JPMorgan

New frontiers in insurance risk management

Santosh Nabar and Michael Chun address four areas of insurance products and risk management that have experienced significant growth in the past year

Introduction

Insurance companies continue to be leaders in financial markets in both their financial product innovation as well as the level of sophistication of their risk management. Volatile markets, heightened competition, a changing accounting and regulatory landscape, stringent capital requirements and focus from equity analysts and rating agencies have all provided a strong tailwind, leading to a more co-ordinated and strategic approach towards product offerings and risk management. Recently executed milestone transactions mark a new frontier in efficient risk allocation between investment banks, investors, insurance companies and reinsurance companies.

This article addresses four areas of insurance products and risk management. First, we discuss the rapid advancements in the growing variable annuity (VA) market; second, similar strides in catastrophe risk securitisation; third, life insurance capital solutions; and fourth, evolution in mortality risk management. JPMorgan has executed several landmark transactions and continues to be at the forefront of creating cutting-edge financial market solutions in these areas.

Variable annuities

Demographic trends toward a growing retirement population, a decline of defined-benefit pension offerings, prospects for achieving higher equity-based returns and attractive guarantees have all contributed to the explosive growth of VAs in the US and in Japan over the last several years. VA account values now far exceed $1 trillion in the US and $100 billion in Japan. VA products are also being offered in certain European markets such as the UK and Germany, as well as in Asian markets such as Korea and Taiwan.

In the wake of market volatility and the technology-bubble correction of the early 2000s, availability of traditional reinsurance solutions for variable annuity guarantees all but disappeared. This change, while unwelcome at the time, did serve as a catalyst in forcing insurers to quickly develop sophisticated risk management infrastructure. Insurance companies are now far better equipped to manage dynamic hedging programmes internally as well as to evaluate and execute more sophisticated bespoke transactions.

Product background

Insurance companies continue to compete in today's market by offering 'richer' and more attractive benefits to policyholders. Today, there are four main types of guaranteed minimum benefits being offered:

- Guaranteed minimum death benefit (GMDB), which guarantees return of premium upon policyholder death, in many cases with predefined minimum return 'roll-ups' and automatic resets.
- Guaranteed minimum income benefit (GMIB), which provides a guaranteed annuitisation after a waiting period.
- Guaranteed minimum accumulation benefit (GMAB), which provides guaranteed minimum growth for a fixed period of time, typically 10 years.
- Guaranteed minimum withdrawal benefit (GMWB), which is the most popular living benefit that allows a policyholder to withdraw the guarantee amount over time (or for life) with certain limitations on amount withdrawn per year.

Risk management 101

Prudent risk management begins with thoughtful product design, such as by implementing asset allocation constraints, adding caps to guarantee step-ups and retaining flexibility to raise rider fees. While these design features contribute to the mitigation of tail risks, VA guarantees are – in their essence – exotic, path-dependent put options on a dynamic underlying basket of equity and fixed-income portfolios. Therefore, these guarantees do give the writer significant core economic and capital markets risk exposure. Further, arguably of equal significance is the risk that policyholder behaviour with respect to withdrawals, elective resets and lapses differs from expectations.

Mark-to-market (MTM) accounting and, to a lesser extent, hedging economic risk have been the primary drivers for insurers implementing active derivative asset hedging programmes. This is evidenced by the level of hedging activity by US writers who are driven by US Generally Accepted Accounting Principles (GAAP) as opposed to international or mutual share company writers. Under US GAAP, GMAB and GMWB are considered embedded derivatives and are therefore bifurcated and marked-to-market through earnings, which has led to hedging using futures and option products. GMDB and GMIB are accounted for under accrual-based SOP 03-01, which has led to the success of reinsurance solutions in this space.

