RISK-POSITION REPORTING IN THE SOUTH AFRICAN LIFE-INSURANCE INDUSTRY

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ABSTRACT

Risk management is central to the running of a successful insurance operation. This means that insurers must be able to measure and monitor their risks using risk-management tools that will effectively help them manage and exploit these risks. This paper considers risk-reporting techniques in the life-insurance industry in South Africa, reporting on the results of a survey of current practice. Liability risk, asset risk, asset-liability risk, and operational risk are each viewed separately. The current state of reporting is considered and a view is taken as to the future outlook, identifying areas for potential improvements in risk reporting. Additionally, comparisons are made with current practices outside South Africa, particularly in North America.

KEYWORDS

Risk reporting; asset-liability management; South Africa

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1. INTRODUCTION

1.1 For as long as they have existed, insurers have used risk-quantification techniques for many purposes including premium setting, financial forecasting and reserving. After so long, then, one might expect that insurers would have risk quantification down to a fine art. Yet insurance operations do run into financial difficulties, and in some instances the outcome is calamitous. This indicates that there is room for improvement in the risk management process.

1.2 It is with this backdrop that a review of the state of risk-position reporting techniques in the life insurance industry in South Africa has been undertaken.

1.3 This paper acknowledges the recent draft of the new King Report on Corporate Governance (King Committee, 2001), which introduces recommendations for effective risk management within the context of promoting the highest standards for corporate governance in South Africa. The recommendations of the King Report could have a significant effect on risk reporting in the South African life insurance industry in the future, and a summary of the risk-management features of that report are given in this paper.

1.4 Additionally, recent international proposals could have major implications for risk reporting and risk management in years to come. First, movements towards an accounting standard that involves the reporting of assets and liabilities at fair value are progressing rapidly. In parallel with this, there are international supervisory developments that are consistent with a move towards a risk-based capital requirement for purposes of prudential reporting on a fair-value basis. A brief overview of these important developments is given in this paper.

1.5 The paper is structured as follows:
- Section 2, entitled 'Objective and Background', expands on what the paper aims to achieve, and gives some background to the aspects of the King Report relating specifically to risk management, and a brief overview of recent international moves towards new accounting and regulatory requirements.
- Section 3, entitled 'Detailed Analysis', presents detailed commentary on risk-position reports under each of the broad categories of risk (liability risk, asset risk, asset-liability risk and operational risk). Under each category of risk reporting, three main areas of discussion are covered. First, current risk-reporting techniques in South Africa are reviewed. Second, a comparison is made with current practices outside South Africa, particularly in North America. Third, the paper identifies areas for potential improvements in risk reporting.
- Section 4, the summary, presents some of the highlights of the paper.

1.6 In order to gain an understanding of current industry practice, interviews were conducted with senior management (mainly actuaries) at some of the major life insurance companies in South Africa.

2. OBJECTIVE AND BACKGROUND

2.1 OBJECTIVE

The objective of this paper is threefold:
- to present the current state of risk-position reporting in the South African life insurance industry;
- to make a comparison with current practices outside South Africa; and
- to identify areas for potential improvements in risk reporting.

2.2 BACKGROUND

2.2.1 In order to gain an understanding of current industry practice, interviews were conducted with senior management (mainly actuaries) at ten of the major life insurance companies in South Africa. This involved discussion around several key areas:
- what types of risk-position reports are being used, and for which asset categories and lines of business;
- what the reports are used for;
- turnaround time and frequency of reports;

– who typically receives these reports;
– what the reports typically encompass;
– the efficiency (accuracy and ease of collection) of the data collected for these reports; and
– how the industry believes these reports will change and evolve.

2.2.2 The interviews were informal, although a written questionnaire was used as the basis for discussion. The questionnaire followed the format and structure laid out in section 3, where the results of the interviews are presented.

2.2.3 In comparing with North America, reference has been made to a survey carried out by a working group (which included the author of this paper) on behalf of the Society of Actuaries (Britt *et al*, 2001). That survey comprised a detailed questionnaire in electronic format (accompanied by various hard-copy documents as a guide), which was mailed to 164 insurance companies in the USA, Canada and Bermuda. The survey response rate was high given the large size of the questionnaire. Of the 164 companies solicited, 44 responded, with a good spread of responses by life versus general insurance companies.

2.3 THE KING REPORT

The recent draft of the new King Report could have a significant impact on the practice of risk management and risk reporting in South Africa. This section provides an overview of some of the features of the report, specifically with respect to risk management and in particular risk reporting. This in turn provides an important backdrop to risk reporting in South Africa, especially with regard to how risk reporting might develop in the future.

2.3.1 Basic Concepts

Corporate governance can, in part, be viewed as a company's strategic response to the need to assume product risks, appropriately mitigated, in exchange for measurable rewards. While risk management should be practised throughout the company by all staff in their day-to-day activities, it is ultimately the responsibility of the board. Directors have an obligation to demonstrate that they have dealt comprehensively with the issues of risk management and internal control. This requires appropriate disclosure on matters such as risk tolerance and the risk-management process.

2.3.2 Responsibility for Risk Management

The board is responsible for disclosures in relation to risk management in the annual report and should acknowledge that it is accountable for the risk-management procedures. The total process of risk management is the responsibility of the board. Management is accountable to the board for designing, implementing and monitoring the risk-management process and integrating it into the day-to-day activities of the company. Effective continuous monitoring is an essential part of the risk-management process. The board should receive and review reports on that process. In this regard, the board is responsible for ensuring that a formal risk assessment is undertaken at least annually for purposes of making its public statement on risk management.

2.3.3 Information and Communication

Pertinent information should be identified, captured and communicated in a form and a timeframe that enables employees to properly carry out their responsibilities. This may include accurate, timely and relevant financial and operational data that are supported by adequate and appropriate systems. These systems should be accompanied by communication practices that ensure that all information, positive and negative, reaches senior management expeditiously, that best practices are shared across the company and that management's intent is understood by all.

2.3.4 Monitoring

It is necessary to generate information about risks and the control environment that is accurate, timely and relevant to good governance principles. The effectiveness of such systems should be communicated and demonstrated to shareholders and relevant stakeholders. The company's capabilities in the disciplines of disaster recovery, crisis management and business continuity should be publicly detailed.

