Canadian Institute of Actuaries | Institut canadien des actuaires

Educational Note

Financial Condition Testing

Committee on Risk Management and Capital Requirements

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The actuary should be familiar with relevant educational notes. Educational notes are not binding; rather they are intended to illustrate the application of the standards of practice. A practice that an educational note describes for a situation is not necessarily the only accepted practice for that situation nor is it necessarily accepted practice for a different situation. Responsibility for ensuring that work is in accordance with accepted actuarial practice lies with the actuary. As accepted actuarial practice evolves, an educational note may no longer appropriately illustrate the application of standards. To assist the actuary, the CIA website contains a reference of pending changes to educational notes.

MEMORANDUM

To: All members in the Life, Property and Casualty, and Mortgage Insurance Practice Areas

From: Dean Newell, Chair
Actuarial Guidance Council

Christian Nadeau-Alary, Chair
Committee on Risk Management and Capital Requirements

Date: January 12, 2023

Subject: **Educational Note—Financial Condition Testing**

The Canadian Institute of Actuaries (CIA) last published an educational note on financial condition testing (FCT) in April 2020. This educational note has been updated to reflect IFRS 17 concepts and terminology with an effective date of January 1, 2023.

Updates to the educational note

Notable updates include:

a) Updates to reflect IFRS 17, including guidance on FCT considerations associated with measurement under IFRS 17 and IFRS 17-specific modeling considerations.

b) Expanded discussion regarding adverse scenario selection and assessment of the percentile ranking of scenarios.

c) Expanded guidance on the role of going concern scenarios.

d) Expanded guidance regarding ripple effects and management actions.

e) Clarification regarding the requirement to use the wording prescribed in the Standards of Practice (SOP) for the FCT opinion.

f) The addition of climate-related risks, and technology and cyber risks to the major risk categories the actuary would consider for FCT analysis.

Comments were received from regulators and other committees of the CIA. Most of the comments were editorial in nature and were addressed through minor edits to the document. Feedback was received that additional guidance is required regarding the impact of the measurement of liabilities under IFRS 17 on the strength of the threshold for a satisfactory opinion for solvency scenarios. In response, the working group developed a new subsection entitled “IFRS 17 considerations” within the Method section of the document to address considerations related to measurement under IFRS 17.

Process

The creation of this cover letter and educational note has followed the Actuarial Guidance Council's (AGC's) protocol for the adoption of educational notes. In accordance with the CIA's *Policy on Due Process for the Approval of Guidance Material Other than Standards of Practice and Research Documents*, this educational note has been prepared by the Committee on Risk Management and Capital Requirements (CRMCR), and has received approval for distribution by the Actuarial Guidance Council on December 13, 2022.

Responsibility of the actuary

The actuary should be familiar with relevant educational notes. Educational notes are not binding; rather they are intended to illustrate the application of the standards of practice. A practice that an educational note describes for a situation is not necessarily the only accepted practice for that situation nor is it necessarily accepted practice for a different situation. Responsibility for ensuring that work is in accordance with accepted actuarial practice lies with the actuary. As accepted actuarial practice evolves, an educational note may no longer appropriately illustrate the application of standards. To assist the actuary, the CIA website contains a reference of pending changes to educational notes.

Working group

The CRMCR would like to acknowledge the contribution of the working group that assisted in the development of this educational note: Andrew Lang (Chair), Gabriel Bisson, Nicholas Caramagno, Richard Chevalier, Guillaume Grondin, Simon Guénette, Cecilia Ho, Daniel Klein, Bruce Langstroth, Crystal Lee, Ivy Lee, David Lim, Christian Nadeau-Alary, Mandy Seto, Jennifer Tan and Valerio Valenti.

Your feedback

Feedback on all aspects of the proposed changes, as well as suggestions for other changes not presented in this educational note, are encouraged.

If you have any questions or comments regarding this educational note, please contact the Chair of the CRMCR at guidance.feedback@cia-ica.ca.

DN, CNA

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1. Introduction

The primary purpose of this document is to provide guidance and support to actuaries of life and property and casualty (P&C) insurers in performing financial condition testing (FCT) analyses in accordance with the Standards of Practice (SOP) – Insurance, Section 2500.

According to paragraphs 2520.01 to 2520.04 of the SOP:

> The appointed actuary should make an investigation at least once during each financial year of the insurer's recent and current financial position and financial condition, as revealed by financial condition testing for selected scenarios.
>
> The appointed actuary should make a report of each investigation in writing to the insurer's board of directors (or to the appropriate committee of the board such as audit committee, risk committee, etc., if they so delegate) or its chief agent for Canada. The report should identify possible actions, and reasons for those actions, for dealing with any threats to satisfactory financial condition that the investigation reveals. The actuary should also comment on the consistency of the results of the investigation and possible actions with the own risk and solvency assessment (ORSA).
>
> The appointed actuary should ensure that the investigation is current. The investigation should take into consideration recent events and recent financial operating results of the insurer.
>
> The timing and frequency of the appointed actuary's investigations would be sufficient to support timely corrective actions by management and the board of directors or chief agent for Canada.

FCT is one of various stress-testing processes that would fit within the insurer's overall risk management process. The FCT process allows management to understand implications the business plan has on capital and provides awareness of the significant risks to which the insurer is exposed. The principal goals of FCT are to identify possible threats to the financial condition of the insurer and appropriate risk management or corrective management actions to address those threats, while considering the ORSA, conclusions, and recommendations. The FCT process should not be viewed as merely a compliance exercise.

