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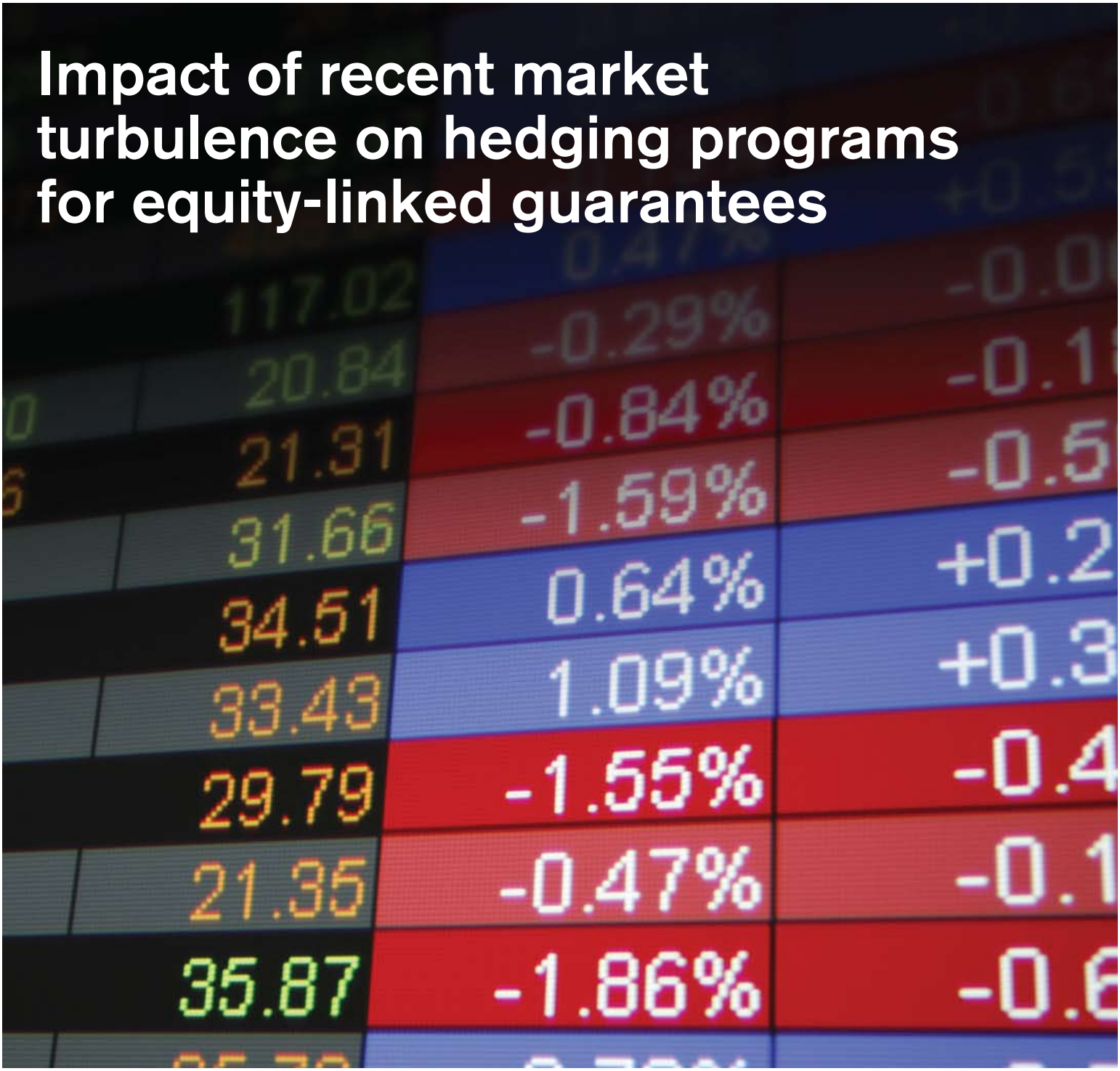
Impact of recent market turbulence on hedging programs for equity-linked guarantees

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EXECUTIVE SUMMARY

The recent period of market turbulence has served as a reminder that financial markets are unpredictable. In light of the downturn in many global markets, the benefits of products containing investment guarantees, such as variable annuities (VAs), are evident. In a number of markets where such products are sold, companies have used sophisticated financial risk-management techniques or hedging programs to manage the underlying exposure.

