

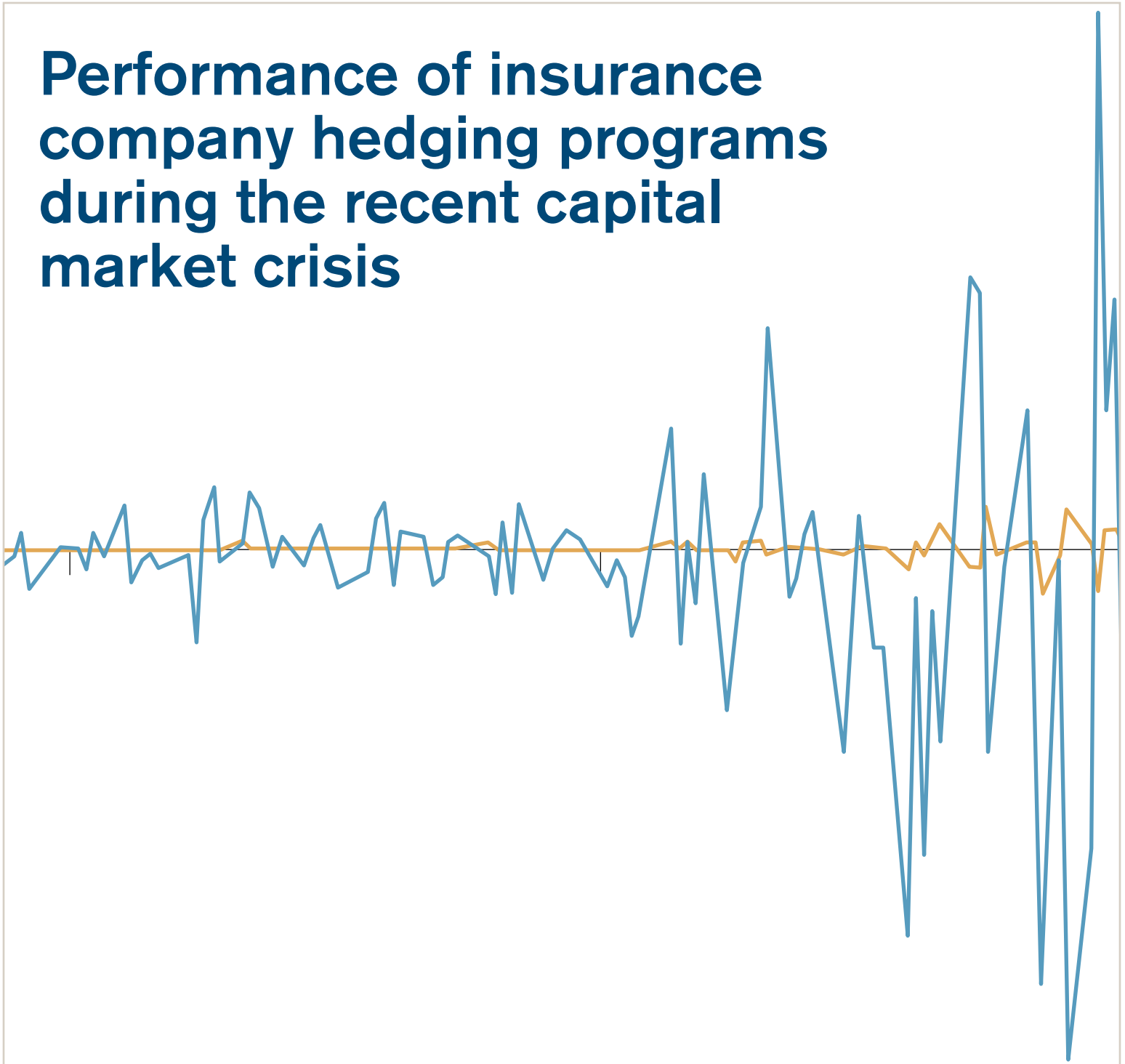
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Performance of insurance company hedging programs during the recent capital market crisis





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EXECUTIVE SUMMARY

Most major VA writers have implemented hedging programs to protect earnings and capital. How have these programs performed in recent months? How have they weathered the recent high-profile failures of prominent financial institutions? How are VA lines affecting insurance company bottom lines during the most intense bear market in recent memory?

We believe the risk-management structure based on hedging will continue to be a pillar for the VA business.

The recent period of market turbulence has been very severe, and most guarantees embedded in variable annuities (VA) have become in-the-money, meaning that the guaranteed benefit now has greater value than the assets accumulated in the policyholder's account balances. Most major VA writers have implemented hedging programs to protect earnings and capital. How have these programs performed in recent months? How have they weathered the recent high-profile failures of prominent financial institutions? How are VA lines affecting insurance company bottom lines during the most intense bear market in recent memory?