Stress testing includes scenario testing and sensitivity testing (refer to the glossary in Office of the Superintendent of Financial Institutions (OSFI) Guideline E-18 – Stress Testing, or to l'Autorité des marchés financiers (AMF) Stress Testing Guideline, for definitions). Stress testing has the following goals:

1. **Risk identification and control** – stress testing may exist at various levels within an insurer, ranging from risk mitigation policies at a detailed or portfolio level to adjusting the institution's business strategy. It can be used to address institution-wide risks and consider concentrations and interactions between risks in stress environments that might otherwise be overlooked. Knowing the sources of threat will help advise the insurer where it is most vulnerable, should strengthen monitoring systems and aid the development of potential management actions that could be applied.
2. **Provide a complementary risk perspective to other risk management tools** – stress tests would complement risk quantification methodologies that are based on complex,

quantitative models using historical data and estimated statistical relationships. Stress-testing outcomes can provide insights about the validity of statistical models at high confidence intervals such as those used to determine value at risk (VaR).

Stress testing can help the insurer assess possible changes in the economic and financial environments. Stress tests can also help detect vulnerabilities, such as unidentified risk concentrations or potential interactions between types of risk, that could threaten the viability of the institution, which may be concealed when relying purely on statistical risk management tools based on historical data. Stress testing can also be used to assess the impacts of customer behaviour arising from options embedded in products, particularly where the behaviour in extreme events is not well understood.

3. **Support capital management** – stress testing would form an integral part of an institution's internal capital management where rigorous, forward-looking stress testing can identify severe events, including a series of compounding events or changes in market conditions.
4. **Improve liquidity management** – stress testing would be a central tool in identifying, measuring, and controlling funding liquidity risks, in particular for assessing the institution's liquidity profile and the adequacy of liquidity buffers in case of both institution-specific and market-wide stress events.

It is essential that the board of directors or chief agent[1] and senior management provide input and review how the stress scenarios were determined and understand the key findings of the stress tests to develop and implement risk mitigation strategies. Risk concentration would be considered throughout the stress-testing process.

FCT has the following key elements:

- Development of a base scenario.
- Development of adverse scenarios.
- Identification and analysis of the effectiveness of corrective management actions to mitigate risks.
- A report on the results of the analysis and recommendations to the insurer's management and the board of directors or chief agent.
- An opinion signed by the Appointed Actuary (AA) indicating the financial condition of the insurer.

The subsequent sections of this document cover the following:

- **Method** – this section provides guidance on the FCT process, forecast period, and approaches to developing the base scenario and adverse scenarios.
- **Modelling** – this section identifies key elements to be considered in building an FCT model used to project the financial results under the base and selected adverse scenarios.

[1] "Board of directors or chief agent" refers to the board of directors (or to the appropriate committee of the board such as audit committee, risk committee, etc., if they so delegate) or the chief agent for the Canadian branch of a foreign company.

- **Reporting** – this section provides guidance on key elements to be considered in reporting the results of FCT, along with an outline of a typical report.
- **Appendices** – discussion and analysis of risk categories for life and P&C insurers. The actuary would also consider the risk categories outlined in the appendices for mortgage insurers.

2. Method

Process

FCT is used for risk identification and control, and assesses threats to an insurer's financial condition. The ORSA further enhances an insurer's understanding of the interrelationships between its risk profile and capital needs, comprehensively addressing the risk universe, including elements such as operational, strategic, and business risks. Both processes relate risk to capital and are complementary in nature. Therefore some level of consistency between the two processes would be expected. The actuary would assess the level of consistency necessary in areas such as, but not limited to, the modelling of ripple effects, the selection of adverse scenarios, the determination of forecast periods, and the consistency of messages.

It is fundamental to this process, and to the proper interpretation of results, to understand that the projected capital position under various scenarios may become inadequate during the forecast period. 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 insurer is particularly sensitive. This, together with the results under the base scenario, would guide the insurer as to the necessity of revising the business plan or preparing for contingencies.

To perform FCT, it is necessary to understand the regulatory capital minimum ratios and the insurer's internal target capital ratios. If the internal target is established using a different capital benchmark, it would be translated to the equivalent ratio under the current regulatory regime. It is recommended that the actuary verify the current regulatory requirements for their own insurer's situation and review any applicable guidelines and educational notes. The actuary would also understand the risk categories (see Appendices A and B for potential risk categories to be considered) posing the most significant threats to the insurer, including the impact of any ripple effects.

Approach

A typical approach would include the following steps:

- Review of operations for recent years and of the financial position at the end of each of them. The number of years reviewed depends on its relevance to the future financial position.
- Development and modelling of the base scenario. As stated in the SOP, this would normally be consistent with the insurer's business plan.
    - Assessment of potential risks and identification of those that are relevant to the insurer's circumstances. Sensitivity testing may be used to determine the relevant risk categories warranting further analysis.
    - In the event of a new regulatory requirement or change in SOP, it may be necessary to perform additional analysis as the sensitivities to certain risk factors may change.

- Selection of adverse scenarios requiring further analysis for relevant risk categories to be applied across all business and product lines:
    - Development and modelling of adverse scenarios likely to significantly impact the insurer's equity and regulatory capital ratios. The scenarios may be single-risk scenarios, or integrated scenarios resulting from a combination of single-risk scenarios. The stress tests would cover a range of scenarios, including any new scenarios with emerging risks. Stress testing may be used to determine the adverse scenarios.
    - Identification and modelling of associated system-wide interactions and feedback effects (ripple effects and macroeconomic effects) caused by a change in assumptions projected to occur under the scenario.
    - Depending on the insurer's circumstances, the board of directors or chief agent and management may also be interested in situations that cross other break points, in which case further stress testing may be beneficial.
- Selection of scenarios showing the greatest sensitivities, from those modelled, for inclusion in the report, where such sensitivity is based on the type of scenario and the associated thresholds (as defined in paragraph 2520.09 of the SOP) being tested.
    - For each scenario where corrective management actions are required to meet the threshold for a satisfactory opinion, these possible actions would be identified, and financial condition results would be presented with and without such actions. In addition, commentary would be included on the rationale for those actions and the extent to which such actions are necessary and achievable and why they are expected to mitigate and/or eliminate the threats to satisfactory financial condition. Any possible constraints on identified corrective management actions would be taken into account.
- Identification of possible regulatory actions for each scenario. For best practices purposes, it would be preferable to also identify possible regulatory actions that may be triggered as a result of falling below any capital requirements set by the regulator(s).

