

INTERNATIONAL ASSOCIATION OF INSURANCE SUPERVISORS



ISSUES PAPER ON ASSET-LIABILITY MANAGEMENT

OCTOBER 2006

This document was prepared by the Solvency and Actuarial Issues Subcommittee in consultation with IAIS Members and Observers.

This publication is available on the IAIS website (www.iaisweb.org).

© *International Association of Insurance Supervisors 2006. All rights reserved. Brief excerpts may be reproduced or translated provided the source is stated.*

Issues paper on asset-liability management

Contents

1.	Introduction.....	3
2.	Risks Covered by ALM.....	3
3.	ALM for Different Product Lines	7
4.	ALM Measurement Techniques	9
5.	ALM Management Techniques	13
	Appendix- Definitions.....	18

1. Introduction

1. This issues paper complements the IAIS *Standard on asset-liability management* (2006) (herein referred to as the ALM Standard) by providing additional background and detail about asset-liability management. As noted in the ALM Standard, insurers should select asset-liability management strategies and techniques that are best suited to their particular business. Insurers need to acknowledge the various trade-offs made between risk and return in selecting their methodologies. For example, a non-life insurer with short term liabilities might invest the supporting assets in instruments of a short duration. The insurer would thus lower its risk profile, but also reduce the potential return on the assets.

2. As outlined in the ALM Standard, there are a number of other IAIS papers which should be referred to when studying ALM including: IAIS *Insurance core principles and methodology* (2003); *Standard on asset management by insurance companies* (1999); and the *Guidance paper on investment risk management* (2004).

2. Risks Covered by ALM

Market Risk

3. As described in the ALM Standard, market risk includes:

- interest rate risk (including variations in market credit spreads): risk of losses resulting from movements in interest rates and their impact on cash flows. To the extent that future cash flows from assets and liabilities are not well matched, movements in interest rates can have an adverse economic impact.
- equity, real estate and other asset risks: risk of losses resulting from movements of market values of equities and other assets. An insurer can be exposed to adverse economic impacts to the extent that the market values of equities, real estate and other assets held do not move in line with liabilities.
- currency risk: risk of losses resulting from movements in exchange rates. To the extent that cash flows, assets and liabilities are denominated in different currencies, currency movements can have an adverse impact on the insurer.
- related credit risk: in coordinating its exposure to market risk an insurer may increase its exposure to counterparty credit risk.

4. As defined in the IAIS *Glossary*, market risk incorporates general market risk (on all investments) and specific market risk (on each investment). It includes the exposure of derivatives to movements in the price of the underlying instruments or risk factors. Market risk also includes exposure to other unanticipated movements in financial variables or to movements in the actual or implied volatility of asset prices and options. Market risk may be linear, non-linear or geared. Exposure to non-linear or geared market risk arises typically through the use of derivatives. In times of significant economic turmoil asset correlations tend towards 1 or -1. During such times the risk reduction benefits of diversification may temporarily disappear and there may be serious financial consequences.

5. An insurer should be able to measure its market risk exposure across risk factors (e.g., interest rate, equity and currency) and across the entire portfolio. The insurer should set appropriate metrics to measure exposure to market risk factors.

6. Market credit spreads can be a major source of market risk. For example, insurers may invest substantially in corporate bonds to take advantage of higher returns on less marketable securities, for example if they have liabilities that are illiquid or discretionary. Interest rates may be affected by changes in general credit market conditions and lead to widespread credit downgrades and to spreads varying substantially according to the rating of the bonds, especially in extreme scenarios. In some jurisdictions it is permissible to achieve greater flexibility in managing this risk by holding a replicating portfolio of government securities together with credit derivatives.

7. The modelling of the interest rates should include scenarios of a shift, a twist and bends¹ of the yield curve, individually and in various plausible combinations.

8. An insurer with a complex portfolio would be expected to demonstrate more sophistication in its modelling (e.g., stochastic interest rate modelling) than an insurer with a simple portfolio. Sometimes the insurer may decide to trade-off sophistication and accuracy in favour of simplicity and conservatism. Decisions taken in this regard should be transparent – i.e., clearly understood and documented.

Underwriting Risk - Policyholder Options

9. Insurance contracts may offer policyholders choices, such as settlement options, policy loan options, over-depositing options and surrender or renewal privileges. These embedded options provide policyholders added flexibility. However, if not managed properly they could result in additional costs to the insurer over the life of the policy and potentially a liquidity cost.

10. The insurer must understand the types of embedded options that exist in new and in-force policies and their possible effects on ALM. The insurer must manage its assets and

¹ A shift means a parallel displacement of the yield curve (i.e. returns of all maturities rise or fall to the same extent). A twist means a turn of the yield curve (i.e. the same change of the slope of the yield curve is observed). A bend means that returns of shorter and longer maturities move in the opposite direction than returns of average maturities (i.e. the curvature of the yield curve changes).

liabilities in a way that would mitigate the risks, recognising that these risks are generally not diversifiable.