We have analyzed the health of our clients' VAs and their guarantees and used sampling to arrive at some encouraging conclusions.

- Based on Milliman's knowledge of major VA writers, hedging programs have been very effective in mitigating the losses from VA guarantees.
- Based on an analysis of actual results among our clients and on a study of the industry, VA hedge programs have been approximately 93% effective in achieving their goals during the September and October period. Overall, VA hedging programs have saved the life insurance industry an estimated \$40 billion because of hedge gains resulting from the September and October market declines.
- VA hedge programs emphasize the use of the simplest, most liquid and transparent hedge assets available. This emphasis on simplicity has helped the life insurance industry to avoid the pitfalls found in the banking industry. In general, life insurers have avoided the complex financial instruments favored by banks, and they have emphasized redundancy and reliability in their operational processes.
- Guarantees in VA products have demonstrated their value to consumers. These guarantees have protected policyholders' ability to generate a reliable income during retirement.
- This period of market turmoil has served as a test for leakages in existing hedging programs and will prompt insurance companies to further tighten these programs. In particular, insurers realize that there are limits to the equity allocation that can be included in a guaranteed product, and there is a need for reasonably close tracking between funds included in a guaranteed product and hedgeable indexes.
- Market stress has highlighted unhedged risk exposures such as deferred-acquisition-costs (DAC) amortization revenue and guarantees that are not subject to mark-to-market accounting. Hedging activity is likely to increase in an effort to cover these exposures.

We believe the risk-management structure based on hedging will continue to be a pillar for the VA business. We also believe the lessons learned will usher in a period of rapid evolution in product innovation, enterprise risk management, regulation, and accounting, and that VA-type guarantees may eventually be used to protect other kinds of retirement-savings products.

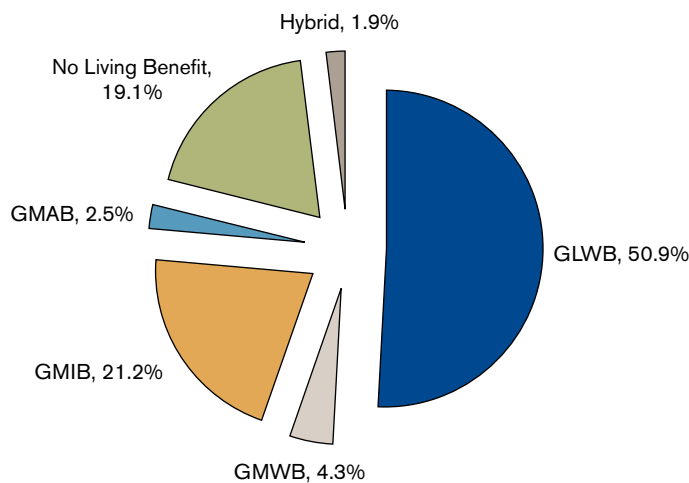
Methodology

This study analyzed the universe of Milliman clients, considering both hedged and unhedged results and results both from Milliman's hedging and from clients' internal use of Milliman software to hedge their own exposure, based on fair value reporting. Industrywide results were sampled from the analysis of clients and from other industry data.

THE VALUE OF A GUARANTEE

While the vast majority of current VA products offer basic return of premium guaranteed minimum death benefit (GMDB) as a default feature, more sophisticated GMDB designs and living benefits, such as the guaranteed minimum accumulation benefit (GMAB), guaranteed minimum income benefit (GMIB), or guaranteed minimum (or lifetime) withdrawal benefit (GMWB, GLWB), are very popular with policyholders. GLWB has been the dominant choice in the past two years, as illustrated in Figure 1.

FIGURE 1: VA LIVING BENEFIT SALES DISTRIBUTION IN SECOND QUARTER 2008



*Source: LIMRA

These guarantees have proven valuable to policyholders during this financial crisis because they offer protection for their investments. Indeed, GLWBs, the guaranteed minimum withdrawal benefits that apply for the life of the customer, are becoming the retirement vehicle of choice around the world. A detailed description of the VA business can be found in Appendix I.

However, the attractive guarantees provided to policyholders create large liabilities to VA writers when account balances are reduced by falling markets to less than the guaranteed benefits. This is the current situation. In the United States, we estimate that the aggregate benefit value exceeds the aggregate account value by about \$232 billion as of October 31, 2008.

These exposures will be reflected on VA writers' financial statements, but the magnitude will not be as high as the exposure because not all policyholders will exercise their guarantees immediately. More importantly, major VA writers have implemented hedging programs to counter this increase in liabilities.

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HEDGING PROGRAM PERFORMANCE

Recent capital market movements have substantially increased VA guarantee liabilities. The major drivers are equity levels, interest rates, volatility, and exchange rates. Appendix II has a more extensive description of the capital market movements.