An individual company's hedging strategy is based on a unique balance of the insurer's economic view, tolerance for earnings volatility, accounting and regulatory governance, ratings agencies and research analysts scrutiny, internal derivatives modelling

1 JPMorgan's full cashflow hedge

- Insurer buckets policies into cells based on age, gender, time of issuance or expected behaviour
- Maturity – 30 years or more
- Underlying – predefined basket of equity and fixed-income indexes
- Parameterise mortality and behavioural assumptions including dynamic lapse, reset and withdrawal assumptions
- Payout equals any shortfall in account value to meet claims on these hypothetical policies

and trading infrastructure and counterparty and transactional concentration exposure from previous derivative and reinsurance treaties. Furthermore, it is important to note that, in reality, insurers implement numerous strategies at once – it is common for an insurer to hedge its non-MTM liabilities in one fashion and its MTM liabilities in another and, similarly, to hedge one MTM liability with a vanilla programme and an exotic MTM liability with a more sophisticated programme or even a tailored cashflow hedge.

Option-based hedging

Over the last few years, hedging strategies have evolved considerably from simple delta-hedging programmes to more dynamic options-based programmes hedging delta, rho and vega (commonly referred to as 'three-greek hedging'). Some three-greek hedgers have now graduated towards hedging the next layer of risks by utilising more exotic derivative products. Products that are now being used by insurers include variance swaps to better mirror the spot sensitivity of vega profile, multi-index basket options to efficiently hedge equity-equity and equity-bond correlation, rebalancing index options to offset asset allocation risk, dividend swaps to mitigate exposure to changes in dividend yield pricing assumptions, lookback options to hedge automatic step-up provisions and dynamic behavioural assumptions and, finally, equity-rate hybrid options that offer greater payouts upon a correlated decline in both equities and rates to more effectively hedge not only the moneyness but also the present value of the guarantee.

Advances in liability modelling techniques being applied by insurers continues to drive the pace of progress in hedging techniques. Stochastic volatility and rate models are now being used to reveal higher-order sensitivities embedded in these VA guarantees. All of the aforementioned hedging instruments supply a valuable enhancement to more generic three-greek hedging programmes by virtue of providing a tighter fit and more favourable hedge effectiveness and hedge accounting.

JPMorgan's full cashflow hedge

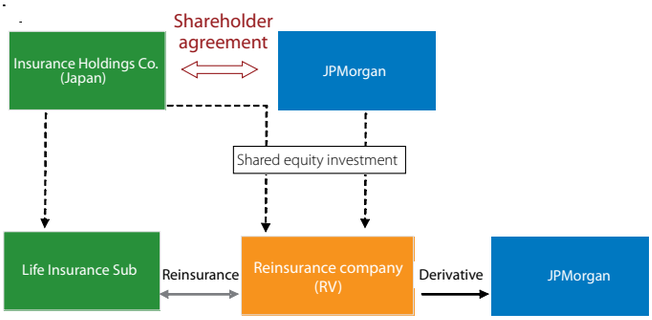
JPMorgan has been working with insurance companies to develop 'full cashflow' hedge solutions for VA products. These solutions require deep interaction between investment banks and product actuaries to communicate and convert an insurer's expectations for policyholder behaviour and mortality into a set of dynamic path-dependent, multivariate functions. The resulting transaction offers a full hedge to the insurer's future shortfalls in account value to meet claims. JPMorgan's full cashflow hedge (see figure 1) defines the frontier of capital markets in that it 'fully' hedges the capital markets exposure of the insurer. Capital markets risk is efficiently transferred to investment banks, who are best positioned to redistribute and manage such risks given their inherent market making role and the breadth of their business with hedge funds, retail structured product channels and other institutional asset managers. Actuarial and behavioural risks are retained by insurers or else transferred to reinsurers, both of whom are best positioned to redistribute and manage such risks given their experience with policyholder surrender and elective behaviour.