11. Options commonly embedded in insurance contracts that should be considered by the ALM include:

- investment products that guarantee the return of policyholder capital on maturity or early termination. This option can affect persistency.
- settlement options that allow the beneficiary to choose to have the benefit payment in the form of either a lump sum or an annuity. The former requires liquid assets while with the latter there may be a problem obtaining assets to match long durations.
- an accumulation annuity contract that may give the policyholder the option of choosing a cash payment at maturity or an annuity at pre-specified interest and mortality rates
- an accumulation annuity contract that allows a book value cash-out option to the policyholder at any time, not just at the maturity date
- a policy loan option that allows the policyholder to borrow, at any time, at specified terms, against the cash value of an insurance policy
- an over-deposit option that allows the policyholder to pay premiums higher than required, which will be credited at a pre-specified rate of interest
- a surrender privilege that allows the policyholder to halt the insurance contract prematurely, to stop paying premiums and to collect any cash values
- a renewal privilege that offers policyholders the right to either renew the insurance contract at pre-specified rates or to halt the agreement at the end of the policy period
- credited rates on liabilities that influence the lapse rate and which in turn may require either unexpected liquidation or reinvestment of assets.

Certain trigger events, such as the insurer receiving a downgrade from a rating agency or other adverse reputational events, can result in a higher level of policyholder surrenders, especially by institutional policyholders. This could lead to liquidity problems.

Underwriting Risk - Impact of new business

12. Insurance and investment products are continually being introduced, redesigned, replaced, expanded or updated. Where relevant, an insurer's ALM process should ensure that the pricing, product development and investment departments work closely together. Features offered to policyholders must be well understood so that products are priced properly and the accompanying investment strategy is appropriate. In particular, well defined investment benchmarks and strategies should be established.

13. Given the relevant new product characteristics, the insurer's investment department should determine whether assets of the term, quality and yield required to meet the future cash flow and solvency requirements are available. In addition, it should assess whether these assets will continue to be available. When suitable assets are not available, the insurer may need to substitute, permanently or temporarily, assets that do not meet its requirements. This may result in yields insufficient to produce an interest margin, or delays between receipt of premiums and investment in assets that could subject the insurer to interest rate risk.

Liquidity risk

14. Liquidity risk is exposure to loss in the event that insufficient liquid assets will be available from among the assets supporting the liabilities, to meet the cash flow requirements when they are due. This may force insurers to sell other assets at unfavourable prices. The liquidity profile of an insurer is a function of both its assets and liabilities and varies with market conditions.

15. To the extent that they are predictable, immediate demands on cash should not pose undue liquidity risk for an insurer. Any immediate demand for a cash payment can be a risk if cash is in short supply. A well-managed insurer will structure its assets so that it has enough cash and marketable securities to cover its obligations when they arise. The insurer may have the ability to reduce payments to surrendering policyholders to reflect adverse market conditions, so that assets can still be matched to the expected duration of the liabilities. There is also sometimes the possibility of timing the payments to policyholders (at least for individual life policies) so that payments are not made until the corresponding assets have been sold.

16. The following are some of the potential causes of liquidity problems for insurers:

- a deliberate mismatching strategy
- affiliated investment risk: the risk that an investment in a member company of the conglomerate or group may be difficult to sell, or that affiliates may create a drain on the financial or operating resources of the insurer
- funding risk: the risk that the insurer will not be able to obtain sufficient outside funding, as its assets are illiquid, at the time it needs it (e.g., to meet an unanticipated large claim)
- liquidation value risk: the risk that unexpected timing or amounts of needed cash may require the liquidation of assets when market conditions could result in loss of realised value
- negative publicity (which may cause increases in lapsed policies)
- a large unexpected loss which is payable immediately
- delays in payments from reinsurers
- policyholder actions
- deterioration of the economy with abnormally volatile or stressed markets
- political and legal risk, from unforeseen changes in legislation and court awards
- investments that cannot be sold due to linked relationships with other companies
- several insurers facing large unpredictable demands on liquidity at the same time and needing to liquidate some of their asset portfolios, with the result that the marketplace is unable to absorb the volume other than at unfavourable prices.

17. An insurer should structure its assets to meet its expected short term liability cash flows. An insurer should have a plan for how to deal with unexpected cash outflows - either by holding additional liquid assets or having an emergency credit facility.

18. The size or credit rating of the insurer, its status (e.g., as a mutual insurer) and/or local regulation, may limit its access to funding. If an insurer is too small, it may not have the funding choices that are available to larger insurers.

19. Where permitted and subject to conditions set by the supervisor, borrowing can be an important aspect of an insurer's ALM strategy. However, insurers should be cautious in relying on this source of liquidity. For example, following an insurance risk event (e.g., a

catastrophe or large claim), banks may be unwilling to lend to an insurer. Where possible, formal credit lines should be established that could mitigate that risk. Such credit lines should also be sufficiently diversified to reduce the concentration risk to financial institutions which may also incur losses in extreme circumstances.