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

Milliman has been working with most major VA writers. Based on our experience, it appears VA hedging programs have been working as intended.

We have focused our study on the aggregate profits and losses (P&L) for the companies within the September/October 2008 scope of this study. We found that hedging has been on average 93% effective in recouping the capital market losses that hedging programs were designed to protect.

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We have normalized our results to \$1 billion of assets under management as of September 1, 2008. Figure 2 shows the fair-value weekly P&L of the business over the past 12 months on a fully hedged and non-hedged basis. This block of business has a mixture of GMDB, GMIB, GMAB, GMWB, and GLWB benefits. The P&L is very volatile without hedging. Figure 3 shows the results in more details.

FIGURE 2: WEEKLY NET P&L—HEDGING VS. NO HEDGING, NOV. 1, 2007–OCT. 31, 2008

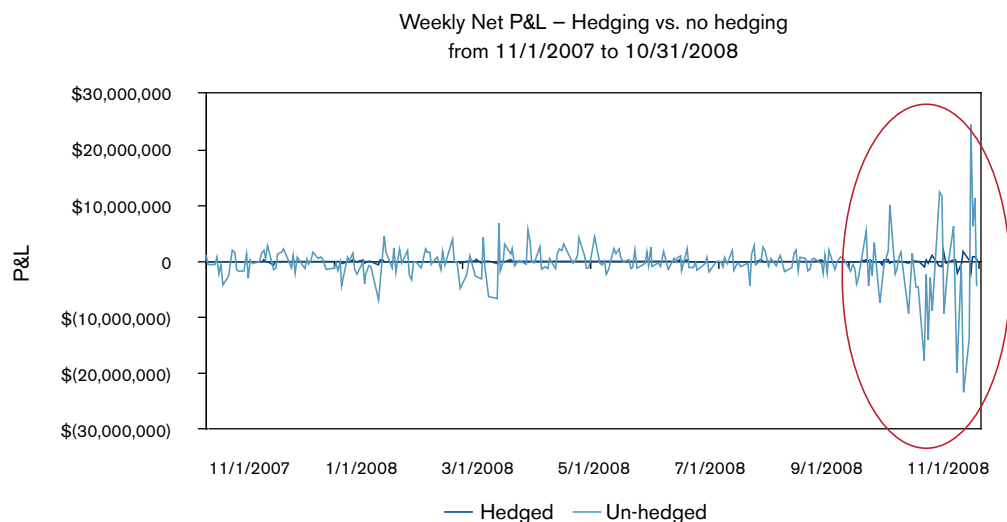
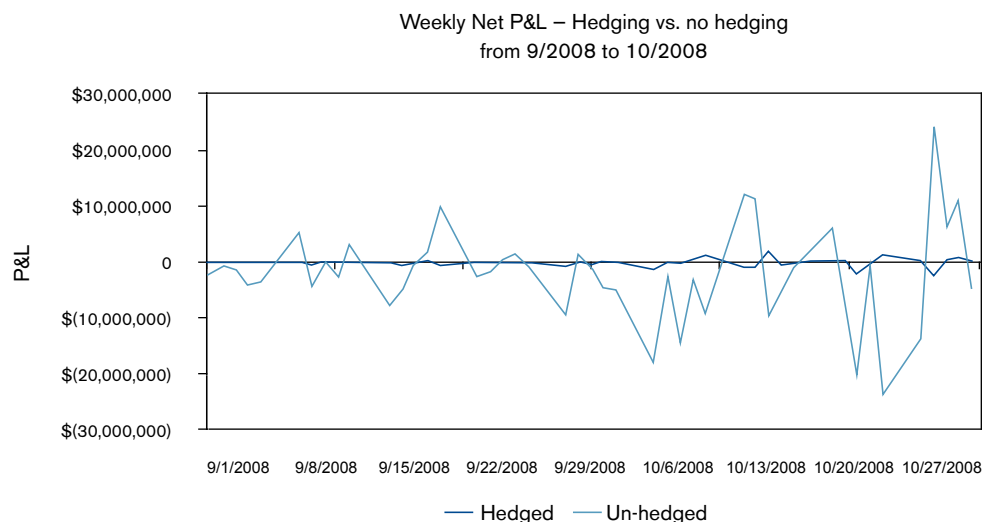


FIGURE 3: WEEKLY NET P&L—HEDGING VS. NO HEDGING, SEPT.-OCT. 2008



The table in Figure 4 illustrates the match between hedged VA guarantee liabilities and hedge assets. These results are drawn from actual hedging programs, and are reflective of typical industry hedging practices. The results have been normalized to \$1 billion of account value as of September 1, 2008.

