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Educational Note

Dynamic Capital Adequacy Testing – Life and Property and Casualty

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EDUCATIONAL NOTE

Educational notes do not constitute standards of practice. They are intended to assist actuaries in applying standards of practice in specific matters. Responsibility for the manner of application of standards in specific circumstances remains that of the practitioner.

DYNAMIC CAPITAL ADEQUACY TESTING – LIFE AND PROPERTY AND CASUALTY

COMMITTEE ON SOLVENCY STANDARDS FOR FINANCIAL INSTITUTIONS

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I. BACKGROUND AND INTRODUCTION

The Appointed Actuary's Role

The current and future solvency of insurance companies is a matter of primary concern to the public, be they present or potential policyholders, beneficiaries or shareholders. They rely on appointed actuaries to capably carry out their role of monitoring and reporting on the financial soundness of insurance companies.

By fulfilling this role, actuaries contribute to the prudent management of capital, and to the orderly correction of those situations where they judge capital to be currently, or likely to become, dangerously impaired.

Not only is DCAT an excellent process to enable the actuary to understand the risk profile of the company and potential threats to its solvency, it is also very valuable to management as a business planning tool in its own right.

The intent of this document is to provide guidance and support for fulfilling the role of the actuary of a life or property and casualty insurer in a professional manner and complying with the CIA Standard of Practice for Dynamic Capital Adequacy Testing (DCAT). It replaces the July 1997 Educational Note on Dynamic Capital Adequacy Testing – Life, and the August 1997 Educational Note on Dynamic Capital Adequacy Testing – Property and Casualty. The actuary also may wish to review the Society of Actuaries' *Dynamic Financial Condition Analysis Handbook* or the Casualty Actuarial Society's *Dynamic Financial Analysis Handbook*.

Introduction to the Concepts of Capital Adequacy Assessment

In the most general sense, solvency is the ability of an entity to honour its financial obligations. From the accounting viewpoint, solvency requires that assets equal or exceed liabilities, and, therefore, that total equity is non-negative. This is ascertained as of a specific date, by the preparation of a balance sheet.

Even though a balance sheet may show a corporate entity to be technically insolvent by this definition, legal insolvency is really only determined through court or regulatory action to terminate the operations of that company. In contrast, the concept of capital adequacy envisioned by DCAT extends beyond the balance sheet at a specific date to the continued vitality of the organization.

Accordingly, in considering the solvency of insurance operations, the amount of, and expected trends in, surplus and other forms of available capital over the near future are of vital importance, especially in terms of the risk profile of the company. It is necessary to consider the purposes of and needs for that capital in relation to anticipated and possible events occurring after the statement date.

Objectives

Dynamic capital adequacy testing is the process of analyzing and projecting the trends of a company's capital position given its current circumstances, its recent past, and its intended business plan under a variety of future scenarios. It allows the actuary to inform company management on the likely implications of the business plan on capital and to provide guidance on the significant risks to which it will be exposed.

The principal goal of this process is to help prevent insolvency by arming the company with the best information on the course of events that may lead to capital depletion, and the relative effectiveness of alternative corrective actions. Furthermore, knowing the sources of threat, the actuary can strengthen the monitoring systems where the company is most vulnerable, and, thus, provide timely advice on a continuous and ongoing basis.

It is fundamental to this process and the proper interpretation of the results to understand that the projected capital position under various scenarios may well become inadequate during the forecast period, especially if company actions have not been assumed to be adjusted on a timely basis as results emerge. This is not in itself an indication of current or anticipated difficulties. It is the specific degree and timing of capital depletion that indicate the risks to which the company is particularly sensitive. This, together with the results under the base scenario, should guide the company as to the necessity of revising the business plan, or preparing for contingencies.

The process described utilizes the regulatory formula for the capital adequacy standard, and does not require the actuary to develop, validate, or give an opinion on such formula. For insurers regulated under the federal *Insurance Companies Act*, the minimum regulatory capital requirement for the purposes of the DCAT standard is based upon the Minimum Asset Test (MAT) for a Canadian property and casualty insurer, the Minimum Continuing Capital and Surplus Requirement (MCCSR) for a Canadian life insurer, the Test of Adequacy of Assets in Canada and Margin Requirements (TAAM) for a Canadian branch of a foreign life insurer and the Test of Adequacy of Deposits (TAD) for a Canadian branch of a foreign property and casualty insurer. For insurers regulated under provincial legislation, the minimum regulatory capital requirement is based upon similar provincial requirement. For insurers subject to minimum capital requirements under multiple jurisdictions, the most restrictive requirement should be used.

Unless the regulator has communicated a different minimum regulatory capital requirement, the actuary should use the requirement in the table below as the minimum requirement, bearing in mind that OSFI may still intervene even if a company's ratio is above this minimum.

	Ratio
MCCSR	120%
TAAM	100%
MAT	5%
TAD	5%

For each insurer the regulator would also have a "target" ratio which in most cases would exceed the ratio given in the table above. If the insurer's ratio were to fall below that level then the regulator would work with the company towards having steps taken to restore its ratio to be greater than or equal to the target. The actuary should be aware of this target and consider it in evaluating the ripple effects.

The actuary would describe the standard of materiality in the report and, if practical, discuss it with the insurer's management. The standard of materiality would usually be less rigorous than that used for valuation of the insurer's policy liabilities. However, the standard of materiality should become more rigorous in examining a scenario where capital adequacy is closer to the minimum threshold.

Generally, the actuary would prepare a single report. However, in some cases it may be useful to prepare an analysis for discussion with management that is more detailed and/or technical than the report prepared for presentation to the board. Nevertheless, it is not appropriate for the report to present different findings than those contained in the more detailed analysis.

II. SCOPE OF THE INVESTIGATION

As the standard indicates, the DCAT process is to include the running of a base scenario and several adverse scenarios. It lists risk categories that the actuary is to examine for possible threats to capital adequacy. The risk categories listed are not necessarily the only risk categories to be examined. The actuary should consider whether the circumstances of the insurer result in the need to examine other risk categories. Sections IIIA and IIIB of this educational note elaborate more fully on each of these risk categories for life insurers and property and casualty insurers, respectively. The standard goes on to state that the risk areas posing most significant threats be examined in detail, including "ripple effects," and that at least three such risk areas be reported on in detail. Finally, the standard includes a model opinion to be included in the report.

Process

The general process to be followed in carrying out this analysis may vary considerably from one company to another, but the existence of the required opinion presumes some degree of uniformity in the standard of plausibility of scenarios and approaches taken towards testing.

One acceptable approach would consist of the following:

- Development of the base scenario – As stated in the standard, this would normally, but not always, be consistent with the company's business plan.
- Examination of the risk categories, and identification of those which need no analysis whatsoever due to the circumstances of the company versus those that are relevant to company circumstances
- For each of the relevant risk categories, "stress-testing" of the risk category in question – In this first stage testing, it is suggested that only limited reflection of the "ripple effects" discussed in Sections IIIA and IIIB be carried out. Stress-testing means a determination of just how far the risk factor in question has to be changed in order to drive the company's surplus negative during the forecast period, and then evaluating if that degree of change is plausible or not.

  When stochastic models with reasonable predictability are available, an adverse scenario would be considered plausible if all remaining probability in the tail beyond this scenario is in the range of 1% to 5%. For risks where no stochastic models with predictive capabilities are available, judgment should be used in selecting plausible, severe adverse scenarios.
- Selection of those scenarios requiring further analysis – At least the three risk categories showing the greatest surplus sensitivity should be examined in further detail, including more detailed reflection of the associated ripple effects. Any risk category under which a plausible scenario causes the insurer to fall below the minimum regulatory capital during the forecast period should be subject to further examination and reporting. Again, the stress-testing approach, but now taking fuller account of ripple effects, can be used to assess plausibility.
- Reporting on the base scenario, and then on all risk categories, but in different levels of detail:
  - for those considered irrelevant, a short explanation of why
  - for the relevant but less sensitive categories, a brief description of the approach taken and results
  - for the most sensitive categories, a more detailed description of the risk category, circumstances in which a negative scenario could arise, what kinds of ripple effects could take place and how they have been taken into account, what management action if any has been assumed, and plausibility of the results
  - for the more sensitive categories, determine whether or not any integrated scenarios are required. To do this the actuary needs to determine if any adverse scenarios are "more probable." Examples of "more probable" adverse scenarios are (i) scenarios involving default on a large or strategic asset where the probability of default is high and the base scenario assumes no default; (ii) status quo scenarios where the base scenario assumes aggressive cost reduction, sales targets or other initiatives and the insurer does not have a good track record in achieving these objectives; (iii) status quo scenarios where the base scenario assumes a favourable event outside management control.
  - for the more sensitive categories, the results without the effect of any extraordinary management actions or regulatory action. An example of extraordinary management action would be discontinuing the sale of a line of business where such discontinuance is not part of the business plan. On the other hand, changing a dividend scale or increasing property and casualty rate levels would not normally be considered to be extraordinary management actions.