2.3.5 Application of Risk Management

The reports from management to the board should provide a balanced assessment of significant risks and the effectiveness of the system of internal control in managing these risks. In its narrative statement in the annual report on how the company has dealt with risk and control, the board should, as a minimum, disclose:

- that it is responsible for the process of risk management and the system of internal control;
- that there is an ongoing process for identifying, evaluating and managing the significant business risks faced by the company;
- that there is an adequate and effective system of internal control in place to mitigate the significant risks faced by the company to an acceptable level;
- that there is a documented and tested process in place that will allow the company to continue its critical business processes if a disastrous incident strikes its activities;
- that there are processes in place to review the system of internal control for effectiveness;
- where material joint ventures and associates have not been dealt with as part of the group for the purposes of the statements; and
- any additional information that will assist understanding of the company's risk-management processes.

Where the board cannot make any of the disclosures set out above, it should state this fact and provide an explanation.

2.4 INTERNATIONAL ACCOUNTING AND SUPERVISORY DEVELOPMENTS

2.4.1 Even more far-reaching changes than those arising from the King Report may be in store for insurers in the near future as a result of impending new international accounting and supervisory requirements. The following briefly reviews some of the main developments. Hairs *et al* (2001) elaborates on many of the points made below. A short summary of international developments is given in Gutterman (2002).

2.4.2 A committee reporting to the International Accounting Standards Board has issued a Draft Statement of Principles for an International Accounting Standard for Insurance (International Accounting Standards Committee, 1999). Central to this is the concept of reporting both assets and liabilities at fair values. It is expected that a draft standard will be ready about the end of 2002, with a final standard in 2004, and implementation in 2005. The standards will apply to both short- and long-term insurance business.

2.4.3 While the accounting standards will apply to general-purpose accounting, as distinct from prudential reporting, there have been parallel international developments with regard to supervision, consistent with the concept of fair-value accounting. Regulators around the world are seeking to harmonise prudential reporting, and much progress has been made in this regard by the International Association of Insurance Supervisors (IAIS). IAIS (2000) considers an international standard for insurance supervision that looks at solvency and capital-adequacy requirements from a true risk-based perspective. The New Basel Capital Accord (Basel Committee on Banking Supervision, 2001) considers solvency for banks, greater emphasis being placed on banks' own assessment of risks to which they are exposed in the calculation of regulatory capital charges, including the use of an approach to credit risk based on internal ratings. An explicit charge for operational risks is also proposed. The proposals are likely to influence the supervision of other types of financial institution as the drive towards harmonising the regulation of all financial institutions continues. Indeed, moves are already well under way to provide for the consistent regulation of all financial institutions: a multidisciplinary working group has prepared a document with recommendations for improving public disclosure on financial intermediaries generally (Multidisciplinary Working Group on Enhanced Disclosure, 2001). The working group includes representation from the IAIS. The recommendations include the requirement that companies state their firm-wide exposure to market risk, integrating assets, liabilities and off-balance-sheet exposures, and including information on liquidity risks and credit risks.

2.4.4 The International Actuarial Association has issued a discussion paper (IAA, 2000) that sets out an overview of possible approaches to the valuation of insurance liabilities in the context of the International Accounting Standards Board proposals. In addition, that paper considers a risk-adjusted basis for determining an economic capital requirement for the purposes of prudential supervision. It also suggests a risk-categorisation approach based on eight distinct categories of risk.

2.4.5 The above initiatives combine to create a very forceful movement towards a new way of thinking about insurance accounting and solvency assessment. To the extent that these new developments reward companies for more effective risk-management techniques, e.g. through having to hold less risk-based capital, it should be expected that there will be associated changes in risk-position reporting by insurers around the world in years to come.

3. DETAILED ANALYSIS

In this section, the contents of risk-position reports with regard to liability risks, asset risks, asset-liability risks and operational risks are considered. In this paper,

'liability risks' cover insurance and expense risks but exclude investment guarantees, which are considered an asset-liability risk, and data risks, which are considered an operational risk. Analytical terms used in this section are defined in Appendix A.

3.1 REPORTS ON LIABILITY-RISK POSITIONS

Liability risks arise primarily from the following categories:

- claim costs, comprising:
  - mortality;
  - morbidity; and
  - persistency;
- expenses; and
- failure of reinsurance.

3.1.1 Risk Materiality

3.1.1.1 Unexpectedly increasing claim costs can quickly destroy the profitability of a line of business or even an entire company. In the South African market, companies rely on being able to vary mortality rates. While this clearly helps mitigate claims-cost risk, it still leaves persistency as a major area of risk exposure.

3.1.1.2 South African life insurers were asked how they rated the liability risk elements according to the materiality of their exposure. The following feedback is noted:

- Overall, liability-risk materiality was ranked on par with asset-risk materiality and operational-risk materiality, which were all ranked somewhat higher than asset-liability-risk materiality.
- Claims-cost exposures were ranked significantly higher than by North American life insurers.
- On average, persistency exposure was ranked above mortality. Smaller companies generally ranked mortality exposures somewhat higher than larger companies.
- Expenses were also ranked high on average (again higher than in North America), indicating the substantial level of concern about the control of expenses in the South African market.
- The materiality of exposure to reinsurance failure was ranked low compared with other liability risk exposures.

3.1.2 Analysis and Reporting Methodology

The existence and materiality of liability risks has brought about the development of some sophisticated tools to analyse these risks. Reports on liability-risk positions include the following categories of analytical approach:

- experience studies;
- embedded-value-added analysis; and
- analysis of financial-soundness valuation (FSV) profits.

All the life insurers interviewed perform the three types of reporting indicated above. Each of the reporting techniques is considered, in detail, in the following sections.

3.1.3 Experience Studies

3.1.3.1 The South African life insurance industry has a long history of performing experience studies to monitor liability risk elements.

3.1.3.2 All the companies interviewed make extensive use of experience studies to track mortality, morbidity, expenses and termination rates. Typically, the studies are used for setting the basis to be used for computing reserves and embedded values, a secondary use being in setting pricing assumptions. A few companies indicated that a primary area for improvement is to develop studies that would be more tailor-made for pricing; experience studies that are used for reserving and embedded values tend to be too aggregated for the pricing team, which needs more finely sliced experience information to set premium rates with reference to a potentially large number of different rating factors.

3.1.3.3 The typical format of a mortality study is an actual-to-expected computation, drilling down by product line and using age bands that make sense from a credibility perspective. In some instances, from a financial-management perspective the emphasis of the mortality studies is on monitoring early death claims, e.g. to track trends in how quickly after policy inception a claim is made.

3.1.3.4 Formal mortality studies are generally performed annually, one company performing a formal study every two years.

3.1.3.5 The formal mortality studies are normally kept to an actuarial audience, although summary statistics are provided to other senior management. One company mentioned sending information on mortality trends etc. to the audit committee, and a summary to the board.

3.1.3.6 Persistency is typically monitored monthly. These studies can generally be produced quickly, within a month or two of the experience. Most companies indicated that trends in persistency are forwarded to senior management and that persistency tends to be reported and managed quite well. Persistency studies are also sometimes used to assist in setting sales personnel's incentive compensation.