20. Lack of diversity in either the liability or the asset portfolio when analysed by product, geography, industry or creditor can lead to increased liquidity risk. An over-concentration of illiquid assets, such as real estate, thinly traded securities or structured investment products, may be especially risky.

21. Each insurer should select appropriate measurement tools, such as liquidity ratios and cash flow modelling, to determine its exposure to liquidity risk; there are no simple formulae that work for all insurers. For further information, liquidity measurement techniques are discussed in the IAIS *Guidance paper on investment risk management* (2004).

22. Insurers may be able to obtain emergency liquidity funding in the event of a catastrophe by drawing cash early under their reinsurance policies or by other means. This could be recognised when assessing the amount of liquidity available to meet the level required.

3. ALM for Different Product Lines

23. ALM strategies differ by line of business. The examples given below are for illustrative purposes only, as products may differ by jurisdiction.

Accumulation Annuities, Deferred Annuities

24. ALM is important for financial intermediation products. Profitability on accumulation or deferred annuities depends on the rates of interest cash inflows can earn. The margin on the spread of the rates of interest is relatively small; thus ALM is critical to maintain profitability. These products may be regular or single premium business, usually with a selected maturity date and can be relatively short-term, for example, five to ten years. Therefore, the risks may be relatively easy to manage. The ALM becomes more complicated, however, if the product has policyholder options for early surrender without a market value adjustment, guaranteed interest rates for future premium deposits or guaranteed cash or annuity options at retirement.

Deposit Funds

25. An insurer may choose to maintain an unmatched asset-liability position for some product lines. For instance, a daily interest fund is cashable any time at the option of the policyholder. While it would be conservative to maintain the supporting assets totally in cash, a longer asset duration is justifiable since experience shows that not all policies are immediately cashed out. For these products, pricing and guaranteed rates must respond quickly to changes in market interest rates, because stale rates will produce losses if rates are too high, or poor sales if rates are too low.

Payout Annuities, Lifetime Annuities, Immediate Annuities

26. Like accumulation annuities and deferred annuities, payout annuities are priced as spread business and their profitability depends on the rates of interest the cash inflows earn. Since the interest rate spread is relatively small, ALM is critical to maintaining profitability.

These products are usually single premium business and have no fixed maturity date. They may have very long durations and may not be totally duration matched with assets at issue. The ALM then has to take into account future reinvestment risk as well as mortality risk. Where insurers use equity or real estate investments as part of the ALM for the long duration terms, the risks associated with these investments must be considered and monitored carefully in light of the entity's risk tolerance.

Non-Participating Permanent Insurance

27. Non-participating life insurance policies include whole-life or endowment type products comprised of long-term liabilities, as well as universal life or unit-linked products. ALM for this business should include the probable cash flows associated with mortality and surrender of the policy. In addition, ALM cash flows should include assumptions for future premium cash flows and a suitable range of future reinvestment rates. For example, universal life² or unit-linked products can include a number of features that make cash flows difficult to predict, such as the policyholder options to suspend premium payments for some periods or to make infrequent larger-than-normal payments.

Participating Insurance, With-Profits Insurance

28. These products are designed so that the policyholder shares the risk and participates in the profit from the business. ALM for participating, with-profits life insurance should include assumptions for future policyholder bonuses/dividends based on reasonable policyholder expectations, as well as for the underlying guarantees that will emerge as policies mature. Since these bonuses/dividends can be altered to take account of changes in interest rates or other cash flows, there could be greater investment freedom than for non-participating product lines. However, the insurer does not have complete discretion and will need to demonstrate that policyholders continue to be treated fairly and that guarantees are adequately covered. Furthermore, policyholders' expectations and marketing considerations may make it difficult for the insurer to fully reduce benefits if risks do materialise. As jurisdictions move towards more transparent and explicit treatment of policyholder bonuses/dividends, ALM is a natural tool to use to determine appropriate asset allocation.

Unit-Linked Products and Variable Annuities

29. Some product lines include a link between policyholder funds and external equity or bond markets or indices. ALM should examine the relationship between contractual and constructive³ liabilities and assets held to back those liabilities. Supervisors have taken different approaches to regulating these products: and some jurisdictions require that there be no ALM risk in the management of such funds (e.g., by requiring that unit-linked liabilities are covered as closely as possible by matching assets). Some products may also have guaranteed payouts at maturity which may give rise to additional ALM issues.

² Universal life is a combination flexible premium, adjustable life insurance policy. The policyholder may select the amount of premium he or she can pay and the policy benefits are those which the premium will purchase. Or, the premium payer may change the amount of insurance and pay premium accordingly.

³ Constructive in the sense that there is an implied obligation to invest linked funds in line with the stated investment policy.