Recent and current financial position

Paragraph 2520.05 of the SOP states the following:

> The investigation would review operations of recent years and the financial position at the end of each of those years.

The review would include the following items:

- core financial statements, such as the statement of financial position, the statement of profit or loss and the reconciliation of insurance contract liabilities,
- internal income reporting/experience analysis, such as an IFRS 17 source of earnings (if available), and/or
- the results of the applicable regulatory tests of capital adequacy.

The actuary would analyze recent trends in these statements, investigate the circumstances and key contributing factors, and report on these findings.

Forecast period

Paragraph 2520.15 of the SOP states the following:

> The forecast period for a scenario would be sufficiently long to be aligned with the risk emergence and the recognition of impacts through the accounting and solvency results, and to capture the effect of management actions.

The SOP does not prescribe a minimum length for the forecast period. However, the following would be considered:

- The forecast period would be long enough to incorporate the vast majority of an adverse scenario's impacts on the financial condition of an insurer, including ripple effects, and long enough to assess the recovery period of corrective management actions (if applicable). The context of the risk being stressed would be considered, as some risks evolve over long periods, as well as the nature of the insurer's business.
- The length of the forecast period would be aligned with the risk emergence and the recognition of impacts through accounting and solvency (e.g., the horizon over which accounting impacts are recognized may be different than those for capital, such as those related to segregated fund guarantees).
- A typical forecast period for an insurer is three to five fiscal years. It is recommended that the actuary use judgment in assessing the forecast period and describe the reasoning in the report.
- Consistency of the forecast period with similar analysis, such as the ORSA.

Materiality standard

The materiality standard would usually be less rigorous than that used for valuation of the insurer's insurance contract liabilities and, if practical, the actuary would discuss it with the insurer's management. In selecting a materiality standard, the actuary would also consider:

- The size of the insurer.
- The financial position of the insurer. The materiality standard would become more rigorous in examining a scenario where the insurer's capital ratios are closer to the threshold for a satisfactory opinion.
- The nature of the thresholds being tested. For example, if the test is measuring the insurer's regulatory minimum capital ratios, the materiality standard might be expressed as a percentage of the required capital. Alternatively, if the test is measuring the insurer's assets and liabilities, the materiality standard might be expressed as a percentage of assets, liabilities or equity.

For more guidance on materiality, refer to subsection 1240 of the SOP.

Base scenario

According to paragraph 2520.17 of the SOP:

> The base scenario would be a realistic set of assumptions used to forecast the insurer's financial position over the forecast period. Normally, the base scenario would be consistent with the

> insurer's business plan. The actuary would accept the business plan's assumptions for use in the base scenario unless these assumptions are so inconsistent or unrealistic that the resulting report would be misleading. The actuary would report any material inconsistency between the base scenario and the business plan.

While the SOP states the base scenario would normally be consistent with the business plan, it does not require that the projected financial results and future financial positions be identical to the projections prepared at the time the insurer's business plan was approved. Typically, there is a difference between the timing of the starting balance sheet date for the FCT analysis and the timing when the business plan was approved. During this time, events may have occurred that led to definitive changes in assumptions. As stated above, the projection of the future financial condition would reflect any material change that has occurred during this time. The projected financial results and future financial positions may continue to be consistent with the business plan while still recognizing updates or changes, such as:

- Sales distribution assumptions updates from those expected in the business plan.
- Recent management decisions not anticipated or discussed in the business plan.
- Changes in the capitalization of the insurer not expected in the business plan.
- The impact on future experience, where appropriate, due to actual recent experience, assumptions, or decisions as described above.

If differences are material, a reconciliation of the base scenario to the business plan would be included in the FCT report. It is expected that significant deviations from the insurer's business plan, as well as significant deviations in the results for the forecast period, would be documented. Where differences in the base scenario are not due to a recent reforecast of the business plan, the actuary would run the business plan as an additional scenario to ascertain the deviations in the results and explain the rationale for the changes. Any differences between the business plan and the base scenario would, typically, also affect all adverse scenarios.

Clear reporting of assumptions made regarding capital injections is essential. There will be some situations where capital injections are a basic part of an insurer's business plan; for example, when the business plan calls for an insurer to grow quickly or is intending a major initiative in a new sphere of operations. In any scenario where capital injections are assumed, it is expected that the actuary would comment on the action in the FCT report and is comfortable that such injections are both realistic and reasonable.

Adverse scenario selection and assessment of percentile ranking

According to paragraphs 2520.18 and 2520.19 of the SOP:

> An adverse scenario is developed by stress testing the assumptions used in forecasting the business plan, including the determination of insurance contract liabilities, with regard to risk factors that may trigger potential threats to the insurer's financial condition. The number and types of adverse scenarios may vary among insurers and over time for a particular insurer.
>
> The actuary would consider material, plausible risks or events to the insurer. Reverse stress testing can help assess whether certain risk factors need to be tested, on the grounds that certain risk factors could never deteriorate to the point where they would be a threat to the

insurer's financial condition. The actuary can thereby determine whether a material, plausible risk or event exists for the insurer over the forecast period.