Full spectrum

Both partial and full reinsurance transactions have also been executed in the VA space (see figure 2 for illustration of JPMorgan's reinsurance solution in Japan). With some of the first VA living-benefit products just now emerging from no-surrender periods, investor behaviour will undoubtedly be under close scrutiny. Behavioural experience looms as the biggest driver of the insurance community's comfort with continuing to aggressively offer VA products and their desired method of risk management. The success of full reinsurance solutions will depend on pricing aggressiveness, available capacity and the ability of the reinsurer to manage capital markets risks efficiently. Insurers are now armed with a full spectrum of VA risk management solutions and are well-equipped to make effective decisions

2 Reinsurance solution in Japan

The risk management paradigm is very different in Japan. The Financial Services Agency of Japan introduced rules in April 2005 that specified minimum reserve requirements. The outcome of this is that most efficient way to reduce reserve requirements in Japan is through reinsurance with an offshore entity. Insurers have therefore either purchased reinsurance from such offshore providers or have started their own joint venture reinsurance companies to hedge their exposure. Reinsurers have, in turn, been hedging their capital market exposure using over-the-counter derivatives. JPMorgan has led the way with its joint venture with a Japanese insurance company earlier in 2007. This transaction is illustrated below.



- Insurance Holding Co. and JPMorgan entered into a shareholder agreement, wherein JPMorgan will take a minority stake in a joint-venture offshore reinsurance entity (RV)
- The RV will reinsure a portion of VA policies written by Life Insurance Sub
- JPMorgan will advise RV on capital markets
- Residual risk components including mortality and policy lapse risk will remain within the RV and will be capitalised appropriately

balancing the trade-off between implementing a dynamic hedging strategy and therefore bearing retained risks as opposed to paying market costs for a structured cashflow hedge or full reinsurance.

Catastrophe risk securitisation

In 2005, hurricanes *Katrina*, *Rita* and *Wilma* (KRW) highlighted the importance of catastrophe securitisation as a risk management tool for insurers and reinsurers. High capital requirements imposed by rating agencies and, to a lesser extent, regulators – combined with equity market's aversion to volatile earnings – are some of the reasons insurers and reinsurers are looking to capital markets to distribute risks associated with catastrophe insurance. Investors are attracted by the prospect of incremental returns well above the expected catastrophe losses, especially as catastrophe returns show low correlation with other available investments. Hurricanes and/or earthquakes in specific geographic areas are the most common perils to be covered, but other natural catastrophes, such as floods in the UK, have also been covered.

Catastrophe bonds

There are four main forms of catastrophe securitisation. The 'catastrophe bond' was the first format to gain significant acceptance. The insurer or reinsurer that wishes to buy protection arranges with an investment bank to set up a special purpose vehicle (SPV) that is licensed, usually in the Cayman Islands or Bermuda, to provide reinsurance. The SPV issues a fairly standard excess of loss reinsurance contract to the protection buyer in exchange for premium payments. The SPV then issues notes to the capital markets, through the investment bank, in an amount equal to the full limit of coverage. The proceeds are invested in high-quality debt instruments, with the returns normally swapped to a floating rate through a total return swap.

At maturity, often three years out, the SPV repays the investors. If, however, a catastrophe does cause a loss on the reinsurance contract, the investors lose part or all of their principal. Until, and unless, there is a loss on the reinsurance contract, the SPV pays interest of Libor (or Euribor) plus a spread. Thus, the investor gets two elements of return – a base return of Libor or Euribor and a risk spread intended to compensate for the potential loss of principal due to catastrophe activity.

Sidecars

More recently, since hurricane *Katrina*, sidecars have become a popular format, particularly for reinsurers. In a sidecar, investors participate pro rata in the profits and losses of a book of catastrophe business, often encompassing essentially all of the catastrophe business written by a reinsurer.