Preparation and Signing of the Opinion

As stated in the standard, the company's financial condition is deemed satisfactory if, throughout the forecast period, it is able to meet all its future obligations under the base scenario and all plausible adverse scenarios, and under the base scenario, it meets the minimum regulatory capital requirement. Otherwise, the company's financial condition is deemed unsatisfactory, and an unsatisfactory opinion is to be reported.

The actuary should also report any plausible adverse scenarios that cause the insurer to fall below the minimum regulatory capital requirement. Even though the actuary may have signed a satisfactory financial condition opinion, the report should make it clear to the board that the company might be prevented from writing new business by the regulators under these scenarios in the absence of capital enhancements.

Level of Detail

In this subsection, "satisfactory financial position" means a financial position which meets minimum regulatory capital requirements. "Strong financial position" means a financial position that is significantly better than satisfactory.

A strong financial position is not a substitute for an investigation, not only because plausible adversity deteriorates financial position, but also because an investigation reveals the timing of deterioration in an adverse scenario, and, thus, reveals how much lead time the insurer needs, or can expect, to deal with the adversity. Similarly, a strong financial position is not a substitute for annual performance of the investigation. It is appropriate, however, for the scope of the investigation to take account of the stability, both historical and expected, of the insurer's environment and operations. The continuing relevance of the results of prior investigations should be considered.

A prior investigation remains relevant if the insurer's:

- products to be sold during the current forecast period are similar to those sold in the prior investigation, or the insurer is closed to new sales;
- current environment, operations and business plan are those of the prior investigation; and
- actual experience has been comparable to that in the prior investigation's base scenario forecast.

A relatively refined forecast and relatively comprehensive adverse scenarios would be appropriate unless the insurer:

- has a strong financial position which is virtually certain to remain satisfactory in the face of adversity during the forecast period; or
- has a satisfactory financial position and stable historical and expected environment and operations, and a prior investigation with a relatively refined forecast and relatively comprehensive adverse scenarios remains relevant.

In those conditions, a less refined forecast would be appropriate in accordance with CIA standards on approximation. However, use of such more approximate forecasts would not be appropriate for any company with material volumes of new business.

In some cases, such as an insurer with a strong financial position closed to new sales, it may not be possible to develop three plausible adverse scenarios that would have a material adverse effect on the capital adequacy of the enterprise, since excess capital may be significantly larger than the impact of any plausible adverse scenario. In such cases, the actuary should write, in confidence, to the chairperson of the Committee on Solvency Standards for Financial Institutions to explain the circumstances and seek guidance. If the chairperson agrees that less than three material plausible adverse scenarios exist, then he or she would authorize the actuary to issue a DCAT report with fewer than three adverse scenarios. The report should explain why fewer than three adverse scenarios were examined in detail.

Assumed Capital Enhancements

There will be some situations where capital enhancements are a basic part of a company's business plan. Examples of such capital enhancements could include private equity from financial investors, public equity, subordinated debt, injection of funds into the Canadian branch of a foreign insurer, etc. This will be true particularly in the case of fast-growing insurers that are either subsidiaries of larger organizations, either Canadian or foreign, or foreign insurers that are present in Canada on a branch basis.

The fact that the business plan and the base DCAT scenario calls for such capital injections should not be cause for the actuary to not be able to sign the usual DCAT opinion. However, the actuary should be satisfied that, in fact, such capital injections are, indeed, the intent of the entity making the injection, and that such injections are within the means of that entity.

A similar circumstance can arise in the case of an insurer without a parent organization that is intending a major initiative in a new sphere of operations, and is intending to raise capital externally in support of that venture. The base scenario will show the need for such capital, but, again, should not be cause for not signing a satisfactory opinion.

A more difficult question arises in the case of the adverse scenarios. Obviously, it would be inappropriate to assume away any negative outcomes merely by an assumed capital injection.

The prerequisite for a satisfactory opinion is that the insurer will be able to meet its future obligations under all plausible scenarios. This would seem to presume that the appropriate level of capitalization for the insurer, from a solvency perspective, would be such that, under plausible scenarios, it would remain solvent. For testing adverse scenarios essentially out of the control of management, it is appropriate, then, not to assume any additional capital from outside, beyond that called for in the business plan and base scenario. For scenarios where the "adverse" factors are more under management's control (in particular a scenario of much higher sales than planned), capital injections above and beyond those anticipated in the base scenario are appropriate.

In order not to present a misleading picture to management, the board, the parent organization, or the regulator, clear reporting of assumptions made on capital injections is essential. This is the case for those intended under the base scenario, as well as the limited occasions of any additional injections deemed appropriate under an adverse scenario. In such adverse scenarios, reporting of DCAT results with and without the assumed additional injections is recommended.

Assumed Management Action

Similarly to the situation with capital injections, there will be some situations where management action in response to adverse scenarios should be assumed to occur. An example would be deteriorating mortality or morbidity experience on group insurance written on a one-year-term renewable basis, or gererally deteriorating loss ratios in certain lines of property and casualty insurance. This is not to say that all the adversity in poor claims should be assumed away through rate increases, but to assume no management action whatsoever in the form of premium rate increases, tightening up of underwriting, modification of benefit definitions, etc., would appear implausible (this is clearly different from long-term individual life insurance policies with fully guaranteed rates and provisions).

In accordance with paragraph 33 of the standard of practice and in order not to present a misleading picture, clear reporting of assumed management action is essential. Also, for each of the plausible adverse scenarios posing the greatest risk, the actuary should report the results without the effect of extraordinary management action. It may be helpful under adverse scenarios to report on DCAT results with and without the assumed management action.

In accordance with paragraph 37 of the standard of practice, the actuary would also report on DCAT results without any extraordinary management action.

Assumed Regulatory Action

After consideration of assumed capital enhancements and assumed management action, there may be some situations where regulatory response to adverse scenarios should be assumed to occur. Examples would be failure to meet the minimum regulatory capital requirement or insolvency. This regulatory action could include restrictions on management's ability to manage the company, restrictions or prohibitions on writing new business, or the regulator taking control of the company in severe situations. In cases where the regulator takes control, the actuary should assume that all assets and liabilities would be re-evaluated on a liquidation basis.

In accordance with paragraphs 31 and 37 of the standard of practice, the actuary would report on DCAT results with and without the assumed regulatory action.

Assumed Rating Agency Action

Rating agency action is not ordinarily a risk category. In scenarios where the financial position of the insurer remains strong, the actuary does not usually need to consider rating agency action. However, in some circumstances, the actuary may feel it is appropriate to include a rating agency downgrade as one of the adverse scenarios. One example might be a situation where other insurers have recently been downgraded.

Many plausible adverse scenarios will result in a significant reduction of capital and surplus. In these scenarios, the actuary should carefully consider the likelihood of a downgrade by a rating agency. In cases where this is likely, the actuary should incorporate the consequences of the downgrade (such as lack of confidence, reductions of new business and cancellations of in-force policies) into the scenario.

It may be helpful under adverse scenarios to report DCAT results with and without assumed rating agency action.

IIIA. LIFE INSURER RISK CATEGORIES

The actuary is expected to develop an understanding of the sensitivity of the insurer's financial condition under each major risk category which is material to the company. This section outlines major risk categories which could be considered, and possible adverse trends and ripple effects for each. These should not necessarily be considered all encompassing for every company. The Society of Actuaries' *Dynamic Financial Condition Analysis Handbook* is a good supplemental reference for risk areas and adverse scenarios that may be relevant for a given company, beyond those covered below.