Term Insurance

30. These products provide life cover over a specified term but usually do not have a surrender value. Insurers should exercise judgement in determining whether these products are to be included in ALM modelling. Generally, ALM modelling is required for longer terms where policy liabilities are relatively large.

Accident and Sickness Insurance

31. Like term business, long term accident and sickness liabilities, such as disabled lives reserves or long-term care, may require some type of ALM modelling.

Non-Life Insurance

32. Although many non-life insurance products have short term liabilities where liquidity is the major ALM consideration, there are instances where the selection of appropriate supporting assets is important. These include long tail business where claims reserves are established to cover liabilities that may emerge or will be finalised several years in the future and may be significantly increased by claims inflation during that time, and structured settlements, where similar considerations to annuity business will apply. The selection of appropriate supporting assets is also important for blocks of business in run-off where there will be no continuing premiums to provide liquidity to meet claims as they arise. Lingered court cases can create material uncertainty for some insurers about the level of claims that will have to be paid and lead to a shortening of the term of the insurer's investments to guard against liquidity risk.

4. ALM Measurement Techniques

33. This section introduces some of the basic measurement techniques and how they can be used for ALM.

Duration and Convexity

34. Duration and convexity are important measures of interest rate risk for fixed income securities and interest bearing liabilities. Duration is a measure for the sensitivity of the value of an asset to changes in interest rates. Duration is a simplistic measure and should be used with care. Convexity measures the rate of change of the duration with respect to the interest rate. This means that it is a measure of how sensitive an instrument's duration is to changes in the interest rate (i.e., it shows the curvature of the price profile of the instrument). It is important to note that both concepts only apply to small parallel rate changes in the yield curve but not to twists or bends in interest rates. Measures include: Macaulay duration, modified duration, effective duration and money duration (refer to the Appendix for definitions of these terms).

35. Duration measures only interest rate risk within one currency, so that it cannot be aggregated across multiple currencies. Also duration cannot be used to capture large factor changes.

36. In duration matching, duration and convexity measures are used to immunise a portfolio of assets and liabilities from fluctuations in interest rates. In other words, the surplus of the portfolio (assets minus liabilities) as a proportion of total assets will be unaffected when the interest rate changes.

37. For immunisation of a portfolio, three criteria must be met:

- the present value of the assets must equal the present value of liabilities
- the duration of assets and liabilities must be equal
- the convexity of the assets must be greater than that of the liabilities.

38. Because the duration of assets and liabilities can drift apart when interest rates change, durations have to be monitored continually. It is often quite difficult to calculate the duration or convexity of assets and liabilities depending on the assets held and the types of policies written.

Value at Risk (VaR) and Tail Value at Risk (Tail VaR)

39. VaR measures, often used in banks, provide a probability-based boundary on likely losses for a specified holding period (e.g., 10 days to 1 year) and confidence level. The holding period typically represents the length of time until a company can defease or exit the position/situation that caused the risk. Tail VaR (also known as Conditional Tail Expectation - CTE) may be preferred to VaR for measuring catastrophe risks and other low frequency high severity risks and risks extending over a long time period. However, quantile measures such as VaR and Tail VaR have a limited ability to accurately capture what happens in exceptional circumstances or extreme events. This is because statistical inference is imprecise without a sufficient number of observations and, in any event, it is based on extrapolation of past experience, which is not necessarily representative of systemic risk.

Liquidity ratio

40. Insurers need to estimate the normal expected amount of liquidity that would be required to meet the demands of their underlying liability portfolios for various time horizons. They can then establish a ratio by taking this amount and adding a margin to cover unexpected liquidity requirements. The liquidity ratio is usually included in the insurer's investment policies.

Cash flow management

41. The aim of this ALM technique is to compare the cash flows of the liabilities with the cash flows of the assets and measure the effect of changes in interest rates, including parallel shifts, twists and bends. Options to adjust cash flows to produce the desired risk profile are then considered.

42. The size and timing of cash flows might be difficult to forecast, however; for example, in the case of a large claim for non-life insurance or with embedded options for life insurance. In addition, an insurer may have difficulty finding assets with the properties needed for cash flow matching. For example, it might find an asset with the desired maturity but the issuer might not meet the insurer's investment standards.

43. The level of precision in cash flow matching is dictated by the cash flow certainty of the liability and the organisation's total return objective and risk tolerance level. Organisations with high total return objectives and higher risk tolerances would accept a lower level of cash flow matching in order to achieve their rate of return goal.

Deterministic scenario testing

44. To manage uncertain future cash flows, ALM requires the use of models. Deterministic models project business results into the future based on a small number of sets of cash flows. The results obtained are valid for these specific scenarios. Deterministic scenario testing may be sufficient where the scenarios are representative of the type of business being considered and can support reliable ALM decisions.

45. More complex models, such as stochastic scenario testing, are needed if future cash flows depend on future economic conditions.