FIGURE 4: TYPICAL HEDGED LIABILITY MOVEMENTS AND HEDGE PAYOFFS FOR \$1 BILLION ACCOUNT VALUE OVER SEPTEMBER AND OCTOBER 2008 (\$ MILLIONS)

| TIME PERIOD | CHANGE IN HEDGED LIABILITY | | CHANGE IN ASSET | | | | TOTAL | HEDGE EFFECTIVENESS |
|------------------|----------------------------|-----------|-----------------|-----|------|------|-------|---------------------|
| | EQUITY | INT. RATE | VOL | FX | | | | |
| SEP-08 | 20.7 | 11.6 | 3.7 | 0.9 | 2.6 | 18.7 | 90% | |
| OCT-08 | 47.2 | 21.6 | 4.0 | 6.2 | 12.7 | 44.4 | 94% | |
| 9/2008 – 10/2008 | 67.9 | 33.2 | 7.6 | 7.2 | 15.2 | 63.2 | 93% | |

Although each individual VA writer's situation is different, it is clear that most of the hedge payoff in the past two months is due to the movements in equity and foreign exchange (FX) markets. The decline in interest rates and increase in volatility contributed to a lesser degree.

The analysis above 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.

Hedging is not a panacea for all issues encountered in the financial crisis. For example, the dramatic increase in volatility has generated losses associated with unhedged Vega. Similarly, in the time of market turbulence, the correlation among the world economies increased, further contributing to the combined volatility of the overall block, and potentially also contributing to losses in some cases.

The hedging programs run by VA writers are designed to reduce the exposures of insurance companies to capital-market risks. The hedging programs themselves do not seek to generate a profit for the life insurer. This is the opposite of other institutions where complex structures are set up to take calculated market risks in order to profit from market movements. The hedging programs follow clearly defined routines and use simple instruments such as futures contracts and plain vanilla options. This relatively

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simple structure has produced predictable results for life insurers. This contrasts with the experience of investment banks and hedge funds, which utilized more complex securities. These complex securities became difficult to value with diminished liquidity during the financial crisis.

Hedging by life insurers is highly transparent. Its techniques are not trade secrets. They are discussed widely among actuaries, investment professionals, auditors, regulators, consultants, and analysts. This open exchange has led to the formation of industry best practices, which have performed as expected.

EFFECT ON CAPITAL REQUIREMENTS

The financial market crisis has also put stress on the capital requirements of VA writers. In the United States, many companies use hedging as a part of their overall capital management strategy.

In the United States, VAs are subject to a capital requirement known as C3 Phase II. The C3 Phase II amount is determined as the larger of either:

- The conditional tail expectation above the 90th percentile scenario (CTE90)
- The standard scenario amount (SSA)

With the capital-market decline, both the CTE90 and SSA increased dramatically, resulting in an increase in the required capital. Hedging can provide some relief from the increased capital requirement. In addition, the actual capital requirement will vary materially based on the use of reinsurance. Some multi-national insurers pool their VA guarantee exposures from operating companies in a central reinsurance company. If this reinsurer is outside of the United States, these capital requirements are not applicable.

Hedging is most effective in reducing the CTE90 amount. In theory, the CTE90 amount could be reduced to zero if hedging is 100% effective. In reality, imperfections in hedging would reduce the effectiveness. Even when hedging credits are only partially allowed, hedging can still be quite effective in managing the CTE90 movements.

However, hedging is generally not effective in managing the SSA movements.

- First, the standard scenario calculation specifies that only existing hedge assets are accounted for, and that all hedging assets be liquidated by the end of the first projection year. Because of this, no asset rebalancing can be reflected, which effectively removes hedging from the SSA calculations.
- Second, the standard scenario is structured so that the recovery of funds is very slow. The recovery rates in the standard scenario are 3% for equities, 4.85% for bonds, and 3.74% for balanced assets. After the mortality and expense (M&E) charges, guarantee fees, and fund management fees, the growth in account value (AV) is often less than 1% or even negative. On the other hand, current VA guarantees often have roll-up features at 5% or even higher. As a result, there is a growing discrepancy between the benefit balance and account value.

The table in Figure 5 is an illustration of the reaction of a typical block of business to the effect of capital market movement on C3 Phase II capital requirements. This is a block of \$1 billion GMWB issued as of January 1, 2008. The SSA is between 14.9% and 28.1% of the account value in 2008, and is dominating the capital calculation.