Adverse scenarios could include:

- Gradual changes in experience which may or may not be detected for some time
- Shock changes to experience
- Incorrect estimates of expected experience

Recent industry and company historical experience and outlook for the future should be considered to determine the range in experience that should be considered.

1. Mortality Risks

There are a variety of scenarios that could lead to significant adverse mortality experience relative to that assumed in pricing and/or valuation. A company with a significant block of life insurance or annuity policies should test the effect of this potential adverse mortality experience. This testing should be done separately for each of these lines of business.

For insurance business, adverse mortality may arise from a variety of causes, some of which include:

- an absolute increase in mortality rates, probably for a specific period of years, potentially arising from an epidemic or other catastrophe;
- a steady and continued deterioration in mortality, arising potentially from antiselective lapse experience as new and more competitive products are offered or due to a weakening in underwriting standards; and
- a misestimation of expected experience due potentially to a lack of complete experience data.

For annuity business, adverse mortality may arise from causes such as:

- a steady and continued decrease in mortality rates, arising potentially from improvement in medical treatment and/or changes in annuitant lifestyles, at a faster pace than that assumed; and
- a misestimation of expected experience due potentially to a lack of complete experience data.

The actuary should consider whether the adverse mortality will be permanent or temporary in nature. Where appropriate, the impact should be reflected through a revaluation of reserves.

The actuary should consider ripple effects such as the following:

- Is the adverse mortality experience on products with adjustable premiums or benefits? To what extent and how quickly is management able and willing to adjust products? This will depend on the nature of the adverse mortality experience, whether temporary or permanent, and whether unique to the company or industry wide. Some delay should be considered before management action is taken and some consideration should be given to only a partial adjustment for the adverse mortality experience and on any history on how the company responded to such circumstances in the past.
- Will management adjust pricing for new business, and how quickly? This will also depend on the nature of the adverse mortality experience, whether it is considered to be temporary or permanent, and whether it is unique to the company or industry wide, but some delay should be considered before management action is taken. Again, any history on past company responses should be considered.
- Will sales levels and/or persistency be impacted if any pricing or benefit adjustments are made that potentially alter the company's competitive position in the marketplace?

2. Morbidity Risks

Adverse morbidity includes:

- Increase in incidence rates for disability, medical, dental, critical illness, and other coverages
- Decrease in rates of claim termination

These may arise from a variety of causes, some of which include:

- A prolonged high unemployment recessionary environment leading to both sharply increased incidence rates and low claim termination rates for disability
- An epidemic that increases incidence rates without increasing death rates
- Improved treatment for diseases, such as AIDS, that decrease both recovery rates and death rates for disabled lives
- Aggravation of the "entitlement" ethic as a result of court rulings

- Retrenchment of government social security programs
- Escalation in dental and medical costs

The actuary should consider ripple effects such as:

- Price increases in new business as well as rate increases for in-force renewable business with their attendant impact on lapses and volumes of new business
- Constraints to price increases as the industry reacts slowly in implementing renewal rate increases
- Rate guarantees that limit or delay required rate increases
- Increases in antiselective lapses that may dampen – or nullify – the intended effect of rate increases
- Increased expenses and litigation resulting from more active claim management

3. Persistency Risks

Policy persistency can pose a significant risk to the capital adequacy of an insurer. Generally, persistency risk can be divided into two distinct categories:

- Whenever the cash value exceeds the reserve, the risk is that lapses or surrenders (hereinafter referred to as "lapses") will exceed those assumed in the valuation assumptions.
- Whenever the reserve exceeds the cash value, the risk is that lapses will be less than those assumed in the valuation assumptions.

For the first category, the impact on the insurer's books can best be illustrated by examining the effect of lapses for a block of business. For the sake of simplicity, assume that, for every policy in the block of business, the cash value exceeds the reserve (this would include policies where the cash value is zero and the reserve is negative). In this case, the "loss on lapse" actually experienced would equal the sum, for all lapsed policies in the block, of the cash value less the reserve. At the same time, the change in reserve during the accounting period will include an expected "loss on lapse." The insurer's earnings will be negatively impacted only to the extent that the experienced loss on lapse exceeds the expected loss on lapse.

The situation is analogous for the second of the two categories (i.e., where the reserve exceeds the cash value). Such blocks of business are often referred to as "lapse supported."

In examining the persistency risk, it is prudent to assume that, because of antiselection, both these adversities may happen concurrently.

Ripple effects for persistency risk include:

- Worsened mortality
- Worsened morbidity
- Mismatch of asset and liability cash flows
- Increased unit expenses
- Liquidity risk

Causes of adverse persistency include:

- Premium increases
- Dividend reductions
- Changes in distribution system
- A new product introduced to the market by a competitor
- Lowering of premium rates in the market

Adverse persistency can lead to liquidity risk, an extreme example of which is a "run-on-the-bank" scenario. The scenario could be instigated by a sudden lack of confidence in the company, as perceived by the outside market. An example could be a sudden downgrade by external rating agencies, combined with extensive publicity. The perception of a problem could be self-fulfilling. None of the assumptions for interest rates or inflation would be affected. But, in addition to the obvious impact on lapses, this scenario would affect the company's new business while, at the same time, it could not proportionately reduce expenses.

The company could not borrow any external capital or debt, such as any commercial paper, preferred shares, etc. Any existing borrowings could not be renewed at maturity. Assumptions with respect to selling non-liquid assets would be very conservative.

The company would experience a sudden virtual stoppage in new annuity business. Roll-overs at maturity would be minimal. The appropriate level of lapses would be assessed for each product line. There would be high levels of surrenders, even with the existence of market value adjustments or surrender changes.

The company would experience much higher lapses in its individual insurance blocks. Again, the appropriate level of lapses should be assessed for each product line. The mortality experience of the remaining policies should be assumed to be worse due to antiselection.

In addition, the actuary should also consider the guidance on this scenario in the educational note on *Liquidity Risk Measurement*. The purpose of this scenario is to project the effect on the company of a major lapse/liquidity problem. In this scenario, only the company in isolation and its subsidiaries are affected, and this scenario does not apply to the industry in total.

4. Cash Flow Mismatch Risks (C-3 Risk)

Adverse scenarios related to C-3 risks could result from:

- Mismatches between the cash flow pattern of assets and liabilities
- Variability in the cash flow pattern of assets and liabilities
- Changes in future rates of interest
- Market value deterioration in segregated fund assets

The actuary should test the impact of potential adverse scenarios on surplus across all lines of business in aggregate, but the potential management actions will depend on the nature and characteristics of the various blocks of assets and liabilities. Changes in future rates of interest will also impact the market value and earnings of surplus assets.

When there is a mismatch between the cash flow pattern of assets and liabilities, there will be a need to reinvest positive cash flow, or borrow, or liquidate assets to fund negative cash flow. Future rates of interest can vary substantially and can adversely impact surplus. The value of derivatives will also be impacted. Where they are used as hedges, they will help mitigate adverse impacts. Where they are used to take mismatch positions, they will add financial exposures.

In assessing the impact of changes in interest rates, the actuary should consider both the current mismatch position as well as the potential for mismatch in the future. These will depend on the maximum position allowed by the company's investment policy and the most aggressive position that has been taken in the past.

Parallel and nonparallel shifts in the yield curve, both on a sudden and on a gradual basis, should be considered. Stochastic modelling as well as deterministic scenarios should be considered. As well as specific scenarios, the actuary should also stress test the C-3 risk by determining what scenario of future interest rates could result in insolvency.

Changes in future interest rates will impact not only future rates of reinvestment and market values, but also the pattern of the cash flows, for example on asset-backed securities and callable bonds and on surrenderable policies.

Future interest rate levels will also impact the level and mix of new business for guaranteed fund and segregated fund products. Likewise, interest rate levels will impact the level of surrenders and transfers between funds and movements to and from portfolio average versus new money products. The movement and financial exposure will depend on surrender charges and market value adjustments embedded in products. Particular consideration should be given to assessing the impact of a "run on the bank" scenario.

Future interest rates may also impact the achievable spread for new business and fixed interest business where rate resets are being made.

Sustained low levels of interest rates could also impact the company's ability to support minimum long-term guarantees embedded in both insurance and annuity products.