Based on the global interest in the development of these products, Milliman has surveyed 25 prominent providers for their views on the recent market events and their candid comments on the performance of hedging programs used to manage them.

Hedging results from the 16 study respondents revealed few unanticipated losses and validated the efficacy of financial risk-management programs.

Hedging results from the 16 study respondents revealed few unanticipated losses and validated the efficacy of financial risk-management programs. These results are significant because many of these programs were implemented since the last significant market downturn in 2001; the recent volatility has provided a real-life test of these programs.

In addition to results from the survey, this report also assesses outcomes from a hypothetical yet typical block of variable annuities with guaranteed minimum withdrawal benefits (GMWBs) under various hedging methods over the recent market turbulence.

SURVEY RESULTS

We surveyed 25 top VA writers and reinsurers and received responses from 16 participants, representing a mix of U.S., Asian, and European operations.

The message from the majority of participants is a positive one, with about 88% of respondents experiencing gains or unanticipated losses of less than 10 basis points (bps) of account value.

The resilience of the hedging programs and processes in insurance companies seen here is comforting, and may be surprising in light of the recent market turbulence. Although the insurance industry, and guarantee writers in particular, have largely operated as anticipated, they have felt the secondary effects of the subprime crisis through:

- General market downturn and reduction of assets under management
- Reduction in the supply of structured investment bank products
- Increases in option-implied volatility and cost of over-the-counter (OTC) instruments

The change in market fortune has resulted in increased customer perception of the value of guaranteed products.

On the positive side, the change in market fortune has resulted in increased customer perception of the value of guaranteed products.

A closer look at the recent movements and volatility in global equity markets helps to explain these positive results together with the following points:

- Historically low levels of market volatility preceded the period we see now with its problems related to subprime mortgages.
- Current levels of realized market volatility are now closer to long-term historical levels.
- Surveyed companies appear to have adequately priced their guaranteed products, allowing for
- long-term levels of market volatility.
- The use of sophisticated risk-management platforms and reliance on liquid hedging assets has helped insurance companies respond to changing market conditions.
- Robust stress testing of proposed hedging strategies prior to implementation generally covers one or more periods of high volatility.

Overall, we believe the combination of these factors has allowed most companies with adequate hedging programs to prevent unanticipated losses and will serve them well through times of greater market volatility should they occur. Of course, there have been organizations without well-formed hedging strategies that have experienced significant losses. Consequently, we anticipate that companies will increasingly look to adopt hedging programs or enter into reinsurance arrangements to transfer risk.

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The analysis of a hypothetical portfolio of GMWB guarantees in this article illustrates the relative performance of a range of hedging strategies over the last few months.