FIGURE 5: CAPITAL REQUIREMENT FOR \$1 BILLION OF GMWB WITHOUT HEDGING (\$ MILLIONS)

| WITHOUT HEDGING | STANDARD SCENARIO | | | | |
|----------------------------|-------------------|------------|------------|-------------|-------------|
| | AMOUNT | CTE(90) | CTE(95) | CTE(97) | CTE(99) |
| JANUARY 1, 2008 | 149.0 | 1.2 | 2.4 | 3.9 | 11.8 |
| OCTOBER 31, 2008 | 234.5 | 3.4 | 6.8 | 11.3 | 28.7 |
| INCREASE IN CAPITAL | 85.5 | 2.2 | 4.4 | 7.4 | 16.9 |

The table in Figure 5 is an illustration of the reaction of a typical block of business to the effect of capital market movement on C3 Phase II capital requirements. This is a block of \$1 billion GMWB issued as of January 1, 2008.

The table in Figure 6 illustrates the capital requirement with hedging. Only 50% hedge credits are reflected in the CTE calculations, consistent with common rating agency practice.

FIGURE 6: CAPITAL REQUIREMENT FOR \$1 BILLION OF GMWB WITH HEDGING (\$ MILLIONS)

| WITH HEDGING | STANDARD SCENARIO | | | | |
|----------------------------|-------------------|------------|------------|------------|------------|
| | AMOUNT | CTE(90) | CTE(95) | CTE(97) | CTE(99) |
| JANUARY 1, 2008 | 134.8 | 0.0 | 0.1 | 0.1 | 0.3 |
| OCTOBER 31, 2008 | 217.5 | 0.1 | 0.3 | 0.5 | 1.5 |
| INCREASE IN CAPITAL | 82.7 | 0.1 | 0.2 | 0.4 | 1.2 |

Hedge asset payoffs for this block of business during this period are \$58.1 million. Although hedging can reduce the SSA amount and SSA increases that result from market decline, the effects are limited and hedge payoffs are not enough to offset the SSA increases. However, hedging is very effective in reducing the CTE amounts, particularly the higher-level CTE measures. Additionally, hedge payoffs are enough to offset any increase in the CTE metrics.

Capital is an important factor reviewed by rating agencies, which have been using CTE measures for rating purposes. For example, S&P correlates capital levels of CTE90, CTE95, CTE97, and CTE99 with BBB, A, AA, and AAA capital requirements, respectively. In addition, rating agencies follow the CTE approach regardless of the use of intra-company reinsurance. VA hedging programs have been generally effective in offsetting increased capital requirements under these CTE measures, as illustrated above. Given this, the American Council of Life Insurers is working with the National Association of Insurance Commissioners to propose a temporary suspension of the SSA for 2008 and 2009.

FUTURE PROSPECTS

We believe that the recent round of market upheaval will be a potent catalyst for a series of changes in the VA market.

In the past several years, the VA product competition has pushed companies to offer increasingly richer benefits for increasingly higher fees. The recent market movements will likely make the hedge cost for these richer benefits significantly higher, and this will likely continue until the markets stabilize. Companies will redesign their product features to deal with higher hedge costs.

Another important area of product evolution is the management of acquisition expenses. Counting commissions, bonuses, and other costs, the expenses to put a block of VA business on the book has become as much as 7%–8% of the initial deposits. These acquisition costs are capitalized as deferred-acquisition costs (DAC) and amortized over the expected future revenue streams. Because the revenue streams are based on account values, the recent decline of capital markets results in a significant reduction of future expected revenues, which has led to DAC recoverability issues and write-downs in a number of cases. This has little to do with guarantees or hedging, but it is possible to extend the hedging to protect the future revenue stream supporting DAC. There must be an appropriate match between the level and market sensitivity of VA distribution costs and VA base product revenue. It is increasingly clear that the industry is not currently achieving the necessary alignment.

Accounting principles for VA business are also likely to undergo review. 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 due to 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.

Financial Accounting Standards Board (FASB) staff position paper 157-3 (FAS 157-3) appears to provide justification for a new approach to fair valuation of VA guarantees. FAS 157-3 addresses 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."

We believe that life insurers will modify their valuation technique to account for these factors.

The recent market movements will likely make the hedge cost for these richer benefits significantly higher, and this will likely continue until the markets stabilize. Companies will redesign their product features to deal with higher hedge costs.

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Hedging programs will face their fair share of evolution, too, although the general framework has been working. The areas that are generating the most interest are basis risk, gap and volatility risk, policyholder anti-selection, and rebalancing strategy refinements.

Basis mismatch has attracted attention among several VA writers. Fundamentally, the rapid market movement has changed the composition of both VA funds and their replicating indexes. For example, the weight of financial company stocks has fallen dramatically. Another reason for basis mismatch in the recent period is the increased correlation of indexes in a down market. Improved “smart” fund-mapping techniques can manage the basis mismatch increase to some extent, but the main lesson for VA writers is that the funds underlying VA policies need to closely track indexes on which hedges are available.