For participating insurance, universal life, and adjustable premium business, considerations would include:

- The impact of the proportion of fixed income assets backing participating business and the duration of those assets, and that of key competitors
- Dividend actions of competitors
- The ability and willingness of management to maintain or change dividend scales
- Related policyholder actions such as surrender levels and potential litigation
- Impact on the level of new sales

For segregated funds, drops in market values may affect the payment of benefits (or the likelihood of future payment of benefits) relating to the existence of guarantees of minimum segregated fund performance. Considerations would include:

- The extent of minimum performance guarantees provided on death or maturity
- The extent of hedging operations or reinsurance to mitigate the risk
- The existence of product features which will affect the risk, such as resets
- The existence of volatile funds, fund switching privileges, guarantees on a "per policy" basis or high MERs

5. Deterioration of Asset Values (C-1 Risk)

Adverse scenarios in respect of C-1 risk (deterioration of asset values) may come from a variety of sources, including:

- Increases in losses from defaults on debt securities
- Poor returns and/or declines in value of equities
- Poor returns and /or declines in value of real estate
- Counter-party defaults on derivatives
- Loss or significant decline of value for other major asset categories
- Concentration risks, including geography (e.g., impact of natural disasters), asset class, industrial sector, subsidiaries, individuals
- Fluctuations in currency values

The actuary should consider what is the appropriate recognition in reserves and expected pricing actions. The ripple effects could vary depending on whether the C-1 results are company-specific or industry wide.

The following are possible ripple effects:

- Exposed risk positions as a result of counterparty default (example C-3 risk)
- Decreased policyowner dividends which could lead to higher surrenders
- A ratings down-grade which could, in turn, have many shock waves such as decreased sales and increased surrenders
- A liquidity crisis caused by large, sustained default losses

6. New Business Risks

One of the uncertainties facing an insurance company is the volume of new business that it will be able to write in the future. Volumes significantly different from those assumed can result in a capital position quite different from that expected, with negative outcomes.

There are several categories of events that could have considerable impact on the amount and type of business written by an insurance company:

- A financial rating downgrade, of either the company itself or of an affiliated company (particularly the parent), or some other event similarly damaging to a company's reputation
- A change in law or regulation directly affecting an important product line

  Examples would include:

  – a change in tax law affecting the position of the policyholder purchasing a particular kind of product;
  – a change in capital or reserving requirements putting a particular type of product at a competitive disadvantage relative to products provided by other financial institutions or even other insurance providers not affected in the same fashion; and
  – entry by government into an insurance area previously within the domain of the private sector.
- Entry of a new and strong competitor into an area where competition was previously weak
- Loss of a key distributor or even an entire distribution channel previously responsible for the production of a significant portion of a company's business
- Loss of a key client, for example, a very significant group client representing a significant portion of an insurance company's group portfolio
- Unexpected success in a new product area or in beating previously stronger competition

Most of these categories of events would lead to lower sales than expected. The clear first-order impact would be on coverage of expenses, particularly where there is a large element of overhead and fixed expense associated with the marketing, underwriting, policy issue and sales functions. Examination of this first-order impact would be of most importance in any scenario testing. Second-order impacts could include:

- Higher lapse rates on existing business (which could be significant, depending upon the event causing the reduction in new business)
- The resulting poorer claims experience on that remaining business
- The resulting poorer coverage of maintenance expenses (resulting from both lower sales now and higher lapse of existing business)
- Possibly ripple effects on other lines of business with some connection to the one initially affected (say, a distribution channel primarily involved in one line of business which leads to significant sales later in another line)

Management action here could include items such as:

- Diversification into more than one line of business
- Control over non-variable expense levels
- Maintaining contingency action plans to be implemented in case of one of these events, etc.

The last category of event in the first list above, leading to larger sales than expected, could result in severe capital strain for a company. Other ripple effects could include problems with management control over policy issue, underwriting, field expenses, financial reporting, etc., due to rapid growth, leading to later problems in claims and expenses as competition eventually catches up and volume levels return to normal.

Possible management actions would include:

- Putting capital-raising plans in place with any parent company or with external sources of capital
- Contingency plans to be able to handle increased volumes of business
- Increasing the use of reinsurance to mitigate need for additional capital, etc.

Normally, the base scenario would incorporate the new business projections of the company business plan and the associated expense levels. Alternate scenarios would be heavily company-dependent, varying in particular with the kind of market the company serves and the distribution channel employed to reach it, but any alternate scenario would be expected to reflect not only the change in new business levels, but also the impact on expense coverage and any other likely second-order impacts.

7. Expense Risks

Expense assumptions are a major consideration in the projected financial positions of every insurer. This assumption is unique in that, to some degree, company management has a greater level of influence on expenses than on other assumptions. Even insurers who have historically managed their expenses aggressively to budgeted targets, however, may face major expense issues in the event of unexpected variations in business growth or litigation, for example. The extent of demonstrated effective actions towards managing expenses should influence the actuary's decision in how closely to relate expense levels to future targets versus current experience in the base scenario. Companies practising strict management of budgets to meet expense levels included in product pricing may have different results from companies that manage budgets to other measures.

Adverse expense scenarios and related ripple effects to which an insurer's financial condition may be sensitive include:

- **Inflation** – A severe inflationary environment may cause a rapid increase in absolute expenses and in unit costs. A high inflation scenario would normally be assumed to accompany a high interest scenario, and the two should logically be linked.
- **Low sales** – Low sales can precipitate an increase in unit costs where a portion of expenses are considered to be fixed. This will place adverse pressures on the profitability of new business and on unit maintenance expenses on in-force business.
- **High terminations** – High terminations of business can precipitate an increase in unit costs. They can increase absolute levels of termination expenses, and can increase unit maintenance expenses on the remaining policies in force.
- **Technological obsolescence** – New technologies may be developed which deliver significant cost, delivery, or service benefits to those who can achieve economies of scale. For companies that do not make use of new technologies, expenses may rise relative to the competition. Such a scenario should also include the sales and termination impacts of technological obsolescence.

- **Court awarded damages** – Potential high costs can result from court awarded damages to plaintiffs relating to such matters as market conduct. Ripple effects resulting from damage to reputation can include ratings downgrades, lower sales and higher terminations.
- **CompCorp assessments** – Further industry failures can precipitate higher assessments to companies in the industry. Ripple effects from such failures can include damaged industry reputation, flight to quality, lower sales and higher terminations in some instances.
- **Company structure** – Holding company expenses may be allocated to subsidiary companies based on historical or anticipated relative profits. This could lead to a major change in the level of expense allocated to the insurer based on the performance of one of the other companies in the enterprise. Within a single insurer, methods of allocating overhead expenses to different business units may produce changing expense levels over time. In an enterprise which has several insurance companies or business units that provide services to one another, the impact of cross-billing should be considered.

8. Reinsurance Risks

Reinsurance terms on most individual life cessions tend to be guaranteed for the life of the underlying policy. The principal risks for a ceding company are outlined below.

The first would be the insolvency of a reinsurer. The actuary should calculate the exposure to the principal reinsurers of the insurance company, assuming liquidation of the reinsurer. The impact should reflect an assumed "realization percentage" of assets to liabilities of the failed reinsurer, and any different treatment of various types of amounts owing from the reinsurer to the direct writer. The impact may well be mitigated by right of offset of amounts owing under all treaties between the two companies, the preferred position insurers will have relative to other creditors of a failed reinsurer, the right of recapture in the event of failure, and any amounts on deposit or in trust with the insurance company, or letters of credit in respect of an unlicensed reinsurer. It would normally be appropriate to assume under this scenario that the business previously ceded to the failing reinsurer could be successfully reinsured elsewhere (but possibly on less favourable terms), unless there is something unique about the business involved that would make securing such replacement reinsurance difficult.

Another risk would be increases in reinsurance rates on future new business. Where reinsurer action is similar across insurers operating in similar markets, such action by a reinsurer or reinsurers would not necessarily pose competitive issues, as many could be faced with similar changes in terms, requiring repricing in the entire marketplace. However, where reinsurer action is targeted to one company because of poor experience, necessary repricing could impact the level of sales.

A third risk would be reduction in reinsurance capacity available for the financing of new business, and the resulting increase in reinsurance costs or constraint on the growth of the company.

9. Government and Political Action

When the government makes changes in its policies or regulations, implementation usually takes a long time. This allows time to analyze the impact and take the appropriate actions. But some changes can occur in a very short period of time and cannot be foreseen. Others can even be effective retroactively.