3.1.3.7 Expenses are analysed in detail by all life insurers at least annually, although some perform a detailed analysis quarterly. A number of companies also perform monthly analysis, at a reasonably detailed level. Expense analysis is typically performed more manually than mortality, morbidity and persistency studies, which are usually highly automated. However, an expense analysis must be timely, and despite the need for a more manual approach, expense analyses are typically available within a month or two of the experience. Like persistency, most companies indicated that trends on expenses are forwarded to senior management and that expenses tend to be reported and managed quite well.

3.1.3.8 Expense analysis can lose usefulness if the company structure is changing. One potential improvement might therefore be to have a process in place where refinements could be made to the expense study to allow for this.

3.1.4 Embedded-value-added Analysis

3.1.4.1 All major life insurers in South Africa compute embedded values and publish the results in their annual statements. Increasingly, embedded values are being

used as a financial-management tool, and as a tool for measuring the growth in the value of a company. One company described the purpose of the embedded-value calculation as being to explain the financial position of the company to the outside world. The South African experience contrasts greatly with the North American experience, where only about 30% of companies indicated that they use embedded values.

3.1.4.2 Most companies calculate embedded values half-yearly, but most would like to move to more frequent calculations, even if only approximate. For companies considering calculations more frequent than half-yearly, it is not expected that the actuarial basis would be altered for interim computations, but rather that the in-force would be rolled forward as appropriate to allow for actual ons and offs and the basis kept the same.

3.1.4.3 The computation of an embedded value in itself does not serve as a tool for monitoring changes in individual liability risks. However, an extension of it is to perform embedded-value-added analysis from time to time and to do a variance analysis on the individual risk elements. This additional step allows the company to understand how each risk element has contributed to the overall change in value.

3.1.4.4 Some companies perform embedded-value-added analysis at a line-of-business level. For those that do not, this is seen as a primary area for potential improvement in the future.

3.1.4.5 A couple of companies indicated that the basis of calculation of embedded values for internal management purposes is different from the basis used for the purposes of publication.

3.1.4.6 A number of companies can now perform their embedded analysis very quickly—certainly within a month or two of the period end. Companies are generally intending to do the calculations in more detail and with better understanding.

3.1.4.7 Embedded-value results are of interest to, and are distributed to, many parties involved in the operations of a life office, including line managers, senior management and board members. External auditors also receive copies of embedded-value reports.

3.1.4.8 Two companies indicated that they felt they could use embedded values to better effect. One company that had only recently begun to perform embedded-value calculations indicated that the focus so far had tended to be on the more mechanical tasks of getting the numbers correct, and reducing the variance to an acceptable level. Once these tasks are automated, the next step will be to use the numbers as a true financial management tool, e.g. to use the variances as a tool for assessing what is creating value, and hence indicate areas for potential management actions.

3.1.4.9 One company also indicated that they would like to spend more time on interpreting results than on calculating numbers.

3.1.4.10 One company indicated that they would like embedded values to better pin-point the effects of embedded options in contracts. This idea anticipates future developments in the area of reporting in asset-liability management (see section 3.3), perhaps envisaging the use of a stochastic embedded-value calculation.

3.1.4.11 The North American study shows what companies may want out of an embedded-value-added analysis report in the future, viz.:

– to indicate the drivers of profitability;
– to provide more effective feedback on the performance of lines of business;
– to understand risk-reward trade-offs; and
– to identify implementable strategies.

Some of these requirements may well be equally applicable to life insurers in South Africa.

3.1.5 Analysis of FSV Profits

3.1.5.1 All life insurers in South Africa compute FSV profits. Whilst recognising that the FSV profits and embedded-value profits are closely interrelated (and differences should be reconcilable), a number of companies indicated that there has been a clear move away from FSV profits as the primary driver of the financial operations of the firm, to embedded values. Several companies also mentioned embedded values as a primary driver of incentive compensation.

3.1.5.2 For some companies, FSV profits continue to be used as the primary driver of the company's financial operations, but these cases tend to be where the firm has a holding company whose primary focus is different to life insurance.

3.1.5.3 Companies generally appeared to be satisfied with their analysis of the source of FSV profits, and that they have their unexplained variance down to acceptable levels. One company whose focus is FSV profits, performs surplus analysis in great detail and with a very low variance.

3.1.5.4 Most companies calculate FSV profits half-yearly, but most would like to move to more frequent calculations, even if only approximate. Two companies indicated that they perform quarterly calculations. Behind this is a strong desire on behalf of companies to avoid surprises at year-ends, and to be able to take corrective action earlier if necessary.

3.1.5.5 One company, whose systems are not fully in place to automatically produce the level of detail they require, sees automation as being key.

3.1.5.6 Two companies specifically mentioned the issue of getting the databases used for actuarial liability calculations consistent with those used for accounting calculations.

3.1.5.7 Another company mentioned that a primary objective is to get the FSV and embedded-value calculations to blend better. In other words, it does not make sense to have two views of the same thing, and if there are differences they need to be properly understood and reconciled.

3.1.5.8 Reports on FSV profits are of interest to, and are distributed to, many parties involved in the operations of a life office, including senior management and board members. External auditors would also receive copies. However, line managers would not typically receive such reports.

3.1.6 Future Trends

There are a number of areas in which developments in liability-risk reporting may be expected in the future. Particularly for companies with high exposure to AIDS, it is to

be expected that the incidence and speed of mortality investigations will increase to enable a company to more actively re-rate its business, avoiding under-performance through lagging the deterioration in experience. As focus increases on customer value management, and also sales practices, it would be expected that experience, particularly persistency, will be analysed by different drivers, e.g. distribution channel, and sales region within distribution channel, by premium size etc. This can provide a good early warning system for problems with selling practices and highlight where value is being generated. In an era of focus on shareholder margins coupled with more transparency and pressure on margins, expense management will become critical. It will not be acceptable to have a black box deriving unit costs, and it should be expected that reporting on the derivation of unit costs will improve, as well as demonstrating why these have changed over time. This requires an analysis of change in unit costs that will cover increases in operating expenses as well as the change in the number of units. Reporting as it currently stands generally highlights the variance in experience, but does not couple this with an impact analysis on the FSV profits and embedded value. It is expected that the link between experience variances and changes in financial results will become more automated, to avoid surprises when the actuary sets his or her basis. For example, embedded-value remuneration schemes may place pressure on the actuary to have smooth, predictable changes in assumptions (which in turn has its own risks in terms of explaining potential differences in actuarial assumptions used for both internal and external purposes).