Stochastic scenario testing

46. To estimate future expected cash flows under various scenarios, stochastic models based on simulations are used. Using these techniques it is also possible to construct many possible scenarios and arrive at statistical distributions of the results. The results measure risk exposures in the portfolio of an insurer. By studying the range of results, the insurer can evaluate different ALM strategies.

47. In general the five components of a model are:

- set of assumptions
- stochastic scenario generator
- financial calculator
- optimizer
- output.

48. The set of assumptions includes general economic assumptions such as changes in interest and foreign exchange rates, changes in liquidity conditions, economic shifts and possible market events. It may also include assumptions related to the business of the insurer such as premium levels and the impact of management responses and controls related to modelled asset movements (e.g., stated bonus/dividend philosophy). Particular attention must be given to the relevance and reliability of the assumptions.

49. The stochastic scenario generator develops scenarios based on the assumptions made which are then transformed by the financial calculator into financial results, which are selected and assessed by the optimizer before the output is produced.

50. Stochastic models apply stochastic processes that are run simultaneously for assets and liabilities. These models are useful for product design as they allow the insurer to examine the impact on its financial position of various new products under simulated market conditions.

51. Stochastic models have their limitations. The underlying probability distributions must be carefully selected. It may also be appropriate to test the dependence of the results on the tail of the distribution where the model may least faithfully represent reality. This may, for example, be achieved by flexing the size and the shape of the tail of the distribution being used. Other potential difficulties are the calibration and validation of models and the interpretation of their output.

Stress tests

52. Stress tests assist insurers in managing risks and maintaining adequate financial resources to deal with those risks. These are discussed in detail in the IAIS *Guidance paper on stress testing by insurers* (2003). Stress tests can be used to identify and quantify the overall impact of different stress scenarios on an insurer's future financial position. They do not predict what will happen, but are useful for examining what might happen.

53. Stress testing encompasses both sensitivity testing and scenario testing. Sensitivity testing examines the effect of changing one or a few variables rather than considering a full alternative scenario. The scenario testing used as part of stress testing may go beyond deterministic scenario testing. Stress test scenarios may, for example, include modelling with reference to historical events and to risk databases.

54. Stress tests should be appropriate to the insurer's own risk profile and the business undertaken. For example, stress tests should reflect the fact that insurers do not all underwrite the same classes of risks, accept the same level of risks, have the same distribution systems, employ the same reinsurance arrangements, have the same distribution of assets by investment type/grade or have the same operational systems and controls.

55. To truly test the insurer's exposure to ALM risk, stress testing should address significant adverse threats to the future financial condition of the insurer, rather than just mildly uncomfortable possibilities.

56. In addition, the insurer should use stress testing for assessing capital requirements, strategic planning and for contingency planning. The board of directors and management need to know how adverse a risk must be for it to impair the insurer's financial position. This should include all risks arising from the insurer's assets and liabilities, including market risk, underwriting risk and liquidity risk.

57. For insurers, market risk is the extent to which an adverse movement in the value of the assets as a consequence of market movements, such as changes in interest rates, foreign exchange rates, equity prices, etc., is not offset by a corresponding movement in the value of the liabilities. Examples of market risk related scenarios to consider when undertaking stress tests are:

- the possibility of a severe economic or market downturn leading to interest rate movements that adversely affect the insurer's financial position
- the impact of price shifts in asset classes on the entire portfolio
- inadequate valuation of assets such as real estate and derivatives that are not effected or issued on or under the rules of a regulated market
- the direct impact on the portfolio of currency devaluation, as well as the effect on related markets and currencies
- the extent of any mismatch of assets and liabilities, including reinvestment risk
- the impact on the portfolio value of a dramatic change in the spread between a market index of interest rates and the risk free interest rate
- the extent to which market moves are non-linear between sectors and could have non-linear effects on values, e.g., derivatives
- the effect of credit rating downgrades and variations in market credit spreads on the value of assets
- the impact of interest rate changes on the potential exercise by policyholders of options under their contracts.

58. Liquidity risk relates to the possibility that an insurer will be unable to realise the assets it needs in order to fund its obligations as and when they fall due without incurring losses. Understanding whether an insurer's cash flow is sufficient to meet its commitments to policyholders and other creditors is fundamental. Factors to consider when undertaking stress tests include, but are not limited to:

- any mismatch between expected asset and liability cash flows
- the inability to sell assets quickly (at a fair and reasonable price)
- the extent to which the insurer's assets have been pledged
- the cash-flow positions generally of the insurer and its ability to withstand sharp, unexpected outflows of funds via payment of claims, or an unexpected drop in the inflow of premiums
- the possible need to reduce large asset positions at different levels of market liquidity, and the related potential costs and timing constraints.

