Program and Abstracts of the Practitioner Workshop

LONG DATED INSURANCE AND PENSION CONTRACTS

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Program

Long Dated Insurance and Pension Contracts

December 14, 2010 at the Hilton Sydney

Stephan Reulein (Munich Re, Germany): Opening Remarks

Stefan Jaschke (Munich Re, Germany): Valuation and Hedging of Variable Annuity Reinsurance in the Real World

Moshe Milevsky (York University, Toronto, Canada): What is the Demand for Long-Dated Pension and Insurance Contracts?

Ragnar Norberg (London School of Economics, UK): Management of Economic and Demographic Risk in Life Insurance and Pensions: Risk Sharing versus Market Operations

Michael Sherris (Australian School of Business, UNSW, Sydney): Longevity Risk Management for Long Dated Insurance Contracts

Alexander Melnikov (University of Alberta, Edmonton, Canada): On Quantitative Risk-Management in Equity-Linked Life Insurance

Klaus Sandmann (University of Bonn, Germany): Equity Linked Pension Schemes with Guarantees

Ken Seng Tan (University of Waterloo, Canada): Threshold Life Tables and their Applications

Knut Aase (Norwegian School of Economics, Bergen, Norway): The Investment Horizon Problem: A Resolution

Eckhard Platen (University of Technology Sydney): Real World Pricing of Long Term Contracts

Valuation and Hedging of Variable Annuity Reinsurance in the Real World

Stefan Jaschke

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Abstract:

Life insurance has always had significant dependencies on market risk factors. The advent of market-consistent valuation in the life insurance industry in the context of MCEV and Solvency II, however, showed that market risks often are the dominant risks in all life insurance products, regardless how explicit the embedded guarantees are.

In life insurance products market risks are often intertwined with actuarial risks like surrender and lapse. This calls for reinsurance solutions that provide cover for the combination of actuarial and market risks.

We will present approaches to the valuation and management of life (re-)insurance in the context of the project of building a hedging platform. Our experience analyses results which demonstrate that life insurance liabilities cannot be easily decomposed into completely hedgeable and completely non-hedgeable parts. Given a real-world model for the main equity, FX and interest rate risk factors, we will highlight the similarities and differences to banking industry solutions.

What is the Demand for Long-Dated Pension & Insurance Contracts?

Moshe A. Milevsky
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Abstract:
Prudent risk management begins at the product design stage since no amount of hedging can repair a mispriced or improperly designed guarantee. Moreover, product design should revolve around creating instruments that make financial economic sense within a larger framework of consumer welfare. Therefore, to better understand the demand side of the equation, in this presentation I will employ a basic lifecycle model to characterize the optimal strategies -- and especially products -- that rational consumers would actually use around retirement. In particular, I will focus on the role of products that jointly hedge against longevity risk and market risk. My main argument is that it makes little sense for insurance companies to design, offer and promote complex products -- that then generate pesky liabilities -- unless there is a strong economic rationale for the existence of these same products.

Management of Economic and Demographic Risk in Life Insurance and Pensions: Risk Sharing versus Market Operations

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Abstract:
The idea of insurance is to average out and redistribute individual losses within the portfolio. This does not work for collective risk factors that affect all policies like catastrophe risk in non-life insurance and financial and demographic risk in life insurance and pensions. Traditional ways of managing collective risk are: (1) Internal risk management (premiums and benefits dependent on collective factors as in with profit and unit-linked schemes); (2) Reinsurance in various forms. The traditional schemes work if implemented properly (do not promise too much!). New alternative ways of managing collective risk, so-called alternative risk transfer (ATR), involve market operations in various forms, e.g. swaps and securitization. The potential and the limitations of ATR in the context of life insurance and pensions will be discussed, and a warning will be issued that dangers are looming if contracts are long term and the operation is on a grand scale.

Longevity Risk Management for Long Dated Insurance Contracts

Michael Sherris
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Abstract:
Longevity risk management is one of the major challenges facing insurers and pension funds in developed economies including Australia. The risk of individuals living longer than expected has been underestimated consistently as longevity has improved. The uncertainty and volatility of future longevity poses serious risk issues for both individuals and product providers such as insurers and pension funds. Insurers offer traditional life annuities, and more recently variable annuity products, with lifetime withdrawal guarantee to provide longevity insurance. Variable annuity rider (guarantees) have been popular in the US, Japan, and Europe and are now being offered in Australia. At the same time there is limited capacity for reinsurance of the tail of the longevity risk and an undeveloped financial market to hedge the risks in these products.
Longevity bonds and recently developed derivative contracts such as q-forwards and longevity swaps provide a means by which insurers can hedge the longevity risk although this market is far from liquid. In Australia there is limited opportunity to hedge these longevity risks in financial markets and a potential for new products. The recent financial crisis has already resulted in large losses from variable annuity writers in the US, and subsequent rating downgrades have caused insurers to increase fees, reduce benefits, or withdraw from selling variable annuities altogether.
Improved mortality models have been developed to better account for the underlying risks in annuities and to allow for the application of modern financial risk management techniques.
This presentation will over view characteristics of longevity risk using Australian experience as a guide. It will review the effectiveness of hedging using longevity bonds and derivatives (q-Forwards) for longevity risk retail products including life annuity, deferred life annuity, indexed life annuity and variable annuity with guaranteed lifetime benefits based on static strategies. The effect of basis risk between annuitant portfolios and population mortality for Australian data as well as the impact of the risk premium for longevity risk will be discussed. The presentation will conclude with a discussion of the issues in using and the potential for securitization of longevity risk.