Examples of adverse events are:

- An increase in premium tax rates
- An increase in taxation rates for corporations (income tax or capital gains tax)
- A prolongation of temporary taxes (e.g., the additional Part VI temporary capital tax for insurance companies should end in December, 1998, but the government could decide to prolong this temporary measure or make it permanent)
- New restrictions on RRSPs or RRIFs which would have a direct impact on the level of new business for those products

- The possible entry of other financial institutions into the life insurance industry (e.g., due to revisions to the Bank Act) which would impact the amount of new business and could lower profit margins due to increased competition.
- Possible new restrictions on the investment practices of life insurance companies (e.g., a restriction on the use of derivative products for speculation or hedging)
- The introduction of new or modified public health care policy which could decrease new sales or in-force business (e.g., the introduction of pharma-care)
- A change in regulatory solvency standards which could increase the capital requirements for life insurers (e.g., the introduction of the lapse component to the MCCSR)
- A reduction in the government's need to borrow funds which could impact the level of government bonds available to the market
- Political instability which could lead to confiscation of assets, closure for new business, exchange controls, etc., particularly in foreign jurisdictions

10. Off-Balance-Sheet Risks

There are numerous off-balance-sheet items which may place an insurer at risk. Often these off-balance-sheet items arise from new or evolving industry practices which, in future years, do get recognized on the balance sheet by the CICA, the CIA or regulators. Therefore, the actuary needs to develop awareness of any emerging risks which may be relevant to the insurer during the forecast period and assess their potential threat to solvency.

Discussed below are examples of common off-balance-sheet items and their related risks that may be relevant to the insurer:

- **Operating lease obligations** – The lessor is exposed to the credit risk associated with the lessee's inability to meet its lease obligations.
- **Derivative instruments** – The risks associated with derivatives include market risk, default risk, management risk and legal risk:
  - Market risk includes marketability risk and basis risk. The marketability risk is the risk of not being able to cancel or unwind the derivative's contract when desired or at a favourable price. Basis risk is the risk that the derivative's price behaviour does not act as expected, undoing the intended hedging benefits. The price behaviour of the instruments can change adversely when market conditions change. Market risk is best evaluated on a security basis and on a portfolio basis since some risks may not net against each other.
  - Default (or credit) risk is the risk that a loss will be incurred due to default in making the full payments when due, in accordance with the terms of the contract.
  - Management risk is the potential for incurring material, unexpected losses on derivatives due to inadequate management supervision and understanding, systems, controls, procedures, accounting and reporting.
  - Legal risk is the risk that the derivative agreement is not binding as intended.
- **Contingent liabilities or losses** – There are a variety of contingent liabilities to which a company may be exposed, such as tax, litigation, etc. The actuary should consider the financial impact of adverse outcomes.
- **Letters of credit and pledged assets** – The insurer may be exposed to the risk that a lending institution defaults on payment under, for example, a letter of credit, or a call on assets pledged.
- **Capital maintenance agreements** – An insurer could be exposed to capital maintenance agreements it must honour for its subsidiaries.

IIIB. PROPERTY AND CASUALTY RISK CATEGORIES

The actuary is expected to develop an understanding of the sensitivity of the insurer's financial condition under each major risk category which is material to the company. This section outlines the major risk categories which could be considered. Plausible adverse scenarios are suggested for each category. Ripple effects and possible management responses are listed where relevant.

The suggested adverse scenarios generally consist of shock changes to experience which take place in the fiscal year following the stub period. For each risk category, the actuary should determine and test the most adverse plausible event.

Ripple effects are effects following shock changes, often with some delay. Post-event inflation may follow a catastrophic loss, for example. A change in inflation unrelated to the catastrophe would not be considered a ripple effect, but would be considered under a separate risk category.

The Standard of Practice for Dynamic Capital Adequacy Testing states that the actuary would consider threats to capital adequacy under plausible adverse scenarios that include, but are not limited to, 11 risk categories which are listed. The remainder of this section addresses each of those 11 risk categories, outlining suggested scenarios which would be considered. These scenarios should not necessarily be considered all-encompassing for every company. Where a risk category relates to changes in economic factors or capital markets, guidelines have been provided for the definition of adverse scenarios.

1. Frequency and Severity

Future claims and loss ratios can differ significantly from the base scenario due to unexpected increases in the frequency of large losses, increased frequency or severity of "normal" losses, or due to inadequate pricing.

Adverse scenarios to which an insurer's financial condition may be sensitive include:

A single catastrophic loss – The actuary should consider earthquakes, windstorms, floods, hail or any other single event which could have a material impact on the insurer. The analysis should be based on the largest single event. The estimate of the amount should be based on simulation models; however, a rule of thumb may be used if a model is not available to the actuary. Earthquake losses should also include fire following. For consistency with regulatory requirements, the actuary should consider a minimum 250-year return period for an earthquake event. Information regarding the largest catastrophe losses in Canada is compiled by the Insurance Bureau of Canada and is published annually in a booklet called "Facts."

Possible ripple effects would include:

- the insolvency of one or more reinsurers accounting for a material amount of the insurer's reinsurance coverage;
- increases in the policy liability related to current reinsurance contracts which are swing-rated, have variable commission, or require reinstatements;
- increases in reinsurance rates at the next renewal;
- post-event inflation; and
- reduced liquidity of assets.

Multiple catastrophic losses – The actuary should consider two or more losses whose joint probability is approximately 1%. The actuary should generally consider the combination of losses which has the largest impact on the net results of the insurer.

Possible ripple effects would include the following:

- reduced liquidity of assets;
- increases in the policy liability related to current reinsurance contracts which are swing-rated, have variable commission, or require reinstatements; and
- increases in reinsurance rates at the next renewal.

Multiple large losses – The actuary should select the size of loss which would be considered by the insurer to be large. The size would depend on the size of the insurer and will generally be smaller than the insurer's net retention. Using historical losses trended to current levels and adjusted for the insurer's current exposure, the actuary should estimate the frequency and severity distribution of these losses. The cumulative distribution may be estimated using assumed distributions or simulation techniques. The cumulative distribution should be constructed for net and gross losses. The adverse scenarios will generally be based on the difference between the losses at a 1% probability level and the expected large losses (which we assume are already included in the base scenario).

Possible ripple effects would include:

- increases in the policy liability related to current reinsurance contracts which are swing-rated, have variable commission, or require reinstatements; and
- increases in reinsurance rates at the next renewal.

Loss ratio (frequency and severity) – The actuary should model the accident year loss ratio or frequency and severity of losses. Since catastrophes, large losses and adverse development are considered in other scenarios, the actuary could remove unusual losses from the data prior to his or her analysis. It is generally prudent to examine the variability of the normal accident year or underwriting year loss ratio, or the combined frequency and severity distribution. The actuary should consider the highest loss ratio possible to within a 1% probability level. It would generally be appropriate to use the expected loss ratio plus 2.33 standard deviations.

Possible ripple effects would include:

- increases in the policy liability related to current reinsurance contracts that are swing-rated, have variable commission, or require reinstatements.

2. Pricing

Rates for property and casualty insurance products are established using historical data which may not be indicative of future conditions or may contain errors. Rates determined by the actuary are often modified for marketing reasons or to meet the requirements of regulators. Therefore, there is a risk that rates will be inadequate and there may be a time lag of one year or more before corrective action can be taken.

Lines of business which are new to the insurer or for which the book of business has changed significantly have a higher risk of inadequate pricing.

Inadequate pricing will usually result in higher than expected loss ratios. To the extent that the impact on the loss ratio is less than the loss ratio scenario under Risk Category #1 (Frequency and Severity), no further investigation of this factor is necessary.

Adverse scenarios to which the insurer's financial condition may be sensitive include:

A rate freeze – With respect to lines of business and jurisdictions in which rates are subject to regulatory approval, the actuary should assume that no rate increases are approved during the stub period or during the following projection period.

An environment of increased competition – This scenario could involve higher loss ratios, reduced volume (due to adequate but uncompetitive rates) or a combination of these factors, depending on the company's expected response to competition.

The effect of competition can be estimated by looking at one, two and three-year changes in the industry loss ratio. To the extent possible, the industry experience should be adjusted to a company's geographic and line of business mix and catastrophe losses should eliminated.