3.2 REPORTS ON ASSET-RISK POSITIONS

Asset-specific risks arise primarily from the following categories:

- credit risk (the risk of default of a party to an investment contract, which includes downgrade risk, default risk, and currency risk);
- market risk (the risk of adverse changes in the markets in which assets are invested, which includes risks associated with the receipt of asset proceeds at times other than originally anticipated, return volatility, asset market values, and liquidity); and
- concentration risk (the risk of being overexposed to any particular asset class, sector or holding).

3.2.1 Risk Materiality

3.2.1.1 Credit, market and concentration risks represent significant exposure for any financial institution, and each needs to be carefully monitored and managed.

3.2.1.2 South African life insurers were asked how they rated the asset risk elements according to the materiality of their exposure. The following feedback is noted:

- Overall, asset-risk materiality was ranked on par with liability-risk materiality and operational-risk materiality, which were all ranked higher than asset-liability-risk materiality.
- On average, market-risk exposure (i.e. exposure to market-value movements) was viewed as the most material, as compared with credit-risk exposure and concentration-risk exposure.

– A number of life offices noted that at first sight they would appear to face potentially huge asset-side exposures, but that these exposures are appropriately monitored and managed.
– One company indicated that market risk is significant but not regarded as unduly problematic because of the company's large capital base.
– So far as credit risk and concentration are concerned, a number of companies have tight exposure rules and counterparty limits. This in turn minimises the potential for credit risk and concentration risk to become problematic.
– Asset-risk materiality was ranked a little higher than by life insurers in North America, probably due to the higher holdings of equities in South Africa than in North America, where companies tend to hold mainly fixed-interest assets.

3.2.2 Analysis and Reporting Methodology

In similar fashion to liability risks, the existence and materiality of asset risks has brought about the development of some sophisticated tools to analyse these risks. Asset-risk reporting in South Africa is very mature and detailed. Reports on asset-risk positions include the following categories of analytical approach:
– liquidity;
– performance measurement and attribution analysis;
– value at risk; and
– the Greeks.

A number of companies indicated that a monthly investment report is prepared for the board, covering liquidity and concentration risk, and analysing investment performance against various benchmarks. A number of the asset reports, such as those on performance, are distributed amongst senior management, and many are presented to the board fairly regularly. Each of the reporting techniques is considered, in detail, in the following sections.

3.2.3 Liquidity

3.2.3.1 The types of effective asset-liquidity reports used by insurers are very varied. Generally, South African life insurers carefully manage cash and are very conscious of their daily cash position. The major concern is about having to liquidate a large portfolio when the markets are in a downturn. In addition, companies want to be aware of how quickly they can liquidate the portfolio, should this be necessary. Generally, the investment mandates of South African insurers are such that liquidity should not become an unduly onerous risk.

3.2.3.2 Some liquidity reports are produced daily, while others are produced less frequently; e.g. cash required may be considered weekly. Information about liquidity will typically be part of any package prepared for senior management and the board on the asset position.

3.2.3.3 One company also specifically mentioned that it considers liquidity in the pricing of products.

3.2.3.4 The types of liquidity reports believed to be used by South African life

offices includes lists of liquid securities and 'stress testing', which shows liquidity needs over a variety of scenarios.

3.2.3.5 In North America, a recurring theme is the use of liquidity scenario analysis, e.g. asset liquidity less liquidity required by liabilities under various scenarios, where the types of scenario tested include run-on-the-bank situations. The rating-agency liquidity formulas, especially S&P, are also mentioned quite frequently as being effective. The following are some of the other reports specifically mentioned by North American insurers:

- lists of highly liquid securities that can be sold without triggering a realised capital loss;
- the maximum cash that can be raised in 30 days;
- the short-term cash match between assets and liabilities;
- a comparison of the expected market value of assets to surrender values over a variety of scenarios;
- the ratio of liquid assets to projected surrenders under three scenarios (base, stressed and panic);
- an assessment of primary and secondary asset liquidity, in connection with liability considerations;
- maturity and investment-income reports, which are considered effective tools for liquidity analysis;
- operating- and crisis-liquidity reporting by segment; and
- liquidity information split by operating needs, corporate needs and amounts available for investment.

3.2.3.6 In general, South African insurers are neither hoping for nor expecting many changes in their asset-liquidity reports in the next few years. Those few companies that do see changes are looking forward to improvements from greater accuracy and from the ability to test more scenarios, rather than from changes in reporting format.

3.2.4 Performance Measurement and Attribution Analysis

3.2.4.1 Asset-performance measurement and attribution reports are important for South African life insurers, and are carefully monitored by senior management and the board.

3.2.4.2 The Association for Investment Management and Research (Bailey, Richards & Tierney, 1990) advocates that a performance benchmark should be:

- unambiguous (the names and weights of securities comprising the benchmark should be clearly delineated);
- investable (the option should be available to forgo active management and simply hold the benchmark);
- measurable (it should be possible to readily calculate the benchmark's own return on a reasonably frequent basis);
- appropriate (the benchmark should be consistent with the manager's investment style or biases);
- reflective of current investment options (the manager should have current investment knowledge—be it positive, negative, or neutral—of the securities that make up the benchmark); and

– specified in advance (the benchmark should be constructed before the start of the evaluation period).

3.2.4.3 Choice of benchmark can be difficult and a sensitive subject, given that asset-manager incentive compensation is typically based on performance against the benchmark. Moreover, there are difficulties in constructing appropriate benchmarks that are specific to South Africa, due to the relatively small market, and the concentration of the JSE-Actuaries all-share index in resources. For this reason, a number of benchmarks are often used, the manager's performance against each one being assessed.

3.2.4.4 Most companies go into great detail with their performance-measurement reports. Senior management is most interested in performance measurement against various market indices, and also against customised benchmarks that recognise the nature of the underlying liabilities. The asset managers additionally look at performance against their peers.

3.2.4.5 The concept of a risk-adjusted return is also becoming important, although this in turn raises questions over how exactly risk should be defined. Historically, on the asset side of the balance sheet, risk has been thought of in terms of asset volatility, but modern definitions introduce concepts such as shortfall risk (i.e. the probability that returns will fall below a certain minimum threshold). A number of life offices in North America have started to consider risk defined in terms of true asset-liability measures such as the probability that surplus will fall below a certain level.

3.2.4.6 Performance reports are typically produced monthly. Companies are generally satisfied with their reports, although those companies not producing monthly reports are keen to do so.

3.2.4.7 Asset benchmarks are typically set out in the investment mandates, enabling the fund managers to have a specific target to aim for at the beginning of each performance period.