5. Methods of managing asset-liability mismatches

59. This section describes a number of additional considerations and approaches that are important for ALM by an insurer. Risks an insurer assumes, and to which it is exposed, are continuously changing. Internal risk factors arise from the financial objectives, risk tolerances, and constraints of the insurer. External risk factors may include: general economic activity, interest rates, equity returns, competition, the legal environment, regulatory requirements, and tax constraints. Such factors may impact both assets and liabilities simultaneously, although the impact is not necessarily of the same magnitude or in the same direction in a particular time period or over a period of several years. This dynamic environment, which is also effected by random factors, creates uncertainties in the future cash flows and balance sheet values and in the true risk exposure of the insurer. The risks an insurer faces will vary as the underlying risk factors change and as future cash flows are replaced by actual cash flows.

60. An insurer has several options for managing the risks associated with assets and liabilities (and the interaction between them). These include bearing the risk, hedging, reinsurance and product management. The method used will depend on the insurer's objectives and risk tolerance along with the effectiveness, relative costs and availability of the options and the relationships with the counterparties involved. At times, the capacity of the market to absorb certain types of risk (e.g., long term reinvestment risk) may be limited.

Hedging

61. Hedging can play an integral role in the ALM process. It is the technique of designing a portfolio with cash flows that can be used to offset another portfolio's cash flows in certain scenarios. The insurer still retains the original risk, but the hedging results in a net reduction of overall risk. Hedging instruments include assets, liabilities, and derivatives (e.g., options, futures, swaps, forwards, swaptions, and exotics). An asset with expected cash flows matching those expected for a liability is a simple hedge.

Hedging is distinct from diversification, i.e., the technique of combining exposures that are less than 100% correlated to reduce overall risk. Hedging is a strategy available to reduce systemic risk or non-diversifiable risk.

62. Hedging is often used:

- to reduce systemic or non-diversifiable risk⁴
- for insurance products with options and/or guarantees.

63. Hedging should be carried out in the context of an appropriate risk management policy approved by the board of directors. Relevant procedures⁵, management information and reporting, and systems and controls should be in place. After hedging, the risk profile should be aligned with the board of directors' risk tolerances. Insurers must regularly reassess their reliance on and the effectiveness of hedging and diversification and rebalance portfolios when necessary. The time horizon over which the hedge is in place may vary, but should be explicitly defined.

64. Hedging opportunities depend on what is available in the market. It may be possible, for example, to arrange specialised tailor-made over-the-counter (OTC) packages through investment banks. Some jurisdictions may not have access to hedging opportunities locally and it may therefore be necessary to seek hedging opportunities in other countries. Hedging methods are either static or dynamic:

Hedging method	Advantages	Disadvantages
Static hedging (uses fixed and unchanging hedges)	Less skill required	High fees to counterparties Requires frequent reviews and adjustments
Dynamic hedging (rebalances hedge positions as market conditions change)	Efficient in terms of managing the risks and rewards	Requires a test period to ensure staff and systems are ready and able to respond High operational risk, basis risk, frictional costs and the risk that, in volatile and illiquid markets, hedging in line with the model may not be possible

65. Hedging reduces some risks but may introduce other risks, such as:

- credit risk from exposure to counterparty default

⁴ For example, when a stock market decline results in guarantees under equity-linked contracts being in the money for many contracts at the same time.

⁵ For example, the successful operation of a derivatives program is likely to require the use of internal models.

- credit risk of the underlying instrument
- basis risk from imperfect or partial hedging, where the hedging instruments are not perfectly negatively correlated with the risks being hedged. In some instances, an incomplete hedge may even increase the overall risk.
- market risk, especially non-linear or geared market risk, through the use of derivatives
- liquidity risk due to requirements to provide collateral on derivative transactions.

66. The supervisor should review the insurer's hedging programme⁶, the availability of necessary financial instruments, the experience and abilities of personnel engaged in this sophisticated activity and the insurer's ability and success in conducting the hedging programme.

67. Supervisors may need to put in place regulatory disincentives (e.g., additional capital requirements) to guard against the hedging programme going beyond what is required for effective hedging (for example, where the programme significantly increases exposure to market risk) and to instil discipline in the financial modelling used by the insurer.

Reinsurance

68. Reinsurance is a method of passing a risk to another insurer and hence can be used to mitigate ALM risk. It is used primarily to manage liability risk, but may also be used to resolve some ALM risks. For example, one alternative to holding assets in order to match equity-linked liabilities would be for the insurer to enter into an equity-linked reinsurance contract.

69. In the context of ALM, reinsurance may also be arranged to:

- compress, truncate or smooth the volatility of the insurer's projected cash flow profile, enabling better matching of assets to the remaining cash flows
- transfer investment risk
- share expertise with the reinsurer
- transfer risk to the capital markets through securitisation.

70. While reinsurance normally transfers away some risks, it introduces counterparty and concentration risk. Counterparty risk occurs if the reinsurer cannot fulfil its obligations to the insurer or if the reinsurer's creditworthiness deteriorates. Factors that lead to counterparty default by reinsurers may be highly correlated with the factors that would lead the insurer itself into financial difficulty. Insurers should monitor the creditworthiness of their reinsurers on an ongoing basis, but particularly when the reinsurer is based in a different country or is less well regulated than direct insurers.