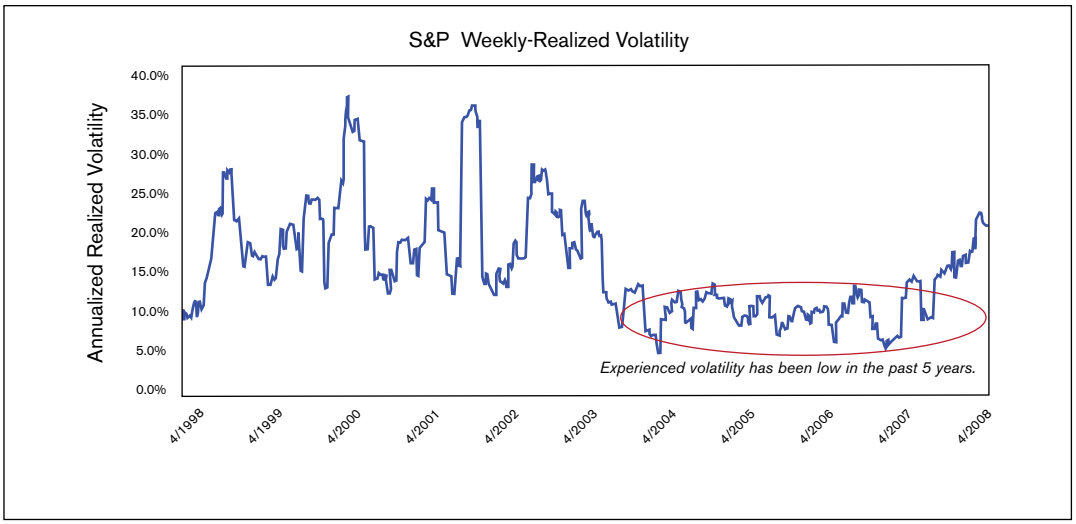
OVERVIEW OF CAPITAL MARKET CONDITIONS

Global capital markets experienced significant volatility in the period from July 2007 through February 2008, due largely to the crisis of confidence that started with subprime and expanded to credit products and their liquidity. The global nature of the capital markets has been evident, with many international markets experiencing significant periods of volatility because of these events.

In the United States, where the effects were first felt, equities dropped sharply in July 2007 and then recovered through October 2007, before experiencing further downturns in January 2008. The effects were not limited to equity markets; the 10-year point on the swap curve fell by more than 150 bps over the period as the Federal Reserve attempted to restore market stability through a series of substantial cuts in short-term borrowing rates. Subsequent uncertainty was transferred to the local yield curve, with a number of weekly moves of more than 15 bps. Option markets were also significantly affected, with implied volatilities rising significantly. One-year at-the-money S&P 500 implied volatility increased from about 14% in mid-June 2007 to more than 24% in late March 2008. Ten-year implied volatility increased from about 21% to about 28%.

Since July 2007, there have been 15 separate days when the daily volatility fell in the 2% tail of the highest volatility days the United States has experienced since going off of the gold standard. However, this period is hardly a doomsday scenario from a historical perspective. Chart 1 shows the historical 13-week rolling weekly-realized volatility for the past 10 years. It is clear that there have been sustained periods of higher volatility than the last several months. Volatility in the last several months has had a strong mean reversion component as a result of the calming effects of government intervention and capital infusions from the Middle East and Asia.

Chart 1



While the recent market volatility is indeed higher than that in the past five years, the market has experienced an unusually quiet period during that time. This juxtaposition makes the recent volatility seem more pronounced than it actually is.

SUMMARY OF SURVEY RESULTS

Given that the market turbulence is actually not as severe as one may perceive from the news media, it is not surprising that the majority of survey participants reported no unanticipated gains or losses. In fact, an effective and robust hedging program has to be able to withstand much more severe conditions than have been observed recently.

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PROFILE OF PARTICIPANTS

There are 16 participants in the survey, with representations from both reinsurers and direct writers of guaranteed products, spanning the United States, Europe, and Asia. The products offered by the participants include both variable annuities and fixed indexed annuities. The variety in the size of the survey participants is illustrated in Table 1. The survey covered at least $468 billion of assets under management, reflecting a high level of interest in the topic, as well as the credibility of the responses.

TABLE 1

ASSETS UNDER MANAGEMENT	NUMBER OF RESPONSES
ABOVE U.S.$10 BILLION	11
ABOVE U.S.$1 BILLION AND BELOW U.S.$10 BILLION	2
BELOW U.S.$1 BILLION	3

Given the wide geographical coverage of the respondents, many have guarantee exposures spanning a number of markets and currencies as shown in Table 2.

TABLE 2

FOREIGN EXPOSURE	NUMBER OF RESPONSES
NO FOREIGN MARKET EXPOSURE	4
BOTH FOREIGN MARKET AND CURRENCY EXCHANGE EXPOSURE	11
FOREIGN MARKET EXPOSURE ONLY; CURRENCY EXCHANGE IS HEDGED	1

HEDGE PROGRAM OBJECTIVE

It is fundamentally important to set a hedge program objective before the hedge program is executed. Because no one hedging program can accommodate all risks, the choice of objective reflects senior management's risk preference and appetite and often results in a trade-off between volatility of financial statements and economic risk management.

Table 3 summarizes hedge objectives for the survey participants, whether based on economical considerations, U.S. generally accepted accounting principles (U.S. GAAP), international financial reporting standards (IFRS), a combination of economical and U.S. GAAP, or cash values.