3.2.4.8 Performance measurement and attribution analysis are typically very detailed, certainly considering individual asset classes (fixed interest, equities, property etc.) but also analysing what has contributed to performance (e.g. sector selection, individual stock selection etc.). Other improvements looked forward to include more detailed attribution analysis and more relevant benchmarks.

3.2.4.9 Asset-performance reports must also be seen in the context of the results of the embedded-value exercise, one company actually stating that embedded value added was the only relevant performance measure and that this applied equally to the assets as to the liabilities.

3.2.4.10 In North America, some of the more effective reports mentioned are:

– attribution analysis by sector, which gives insight into the value of manager and asset class over time;
– potential-exposure reports for derivatives, stressed mortgage performance and credit default analysis; and
– measurement of performance across sectors, including attribution analysis of trader performance.

3.2.4.11 A number of additional improvements are hoped for in North America:

– the provision of more detail and the monitoring of performance against policy constraints;
– better quantification of how excess returns are generated;
– more quantitative measures of risk; and
– better integration with the liability side, e.g. customised benchmarks and the use of performance measures that consider assets and liabilities together.

3.2.5 Value at Risk

3.2.5.1 In very broad terms, 'value at risk' can be defined as the greatest amount of cash that a company can lose over a particular period, and is commonly used as a measure of risk in the banking industry. Value at risk is one of the newer risk-reporting approaches being considered by life insurers, not just in South Africa, but around the world. It has more meaning in the context of banking, where it is relatively straightforward to quantify and understand the maximum loss that the bank could face at any given time. Value-at-risk quantification techniques used by banks include stress testing and the use of stochastic modelling. New thinking on value at risk and other risk quantification techniques in the banking industry can be found on the Bank for International Settlements website (www.bis.org).

3.2.5.2 A number of the South African life offices do calculate value at risk, although its use appears to be relatively limited so far.

3.2.5.3 One company indicated that value at risk is considered by the asset managers, but not reported outside of the investment department.

3.2.5.4 Another company indicated that they consider how much capital could be lost under adverse scenarios, but that this is really more asset-liability management than pure asset management.

3.2.5.5 The South African experience with value at risk is similar to that reported in North America, where only a handful of life offices indicated that value at risk is computed with reasonable rigour, and that the results are used effectively. A number of companies highlighted computational difficulties, and pointed out that more traditional measures are, at present, much more effective tools.

3.2.6 The Greeks

3.2.6.1 As would be expected, the Greeks are routinely calculated by those life offices in South Africa that hold derivative instruments.

3.2.6.2 Some companies produce detailed derivative reports that measure and monitor the underlying risks excellently. In addition to using such reports as an important trading tool, companies provide separate reports on derivatives to general management. However, not all companies are happy with their reporting on derivatives. Some indicate that while the asset managers may indeed be producing detailed reports, neither these nor meaningful summaries are submitted to senior management. In addition, few companies mention stress testing for derivatives; this appears to be a potential area for improvement.

3.2.7 Other Reports on Asset-risk Positions

Some other reports on asset-risk positions are used by life offices in South Africa:

- credit- and counterparty-exposure reports (although, surprisingly, this was not specifically mentioned by all companies);
- concentration- and diversification-risk reports; and
- property-exposure reports, including the duration of tenancy agreements and any concentration of expiry of leases in any particular year.

3.2.8 Future Trends

Asset-risk reporting in South Africa is very mature, and generally companies appear very satisfied with their reporting in this area. However, there are a few areas in which developments in asset-risk reporting may be expected in the future. Performance measurement will continue to evolve as something of a mixture of art and science. Improvements expected for the future include more detailed attribution analysis and more relevant benchmarks, including customised (or asset-liability) benchmarks. It appears that not all companies report in detail on credit and counterparty exposure. For companies presently not reporting in detail in this area, this would certainly appear to be an area for potential improvement. While derivatives reporting by the asset managers for trading purposes appears to be detailed and effective, there appears to be some scope for improvements in derivative reporting to senior management. This includes reporting on stress testing, showing the impact of derivatives on the company or line of business under various scenarios.

3.3 REPORTS ON ASSET-LIABILITY-RISK POSITIONS

Asset-liability risks arise from the following categories:

- cash-flow mismatch risk;
- duration and convexity mismatch risk;
- liquidity mismatch risk;
- currency mismatch risk; and
- policyholders' reasonable expectations (PRE) mismatch risk.

3.3.1 Risk Materiality

3.3.1.1 Mismatch risk can represent a significant risk for certain product lines, especially those where there is inherent optionality (i.e. where policyholders have the option to select against the office in the event of movements in interest rates).

3.3.1.2 South African life insurers were asked how they rated the asset-liability risk elements according to the materiality of their exposure. The following feedback is noted:

- Overall, asset-liability-risk materiality (compared to liability risk, asset risk and operational risk) is perceived by quite a high margin to be the lowest faced by insurers. This is a surprising result. In particular, it may be that life insurers have so far not perceived there to be great asset-liability risks inherent in products with interest-rate guarantees simply because interest rates have historically remained high. Moreover,

companies may in the past have relied on their ability to pass on poor experience to policyholders; however, this reliance may be tested in the future.
– On average, duration, convexity and currency mismatch risk is generally very low, while cash-flow mismatch and product-guarantees risk is somewhat higher.
– Although currency-risk materiality ranks very low, one company has some overseas investments through overseas subsidiaries, a risk that is closely monitored and managed.
– The materiality of asset-liability risk in South Africa is generally somewhat lower than in North America, where the interest-rate options in the assets and liabilities are relatively onerous.

3.3.2 Analysis and Reporting Methodology

Reports on asset-liability-risk positions include the following:
– stochastic scenario testing;
– deterministic scenario or stress testing; and
– mismatch risk analysis.

In South Africa, reporting on asset-liability risk is at a relatively early stage of development, compared with reporting both on liability-only risk and on asset-only risk, and with reporting on asset-liability risk in North America. One area where asset-liability reporting is quite sophisticated, however, is for annuity portfolios, where duration and convexity are usually carefully monitored. Whereas stochastic scenario testing is commonplace among North American life offices, a number of life insurers in South Africa believe that its applications are limited. Each of the various types of techniques used for reporting on asset-liability risk is considered, in detail, in the following sections.

3.3.3 Stochastic Scenario Testing

3.3.3.1 Perspectives on stochastic modelling and reporting are widely different amongst South African life insurers. Even where there is significant asset-liability exposure, some companies feel that the value of stochastic modelling is limited, and that the cost of setting up the systems to do the calculations outweighs the potential benefits. This contrasts sharply with the experience in North America, where stochastic modelling is now a widely accepted tool of financial management. This may be due to the fact that the optionality in the assets and liabilities of a North American life insurer make stochastic modelling a critical tool, whereas amongst South African insurers such optionality does not exist to the same extent. Moreover, one South African life insurer questions the validity of stochastic scenario testing if interest-rate risk is apparent but the business is matched.