Parameter risk, estimation error or data errors – The potential impact on the loss ratio due to parameter risk, estimation error (process risk) and data error would depend on the quality and credibility of the company and industry data and the pricing actuary's knowledge of the lines of business. In most cases, the impact of the above factors on loss ratio would be less than the impact of increased frequency and severity.

3. Misestimation of Policy Liabilities

Ultimate claim costs and claim adjustment expenses required to settle unpaid (including IBNR) claims are not easy to estimate with both precision and confidence. Especially for long tail lines, there may be several reasons for this, including parameter risk, process risk, data errors, social inflation with a retrospective impact, and the occurrence of future events with a retrospective impact, such as court decisions. Generally, for long tail lines, these unpaid claim amounts represent significant and material portions of the overall policy liability of the insurer. Estimates of the cost of future claims (both those related to the runoff of the unearned premium, and those related to future new and renewal business) generally depend materially on the estimates of the unpaid claim liability for long tail lines, and so a misestimation of the unpaid claim and adjustment expense amount may have a concomitant effect on estimates of the cost of future claims and expenses.

Even if the ultimate claim costs and claim adjustment expenses required to settle unpaid claims are appropriately estimated, it still may be difficult to estimate the cost of future claims (both those related to the runoff of the unearned premiums, and those related to future new and renewal business) with both precision and confidence. For all lines, there may be several reasons for this, including future social inflation, and the occurrence of future events, such as court decisions, legislative changes, and catastrophic events. For lines of business which are new to the insurer, or for which the book of business has changed significantly (whether by change in volume or significant change in the profile of risks), the cost of future claims and expenses are additionally exposed to parameter and process risk.

Adverse scenarios to which an insurer's financial condition may be sensitive include:

A significant understatement of the unpaid claim liability – This scenario would lead to increases in the ultimate cost of settlement of unpaid (including IBNR) claims and claim adjustment expenses from the current and prior periods.

Possible ripple effects, especially for long tail lines, would include:

- increases in the policy liabilities related to current and past reinsurance contracts which are swing-rated, have variable commission, or require reinstatements;
- increases in ultimate claim costs and claim expenses in connection with the runoff of the unearned premium; and
- increases in ultimate claim costs and claim expenses in connection with future new and renewal business.

Possible management responses, especially for long tail lines, would include:

- settling claims faster;
- implementing rate increases, subject to filing and approval mechanisms where applicable, and to general market conditions; and
- changing the target mix of future lines of business in the business plan, subject to general market conditions.

A significant understatement of the cost to settle future claims – This scenario would lead to increases in the ultimate cost of settlement of future claims (both those related to the runoff of the unearned premium, and those related to future new and renewal business). Where this results from the occurrence of a catastrophe, this scenario would normally be covered under a scenario under Risk Category #1 (Frequency and Severity), and where it results from legislative change, it would normally be covered under a scenario from Risk Category #10 (Government and Political Action).

Possible management responses, likely after a significant period of delay, would include:

- implementing rate increases, subject to filing and approval mechanisms where applicable, and to general market conditions; and
- changing the target mix of future lines of business in the business plan, subject to general market conditions.

4. Inflation

Claim costs and claim adjustment expenses tend to be quite sensitive to the overall rate of inflation in the insurance environment. The overall rate of inflation in the insurance environment will tend to be positively correlated with the general rate of inflation as measured by changes in such indices as the overall Consumer Price Index, but may also be a function of other sector-specific cost changes, increases in the cost of materials and labour following a property catastrophe in the case of property claims, and increases in automobile accident benefits, property, professional liability and surety claims due to changes in the general state of the economy.

Besides general inflation, the actuary should also consider social inflation when the insurer has a material amount of third party liability exposure.

Social inflation in the case of liability claims may co-exist in a period of low inflation or deflation in the general economy. Social inflation exists because demand for services paid by liability policies is not held in check by normal competitive forces in the economy (e.g., party-to-party cost for the plaintiff's lawyer and non-pecuniary damages).

Adverse scenarios to which an insurer's financial condition may be sensitive include:

A significant rapid and sustained increase in the general rate of inflation – This scenario would tend to lead to increases in the ultimate cost of settlement of unpaid (including IBNR) claims and sustained increases in the cost of settlement of future claims (both those related to the runoff of the unearned premium, and those related to future new and renewal business), as well as various expenses. It would normally be linked to a rapid and sustained increase in market interest rates.

As a minimum, the actuary should consider a scenario where each of the following occurs:

- a sustained increase in trend of at least three percentage points per annum over those in the base scenario for five consecutive years;
- the yield curve for fixed income assets shifts up by half of the change in trend, with a concomitant change in market value for these assets – for example if the trend increases by three percentage points, then the yield curve should increase by 150 basis points;
- at least half of all future payments related to current unpaid claims will inflate at the higher trend factor; and
- these changes would be reflected in the policy liability at, or before, the end of the year when the change is first hypothesized.

Possible ripple effects would include:

- increases in general expenses.

Possible management responses would include:

- settling claims faster for long tail lines;
- implementing rate increases, subject to filing and approval mechanisms where applicable, and to general market conditions; and
- changing the target mix of future lines of business in the business plan, subject to general market conditions.

A significant sustained increase in the rate of social inflation – This scenario would tend to lead to increases in the ultimate number and perhaps severity of unreported liability claims and sustained increases in the number and perhaps severity of future liability claims (both those related to the runoff of the unearned premium, and those related to future new and renewal business), as well as claim adjustment expenses. It would not normally be linked to a change in market interest rates.

A significant temporary increase in the cost of labour and materials following a property catastrophe – This scenario would tend to lead to increases in the ultimate cost of settlement of unpaid (including IBNR) property claims and of future property claims (both those related to the runoff of the unearned premiums, and those related to future new and renewal business) for a while, as well as claim adjustment expenses, in the region where the catastrophe occurred. It would normally not be linked to a change in market interest rates. This scenario would normally be covered under a scenario under Risk Category #1 (Frequency and Severity).

Possible ripple effects would include:

- increases in the policy liability related to current reinsurance contracts which are swing-rated, have variable commission, or require restatements; and
- increases in reinsurance rates at the next renewal.

A severe recession in the general economy – This scenario would tend to lead to increases in the ultimate number and cost of settlement of unpaid (including IBNR) accident benefits, property, and surety claims and sustained increases in the number and cost of settlement of future accident benefits, property, professional liability and surety claims (both those related to the runoff of the unearned premium, and those related to future new and renewal business), as well as claim adjustment expenses. It might be linked to a sustained increase in general inflation, the level of unemployment, and market interest rates.

Possible management responses would include:

- implementing rate increases, subject to filing and approval mechanisms where applicable, and to general market conditions; and
- changing the target mix of future lines of business in the business plan, subject to general market conditions.

5. Interest Rate

When there is a significant increase in interest rates, the market value of debt securities will also change, affecting the minimum asset test or test of adequacy of deposits, as applicable. When there is a mismatch between the cash flow pattern of assets and liabilities, there will be a need to reinvest positive cash flow, or to fund negative cash flow by borrowing or liquidating assets. Future rates of interest can vary substantially and can adversely impact surplus. The value of derivatives will also be impacted. Where they are used as hedges, they will help mitigate adverse impacts. Where they are used to take mismatch positions, they will add financial exposures.

Adverse scenarios related to interest rate (C-3) risks may include the following:

A change in future rates of interest – The actuary should consider a parallel shift of 300 bp in the yield curve, both on a sudden and on a gradual basis. Emphasis should be on the +300 bp though – 300 bp should also be considered. If the shape of the current yield curve is unusual, nonparallel shift of the yield curve should also be considered.

Changes in future interest rates will impact not only future rates of reinvestment and market values, but also the pattern of the cash flows, for example on asset-backed securities and callable bonds.

Possible management action may include:

- the sale or reinvestment of assets.

A change in claims payment pattern – The actuary should consider a change in claims payment pattern which causes a mismatch between the cash flow pattern of assets and liabilities. For a company that does not discount a significant portion of the liabilities, this may not be a significant consideration.

6. Premium Volume

One of the uncertainties facing an insurance company is the volume of new business that it will be able to write in the future. Volumes significantly different from those assumed in the business plan can result in a capital position which differs from that expected, with negative consequences.