We have also seen some limited evidence of policyholder anti-selection. This includes policyholders who put large amounts of money in funds with the highest possible volatility. A company pricing based on an average fund allocation would be adversely affected in this case. Fortunately, this kind of anti-selection behavior can be detected through performance attribution analysis. To combat such policyholder anti-selection, explicit restrictions in fund selections are becoming more common in the VA industry.

The recent high market volatility does place VA hedging programs under stress. Life insurers varied in the degree to which they hedged exposure to a change in market volatility. Sustained, high volatility will generate losses for VA hedging programs. However, it is important to note that these losses are a mark-to-market effect and not a realized cash loss.

The recent high market volatility does place VA hedging programs under stress. Life insurers varied in the degree to which they hedged exposure to a change in market volatility. Sustained, high volatility will generate losses for VA hedging programs. However, it is important to note that these losses are a mark-to-market effect and not a realized cash loss. For the loss to be permanent, volatility will need to remain elevated for a multi-year period. If volatility remains at today's levels for many years, consumers will no longer be attracted to equity-based savings products. They will demand low-risk, fixed-income products. Also in this event, life insurers would likely shut down their VA business lines. Management of run-off VA blocks would change dramatically to maximize revenue and minimize capital market risk to the extent possible.

CONCLUSIONS

VA has become a major retirement-savings vehicle for the public. During the market decline, VA guarantees have generated large liabilities and increased capital requirements for life insurers. The good news is that the guarantees have proven their value to policyholders by providing guaranteed retirement income.

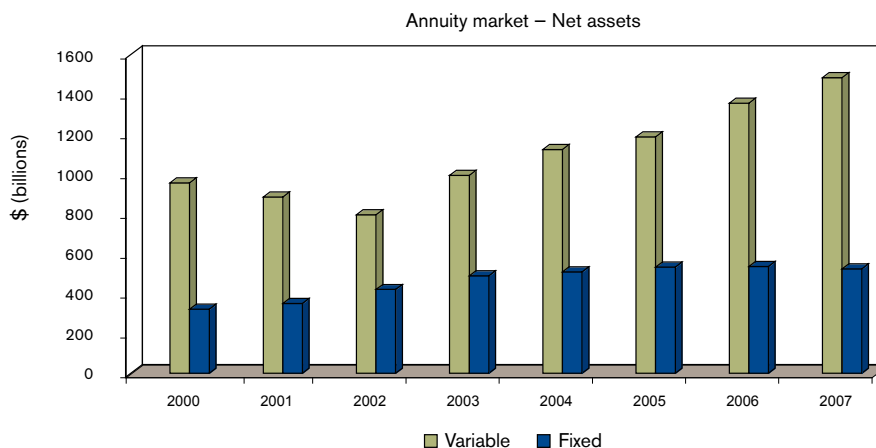
In recent analyst conference calls, major VA producers have reported that their hedging programs have been working as intended. Lately any company with a hedging program would be glad to have it in place. While some refinements are likely, we should expect more hedging, to cover other blocks of business and other risks that have previously gone unhedged.

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APPENDIX I: OVERVIEW OF THE VA BUSINESS

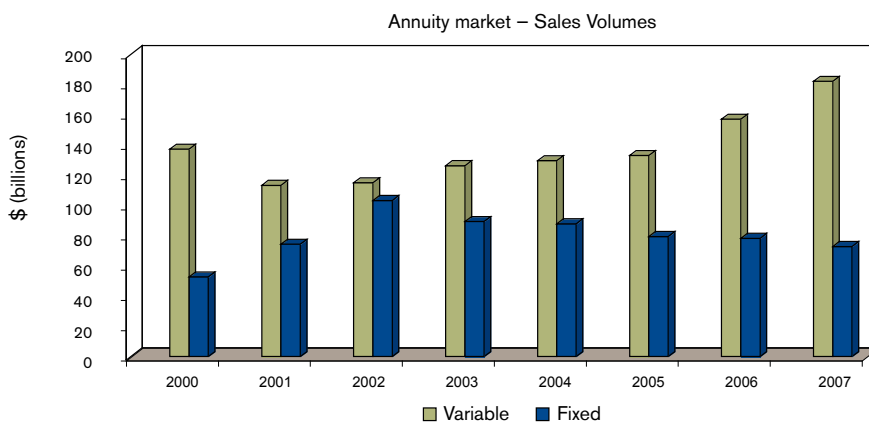
The VA market in the United States has experienced rapid growth in recent years. According to the National Association for Variable Annuities (NAVA), the total VA industry net assets were \$1.41 trillion as of June 30, 2008, as compared to the 2007 U.S. GDP of \$13.8 trillion (see Figure 7). As illustrated in Figure 8, variable annuities have surpassed fixed annuities as the dominant savings vehicle for Baby Boomers to save for their retirement.