3.3.3.2 Yet even for life insurers with portfolios comprising little optionality, stochastic modelling can be of great benefit. Advantages include the following:
– It is difficult in practice to match a portfolio completely. A stochastic model can help establish the extent and potential financial impact of any mismatching.
– A stochastic model may help to define the extreme points of the underlying probability distributions affecting the financial operations of the company, which may be difficult using a more traditional model.

– A stochastic model enables development of more meaningful risk-reward profiles for various potential strategies available to the company.
– A stochastic model can capture financial features of the business that may be overlooked in a deterministic model (e.g. underpinning investment guarantees).
– A stochastic model requires the user to think more carefully about what asset-liability risks face the business.
– A stochastic model enables companies with foreign operations to model risks on a consistent company-wide basis, where optionality is a critical element in the asset-liability profiles of such operations.

3.3.3.3 A number of South African companies are viewing stochastic modelling as an important tool for establishing economic capital in order to compare returns on economic capital across product lines. Indeed, some offices have already developed some sophisticated models for this purpose, although they admit that these models are still in the testing phase, with considerable refinements expected in the future.

3.3.3.4 One company indicated that it did not use stochastic modelling for its in-force business, but that it did use stochastic modelling for new business (i.e. stochastic pricing).

3.3.3.5 Reports on stochastic scenario testing thus far tend to remain in the actuarial domain, but as the models begin to mature, reports will become of more interest to a non-actuarial audience. This contrasts with deterministic scenario testing, which is well established and widely understood in South African life offices, and the results of which are often reported to the board.

3.3.3.6 For North American life insurers, stochastic scenario testing is closely linked with duration and convexity computation and a large number of companies actually perform their portfolio-duration and -convexity calculations using their stochastic models. In addition, a number of companies now use stochastic scenario testing to develop a risk-reward profile for a given set of strategies, hence creating an efficient frontier. South African insurers may be able to use stochastic scenario testing in similar ways in the future.

3.3.4 Deterministic Scenario Testing

3.3.4.1 Deterministic scenario testing is more common than stochastic scenario testing in the South African life-insurance industry, although still not prevalently used as a financial-management tool. This is comparable to the North American position, where deterministic scenario testing, while still performed (it has to be, by legislation, as part of annual statutory cash flow testing) is rarely used as an active-management tool.

3.3.4.2 Deterministic models can generally be run, and results compiled, quite quickly (a line of business is unlikely to take more than an overnight run). Moreover, the results are typically easily understood by a non-technical audience, and thus where companies do produce results based on deterministic models, the distribution of reports tends to be wide, often going to the board.

3.3.4.3 Deterministic modelling should be viewed as a separate exercise to embedded-value sensitivity testing, the latter being performed by all South African life insurers as part of the embedded-value reporting process.

3.3.5 Mismatch Risk

3.3.5.1 Mismatch-risk reports are produced as part of the normal reporting process by all companies with substantial annuity portfolios, and are regularly considered in some detail by senior management. This is similar to the position in North America.

3.3.5.2 As expected, a number of companies specifically mentioned that duration- and convexity-mismatch reports are their most effective mismatch reports, especially where companies have large portfolios of annuities and asset-liability duration matching is important. Some companies also look at cash-flow projections of the insurance operation versus investments, and also indicate that mismatch reports are performed by line of business, operating division and asset portfolio.

3.3.5.3 Asset-duration and -convexity reports can be produced very quickly (daily if necessary), but, for those with large annuity portfolios, are usually disseminated among senior management only monthly, normally including information on liability duration and convexity in the form of a matching report.

3.3.5.4 There are limitations to using duration and convexity, especially with regard to non-parallel shifts in the yield curve. Refinements can be made to improve the technology (Reitano, 1991; Maitland, 2001), but it is believed that such refinements are not commonly used by South African life insurers.

3.3.5.5 For those life insurers in South Africa preparing duration- and convexity-matching reports, most generally appear to be satisfied with these reports, and are not wishing to get much more out of the reports in the future. This reflects a perception of duration and convexity as a mature technology. This corresponds closely with the North American perception, although North American life offices are generally hoping to prepare faster, more accurate calculations as more accurate methodologies and relatively inexpensive computer resources become available.

3.3.6 Future Trends

A number of future developments in reporting on asset-liability risk can be expected. The management of a life company depends heavily on the sharing of risks between policyholders and shareholders. In many instances companies rely, to various degrees, on their ability to pass on poor experience to policyholders. This seems in part to explain the low rating placed on asset-liability risks. However, with issues such as the increasing volatility of equity markets and deterioration in mortality from AIDS and violent crimes, this underlying reliance may be tested. Indeed, as an indicator of the potential risks this poses, a recent ruling by the House of Lords in the UK had the effect of overturning the reliance that the management of Equitable had placed on their ability to pass on poor experience to policyholders. With regard to asset-liability reporting, South African life insurers may start to examine the implications of having their management actions restricted. Many insurance companies provide underlying investment guarantees on products with underlying assets heavily weighted to equities. This necessitates the use of stochastic techniques to fully understand the underlying risks. While there are certainly weaknesses in stochastic models, it seems likely that the use of such models will become more prevalent. Although not specifically mentioned by any companies, it is expected

that the mismatching of PREs and negative rand reserves will become of more concern, and developments in risk reporting in these areas may be expected.

3.4 REPORTS ON OPERATIONAL-RISK POSITIONS

Operational risks relate to any non-financial risk and arise from many sources, including (but not limited to) the following:

- event risk, including risk exposures arising from:
  - taxation;
  - political sources;
  - regulation; and
  - capital markets (this relates to non-financial risks associated with the capital markets and is different to the market risks described in section 3.2);
- people risk, including risk exposures arising from:
  - integrity;
  - health and safety; and
  - key personnel;
- technology risk, including risk exposures arising from:
  - inappropriate transactions;
  - lost and incorrect data; and
  - availability and infrastructure;
- distribution risk, including risk exposures arising from:
  - business volumes;
  - market conduct; and
  - sales compliance; and
- catastrophic risk, including risk exposures arising from:
  - property damage;
  - flood, hurricane and tornado; and
  - business interruption.

3.4.1 Risk Materiality

South African life insurers were asked how they rated the operational risk elements according to the materiality of their exposure. In general, South African life insurers rate the materiality of operational risks as high as financial risks. Other notable features are as follows:

- Generally, operational risks are regarded as being more material in South Africa than in North America.
- The main areas of risk materiality are those of event risk (where tax, political sources, and regulation each rank very high), technology risk (where inappropriate transactions, lost and incorrect data, and availability and infrastructure rank very high) and distribution risk.
- A number of companies indicated controlling certain operational risks by careful internal management, e.g. use of insurance to mitigate catastrophic risk.