An insurer would consider the impact of a range or series of adverse scenarios of varying nature and its ability to meet the thresholds for a satisfactory opinion for going concern and solvency scenarios. The actuary would consider threats that include, but are not limited to, the common risk categories for life and P&C insurers as listed in Appendices A and B in order to develop adverse scenarios. From the adverse scenarios, the actuary would select those to which the insurer shows the greatest sensitivity and examine them in further detail, considering associated ripple effects. Any modelled scenario that causes the insurer to fall below, or come close to, the defined thresholds during the forecast period would be subject to further examination and reporting. In selecting adverse scenarios the actuary would also consider the ORSA, the insurer's stress testing program, any scenario prescribed by the regulator, changes in external factors impacting the insurer (such as change in the economic, business, regulatory or political environment), and whether the circumstances of the insurer result in the need to examine other risk categories.

Adverse scenarios build on the assumptions and actual experience already reflected in the base scenario. This is particularly true if the first part of the projection of the base scenario already reflects some adverse conditions that have been experienced. If the base scenario does not reflect adverse experience already seen because it is projected to improve in the future, the adverse scenarios should be consistent, except for any adverse scenarios specifically designed to test the impact of the adverse experience persisting in the forecast period.

If possible, insurance contract liabilities would be revalued or appropriately estimated for each adverse scenario for at least each year of the projection. Revaluation only at the end of the forecast period may be a suitable compromise if the actuary believes, given the financial position at the end of the forecast period, that the financial condition would be satisfactory throughout the forecast period.

Scenarios would be framed and calibrated based on the threshold being tested, i.e., either in the context of going concern or solvency. In situations where it is unclear as to the percentile ranking of the scenario, for example in the case of integrated scenarios, the actuary would use judgment to determine the appropriate grouping.

Both deterministic and stochastic models can be used to develop scenarios. To assess the percentile ranking of an adverse scenario the actuary may employ stochastic models, a comparison of the scenario against historical experience or a combination of these approaches. The percentile rank of a scenario may be benchmarked against historical experience that is representative of a certain percentile ranking. Examples include:

- Changes in key economic variables (e.g., public equity returns and interest rate movements) during economic recessions, such as the early 2000's recession, 2008 global financial crisis or COVID 19 pandemic.
- Mortality experience during the 1918 flu pandemic or COVID 19 pandemic.
- Major catastrophes that affect transportation or supply chains such as flood, earthquake or windstorm (e.g., 2021 floods in British Columbia).
- Cyber breaches due to security breach and vulnerabilities and shutdown of important

websites such as the Canada Revenue Agency shutdown in 2021.

Reverse stress testing may be used to develop adverse scenarios and determine how far risk factor(s) need to change in order to drive the insurer below the scenario thresholds and evaluating if that degree of change is plausible and helps insurers better understand the impact of business vulnerabilities. Reverse stress testing begins with the assumption that a specific outcome occurs. For instance, in the case of a solvency scenario the reverse stress test may assume the insurer's equity becomes negative during the forecast period. Next a sequence of events producing the desired outcome would be identified. These events may be concurrent or occur over a period of time, and may or may not be more severe than those seen historically. An evaluation is then performed to determine whether that degree of change is plausible in the context of what is being tested. The results of reverse stress testing can also help with strategic business decisions, contingency planning (e.g., corrective management action), and designing risk management arrangements (e.g., reinsurance).

It is expected that the actuary would report on the considerations for determining the adverse scenarios, including any consideration of reverse stress testing. The stress testing performed as part of the ORSA and any other similar analysis could be considered in the selection of the adverse scenarios, or vice versa. The stress testing performed by the insurer can be harmonized for FCT, the ORSA, and any other testing. It is expected that the adverse scenarios to which the insurer shows the greatest sensitivity would be discussed in the report in detail.

Solvency scenarios

According to paragraph 2520.18.1 of the SOP:

> A solvency scenario is a plausible adverse scenario if it is credible and has a non-trivial probability of occurring. The actuary may use percentile rankings of outcomes to determine whether a solvency scenario is both plausible and adverse.

In a solvency scenario, an insurer would be expected to consider the occurrence of event(s) that test its ability to maintain a positive equity position.

A solvency scenario is a plausible adverse scenario, with the percentile ranking of the scenario recommended to be at least at the 95th percentile over the scenario horizon. Although this guideline suggests this minimum, it is strongly recommended that analysis be performed at even higher percentile rankings and it would not be unreasonable to conduct scenario testing at the 99th percentile or beyond. If the actuary is unable to ascertain the percentile ranking of the scenario, the actuary would be comfortable that the scenario is of sufficient adversity to appropriately test the relationship of the insurer's statement value of assets to its liabilities. The actuary would disclose in the FCT report the reasons for selecting the scenario, including considerations regarding its frequency, severity and period of adversity.

The threshold for solvency scenarios is a higher statement value of assets than liabilities.

A solvency scenario could align with the level of shocks used in the ORSA.

It is recommended that at least two solvency scenarios be tested.

Going concern scenarios

According to paragraph 2520.19.1 of the SOP:

> A going concern scenario is an adverse scenario that is more likely to occur and/or less severe than a solvency scenario, and could include risks not considered in solvency scenarios.

A going concern scenario is intended to test an insurer's ability, through its developing capital position, ripple effects, and corrective management actions, to maintain operations and fulfill its obligations while meeting or exceeding the regulatory minimum capital ratio(s). The scenario would maintain sufficient capital resources, as defined in OSFI's Guideline A-4 – *Regulatory Capital and Internal Capital Targets* or in AMF's *Capital Adequacy Requirements for Life and Health Insurance (CARLI)* or Minimum Capital Test (MCT) guidelines, to meet or exceed the regulatory minimum capital ratios.