TABLE 3

HEDGE OBJECTIVE	NUMBER OF RESPONSES
ECONOMICAL	6
U.S. GAAP	4
IFRS	1
BOTH ECONOMICAL AND U.S. GAAP	4
STATUTORY CASH VALUE	1

Table 4 indicates that the vast majority of the participants do not plan to change their hedge objectives as a result of recent events. One responding company commented that it would be interested in moving toward a more economical basis objective due to limitations in U.S. GAAP. It is interesting to note that recent changes to U.S. GAAP accounting, through adoption of the Financial Accounting Standards Board's FAS 157 and FAS 159 statements, have provided greater consistency with fair value principles for liabilities.

TABLE 4

PLANNING CHANGE OF HEDGE OBJECTIVE	NUMBER OF RESPONSES
NO	14
YES	2

HEDGE STRATEGY

A range of hedge strategies has been taken by the companies that participated in our survey. Interestingly, almost all exclusively utilize dynamic hedging approaches, with the main source of variation being the Greeks that are hedged. Table 5 summarizes the responses.

It is clear that essentially all companies are implementing some form of delta hedging. Alternative strategies layer on rho and vega hedging as well.

A number of companies also opportunistically use a combination of hedge strategies, depending on the relative availability and cost of OTC instruments. As mentioned earlier, the recent increase in option costs due to higher implied volatility and contraction of various structured instruments has resulted in some hedging programs relaxing their positions with respect to vega, for example.

TABLE 5

HEDGE STRATEGY	NUMBER OF RESPONSES
DELTA	3
DELTA/RHO	2
DELTA/VEGA/RHO	5
STATIC	1
VAR	1
COMBINATION	4

Most of the responding companies partially hedge their exposure and have no plans to change their hedging ratio as a result of recent market events.

Tables 6 and 7 indicate that most of the responding companies partially hedge their exposure and have no plans to change their hedging ratio as a result of recent market events.

The primary reason for not fully hedging all liabilities seems to be that companies do not want to hedge the portion of liabilities that are subject to American Institute of Certified Public Accountants Statement of Position 03-1 (AICPA SOP 03-1).

TABLE 6

LIABILITIES FULLY HEDGED	NUMBER OF RESPONSES
YES	5
NO	11

TABLE 7

PLANNED HEDGE RATIO CHANGE	NUMBER OF RESPONSES
NO	15
INCREASE ASSET HEDGE RATIO	1

HEDGE PERFORMANCE

Most companies did not have significant unanticipated losses, with two participants even experiencing unanticipated profits during this period.

Table 8 shows the hedge performance of the responding companies. As mentioned above, most companies did not have significant unanticipated losses, with two participants even experiencing unanticipated profits during this period, one of which was a result of a positive tracking error.

TABLE 8

HEDGE PERFORMANCE	NUMBER OF RESPONSES
UNANTICIPATED PROFIT	2
NO UNANTICIPATED PROFIT OR LOSS	9
UNANTICIPATED LOSS OF LESS THAN 10 BPS OF AV	3
UNANTICIPATED LOSS OF BETWEEN 10 AND 20 BPS OF AV	0
UNANTICIPATED LOSS OF BETWEEN 20 AND 30 BPS OF AV	0
UNANTICIPATED LOSS OF BETWEEN 40 AND 50 BPS OF AV	0
UNANTICIPATED LOSS OF 50+ BPS OF AV	1

Also previously mentioned, the overall losses experienced by respondents have been within expected ranges with a small number of exceptions. In those cases, the key causes were identified as:

- Basis mismatch
- Volatility
- Cross-Greek movements
- Operational hedging issues due to increased cost of OTC hedging instruments or lack of capacity

Significantly, 15 of the participants indicated that they did not experience operational issues as a result of the market turmoil. One respondent indicated operational issues due to hedging instruments becoming expensive. As observed earlier, the impact of credit issues resulted in:

- Removal of certain structured instruments
- Demand restrictions via increased prices

It is not surprising that most respondents handled the recent market turbulence gracefully, given that the turbulence is really not that severe from a historical perspective. It is common practice to test the robustness of a hedging program across a range of adverse historical periods. The most commonly used stress-test scenarios include the periods in late 1987 and late 2001 in the United States and the collapse of the Japanese stock market. These periods saw much more severe volatility and market declines, often combined with significant drops in interest rates, compared with the recent period. This type of analysis is needed to create a robust hedging program able to withstand severe market conditions.