Structurally, a sidecar is very similar to a catastrophe bond. The main difference is in the form of the reinsurance contract, which is on a 'quota share' or proportional basis, as opposed to 'excess of loss'. The protection buyer agrees to pass on a fixed share of the premiums that it receives from the specified book of business. In return, the SPV agrees to pay the same proportion of any losses incurred on that book during the life of the contract. The SPV also pays a ceding commission (often 10% of premiums plus a pass-through of the brokerage costs incurred by the protection buyer to generate the business) and a profit-sharing commission based on actual results.

Two other forms of catastrophe securitisation are derivatives and industry loss warranties (ILWs). ILWs are a specialised form of reinsurance contract that closely mimics a derivative. ILW activity is already significant but there are no reliable figures on total size. Pure derivative activity is in its early stages.

Growth of the market for catastrophe bonds and sidecars

The catastrophe securitisation market grew slowly until KRW and has grown sharply since then. Prior to 2005, the annual dollar value of catastrophe securitisation ranged from $1 billion to $2 billion. In 2006, about $9 billion of catastrophe risk was securitised using catastrophe bonds and sidecars.[1] In the longer term, we believe there is a potential market for $100 billion a year or more of securitisations, which would represent only one-quarter of the estimated potential of losses from large-scale catastrophes.

New directions

It has been apparent for some time that existing catastrophe securitisations generally suffer from a significant financial inefficiency – investors are required to fund the full limit of coverage. At the extreme, the funds remain 'dead money' even during periods when the catastrophe event cannot occur, such as during the winter for US hurricane catastrophe bonds. Investors can lever their catastrophe bonds by obtaining margin loans, but the leverage available remains well below what would be supported by a more efficient design coupled with an understanding of the precise nature of the risks.

JPMorgan has developed a set of innovative structures that allow a strong credit intermediary to sit between the protection buyer and the investors. The investors accept the economic risk from the catastrophe event, but are able to put up funds considerably less than the full limit of coverage, on average. The protection buyer is protected by the credit intermediary from the possibility that the investor may renege on its financial commitment. This innovative structure allows investors to obtain substantially improved cash-on-cash returns at the same time the protection buyers pay a lower spread. The recent Swiss Re sidecar transaction demonstrated that this approach can significantly reduce costs for insurers and reinsurers buying catastrophe protection.

JPMorgan believes that expanding the current pool of catastrophe investors to the universe of structured product investors as well as growth in derivative-like structures would greatly enhance efficiency and transparency of this market.

Life insurance securitisation

The life insurance securitisation market has grown rapidly over the past few years. Much of the growth has been driven by US statutory-reserving requirements for life insurance business. Statutory requirements for reserve assumptions lead to cases where the statutory reserve can be four to five times the best estimate liability. While this 'redundant reserve' is not recognised by regulators as a surplus asset, the capital markets are willing to give credit for all or part of this amount. This enables the company to raise debt-like finance using the redundant reserve as collateral.

There are two main types of life insurance businesses that are affected – term life, which is expected to have a total industry funding need of $100 billion at its peak; and universal life, with a similar peak funding need. The reserving requirements for these two types of businesses are commonly known as Regulation XXX and Regulation AXXX, respectively. We estimate $10 billion–$15 billion of XXX/AXXX transactions were executed in 2006.

Solutions for funding redundant reserves typically involve segregating the cashflows from a block of business into a special purpose reinsurer using a reinsurance arrangement. The special purpose reinsurer raises debt finance from the capital markets to back the redundant reserve.

[1] *Source: Insurance Insider, autumn 2007.*

Full securitisation and bilateral solutions

The two broad categories of debt financing are full securitisation and bilateral transactions involving financing from a single investor, which is typically a bank.

Full securitisations are typically non-recourse and involve the special purpose reinsurer issuing notes to asset-backed securities investors. Most transactions to date have been wrapped by financial guarantors with some deals having smaller unwrapped mezzanine tranches.