FIGURE 7: VARIABLE AND FIXED ANNUITIES TOTAL ASSETS



As illustrated in Figure 8, variable annuities have surpassed fixed annuities as the dominant savings vehicle for Baby Boomers to save for their retirement.

FIGURE 8: VARIABLE AND FIXED ANNUITIES TOTAL SALES VOLUMES



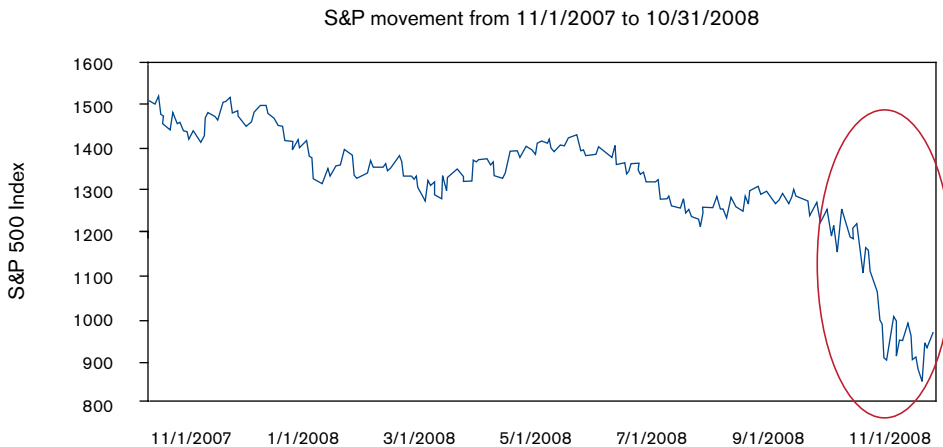
VA sales were particularly robust with the introduction of guarantees on the VA assets. The embedded guarantees in VAs are attractive to consumers because they provide a minimal floor of benefits when VA assets perform poorly, and yet leave upside potential for good VA asset performance. This feature makes VAs compare favorably to alternatives such as fixed annuities, bank certificates of deposit (CDs), or mutual funds. While fixed annuities and bank CDs are guaranteed, they do not offer participation in the capital markets. Conversely, mutual funds offer participation in the capital markets, but the investor could suffer significant losses.

APPENDIX II: OVERVIEW OF CAPITAL-MARKET CONDITIONS

The capital market has experienced dramatic turbulence in the past year, particularly in October 2008. In financial modeling, “tail scenario” is the term used to describe the very worst scenarios. One can safely say that we are currently in a tail scenario. The present financial crisis has been dominated by high-profile institution failures, but the most relevant issues for hedging programs are declining equity markets, increased volatility, and falling interest rates. As shown in Figure 9, the S&P 500 index lost 47% of its value between October 31, 2007, and October 31, 2008. This is probably the worst 12-month market decline ever experienced anywhere.

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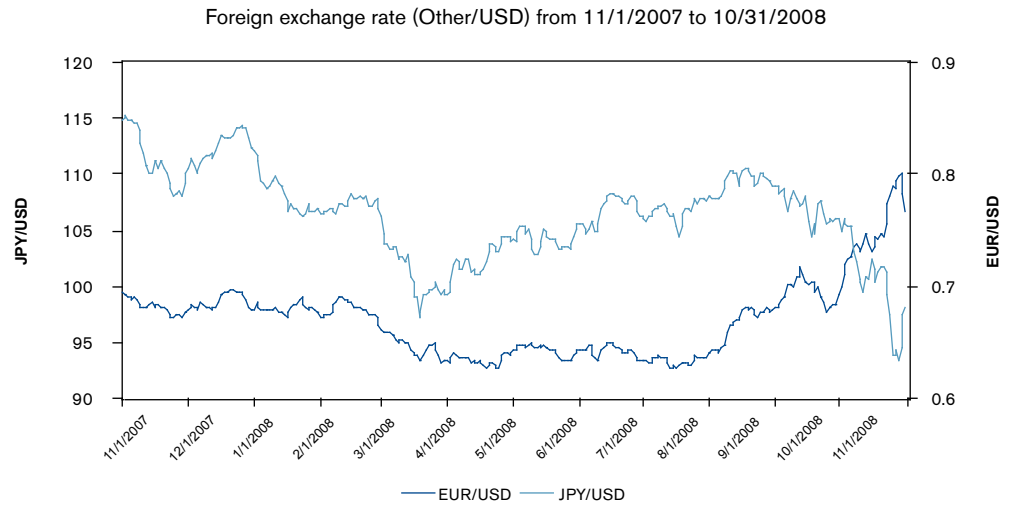
FIGURE 9: S&P INDEX MOVEMENT IN 2008



October 2008 is by far the worst month in the past year, with the S&P dropping 17%. This capital market decline is not limited to the United States. We also saw drops of 21.3% in Japan’s TOPIX index, 11.7% in the U.K.’s FTSE index, and 12.5% in Europe’s STOXX index.