71. Counterparty risk may be reduced by collateral requirements or rating triggers in the reinsurance contract whereby, for example, the reinsurer is required to post collateral if its external credit rating falls below a particular level. This may lead to a significant drain on the reinsurer's liquidity and may need active management in the ALM process.

72. Reinsurance can also give rise to concentration risk, for example:

⁶ This applies to derivatives used for existing and new insurance business.

- a diverse asset portfolio may be replaced with a single reinsurance asset (albeit that the reinsurer may hold a diverse portfolio itself)
- reinsurance with insurers in the same corporate group may obscure the level of risk within the group
- an insurer may have exposures to a particular reinsurer or its group companies, other than those arising from reinsurance itself.

Matching across asset-liability segments

73. An additional approach to ALM is to identify separate homogeneous segments of liabilities and obtain matching investments appropriate to each segment, which would be appropriate if each liability segment was a stand-alone business. However, this strategy could be suboptimal ALM, as it ignores the opportunities for profit and management of risk that can be gained from treating the business as a whole within the insurer.

74. There are some types of insurance business for which, to protect policyholders, it is appropriate for assets and liabilities to be ring-fenced, or for liabilities to be closely matched with corresponding assets. For example: i) non-life insurance business is normally ring-fenced from life insurance business; ii) a separate fund of assets may be used to determine the benefits under with-profits business; iii) equity-linked or indexed-linked benefits may be closely matched with corresponding assets; and iv) annuities cash outflows may be matched with cash inflows from fixed income instruments.

75. Although ALM can be practised for each business segment within the insurer separately, this is likely to mean that the benefits of scale, hedging, diversification, and reinsurance that can be gained from managing the different segments of assets and liabilities together are ignored or receive less attention. This may apply to assets and liabilities managed within a corporate group by different management teams. When the insurer is part of a corporate group, there may therefore be benefits to be gained from coordinating ALM across a corporate group or applying it as a centralised function, subject to restrictions on movement of funds across legal entities. This may possibly be achieved using notional segment asset portfolios to help distinguish between the performances of different management teams. Operational risk that the coordination may be inadequate may arise from this less specific approach to ALM.

Long duration liabilities

76. Some liabilities may have particularly long durations, such as product liability and whole-life policies and annuities. There may be a significant reinvestment risk, such that the present value of future net liability cash flows is particularly sensitive to changes in interest rates.

77. Many markets throughout the world do not have long fixed-income assets to back long duration liabilities. There may also be gaps in the asset durations available. This may be an issue even in the most well developed markets for some types of liabilities. Possible ways of addressing this may include:

- using derivatives to align the sensitivity of the assets with the likely movements in the value of liabilities
- designing products that share the risk with the policyholder and/or provide low monetary guarantees.

78. Because of the difficulty of matching the long-term liabilities, it may be appropriate for the insurer to separate the long term ALM portion of the tail liability from that of the shorter term

assets and liabilities. This can help to ensure that adequate focus is maintained on the long-term risk and that action is taken early enough to anticipate problems that may only emerge many years into the future (for instance, with annuity guarantees). Long tailed liabilities should be the subject of specific supervisory focus to ensure that ALM risks are identified and properly managed.

Appendix- Definitions

Throughout this paper and the ALM Standards paper a number of definitions and key words are used. Some of the key terms are defined here; for more general insurance terminology refer to the IAIS *Glossary of terms*.

1. **Accumulation annuity:** a contract that accumulates, with interest, either a single premium or a series of premiums and which provides a maturity benefit at some point in the future or provides an option to convert to a payout annuity.
2. **Asset-liability management:** the practice of managing a business so that decisions and actions taken with respect to assets and liabilities are coordinated. ALM can be defined as the ongoing process of formulating, implementing, monitoring and revising strategies related to assets and liabilities to achieve an organisation's financial objectives, given the organisation's risk tolerances and other constraints. ALM is relevant to, and critical for, the sound management of the finances of any organisation that invests to meet its future cash flow needs and capital requirements. (Source: Society of Actuaries, *Specialty Guide on ALM* (2003))
3. **Asset-liability risk (ALM risk):** the risk addressed by asset-liability management. ALM risk (sometimes referred to as mismatch risk) is the risk that the cash flows arising from the assets supporting the liabilities do not match the liability cash flows.
4. **Convexity:** an important measure of interest rate risk (together with duration) for fixed income securities and interest bearing liabilities. It measures the rate of change of the duration with respect to the interest rate. This means that it is a measure of how sensitive an instrument's duration is to changes in the interest rate i.e., it shows the curvature of the price profile of the instrument.
5. **Deferred accumulation annuity:** an annuity providing for payments to begin at some future date. (Source: Canadian Life & Health Insurance Association, *Glossary of Insurance Terms* (2006)).
6. **Duration:** is an important measure of interest rate risk (together with convexity). It is a measure for the sensitivity of the value of an asset to changes in interest rates.
7. **Economic value:** the value of asset or liability cash flows, derived in such a way as to be consistent with current market prices where they are available, or using market-consistent principles, methodologies and parameters. (Source: Comité Européen des Assurances – Groupe Consultatif Actuariel Européen, *Solvency II Glossary (Draft April 2006)*)
8. **Effective duration:** is defined as the approximation