A going concern scenario is a plausible adverse scenario, with the percentile ranking of the scenario recommended to be at least at the 90th percentile over the scenario horizon. If the actuary is unable to ascertain the percentile ranking of the scenario, the actuary would be comfortable that the scenario is of sufficient adversity to appropriately test the insurer's ability to meet or exceed the regulatory minimum capital ratio(s). The actuary would disclose in the FCT report the reasons for selecting the scenario, including considerations regarding its frequency, severity and period of adversity. A going concern scenario may examine the same risks as a solvency scenario or consider a distinct set of risks. If a going concern scenario is examining the same risks as a solvency scenario, it may be developed by reducing the percentile ranking of the stressed assumptions over the same horizon, or by testing a more gradual deterioration in the stressed assumptions.

It is important to note that the threshold for going concern scenarios is defined by the regulatory minimum capital ratio(s), whereas the threshold for solvency scenarios is a higher statement value of assets than liabilities. In some cases, a solvency scenario can meet both satisfactory financial condition thresholds of going concern and solvency scenarios. The actuary would still be interested in analyzing additional going concern scenarios, for different risk types or projection horizons, to further understand other potential risks that may impact the insurer's ability to maintain operations and meet its obligations while meeting or exceeding the regulatory minimum capital ratio(s).

It is recommended that at least one going concern scenario be tested.

Integrated scenarios

According to paragraph 2520.22 of the SOP:

> The actuary would construct integrated scenarios by combining two or more risks factors whose combination gives rise to an adverse scenario.

An integrated scenario is a type of adverse scenario resulting from the combination of two or more adverse risk factors. The integrated scenarios could be a combination of risk factors with low percentile ranking and/or risk factors with higher percentile ranking. The adverse risk factors to be combined may be based on correlated or uncorrelated risk factors but the resulting integrated scenario would remain plausible and would consider associated ripple effects.

The percentile ranking of an integrated adverse scenario may be assessed based on an integrated stochastic model, if available. If an integrated stochastic model is not available, judgment regarding the correlation between risk-factors could be used to assess the overall percentile ranking of the integrated scenario based on stochastic models for individual risk-factors. Similar to individual risk factor scenarios, the overall percentile ranking of an integrated scenario may be benchmarked

against historical experience.

It is recommended that at least one integrated scenario be tested.

Ripple effects and corrective management actions

The SOP defines "Ripple effects" and "Corrective management actions". The next three sections described ripple effects (which includes routine management actions), corrective management actions and considerations for the classification of management actions.

Ripple effects

A ripple effect is an event or incident that occurs when an adverse scenario triggers a change in one or more interdependent assumptions or risk factors and includes policyholder actions, routine management actions, regulatory actions, and/or rating agencies actions. The following are examples of ripple effects:

- Post-event mortality as a result of a catastrophe. However, a change in mortality unrelated to the catastrophe would not be considered a ripple effect but a separate risk category.
- Increased post event non-catastrophe related claim severity following a catastrophic event.
- Steady and continued deterioration in mortality, versus that assumed in valuation and/or new business pricing assumptions, which would likely result in a routine reprice to reflect emerging experience. The actuary would reflect any knock-on impact on new business sales volumes and/or expense coverage.
- Routine management actions to address deteriorating mortality or morbidity experience on group insurance written on a one-year term-renewable basis, or deteriorating loss experience in certain lines of P&C insurance, which may take the form of premium rate increases, tightening of underwriting, modification of benefit definitions, etc. The actuary would reflect any knock-on impact on retention, new business sales volumes and/or expense coverage.
- Adjustments to assumptions used in the base scenario that may no longer be appropriate in the adverse scenario being tested. For example, depending on the nature of the adverse scenario, increases in future new business sales volumes under the base scenario may not be appropriate in the adverse scenario.
- Regulatory actions, by both Canadian and foreign regulator(s), and especially under any adverse scenario where the insurer fails to meet the supervisory target capital ratio(s).
- Rating agency actions due to significant changes in capital or equity.
- Changes in planned capital injections or distributions.

Refer to the appendices for examples of potential ripple effects associated with the major risk categories.

Management actions considered routine by one insurer may not be considered routine by another. Actions that may be classified as routine are those the insurer considers to be a component of standard policies and procedures and remain within the range of accepted actions.

According to paragraph 2520.26 of the SOP:

> Selection of the assumptions for management's routine action would, where appropriate, take into account:
>
> - Effectiveness of the insurer's management information systems and adjustment mechanisms;
> - Insurer's historical record of promptness and willingness, to respond to adversity;
> - Policy owner action; and
> - External environment assumed in the scenario.

According to paragraph 2520.27 of the SOP:

> The actuary would report management's routine action, so that users may consider its practicality and adequacy. The actuary may also report the results assuming that the insurer does not respond to the adversity.

For example, management's routine action in response to an adverse scenario may be to increase premium rates. To help the users assess the practicality and adequacy of this routine management action, the actuary would discuss the impact due to delayed realization of the full impact of the rate increase, denied proposed rate increase of a regulated insurance product (e.g., automobile insurance), decreased policyholder retention, loss of new business, and increased expenses to regain lost business, among other things. Repricing can be a routine management action or a corrective management action depending on the circumstances (i.e., type of product, degree of the premium increase, market competition, etc.).

The actuary would inform management of potential regulatory actions and repercussions and would consider when it may be appropriate to model or calculate the financial impact of such actions. The financial impact of regulatory actions could be significant, and the board of directors or chief agent may be particularly interested in seeing the modelled impact in the analysis. The actuary would consider actions that could be taken by both Canadian and foreign regulator(s). Such regulatory actions and associated management response would consider the local assessment of solvency, regardless of the insurer's worldwide solvency position as measured by Canadian regulatory standards. If the impact of potential regulatory actions has been modelled in a recent FCT or the ORSA analysis, it may not be necessary to model the impact again in the current FCT. This would be reasonable if the actuary believes the scenario results have not changed materially and the regulator response and impact would be consistent with the earlier work.