3.4.2 Analysis and Reporting Methodology

Reports on operational-risk positions include the following:

– empirical evaluation based on historical data;
– evaluation using a probability function with analysis used to derive parameters; and
– management surveys.

Of the companies interviewed, most indicated that they perform some type of operational-risk assessment and reporting, the majority having implemented these processes in the past year or two. This contrasts with North America, where a large proportion of life offices do not compile any operational-risk reports at all. Moreover, South African life insurers generally use management surveys rather than relying on historical or statistical analysis. This again contrasts with the North American position where of those companies performing any operational risk assessment at all, the vast majority use empirical evaluation based on historical data, and none at all use management surveys. It is clear that it is in the area of operational-risk reporting that the South African life-insurance industry has made considerable progress in recent years, which contrasts with other countries where operational-risk reporting has been limited in scope. Each of the various types of techniques used for reporting on operational risk is considered, in detail, in the following sections.

3.4.3 Empirical Evaluation Based on Historical Data

3.4.3.1 None of the offices interviewed monitors its operational risks by means of empirical evaluation, although one company uses something of a hybrid of internal management surveys and evaluation using past data. However, it is interesting to note the experience of this type of reporting in North America, where the following are regarded as being of much use:

– assessment of vulnerability to and likely changes in customer choice of distribution channel;
– assessment of contract-processing turnaround time; and
– assessment of catastrophic property risks, sales practices, and employee dishonesty.

3.4.3.2 In North America, those companies doing empirical evaluation reports felt that they had gone as far as they could with these reports, and most expected that reports would not look any different in five years' time to what they are today. This does not imply that companies are satisfied generally with their operational-risk reporting, but merely that they have taken empirical evaluation as far as it will go. Judging from the experience in South Africa, progress on operational-risk reporting in North America may come from management surveys, rather than through further enhancements to empirical evaluation.

3.4.4 Evaluation using a Probability Function with Analysis used to derive Parameters

None of the offices interviewed monitors its operational risks by way of evaluation using a probability function. This is also the case for North American life offices, although the method is used a little amongst general-insurance companies (e.g.

for hurricane modelling and statistical catastrophe studies, where a stochastic model might be used to capture the tails of the probability distributions).

3.4.5 Management Surveys

3.4.5.1 Management surveys are used by most of the insurers interviewed to assess operational risk. The surveys are typically performed by the company's internal audit division, or by a firm of outside consultants. The companies have only recently put the process in place, having run it for either one or two years so far.

3.4.5.2 The approach is typically to discuss with senior management what they perceive to be the main risk exposures and to then document each of these risks. Depending on the type of collective feedback received from management, each risk will be allocated a weighting depending on its severity. The process then involves identifying whether the company has appropriate strategies in place to control and mitigate the risk. Where such strategies appear to fall short, a 'red-light' indicator is marked against the risk, and this risk is then monitored throughout the year to establish whether remedial action has been taken.

3.4.5.3 A full-blown risk assessment is performed each year, and it would be hoped that at the end of each year any red-light indicators from previous years will have been eliminated or at least substantially diminished.

3.4.5.4 The management survey of operational risks is a time-consuming exercise and the results are reviewed keenly by senior management, also going to members of the board. The results also go back to the line managers and those people surveyed, for purposes of establishing areas for action and for setting goals.

3.4.6 Future Trends

It is clear that operational-risk reporting will become more effective as it matures. While South African insurers currently appear to be in a good position so far as such reporting is concerned, it should be borne in mind that the companies have only recently implemented their processes. The real benefits from the reporting processes recently put into place will become apparent only once it can be demonstrated that these reports are assisting in developing tools and techniques to control the operational risks identified.

4. SUMMARY

4.1 The recent draft of the new King Report on corporate governance could have a significant impact on the practice of risk management and risk reporting in South Africa. In particular, directors have an obligation to demonstrate that they have dealt comprehensively with the issues of risk management and internal control. This requires appropriate disclosure on matters such as risk tolerance and the risk-management process.

4.2 As a result of recent international developments, accounting and statutory supervision are moving towards the assessment of assets, liabilities and risk-based capital

requirements on a fair-value basis. This in turn is likely to lead to more sophisticated risk-position reporting.

4.3 South African life insurers were asked how they rated their underlying risk exposures according to the materiality of their exposure. The following feedback is noted:

- Overall, asset-liability risk (compared to liability risk, asset risk and operational risk) is perceived by quite a high margin to be the lowest risk faced by insurers. This is a surprising result. In particular, it may be that life insurers have so far not perceived there to be great asset-liability risks inherent in products with interest-rate guarantees simply because interest rates have historically remained relatively high. Moreover, companies may in the past have relied on their ability to pass on poor experience to policyholders; however, this reliance may be tested in the future (see ¶4.10).
- Of the liability risks, claims-cost exposures taken together are perceived as the greatest risk, with persistency ranking above mortality.
- On the assets side, market-risk exposure (i.e. exposure to market-value movements) is viewed as the most material, as compared with credit-risk exposure and concentration-risk exposure.
- As regards asset-liability risk, duration, convexity and currency mismatch risk is generally very low, while cash-flow mismatch and product-guarantees risk is somewhat higher.
- On the operational-risks side, the main areas of risk materiality are those of event risk (where tax, political sources, and regulation each rank very high), technology risk (where inappropriate transactions, lost and incorrect data, and availability and infrastructure rank very high) and distribution risk.

4.4 The existence and materiality of liability-specific risks has brought about the development of some sophisticated tools to analyse such risks. All the life insurers interviewed perform experience studies, embedded-value-added analysis, and analysis of FSV profits. The position contrasts greatly with North America, where although experience studies are common, embedded value added is a relatively new concept.

4.5 Although all life insurers in South Africa compute FSV profits, a prevalent response from companies is that there has been a clear move away from such profits as the primary driver of the financial operations of the firm, to embedded values, several companies also mentioning embedded values as a primary driver of incentive compensation.

4.6 In a similar fashion to liability risks, the existence and materiality of asset risks has brought about the development of some sophisticated tools to analyse these risks. All the life insurers interviewed perform some asset reporting, typically in great detail. A number of companies indicated that a monthly investment report is prepared for the board, which would cover liquidity and concentration risk, with a section on investment performance against various benchmarks.

