 shows, products from different writers can be compared on the same basis on the MGI platform.

FIGURE 1: SAMPLE ANALYST AND INVESTOR REPORT

LIFE INSURER	VA PRODUCT	GUARANTEE CHARGE	MG-INDEX EXPECTED HEDGE COST
ABC LIFE	SECURE RETIREMENT GMWB	0.65%	0.04%
DEF LIFE	INDEPENDENCE GMAB	0.55%	0.40%
XYZ LIFE	ADVANTAGE LIFETIME GMWB	0.70%	0.95%

The VA industry has welcomed the MGI warmly. Since its introduction at the end of 2008, six major VA writers have already subscribed to the MGI for their VA guarantee pricing and valuation purposes. It is anticipated that more will follow.

Investment in corporate bonds

Almost all major VA companies have implemented some form of dynamic hedging. In theory, dynamic hedging requires borrowing and investing at the risk-free rates. This requirement is necessary so that cash is always available for the rebalancing of hedging positions. The current financial environment, however, provides some companies with an attractive alternative.

Almost all major VA companies have implemented some form of dynamic hedging.

For many companies that implemented effective hedging programs before the financial crisis hit, a large sum of payoff from the hedges has been received as a result of the equity market decline, interest rate reduction, or the implied volatility increases. Some companies have collected as much as $2 billion to $4 billion from the payoffs. In the meanwhile, the credit spreads for high-quality corporate bonds has widened significantly. A-rated corporate bonds are currently yielding 300 to 400 basis points over Treasuries.

Companies with large payoffs could still invest that money in risk-free assets. However, some are willing to take on what they view as a relatively low amount of risk and increase their return by investing in high-quality corporate bonds. This approach takes advantage of the opportunities unique to the current capital market conditions in three ways. First, because the VA guarantees are very deep in-the-money because

of the recent market downturn, they are unlikely to recover to being at-the-money in a short period of time. This means that a portion of the hedge payoff is not immediately needed and therefore available for longer-term investment. Second, there is historically a wide credit spread for corporate bonds on the market. Third, as the market recovers, the credit spread for corporate bonds will almost certainly narrow, leading to a gain for the company.

This approach can generate significant savings for VA writers in the right condition. This could save a company with $2 billion to $3 billion of liabilities over $150 million dollars without much added exposure.

PRODUCTS

VA product evolution was characterized by an *arms race* among VA writers up to the last quarter of 2008. VA writers were offering increasingly rich benefit designs. We saw the appearance of up to 7% annual roll-up benefit designs. Some companies even offered *10-year doubler* or *15-year tripler* types of designs. These are equivalent to about 7.2% annual roll-up rates and 7.6% annual roll-up rates.

The *arms race* has been put to an abrupt halt since the fourth quarter of 2008. Instead, most VA writers have been busy scaling back on their product designs and increasing their fees. According to Milliman's research of SEC product filings, there are 33 companies modifying their VA product offerings through May 16, 2009. Of these, 29 have planned a fee increase and 19 have planned a scaleback on their product designs. There are also 10 companies restricting their asset allocations. The chart in Figure 2 shows the details of these companies' actions.

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FIGURE 2

CHANGE CATEGORY	# OF PRODUCTS	# OF COMPANIES
SALES DISCOUNTED OR RESTRICTED	42	18
FEE INCREASED	62	29
PRODUCT FEATURES SCALED BACK	44	19
ASSET ALLOCATION CHANGED/RESTRICTED	16	10
TOTAL	125	33

Many companies also have planned multiple actions in response to the market conditions, as shown in the table in Figure 3.

FIGURE 3

# OF CHANGES (FROM THE ABOVE 4 CATEGORIES)	# OF PRODUCTS	# OF COMPANIES
1	90	15
2	31	15
3	4	3
TOTAL	125	33

Given the increased hedging cost that is due to high volatility and a low-interest-rate environment, one can reasonably expect VA writers to take measures such as benefit scaleback and fee increases in response. However, it is probably more important to take a hard look at the pricing models that led to the *arms race* in the first place

The capital market upheaval has captured the public's attention recently, but policyholder behavior risks have always been a part of the VA product pricing and hedging process. The pricing models for the vast majority of the VA products on the market now assume that certain levels of surrenders will occur over the lifetime of the product. However, if the assumed surrenders do not materialize, the product can be seriously underpriced.

As an example, for a typical guaranteed minimum accumulation benefit (GMAB) product with 80 basis points (bps) of hedge cost assuming annual 8% surrender rates over 10 years, the hedge cost would be over 180 bps if no surrender is assumed.