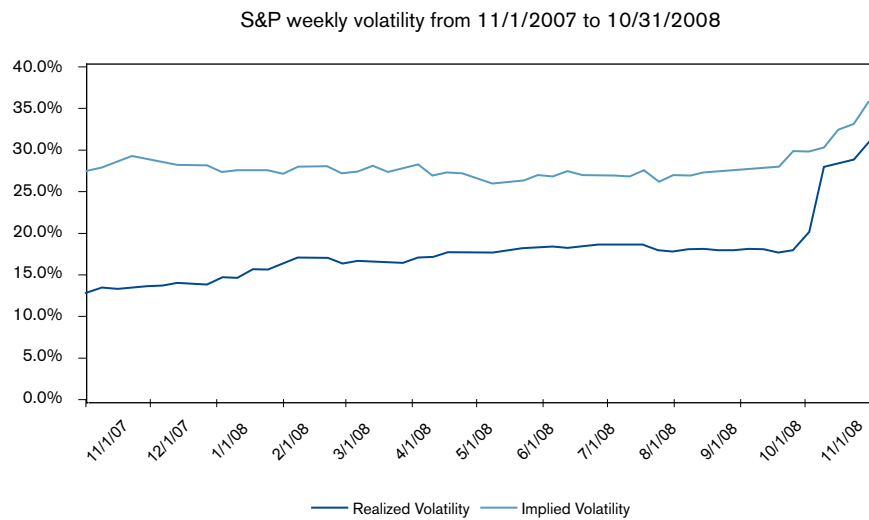
Not only have the equity markets moved dramatically, the foreign exchange (FX) market also experienced significant changes. For example, the exchange rate of the Japanese yen to the U.S. dollar dropped from 114.67 to 98.23 within a year. Figure 10 illustrates the FX market movements in the past year. Many of the assets of VA writers have exposure to foreign economies. The drop in the U.S. dollar exacerbates the decline in the global equity markets.

FIGURE 10: FOREIGN EXCHANGE RATES TO U.S. DOLLAR



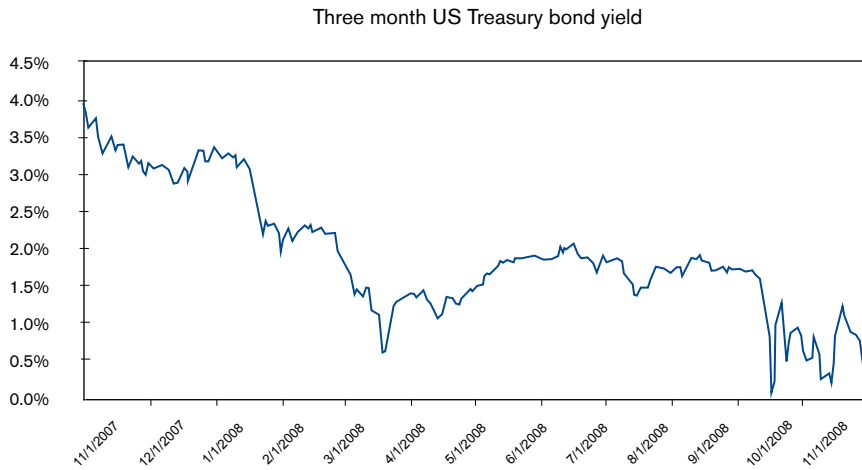
Both the implied and realized volatilities have increased significantly. The annualized volatility is 40% as of October 2008. Figure 11 illustrates the pattern of the S&P 500 volatilities over the past year. The prolonged daily swing of up to 10% is literally unseen in history.

FIGURE 11: S&P INDEX WEEKLY REALIZED AND IMPLIED VOLATILITY



In response to the financial crisis and in order to increase liquidity, governmental actions have caused the government bond rates to reduce to historical low points. The current U.S. Federal Reserve rate is the lowest since 1990, as illustrated in Figure 12.

FIGURE 12: INTEREST RATE MOVEMENT



However, there are some bright spots in this gloomy picture. While availability of credit and securitized debt—mortgages in particular—have dried up, and there have been temporary suspensions of taking short positions on individual stocks, liquidity in the index-futures and interest-rate-swap markets have remained very high. The collateralization process through the margining system of exchange-traded futures and credit-support annexes for swaps has been extremely effective at dealing with credit risk in respect to these instruments. This is very good news for VA writers because these derivatives are the foundations of VA hedging programs.

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