$$D \approx (-1/P) ((P^+ - P^-)/(r^+ - r^-))$$

where P is the price of the instrument before any parametric shift. In the case of interest rates this represents the unshifted yield curve. r^+ represents a parallel up shift whereas r^- represents a parallel

down shift. P^+ represents the value for the positive shifted scenario r^+ and P^- the value for the negative shifted r^- . This concept is very sensitive to the size of the shift of the yield curve.

9. **Exotic contract:** an investment contract with a new or complex structure

10. **Forward (or Forward contract):** a contract for the delivery of a particular commodity or financial product in the future in exchange for a contract-specified price. A commitment to buy (sell) an asset at a future date for a price determined at the time of commitment, usually reflecting the net cost of carry.

11. **Future:** a standardised forward contract offered by a central trading exchange (such as the New York Mercantile Exchange, or NYMEX).

12. **Immediate payout annuity:** an annuity contract that provides an income on an immediate basis, as distinct from a deferred annuity.

13. **Lifetime annuity:** same as a life annuity, defined in the IAIS *Glossary* as a contract that provides income for the life of the annuitant.

14. **Macaulay duration:** The duration for any bond with cash flow payments of $C_1 \dots C_n$ at times $t_1 \dots t_n$ and interest rate r is defined as:

$$D = \frac{\sum_{i=1}^n C_i (1+r)^{-t_i} t_i}{\sum_{i=1}^n C_i (1+r)^{-t_i}}$$

15. **Modified duration:** is expressed as:

$$MD = \frac{1}{1+r} \frac{\sum_{i=1}^n C_i (1+r)^{-t_i} t_i}{\sum_{i=1}^n C_i (1+r)^{-t_i}}$$

16. **Money duration:** measures the absolute sensitivity of an investment's position in the local currency. For fixed income instruments it can be expressed as:

Duration = Delta * Market Value, where delta is the change in interest rates.

This measure can be useful when the economic values of assets and liabilities differ.

17. **Monte Carlo simulation:** a method that estimates possible outcomes from a set of random variables by simulating a process a large number of times and observing the outcomes.

18. **Option:** the contractual right, but not the obligation, to buy or sell a specified amount of a given financial instrument at a fixed price before or at a designated future date. A call option involves the right to buy the financial instrument. A put option involves the right to sell the financial instrument.

19. **Payout annuity:** a contract that provides income to a policyholder for a specified period of time, such as a number of years or for life.

20. **Surplus ratio:** the ratio of the insurer's capital available to its capital requirements as defined by the solvency regime within the insurer's jurisdiction.

21. **Swap:** a financial transaction in which two counterparties agree to exchange streams of payments over time according to a predetermined rule. The most common form of swap is a "vanilla" interest rate swap. With that structure, one party pays interest at a fixed rate while the other pays according to a floating rate such as LIBOR.

22. **Swaption:** an option on a swap.

23. **Tail Value at Risk (TVaR or Tail VaR):** is the quantile value at risk (VaR) plus the average exceedence of that quantile if such exceedence occurs. (Source: International Actuarial Association, *A Global Framework for Insurer Solvency Assessment* (2004))

24. **Underwriting risk:** is the specific insurance risk arising from the underwriting of insurance contracts. The risks within the underwriting risk category are associated with both the perils covered by the specific line of insurance (including reserving risk) and with the specific processes associated with the conduct of the insurance business. (Source: International Actuarial Association, *A Global Framework for Insurer Solvency Assessment* (2004))

25. **Unit-linked policy:** is a life insurance contract which guarantees a link between policyholder funds and external equity or bond indices or market values.

26. **Universal life policy:** is a combination flexible premium, adjustable life insurance policy. The policyholder may select the amount of premium to pay and the policy benefits are those which the premium will purchase. If the policyholder may choose to pay a premium that is greater than that required to support the chosen benefit, the excess accumulates as an investment.

27. **Value at Risk (VaR):** a measure of the potential financial loss in the investment portfolio or on the whole balance sheet. Value at risk provides an estimate of the worst expected loss over a certain period of time at a given confidence level. For example, a 12 month value at risk with a 95% confidence level of \$1 million means that an insurer would only expect to lose more than \$1 million 5% of the time or once in 20 years. [Source: *Investments Subcommittee Guidance paper on investment risk management – October 2004*]

28. **Variable annuity:** an annuity contract under which the amount of each periodic payment fluctuates according to the investment performance of the block of assets backing the annuity portfolio that is held by the insurer.