Similarly, the actuary would inform management on potential rating agency actions and possible repercussions but would not necessarily model or calculate the financial impact of such actions, unless the actuary thought it would be beneficial to include.

Corrective management actions

Paragraphs 2520.29, 2520.29.1, and 2520.34 state:

> For each of the adverse scenarios that would result in a threat to satisfactory financial condition, the actuary would identify possible corrective management actions that would lessen the likelihood of that threat, or that would mitigate that threat, if it materialized.

> Consideration would also be given to the effectiveness of possible corrective management actions in a volatile or stressed environment.
>
> If the investigation identifies any plausible threat to satisfactory financial condition, then the actuary would identify possible corrective management action that would lessen the likelihood of that threat, or that would mitigate that threat, if it materialized. For each such adverse scenario reported upon, the actuary would report the results both with and without the effect of corrective management action. The actuary would ensure that the disclosure of the corrective management action is sufficiently clear so that users may consider its practicality and adequacy.

Actions not considered by the insurer in the normal course of business, and which require escalation to senior management, the board of directors or chief agent beyond routine management actions and the normal course of such requests would be classified as corrective management actions. For example, depending on the insurer's circumstances this could include implementing non-routine rate increases, raising additional capital, implementing a new reinsurance arrangement, or suspending dividend payments.

Corrective management action(s) can be used in both going concern and solvency scenarios. For the solvency scenarios in particular, the actuary would consider the insurer's ability to sufficiently control completion of the action in a volatile or stressed environment. The involvement of third parties in the management action could reduce the ability of the insurer to control such actions; however, the presence of existing policies and processes and/or successful completion of such actions in the past could provide the actuary with a level of comfort that such actions are within the insurer's control and will provide the expected result. Examples of situations where the actuary may consider whether the insurer has sufficient control over the management action(s) include:

- The ability to issue debt or preferred shares at a given price or volume.
- The ability to incorporate price adjustments given any action or inaction of its competitors and potential repercussions from policyholders.
- A parent company's ability to inject capital due to increased demands from other business units or a subsidiary's ability to remit amounts to a parent company.
- The ability to develop a hedging program where no capabilities currently exist.

Classification of management actions

Paragraphs 2520.30 states:

> Whether a management action is considered a ripple effect, a corrective management action, or a combination of both, would depend on the scenario analyzed and circumstances of the insurer.

As the distinction between ripple effects (including routine management actions) and corrective management actions is critical to the development of the opinion statement, the actuary will need to carefully assess the appropriate categorization of the management actions.

Management actions, which could be considered as ripple effects, corrective management action, or a combination of both, depending on the scenario being analyzed and circumstances of the insurer, include but are not limited to:

- Repricing of insurance products.
- Regular policyholder dividend scale updates.
- Adjustments to non-guaranteed product elements.
- Suspending dividend payments, and reduced capital transfers to the parent or home office, where applicable.
- Raising additional capital or adopting an approved plan to raise additional capital if and when needed within a reasonable time frame, or, in the case of a branch, requesting transfer of adequate funds from the parent company.
- Strengthening risk management practices.
- Mitigating the risk causing the capital shortfall.
- An increased level of monitoring and reporting of the insurer's capital position.

Refer to the appendices for examples of potential management actions associated with the major risk categories.

IFRS 17 considerations

The actuary will want to consider the objective and requirements of IFRS 17 in considering the preceding aspects of FCT. The IFRS 17 measurement model includes features and/or omissions which may impact the base scenario and/or company risk exposures.

Under IFRS 17, fulfillment cash flows are a market consistent measurement of the liabilities as compared to other potential measurement objectives such as fulfillment value. This implies that the liability may under- or over-value risks relative to real world expectations and therefore increase or decrease the exposure to risks that should be considered in FCT.

Specific examples of IFRS 17 measurement features that may warrant consideration include:

- IFRS 17 liabilities generally make no provision for default risk, reinvestment risk or other asset-related risks, and liabilities may exhibit greater sensitivity to movements in interest rates and other economic variables.
- IFRS 17 liabilities only include provision for maintenance expenses that are directly attributable to the administration of the contracts.
- Embedded financial guarantees are valued on a market consistent (risk neutral) basis, the results of which may differ materially from real world scenarios.
- Risk adjustment incorporates the entity's view of risk and may incorporate diversification benefits that might not be realized in adverse scenarios.
- IFRS 17 liabilities do not reflect certain benefits such as the impact of discounting arising from deferred tax assets and risk premiums that are deducted in determining discount rates.
- When considering the threshold for a satisfactory opinion for solvency scenarios, the statement value of an insurer's liabilities includes the CSM.

IFRS 17 measurement of liabilities may impact the emergence of earnings in the base scenario and the sensitivity of future results to adverse scenarios. The actuary should be aware of these aspects of IFRS 17 in conducting FCT, the potential impact on the measurement of the thresholds for a

satisfactory opinion and the ability to achieve a satisfactory opinion.

3. Modelling

The following section sets out modelling considerations associated with FCT analysis.

Basic requirements of the model

Typically, the model reproduces key elements from the financial statements and regulatory capital statements. The actuary should use professional judgment in determining the financial and regulatory capital elements to be modelled, taking into consideration the expectations of the FCT report users. Examples of situations where an element would be modelled in FCT include, but are not limited to, the following:

- It is a key metric used by the board of directors or chief agent in overseeing the insurer's financial performance and condition.
- It could reasonably be expected to provide useful insights into the insurer's exposures under the adverse scenarios and the extent of its reliance on management actions.
- It could assist users of the FCT report, including regulators, in assessing the reasonableness of FCT results and the actuary's conclusions.