Moreover, policyholder surrender behavior is not something that a VA writer can control, nor is it something that a VA writer can diversify away. VA writers need to reexamine the assumptions underlying their pricing models and ask themselves if those assumptions are realistically going to materialize, and what would happen if they didn't.

VA guarantees were initially introduced as a floor of protection that still allows policyholders upside potentials. This philosophy makes sense both for policyholders and VA writers. However, competition pushed VA writers to offer richer and richer benefits, to the point where the VA guarantees were no longer the floor, but the actual expected benefits. It is encouraging that the current product trend is to revert to the original fundamentals of the VA guarantees.

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M&A

In the past six months, there has been a flurry of M&A-related activities in the VA industry. Some companies are public about their talks on M&A deals, and many more activities are shrouded in secrecy.

Unfortunately, there has not been a successful transaction to date. The current VA market consists of a long list of sellers shouting out to buyers who are just not available. This is especially pronounced given public announcements of prominent companies exiting the VA market.

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Retirement savings will continue to be a growing need in the United States as Baby Boomers approach their retirement ages. VA with guarantees will still be a valuable tool in achieving retirement income security.

VA sales growth really took off in the past 10 years, offering compelling benefits to policyholders that no other investments have: the upside potential with floor protection guarantee. In order to back up the guarantee, hedging programs are needed.

The business model of providing floor guarantees with hedging is still a workable one. The issues some companies have run into are basically by deviation from this business model. Floor protections are good, but that does not mean the guarantee can be so rich that there is little chance of upside beyond the floor. Hedging programs work well in protecting the risks they are designed to protect, but hedging programs are useless for risks that are not hedged.

We believe the current M&A activities will lead to further consolidation of VA writers. Companies that have the right products and proper hedging programs will emerge from this round of financial crisis as stronger and bigger VA writers. Companies that fail in either product or hedging will find themselves retreating from the VA market.

AVAILABILITY OF REINSURANCE AND STRUCTURED SOLUTIONS

Reinsurance and structured derivatives from investment banks have been a part of the risk management strategies of many VA writers. While they worked in some cases, the financial crisis has caused many reinsurers and investment banks to withdraw from this market.

With reinsurance, VA writers can pass the claims of a portion of the business in exchange for a fixed annual fee. This is attractive to VA writers because reinsurance fully transfers the VA guarantee risks and the cost is sometimes quite attractive.

However, reinsurance solutions are not always available. Historically, many VA writers relied on reinsurance for VA guarantee risk management up until 2003. By 2003, all major reinsurers left the VA reinsurance market as a result of the last recession, causing major difficulties for some VA writers. In the years that followed, reinsurance was simply not available for VA writers. By 2007, reinsurers had gradually reentered the market, and prices of reinsurers became at times quite competitive. However, as a result of the recent financial crisis, many reinsurers have again begun to withdraw from the market, the most prominent example being Swiss Re. The prices from remaining VA reinsurers are generally not attractive to direct VA writers.

A similar story has also happened to structured solutions from investment banks. Many banks are exiting the market or quoting prohibitively high prices as a result of corporate headquarters' overall pullback in risk tolerance, often not directly related to the specific business written to VA writers.

Reinsurance and structured derivatives can be a valuable weapon in combating the risk management problems encountered by VA writers. However, the availability issue associated with reinsurance and structured derivatives means that they cannot be the cornerstone of any VA writer's risk management strategy.

Reinsurance and structured derivatives can be a valuable weapon in combating the risk management problems encountered by VA writers. However, the availability issue associated with reinsurance and structured derivatives means that they cannot be the cornerstone of any VA writer's risk management strategy. It is critical for a VA writer to have its own hedging capability. A VA writer that builds a dynamic hedging infrastructure in conjunction with a reinsurance or structured derivative strategy is much better prepared than one that relies almost entirely upon reinsurance or structured derivatives. When reinsurance or a structured derivative is unavailable or unattractive, it is much easier to shift more weight upon an existing dynamic hedging infrastructure than to build one from scratch. When reinsurance or structured derivative solutions are attractive, the VA writer can dial back its internal hedging program and take advantage of those opportunities.

CONCLUSIONS

Hedging programs have been quite effective in protecting the risks they were designed to protect. The refinement and expansion of existing hedging programs is necessary for future vitality of the VA industry. The recent financial crisis is harsh and will undoubtedly weed out some weak players in the VA market. However, the economic fundamentals for VA products are still sound. We believe VA writers that stick to the basics of VA product designs and have a robust hedging program will emerge from this financial crisis bigger and stronger.

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