The relatively recent development of these products and hedging programs in the life insurance industry has led some skeptics to claim that to date they have been largely untested. As the results above show, companies have learned many lessons from the past and have kept them in mind when developing their current risk-management systems.

FUTURE DIRECTION

Seven responding companies also shared their plans for enhancements to existing hedge programs. Given the positive results above, this is more demonstrative of the natural evolution of hedging practices over time as opposed to a reaction to current events. Planned enhancements included:

- Enhanced vega/rho hedging
- Increased frequency of in-force updates
- Expansion of hedging coverage
- Reductions in derivative execution costs through increased use of exchange-traded instruments

Interestingly, when questioned about the impact the present market environment would have on sales of these products, half of the participants expected sales to fall, perhaps reflecting the trend of previous market cycles as people shy away from investing during market downturns. However, as one noted, the expected downturn in sales is likely to be less severe than previous cycles because of the presence of guarantees.

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Other respondents expected sales to increase, particularly for guaranteed living benefits, as both brokers and potential policyholders realize the significant value offered by these guarantees.

Most of the participants also expect that recent market conditions represent an opportunity for continued development and demonstration of the value that guaranteed products have to consumers. As a result, they expect a surge in competition and continued product innovation in the short to medium term.

From what Milliman has observed, the industry is also implementing operational improvements to hedging programs, including more frequent evaluation of fund offerings, dynamic price-setting mechanisms, improved data quality, and enhanced techniques in fund-manager selection.

AN ILLUSTRATIVE EXAMPLE

To illustrate the effectiveness of various hedging strategies, we show the hedge performance of a hypothetical block of VA business. This block of business consists of a common block of GMWB with $1 billion of account value. In order to understand the performance of each hedging strategy, the block has been projected over the market conditions in the last eight months assuming the following approaches:

- No hedging
- Delta
- Delta, rho
- Delta, rho, and vega

For the sake of simplicity, a hedge ratio of 100% has been assumed. Results below show the profit and loss (P&L) on a U.S. GAAP FAS 133 basis for an economic hedging strategy.

Hedge instruments used for the purposes of the illustration are exchange-traded and include:

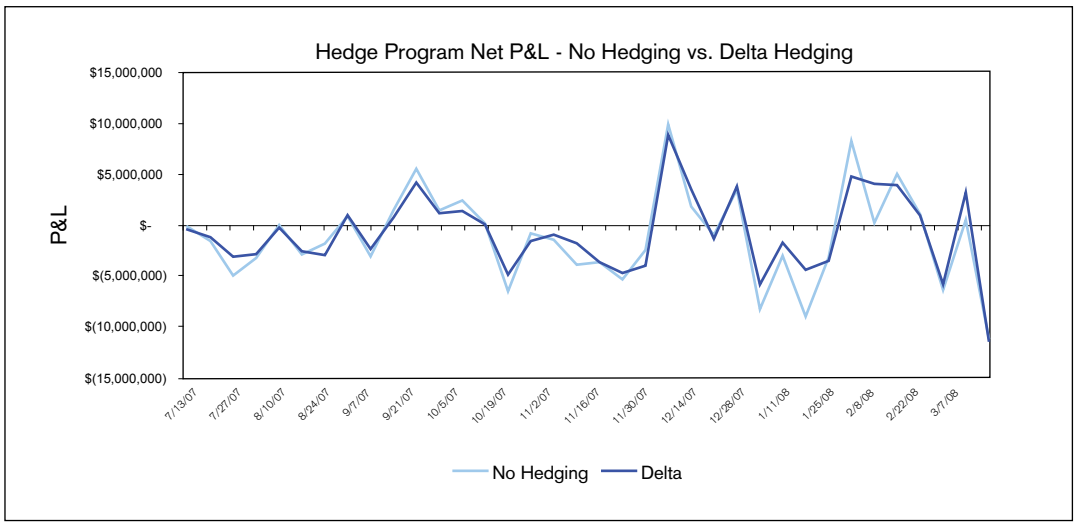
- Index futures
- Interest rate swaps
- Exchange-traded options

This example assumes weekly rebalancing of all hedge positions.