The following elements could be considered for inclusion in FCT modelling:

- Statement of Financial Position:
    - Assets (investments, insurance contract assets, reinsurance contract held assets, deferred tax assets, and other assets).
    - Liabilities (insurance contract liabilities, reinsurance contract held liabilities, financial instrument derivative liabilities, debt and other liabilities).
    - Shareholders' equity (contributed surplus, retained earnings, accumulated other comprehensive income (AOCI), and other equity).
    - Policyholders' equity (participating account, non-participating account, AOCI, and other equity).
    - Head office amount (Head office account, AOCI and other amounts).
    - Non-controlling interests.
- Statement of Profit or Loss:
    - Insurance revenue.
    - Insurance service expenses.
    - Insurance service result.
    - Net investment result (investment income, finance income/expenses).
    - Other income and expenses.
    - Income taxes.

- Applicable regulatory capital ratios.
- Internal income reporting, such as an IFRS 17 source of earnings (if available).
- Relevant items from the notes to the financial statements.

The actuary would verify that the model is valid on an accounting basis. Section 1450 of the SOP sets out the standards for model use.

Financial results would be consistent among the various parts of the model as well as from year to year. This would be true for major items such as invested assets, insurance contract liabilities, reinsurance contract held assets and equity.

The insurer may use more than one model depending on the lines of business and jurisdictions. The modelling capability needs to be sufficiently flexible to enable the actuary to assess risks within each risk category.

Approximations may be used when a complete model is not possible or practical. Subsection 1510 of the SOP sets out standards related to approximations in selection of models or assumptions and reporting of the approximations used.

IFRS 17 modelling considerations

IFRS 17 introduces a number of changes to insurance accounting that will be significant to actuaries in FCT modelling for 2023 and beyond. Of particular note is the contractual service margin (CSM) under the general measurement approach (GMA) and the variable fee approach (VFA).

The CSM may absorb changes to the fulfillment cash flows related to future service and recognize the impact in earnings and available capital as the insurance service is provided. Offsetting these changes will be corresponding changes to the credit given in the regulatory capital ratios for the CSM. Changes in CSM may also affect deferred tax assets/liabilities. FCT modelling will need to properly reflect the behaviour of the CSM and be sensitive to all of its characteristics.

Under the premium allocation approach (PAA), there is no CSM, but a loss component may be required and should be modeled in FCT whenever onerous contracts/groups are identified or expected. Offsetting the loss component on onerous cohorts with future profits on non-onerous cohorts is not permitted. As a result, the aggregation level selected to model the loss component can impact model results. The actuary should exercise caution in the aggregation method used to avoid misestimation of modelled results.

Other aspects of IFRS 17 which will require consideration may include:

- The impact of adverse scenarios on onerous groups (or groups that become onerous due to the depletion of the CSM), will not be absorbed by the CSM but will be reflected in earnings immediately.
- The unit of account for IFRS 17 is groups of contracts as a result of the concept of level of aggregation. Modelling will need to capture the behaviour of groups of contracts rather than individual contracts (e.g., the CSM is calculated for a group of contracts).
- The need to model and report on groups of reinsurance contracts held separately from the underlying primary insurance contracts issued.
- Modelling of new business and renewals will need to capture the determination of whether a

group of contracts is onerous or profitable at inception under the base and adverse scenarios.

- The business volume forecast will require sufficient granularity to model the timing of recognition of new cohorts. A portion of a cohort may need to be recognized and accounted for before the first contract of that cohort is in effect. The date of recognition would be the earliest of the issue date (if onerous), the date when the premium is due (e.g., one month before the effective date for the renewal of a primary insurance contract where the client is paying on a monthly basis) or the effective date.
- Processes for projecting future discount rates consistent with the company's accounting policies will need to be established and maintained. The CIA has published educational notes on *IFRS 17 Discount Rates for Life and Health Insurance Contracts*, and *IFRS 17 Discount Rates and Cash Flow Considerations for Property and Casualty Insurance Contracts* which include planned annual updates to key discount rate parameters. The actuary would consider the implications of this guidance on the FCT model, under the base and adverse scenarios. Similarly, processes for projecting other financial variables (e.g., inflation, stochastic parameters) will be required for certain elements of the model.
- The impact of changes in financial variables generally impacts earnings (the yield curve selected to discount the insurance service liabilities and the supporting assets are not directly linked under IFRS 17). Modelling must be appropriately refined to capture the impact of material financial exposures that can be expected to impact the company's financial condition.
- Modelling of financial exposures also needs to be sufficiently refined to reflect the different treatment of the impact of changes in financial variables under the GMA and the VFA.
- The explicit, and market consistent, valuation of embedded financial guarantees demand additional, more sophisticated modelling in order to capture the impact of adverse financial exposures (on top of creating potential scenarios that need to be explored).
- Where companies defer material amounts of acquisition costs, modelling may need to consider how the recoverability of those costs are modelled and the potential need to project certain elements beyond the normal projection period.

Model validation

The validity of the model is typically tested with the base scenario. Unless extraordinary changes are occurring in the insurance environment or in the business written by the insurer, it is expected that there would be continuity from the actual financial results of the most recent year to the first projected year and subsequent years, such as in the following components:

- Assets (invested assets, reinsurance assets, deferred taxes, and other assets)
- Liabilities and debt (fulfillment cash flows, risk adjustment, CSM, reinsurance liabilities held)
- Shareholders' equity (contributed surplus, retained earnings, and AOCI)
- Policyholders' equity (participating account, non-participating account, AOCI, and other equity).
- Head office amount (head office account, AOCI and other amounts).

- Insurance revenue
- Insurance service expenses
- Net investment results (investment income, finance income/expenses)
- Other income and expenses
- Income taxes
- Applicable regulatory capital ratios

When building a new model, a possible approach to check the validity of the model is to back-test it against recent financial results. If the financial results projected by the model are sufficiently close to the actual results, the model may be acceptable. The actuary would determine in advance acceptable differences in assets, insurance contract liabilities, equity, insurance revenue, investment income, and net income.