4.7 In line with its materiality rating, asset-liability risk reporting in South Africa is in a relatively early stage of development, compared with reporting both on liability-only risk and on asset-only risk, and with reporting on asset-liability risk in North America. One area where asset-liability reporting is quite sophisticated, however, is that of annuity portfolios, where duration and convexity are usually carefully monitored. Notable differences between perspectives in South Africa and North America are evident so far as stochastic scenario testing is concerned: such reporting is commonplace among North American life offices, while a number of life insurers in South Africa believe the value of stochastic models is limited, and that it would be risky to place a great deal of reliance on such models. Nevertheless, there are a number of South African insurers viewing stochastic modelling as an important tool for establishing economic capital and assessing comparative returns on economic capital across product lines. Indeed, some offices have already developed some sophisticated models for this purpose, although they admit that these models are still in the testing phase and expect considerable refinements in the future.

4.8 Of the companies interviewed, most perform some type of operational-risk assessment and reporting, the majority having implemented these processes in the past year or two. This contrasts with North America, where a large proportion of life offices do not compile any operational-risk reports at all. Moreover, South African life insurers generally use management surveys rather than historical or statistical analysis. This again contrasts with the North American position where, of those companies performing any operational risk assessment at all, the vast majority use empirical evaluation based on historical data, and none at all use management surveys. North American life insurers have considerable reservations about the use of empirical evaluation, primarily because of the lack of robust data, which in turn means that any resulting analysis must be limited in scope and usage.

4.9 It is clearly in the area of operational-risk reporting that the South African life insurance industry has made most notable progress in recent years, which contrasts with other countries where operational-risk reporting has so far been focused on using historical analysis and has been limited in scope.

4.10 The King Report will soon increase pressure on directors to ensure that appropriate risk-monitoring and -management procedures are in place, and in the longer term this pressure will be bolstered by international accounting and supervisory requirements. This should increase resources allocated to this activity. In South Africa, it may be expected that these resources will focus on the following areas:

– The management of a life company depends heavily on the sharing of risks between policyholders and shareholders. In many instances companies rely, to various degrees, on their ability to pass on poor experience to policyholders. This seems in part to explain the low rating placed on asset-liability risks. However, with issues such as the increasing volatility of equity markets and deterioration in mortality from AIDS and

violent crimes, this underlying reliance may be tested. With regard to asset-liability reporting, companies may start to examine the implications of having their management actions restricted.

– Many insurance companies provide underlying investment guarantees on products with underlying assets heavily weighted to equities. This necessitates the use of stochastic techniques to fully understand the underlying risks. While there are certainly weaknesses in stochastic models, it seems likely that the use of such models will become more prevalent.
– Many South African insurance companies form part of larger groups of companies. As risk management and reporting techniques improve, there is likely to be a greater focus on related company exposure (e.g. holdings of debt or equity in other companies).

ACKNOWLEDGEMENTS

The author acknowledges the help of Michael Davies and Jo Atkinson, who provided much useful input on the elements of the paper specific to South Africa. The contribution of Anthony Asher in providing review is also acknowledged.

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APPENDIX A
GLOSSARY OF ANALYTICAL TERMS

A.1 LIABILITY RISK

A.1.1 EXPERIENCE STUDIES

Analysis of historical product experience, typically performed on the same basis as that on which pricing assumptions are set, e.g. mortality, lapse, expenses, etc.

A.1.2 EMBEDDED-VALUE-ADDED ANALYSIS

Embedded value is the present value of future distributable earnings. A change in embedded value represents the difference between two values at given times and variance analysis is the identification of what has contributed to this change (e.g. mortality etc.).

A.1.3 ANALYSIS OF FINANCIAL SOUNDNESS VALUATION (FSV) PROFITS

The FSV is the statutory valuation method in South Africa and is intended to give a prudently realistic picture of the overall financial position of a company, allowing explicitly for actual premiums that will be received and future experience that may be expected in respect of interest rates, expenses, mortality, morbidity and other relevant factors. The surplus is the excess of assets over the liabilities and the change in surplus, allowing for any changes in shareholders' capital and the payment of dividends to shareholders, is the FSV profit. Surplus analysis is the identification and analysis of items leading to a change in surplus.

A.2 ASSET RISK

A.2.1 LIQUIDITY

The assessment of the ability to liquidate assets readily.

A.2.2 PERFORMANCE MEASUREMENT AND ATTRIBUTION

Analysis of performance and of historical security behaviour, to determine expected cash-flow characteristics of the security type under different economic scenarios. An example of attribution analysis would be a study of the prepayment behaviour of mortgage-backed securities.

A.2.3 VALUE AT RISK

The systematic measurement of the amount of money at risk over the portfolio, over a specific period, with a specific probability.

A.2.4 THE GREEKS: DELTA, GAMMA, RHO, THETA, VEGA

In relation to derivative instruments, 'the Greeks' refer to the theoretical

sensitivity of the price of the derivative instrument to one of the following: change in the price of the underlying security (delta), change in interest rate (rho), change in volatility (vega), change in time to expiration of contract (theta). The Greeks also include the sensitivity of delta (i.e. sensitivity of the price to a change in the price of the underlying security) to a change in the price of the underlying security (gamma).

A.3 ASSET-LIABILITY RISK

A.3.1 STOCHASTIC SCENARIO TESTING

Asset-liability analysis involving any process where projections are made on the basis of a stochastic process.

A.3.2 DETERMINISTIC SCENARIO OR STRESS TESTING

Asset-liability analysis involving any process where projections are made on the basis of specified scenarios defined by the user.

A.3.3 MISMATCH RISK

This covers a number of important types of mismatches between assets and liabilities, as follows:

- cash-flow mismatch (where the emerging cash flows on assets and liabilities are not entirely coincident);
- duration and convexity mismatch (where 'duration' is defined as the sensitivity of the price of an investment to shifts in the yield curve and 'convexity' is defined as the sensitivity of the duration of an investment to shifts in the yield curve);
- liquidity mismatch;
- currency mismatch; and
- policyholders' reasonable expectations (PRE) mismatch.

A.4 OPERATIONAL RISK

A.4.1 EMPIRICAL EVALUATION BASED ON HISTORICAL DATA

Assessment using historical data only, e.g. using past trends to extrapolate into the future.

A.4.2 EVALUATION USING A PROBABILITY FUNCTION WITH ANALYSIS USED TO DERIVE PARAMETERS

Assessment using a probability function or statistical process (such as a stochastic process).

A.4.3 MANAGEMENT SURVEYS

This is a formal process whereby management are interviewed in order to assess what the underlying risks may be. This would include the Delphi method, which is an approach to structuring group communication, usually involving anonymity of responses,

feedback to the group as collective views, and the opportunity for any respondent to modify an earlier judgement.