DELTA-ONLY HEDGING

Chart 2 illustrates the P&L for no hedging and delta-only hedging. It is clear that the delta-only strategy has very little effect in reducing earnings volatility.

Chart 2



DELTA/RHO HEDGING

The delta/rho strategy effectively hedges the exposure of the liability to shifts in equity and interest rates over this time period.

As shown in Chart 3, the delta/rho hedge significantly reduces the volatility of the net P&L that would have been experienced without hedging, and is a major improvement to the delta-only hedge.

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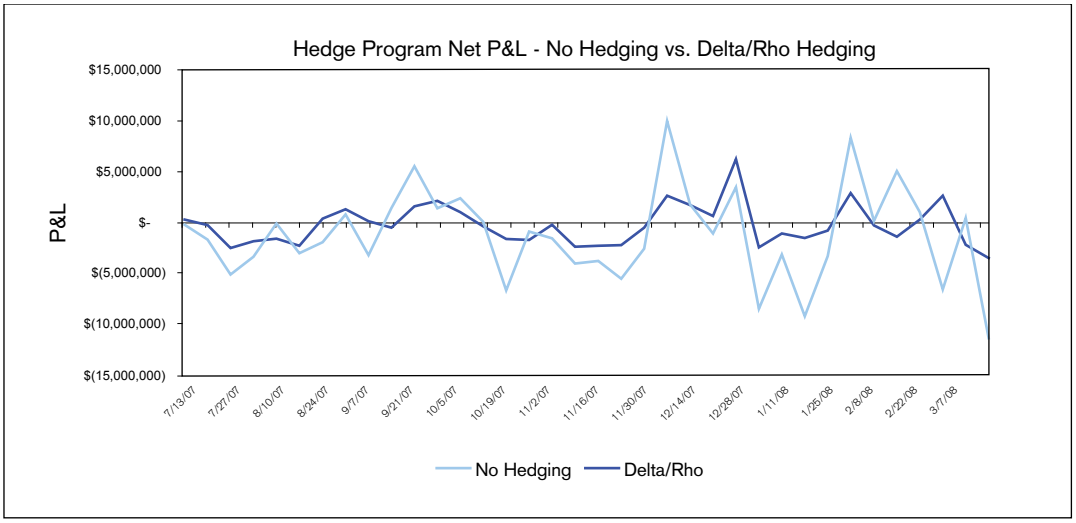
Chart 3