Bilateral solutions represent the majority of new XXX and AXXX solutions. Rather than issuing the notes to a group of investors, the financing is provided by a bank. The parent company of the ceding life insurance company typically guarantees the payments on the debt. As there is added protection to the provider of financing, the cost of funding is typically lower than for a non-recourse solution. The cost of funding is also typically less than the cost of holding company debt due to the redundant reserve collateral. In addition, the process tends to be less complicated than full securitisation. JPMorgan completed the $3 billion bilateral XXX solution for Prudential in 2006, which is the largest such transaction to date.

Embedded value securitisations

Recently, embedded value securitisation, which is a generalisation of XXX/AXXX, has been growing in popularity. Rather than restricting the collateral to redundant reserves of term life and universal life blocks of business, embedded value securitisations can use the emerging cashflow from any appropriate life insurance block as collateral. Increased experience by insurers, regulators, rating agencies, banks and investors will increase the range of solutions and shorten the time to market of this valuable and innovative asset class.

Mortality and longevity risk management

Longevity risk is the risk that people live longer than expected, while mortality risk is just the opposite – the risk of lifespans being shorter than expected. Whereas the former is a huge risk facing both defined-benefit pension plans and annuity providers, the latter reflects the exposure inherent in a life insurance portfolio. In spite of the existence of large exposures to these risks, a liquid market in mortality/longevity trading has not developed. One of the key reasons has been the lack of widely accepted index.

Previous attempts at an index have had several shortcomings, in particular, lacking transparency, being restricted to a single country and/or designed for a single ad hoc application.

In March this year, JPMorgan, together with advisors Watson Wyatt and the Pensions Institute at Cass Business School, publicly launched its LifeMetrics toolkit to facilitate the transfer of life-related risks – both longevity risk and mortality risk – to the capital markets. The objective of LifeMetrics is to provide data, tools and education to various market participants, including pension plans and their sponsors, insurers and reinsurers and potential investors.

LifeMetrics consists of three components:

- ☐ Index of mortality and longevity
- ☐ Framework and tools for mortality and longevity risk management
- ☐ Software for modelling mortality and longevity risks.

Based on the principles of transparency, objectivity and openness – essential to the success of any index– LifeMetrics is fully documented and available publicly on the web (*www.lifemetrics.com*) and Bloomberg (LFMT <GO>). The LifeMetrics index provides current and historical data on life expectancy and mortality for males and females of different ages in different countries. Currently, indexes are published for the US, England and Wales and the Netherlands, and there are plans to add further countries. The LifeMetrics index has already brought benefits in terms of increased visibility and transparency to what has been a very opaque risk, standardisation in the measurement of risk, in vocabulary and in risk transfer products and education of financial market participants.

The aim of LifeMetrics is to continue to develop the index into an international benchmark for longevity and mortality risk. Furthermore, it remains our intention to evolve the index into a fully independent platform for the benefit of the industry.

A number of capital markets instruments have been developed to transfer longevity and mortality risks based on the LifeMetrics index, including mortality forward-rate contracts known as 'q-forwards', survivor swaps, longevity bonds and mortality catastrophe bonds.

Products such as q-forwards and survivor swaps provide the capability to design and implement cost-effective hedges to transfer these risks out of pension plans and insurance portfolios to other parties. These instruments provide a set of building blocks from which an effective hedge can be constructed to match the specific mortality/longevity sensitivities of a given pension or insurance liability.

A growing number of hedgers and investors are now seriously evaluating this market with a view to transacting mortality or longevity risk transfers in capital markets format. The transparency and standardisation provided by LifeMetrics, together with the newly developed risk transfer instruments, are creating the right conditions for this nascent market to take off.

Conclusions

Rapid developments in these four key areas suggest an important trend towards more efficient allocation of risk. Insurers are actively seeking ways to redistribute their risks to investment banks and the investor community through sophisticated derivative and securitisation transactions. In the long run, this virtuous cycle of risk redistribution should allow the insurance industry to continue to grow its businesses at an even faster pace and, more importantly, with the confidence of having prudence and sophisticated tools to manage their risk.

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