There are several categories of events that could have considerable impact on the amount and type of business written by an insurance company, including:

- entry of a new and strong competitor into a market;
- increased competitiveness in a market through higher usage of advertising;
- loss of a key distributor, or even an entire distribution channel, previously responsible for the production of a significant portion of a company's business;
- loss of a key client, for example a group client representing a significant portion of an insurer's group portfolio;
- a change in law or regulation directly affecting an important product line, such as the entry of government into an insurance market;
- a financial rating downgrade, or some other event that damages an insurer's reputation; and
- unexpected success in a new product area, or against previously stronger competition.

Adverse scenarios to which an insurer's financial condition may be sensitive, include:

A significant reduction in written premium volume – Since the base scenario could anticipate a drop in volume from the previous year, the actuary should consider the impact of a reduction of up to 30%, from the lower of the plan, or the prior year, unless the resulting scenario is clearly unreasonable. For larger companies (over $200 million in annual net written premiums), a 20% reduction may be used. No reduction in the fixed costs should be assumed.

Possible ripple effects may include:

- an increase in loss ratio if reduced premiums have resulted from a soft market;
- an increase in reinsurance costs as a percentage of subject premium (i.e., a nonproportional decrease in the amount of reinsurance costs); and
- a capital loss arising from the need to liquidate assets to meet current obligations.

Possible management action may include:

- rate reductions or other measures to improve the insurer's competitive position.

A significant increase in premium volume – This scenario could lead to severe capital strain for the insurer.

Possible ripple effects may include:

- a higher loss ratio on the new business; and
- a higher expense ratio on the new business.

Possible management action may include:

- controlling growth through an increase in rates, or through underwriting, and
- an increase in surplus, or use of reinsurance, to mitigate the capital strain.

7. Expense

Expense assumptions are a consideration in the projected financial position of every insurer. This assumption is unique in that, to some extent, company management has greater control on expenses than on loss-related factors. Even insurers that have historically managed their expenses aggressively to meet budgeted targets, however, may face expense issues in the event of unexpected variations in business growth or litigation, for example. For most insurers, however, all of the scenarios identified below are adequately handled under other risk categories, in which case, no further investigation is required.

Adverse scenarios to which an insurer's financial condition may be sensitive, include:

A severe inflationary environment – This scenario may lead to a rapid increase in the overall level of expenses, and in unit costs. A high inflation scenario would normally be assumed to accompany a high interest rate scenario, and the two should be logically linked.

An unexpectedly low premium volume – A low premium volume can precipitate an increase in unit costs where a portion of expenses are considered to be fixed.

Technological obsolescence – New technologies may be developed which deliver significant cost, delivery, or service benefits to those who can achieve economies of scale. For companies that do not make use of new technologies, expenses may rise relative to the competition. Such a scenario should include the effect of technological obsolescence on new and renewal business.

Court decisions related to market conduct – The actuary should consider an increase in expenses arising from changes in market conduct necessitated by court decisions.

Ripple effects may include:

- damage to insurer reputation, leading to rating downgrades, or poor competitive position.

PACICC assessments – The actuary should consider the expense implications of PACICC assessments arising from significant industry failures.

Ripple effects may include:

- damage to industry reputation, leading to consumer focus on financial strength.

8. Reinsurance Risks

Reinsurance risk arises from a reinsurer's failure to meet its obligations to the insurer, or from a change in market conditions causing an increase in rates, inadequate limits, or otherwise inadequate or unaffordable coverage. In this context, the term "reinsurer" is intended to include both reinsurers, if the company is a primary insurer, or retrocessionaires, if the company is itself a reinsurer.

Adverse scenarios arising from (ceded) reinsurance risks include:

Reinsurer insolvency – The impact of reinsurer insolvency should reflect an assumed "recoverable percentage" of assets to liabilities of the failed reinsurer, and any different treatment of various types of amounts owing from the reinsurer to the company. The impact may be mitigated by right of offset to amounts owing under all treaties between the two companies; the preferred position insurers will have relative to other creditors of a failed reinsurer; the right of recapture in the event of failure; and any amounts on deposit or in trust with the insurance company, or letters of credit in respect of an unlicensed reinsurer. Normally, it would be appropriate under this scenario to assume that the business previously ceded to the failing reinsurer could be successfully reinsured elsewhere (but possibly on less favourable terms), unless there is something unique about the business involved that would make securing such replacement reinsurance difficult.

The actuary should calculate the exposure to the two largest reinsurers in terms of unpaid claims, including IBNR, but less amounts payable to, and security held from, the same reinsurers. At a minimum, the actuary should evaluate the impact of a 50% default by the largest reinsurer, a 25% default by the second largest reinsurer, and an additional 25% (or more) default by any reinsurer experiencing financial problems (e.g., if the largest reinsurer is experiencing financial problems, a 75% default should be used).

Ripple effects may include:

- increases in reinsurance rates arising from the need to obtain replacement reinsurance coverage.

An increase in reinsurance rates, or a reduction in reinsurance commission – Where reinsurer action is similar across insurers operating in similar markets, such action by a reinsurer or reinsurers would not necessarily pose competitive issues as many companies could be faced with similar changes in terms. However, where reinsurer action is targeted to one company because of poor experience, necessary repricing could affect the volume of new business, or the profitability of that business if the reinsurance commission has been reduced. These events would normally be considered a ripple effect arising from an adverse scenario which resulted in poor experience.

Reduction in capacity – A reduction in reinsurance capacity available for the financing of new business may result in an increase in reinsurance costs or constraint on the growth of the company.

Disputes over policy conditions – The effect on a company of disputes with reinsurers may be similar to the effect of a reinsurer insolvency. To differentiate between these scenarios, however, the actuary should consider a dispute which results in a principal reinsurer denying coverage for a significant class of business or category of claims.

9. Deterioration of Asset Values

Adverse scenarios in respect of deterioration of asset values (C-1) may come from a variety of sources, including:

- increases in losses from defaults on debt securities;
- poor returns and/or declines in the value of equities;
- poor returns and/or declines in the value of real estate; and
- poor returns and/or declines in a value of subsidiary.

The actuary should consider a scenario in which all of the following events occur:

- a drop in the market value of debt securities based on an increase of 150 b.p. in the yield curve;
- a decline in equities consistent with a 25% decline in the TSE 300 index;
- a 50% decline in the value of all real estate; and
- a 75% decline in the value of the largest subsidiary.

Possible ripple effects may include:

- counter-party defaults on derivatives;
- loss or significant decline of value for other major asset categories;
- fluctuations in currency values;
- a ratings downgrade which could in turn have many shock waves such as decreased new business;
- a liquidity crisis caused by large, sustained default losses; and
- economic conditions related to the decline in asset values which could effect losses.

10. Government and Political Action

When the government makes changes in its policies or regulations, implementation usually takes a long time, thereby allowing time to analyze the impact and take the appropriate actions. Some changes, however, occur in a very short period of time and cannot be foreseen, or may even be effective retroactively.

Adverse scenario to which an insurer's financial condition may be sensitive, include:

An increase in premium tax rates

An increase in assessments (e.g., health care levy, insolvency fund contributions) – The assessments which the actuary should consider include provincial health care levies for automobile insurance, and insolvency fund (PACICC) contributions.

An increase in taxation rates or rules for corporations – The actuary should consider income tax, capital gains tax deductions and offshore income, as applicable.

The possible entry of new distribution channels – The scenario, which could result from revisions to the Bank Act, for example, could impact the amount of new business and could lower profit margins due to increased competition.

A change in regulatory solvency standards which could increase the capital requirements for property and casualty insurers

Political instability – Under this scenario, the actuary should consider political instability that could lead to confiscation of assets, closure for new business, exchange controls, etc., particularly in foreign jurisdictions.

Takeover of a line of insurance by a provincial government

Change to statutory coverages (e.g., automobile accident benefits)

11. Off-Balance-Sheet Risks

There are numerous off-balance-sheet items which may place an insurer at risk. Often these off-balance-sheet items arise from new or evolving industry practices which, in future years, do get recognized on the balance sheet by the CICA, the CIA or regulators. Therefore, the actuary needs to develop awareness of any emerging risk which may be relevant to the insurer during the forecast period and assess its potential threat to solvency.