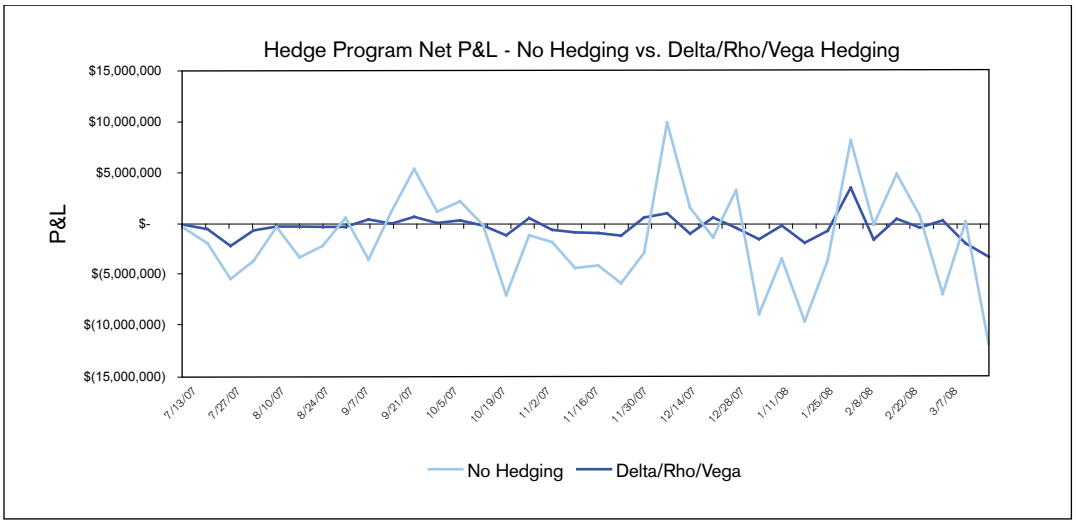


DELTA/VEGA/RHO HEDGING

Chart 4 shows the effectiveness of the delta/vega/rho hedging strategy. The application of a volatility hedge provides a more significant improvement of P&L volatility than the delta/rho hedging strategy.

The application of a volatility hedge provides a more significant improvement of P&L volatility reduction than the delta/rho hedging strategy.

Chart 4



WHICH HEDGING STRATEGY IS THE BEST?

Table 9 summarizes the P&L for our hypothetical block of VA business over the last eight months. The results are consistent with what is shown in Charts 2, 3, and 4. A more sophisticated hedging program can provide better protection both in terms of cumulative P&L and P&L variability.

TABLE 9

	WEEKLY P&L 2007-07-13 TO 2008-03-14	
	TOTAL	STANDARD DEVIATION
NO HEDGING	(49,385,592)	4,578,505
DELTA	(37,317,436)	3,957,001
DELTA/RHO	(13,828,579)	2,015,162
DELTA/RHO/VEGA	(9,177,679)	1,122,715

As this study demonstrates, significant improvements can be obtained by expanding the range of risks covered by a hedging program. However, this is not to say that an increased level of sophistication is always desirable. In our experience, there are valid business reasons for keeping a simpler hedging program. The most common reasons are a small portfolio size and cost/benefit balance.

There are valid business reasons for keeping a simpler hedging program. The most common reasons are a small portfolio size and cost/benefit balance.

- **Portfolio size**
  Many companies opt for a staged development of their hedging programs as the underlying blocks of business grow in size, resulting in periods of time where certain unprotected positions may be taken.

- **Cost/benefit balance**
  Increases in sophistication ultimately require additional resources and technical expertise, resulting in additional costs. Also, using instruments such as options and interest rate swaps results in transaction costs. The growth of third-party risk-management execution and management services should continue to give providers the benefit of scale and the ability to avoid operational risks and issues requiring development of the significant internal resources necessary to manage these types of programs.

  There is a trade-off between the benefits of a tighter hedge program and its increased costs where a company needs to strike a careful balance. From what we have seen in the industry, the benefit of adding rho hedging to delta hedging appears to be quite worthwhile for most companies. There is a clear split regarding vega hedging. Some companies choose to fully hedge vega for better P&L stability, paying the additional expenses. Others choose to partially hedge or not to hedge vega, believing volatility will revert to its historical average over time. Both approaches are valid, as long as the cost and benefit are clearly understood and documented.

CONCLUSIONS

The recent market turbulence is severe but not extreme by historical standards. Most programs fared well when stress-tested against stronger downturns, including Black Monday, 9/11, and the crash of the Japanese market. Robust hedging programs are built to withstand even more volatility than we have seen so far during the subprime fallout.

No hedging program is perfect. There are cost/benefit balances to be considered in executing a hedging program, as well as other conflicting objectives. The potential demand and supply considerations for hedging instruments should be well understood when assessing the benefits of one strategy over another. Selecting which risks are hedged and to what degree should be carefully studied and communicated to avoid surprises in a more severe market scenario, which may just be around the corner–because, as people say, history repeats itself.

Milliman, whose corporate offices are in Seattle, serves the full spectrum of business, financial, government, and union organizations. Founded in 1947 as Milliman & Robertson, the company has 48 offices in principal cities in the United States and worldwide. Milliman employs more than 2,100 people, including a professional staff of more than 1,000 qualified consultants and actuaries. The firm has consulting practices in employee benefits, healthcare, life insurance/ financial services, and property and casualty insurance. Milliman's employee benefits practice is a member of Abelica Global, an international organization of independent consulting firms serving clients around the globe. For further information visit www.milliman.com.

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