References:

Carolyn Njenga and Michael Sherris, (2009), Longevity Risk and the Econometric Analysis of Mortality Trends and Volatility, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1458084

Andrew Ngai and Michael Sherris, (2010), Longevity Risk Management for Life and Variable Annuities: Effectiveness of Static Hedging Using Longevity Bonds and Derivatives http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1587890

John Evans and Michael Sherris, (2010), Longevity Risk Management and the Development of a Life Annuity Market in Australia, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1585563

Sherris, M. and S. Wills, (2008), Financial Innovation and the Hedging of Longevity Risk, Asia Pacific Journal of Risk and Insurance, Vol 3, Issue 1, 52-64.

Wills, S. and Sherris, M., (2010), Securitization, Structuring and Pricing of Longevity Risk, Insurance: Mathematics and Economics –Volume 46, Issue 1, February 2010, Pages 173-185.

On Quantitative Risk-Management in Equity-Linked Life Insurance

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Abstract:

In the talk we study equity-linked life insurance contracts with fixed and stochastic guarantees linked to the evolution of a financial market. The presence of a client's mortality risk does not allow perfect hedging, and we utilize imperfect hedging methodologies. These methodologies were developed in mathematical finance based on loss function conceptions (quantile and efficient hedging) and risk measures. We allow an insurance company to be exposed to financial risk. The price of the contracts will be subject to a maximization/minimization of the expected loss function/risk measure under initial budget constraints. In the Black-Scholes setting we derive equations separating financial and insurance risks embedded in the contracts and propose a methodology for effective risk-management of the contracts. Pooling homogeneous clients together enables the insurance company to take advantage of diversification of mortality risk. A large enough portfolio of life insurance contracts will result in a more predictable mortality exposure and reduced prices. The results will be illustrated with the help of financial indices (S&P 500 and the Russell 2000).

Equity Linked Pension Schemes with Guarantees

Klaus Sandmann

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Abstract:

In this study we focus on the relationship between the level of a return guarantee in an equity linked pension scheme and the proportion of an investor's contribution needed to finance this guarantee. Three types of schemes are considered: investment guarantee, contribution guarantee and participation surplus. The evaluation of each scheme involves pricing an average rate Asian type option, for which relatively tight upper and lower bounds can be calculated in a numerically efficient manner. We find a negative (and for two contract specifications also concave) relationship between the participation in the surplus return of the investment strategy and the guarantee level in terms of a minimum rate of return. Furthermore, the introduction of a possibility of early termination of the contract (e.g. due to the death of the investor) has no qualitative and very little quantitative impact on this relationship.

Threshold Life Tables and their Applications

Ken Seng Tan
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Abstract:

The rapid emergence of centenarians has highlighted the importance of survival probabilities at extreme ages and has motivated actuaries to look for alternative ways to close off life tables in place of assigning a death probability of one at an arbitrarily chosen age. Using the asymptotic results of modern extreme value theory, we propose a model, which we call the threshold life table, to extrapolate survival distributions to extreme ages and to determine the appropriate end point of a life table. By combining the threshold life table with the Lee-Carter model for stochastic mortality forecasting, we consider applications to the valuation of a life annuity portfolio and to the prediction of the highest attained age. We illustrate the theoretical results using US, Canadian and Japanese mortality data.

The Investment Horizon Problem: A Resolution

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and
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Abstract:

In the canonical model of investments, the optimal fractions in the risky assets do not depend on the time horizon. This is against empirical evidence, and against the typical recommendations of portfolio managers. We demonstrate that if the intertemporal coefficient of relative risk aversion is allowed to depend on time, or the age of the investor, the investment horizon problem can be resolved. Accordingly, the only standard assumption in applied economics/finance that we relax in order to obtain our conclusion, is the state and time separability of the intertemporal felicity index in the investor's utility function. In this investment setting we include both life and pension insurance. We can solve the problem of finding an optimal amount of life insurance, which could, perhaps, constitute an innovation in the market for life insurance contracts.

Real World Pricing of Long Term Contracts

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Abstract:

Long dated contingent claims are relevant in insurance, pension fund management and derivative pricing. This paper proposes a paradigm shift in the valuation of long term contracts, away from classical no-arbitrage pricing towards pricing under the real world probability measure. In contrast to risk neutral pricing, the long term excess return of the equity market, known as the equity premium, is taken into account. Furthermore, instead of the savings account, the numeraire portfolio is used, as the fundamental unit of value in the analysis. The numeraire portfolio is the strictly positive, tradable portfolio that when used as benchmark makes all benchmarked nonnegative portfolios supermartingales, which means intuitively that these are in the mean in the long run downward trending or at least trendless. Furthermore, the benchmarked real world price of a benchmarked claim is defined to be its real world conditional expectation. This yields the minimal possible price for its hedgable part and minimizes the variance of the benchmarked hedge error. The pooled total benchmarked replication error of a large insurance company or bank essentially vanishes due to diversification. Interestingly, in long term liability and asset valuation, real world pricing can lead to significantly lower prices than suggested by classical no-arbitrage arguments. Moreover, since the existence of some equivalent risk neutral probability measure is no longer required, a wider and more realistic modelling framework is available for exploration. Classical actuarial and risk neutral pricing emerge as special cases of real world pricing.