Discussed below are examples of common off-balance-sheet items and their related risks that may be relevant to the insurer:

Structured settlement – When a property and casualty insurance company purchases an annuity to satisfy a structure settlement, it is exposed to the credit risk associated with the insolvency of the annuity company.

Contingent liabilities or losses – There are a variety of contingent liabilities to which a company may be exposed, such as tax, litigation, etc. The actuary should consider the financial impact of adverse outcomes.

Letters of credit and pledged assets – The insurer may be exposed to the risk that a lending institution defaults on payment under (for example) a letter of credit, or a call on assets pledged.

Capital maintenance agreements – An insurer could be exposed to capital maintenance agreements it must honour for its subsidiaries.

Derivative instruments – The risks associated with derivatives include market risk, default risk, management risk and legal risk:

- Market risk includes liquidity risk and basis risk. Liquidity risk is the risk of not being able to cancel or unwind one's contract when desired or at a favourable price. Basis risk is the risk that the derivative's price behavior does not act as expected undoing the intended hedging benefits. The price behavior of the instruments can change adverse when market conditions change. Market risk is best evaluated on a security basis and on a portfolio basis since some risks may not net against each other.
- Default (or credit) risk is the risk that a loss will be incurred due to default in making the full payments, when due, in accordance with the terms of the contract.
- Management risk is the potential for incurring material, unexpected losses on derivatives due to inadequate management supervision and understanding, systems, controls, procedures, accounting and reporting.
- Legal risk is the risk that the derivative agreement is not binding as intended.

IV. MODELLING

Modelling will normally be required to test the capital adequacy of the insurer under the base scenario and adverse scenarios for the DCAT standard. Asset, liability and surplus (capital) modelling are required. Within any one company, there may be a variety of different types of models for the various lines of business and jurisdictions. The modelling capability needs to be flexible enough to enable the actuary to assess risks within each risk category.

Depictive

Unless the model results resemble the company's results, the scenario testing will have no credibility. The model must respond in the same direction and in about the same magnitude as the company in reality will respond to events.

In considering whether a model is depictive, the main focus is on the base scenario. There should be no major discontinuities from the last actual year to the first projected year, unless extraordinary changes in the insurance environment are known to be or likely to be coming. The numbers should generally flow fairly smoothly from one year to the next.

A good way to check the depictiveness of a model is to use, as input for the model, the data prior to the most recent actual year, and use the experience of the last year to set the parameters. The result from the model could then be compared to the actual results. If the results between actual and projected are found to be sufficiently close, the model may be acceptable. The actuary should determine in advance acceptable differences in assets, liabilities, surplus, premium, investment income and net income. There is also a retrospective check on depictiveness that can be made. Each year after the actual results have been determined, differences between actual and base scenario model results should be justified.

Validity

There are two aspects to checking the validity of the model. The first relates to accounting balances (i.e., verification of the mechanical accuracy and consistency among the various parts of the model) and the second to reasonableness.

The reasonableness of a model concerns all the scenarios, but looking at the difference between the results of two scenarios probably best assesses it. Do the differences seem reasonable?

Organizational Considerations

The objective in designing the structure of the model is to facilitate the projection of the company's operations under a number of different scenarios.

The company being modelled operates within an industry that is itself influenced by, and operates within, a geographic and economic environment. The company will have its own legal structure, and, within that, a management structure around which it will plan and monitor its financial results. In organizing the model, it is necessary to reflect this structure and determine where constraints apply and at which level within the hierarchical structure of the model parameters are best set.

Economic parameters, such as interest rate levels, inflation, capital appreciation and unemployment levels are illustrative of assumptions that need to be established at the highest level, as they must be applied throughout the model.

There are demographic and other parameters which need to be established at the highest level as well, such as an overall deterioration in mortality or morbidity for a life insurer or the secular trend in claim costs for a property and casualty insurer; however, these may best be handled as indicators to modify an assumption at a product level. A good illustration may be the approach used for the required scenarios regarding improvement or deterioration in the underlying mortality levels or lapse rates. Distinctive tables would be expected to be applied to annuities and life insurance, for example, but the corresponding changes from expected levels should be consistent.

In designing the structure for the model, the size and complexity of the organization will dominate. At a corporate level, capital infusions, shareholder dividend payments, income taxes, required surplus, investment of surplus, and corporate expenses, such as head office lease and overhead costs, have to be modelled. In a single product line company, these may be combined with the product projection.

In the more complex organization, while similar issues arise as in the single product line company, the need to segment the model arises. This may be driven by size, or certain products may be more efficiently modelled using different languages or techniques. Alternatively, there may be a desire to analyze specific units separately.

- **Management** – This usually reflects the management structure. The business is subdivided into units and cost structures and management reports have been developed around them. Existing plans are assembled and decision-making centred on these units. These units will combine products and possibly investment units. Subsidiaries and foreign operations would fall into this category.
- **Product** – This is usually the smallest subdivision of business considered. For life insurers, asset share projections are usually already available, and the model can be built using these as the foundation.

- **Investment** – Usually these reflect where assets are actually separated, but can include where a different investment strategy is followed regarding one block of assets compared to another. Investment income allocation follows the investment structure. This method of subdivision would combine a number of like products for investment purposes.

  It may be desirable to have further breakdowns within a segment to take into consideration different investment strategies or products that are exposed to distinctly different risks. These will require separate parameters, at the least, and may, in fact, need different modelling techniques or valuation methods.

The interrelationship of product cash flows feeding the asset model is critical. Cash available needs to be established before investment decisions can be implemented.

It may be desirable that calculation of taxes and required surplus be done at a divisional level of the model on a stand-alone basis. However, when results are consolidated, these will have to be redone on a consolidated basis. This implies that such data, as necessary must be transferred to the corporate model to facilitate these calculations.

Flexibility

Models constructed for purposes of solvency testing will have to be run repeatedly under many different scenarios of possible future experience. Variations in experience levels apply not only to the usual factors such as deaths, withdrawals, expenses, and interest rates, but also to items which can be thought of as company policies. These include investment strategies, valuation assumptions, and marketing and new sales.

It follows that any models that are to be used for capital adequacy testing purposes must be flexible and allow for changes to be made in the underlying assumptions that form the various scenarios.

Another aspect of flexibility involves the ability of the model to focus on a particular line of business, division of the company, fund, or territory. Since it is likely that models constructed for solvency testing purposes will also be used for corporate planning, the model should be sufficiently flexible to reflect any reasonable changes in company operations which it might be desired to test. Of course, these same changes might very well be the subject of additional scenarios in the solvency testing process.

V. SAMPLE REPORT OUTLINE

Significant time and effort will be required to develop the capabilities to perform and to execute the projection and analysis. The preparation of a clear and complete report on the results and implications of this work is an important component in the entire process. The audience for this report is company management as well as the board of directors and the regulator.

The actuary should report all plausible adverse scenarios that cause the insurer to fall below the minimum regulatory capital requirement during the forecast period. In addition, if the insurer is unable to meet all its future obligations under any adverse scenario or the base scenario causes the insurer to fall below the minimum regulatory capital requirement, then an unsatisfactory condition must be reported.

A sample report outline follows:

1. Executive Summary

- summary of the base and adverse scenario results (regulatory capital adequacy ratios, earnings, assets, liabilities, surplus)
- summary of the recent and current financial position
- highlighting of the most significant solvency risks
- DCAT Opinion

2. Introduction to DCAT

- purpose, scope, process, method

3. Capital Adequacy Measurement

- description and summary of the current position (e.g., MCCSR ratio)
- definition of minimum regulatory capital requirement
- definition of satisfactory financial condition used in DCAT

4. Base Scenario

- description of scenario, assumptions, results
- discussion of consistency with business plan

5. Adverse Scenarios

- description of scenarios, assumptions, assumed management action, results
- description of results without extraordinary management, if applicable
- recommendations on what actions management could take to mitigate adversity
- additional comments regarding any adverse scenarios causing the company to fall below the minimum regulatory capital requirement (per paragraph [illegible] of the Standard)

6. Analysis of Risks by Line of Business

- discussion of risks and scenario results

7. Conclusions and Recommendations

- summary and future developments

8. Appendices

- key corporate objectives/initiatives
- capital enhancement activities
- key assumptions and other considerations (rating agencies, taxation, valuation/accounting issues)