When updating an existing model, a retrospective check on validity may be made. Each year after the actual results have been determined, differences between actual and base scenario model results would be justified.

The model would also be reasonable for all adverse scenarios. Evaluating the difference between the results of two scenarios is a good way to assess the ability of the model to quantify changes in key results under different sets of assumptions. The actuary would verify that the magnitude and direction of change in key elements of the model is consistent with the change in assumptions. Adverse scenarios may also be validated by comparing key results against known past events (e.g., the decrease in interest rates driven by an economic recession).

Modelling of ripple effects

The model would allow for the quantification of ripple effects of adverse scenarios. There are two possible approaches to generate the ripple effects:

- Automatically generated by the model.
- Manually created by the actuary by modifying the appropriate assumptions.

For example, for a P&C insurer, the model could be built such that reinsurance held rates will automatically increase in the year following a catastrophe. Alternatively, the actuary may manually modify the relevant parameters. For a life insurer, increases in new money interest rates may provide an incentive for some policyholders to lapse products that do not adjust, or slowly adjust, policy elements to changes in interest rates. The change in lapse rate could be modelled automatically based on changes in interest rates, or the actuary could make the adjustment manually.

Organizational considerations

For regulatory purposes, the actuary needs to report on a company’s financial condition at the aggregate legal entity level. It is common for modelling to provide more granular information to reflect key aspects of the insurer's business such as line of business, business unit or geographical area.

Some assumptions are established at an enterprise level to ensure consistency throughout the model. The following are possible examples:

- Economic parameters – interest rates, inflation, capital appreciation, and unemployment levels.
- Demographic parameters – overall trend in mortality or morbidity for a life insurer.

It is expected that the enterprise assumptions underlying the economic and demographic parameters be consistent within each scenario and between scenarios unless being specifically tested by the scenario.

For life insurers, it may also be informative to examine changes to the statement of profit or loss or internal income reporting, such as an IFRS 17 source of earnings (if available). A model that has the ability to focus on a particular line of business, division of the company, fund or territory can provide the insurer with important insights into its operations. Since it is likely that models constructed for FCT purposes will also be used for corporate planning, the model would be sufficiently flexible to incorporate operational changes that management may want to test with additional scenarios.

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

The size and complexity of the organization are key considerations in designing an appropriate model structure. At a corporate level, capital infusions, shareholder dividend payments, income taxes, required equity, investment of equity, and expenses would be modelled. These may be combined with product projections for insurers with only a single product line. More complex organizations will need to segment the model. Different segments may employ different modelling techniques and tools to reflect a range of complexity.

To derive model segments, the actuary may consider the following:

- **Management** – this usually reflects the management structure. The business is subdivided into lines of business and cost centres, and management reports have been developed around them. Existing plans are assembled and decision-making is centered on these units. These units will combine products and possibly investment units. Subsidiaries and foreign operations would fall into this category.
- **Investment** – investment segments are usually defined based on asset categories. Investment income allocation follows the investment structure. This method of subdivision would combine a number of similar assets for investment purposes.
- **Product** – this is usually the smallest subdivision of business considered. For life insurers, cash flow projections are usually already available, and the model may be built using these as the foundation. For P&C insurers, products with similar characteristics may be grouped together.

It may be desirable to have further breakdowns within a segment to take into consideration different investment strategies or instruments that are exposed to distinctly different risks. These

will require at least separate parameters and may need different modelling techniques or valuation methods.

It may be desirable that calculation of taxes and required equity 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 would be transferred to the corporate model to facilitate these calculations.

4. Reporting

The FCT report enables the actuary to communicate the current and expected future financial position of the insurer. It is intended to capture the discussion, analysis, and management actions associated with the FCT analysis. An interpretative report is more useful than a purely quantitative report.

The purpose of the report is to communicate plausible threats to the satisfactory financial condition of the insurer, actions that would lessen the likelihood of those threats, and actions that would mitigate a threat if it materialized. The primary audiences for this report are the board of directors or chief agent, as well as the regulator. In the case of a Canadian branch of a foreign insurer, the audience is the chief agent for Canada and may include senior officers of the foreign entity located outside Canada.

It is recommended that the FCT report would include a minimum of three scenarios comprising at least one going concern scenario and two solvency scenarios. The actuary would provide rationale in the FCT report if less than three scenarios are included.

The actuary would disclose how the percentile ranking of each scenario was assessed against the corresponding recommended minimum percentile ranking. The actuary would disclose the percentile ranking of the adverse scenarios, if available.

The actuary would discuss the report with senior management. The actuary's challenge is to provide pertinent information in a comprehensible fashion to individuals with different backgrounds and qualifications. The report would be in writing, but an additional oral report that permits questions and discussions is expected. The written report would be updated to reflect feedback arising from these discussions. The report would need to consider the timing of other reporting such as the ORSA to ensure consistent conclusions. The report would also consider recent events and recent operating results of the insurer up to the report's date.

It may be useful to prepare a supplementary analysis for discussions with management. Any such analysis would contain consistent findings with the report.

According to paragraph 2520.14 of the SOP:

> If an adverse event occurs between the date of the report and the date of its presentation to the insurer's board of directors (or its chief agent for Canada), then the actuary would, at a minimum in the presentation to the insurer's board of directors (or its chief agent for Canada), address the event and its potential implications on the results of the investigation. If appropriate, the actuary would redo the investigation.

Refer to the CIA educational note on *Subsequent Events* for considerations related to adverse events subsequent to the date of the report.

According to paragraph 2530.04 of the SOP:

> The report would be submitted within 12 months following each fiscal year-end.

OSFI's filing directions for the FCT report are published in the Life Memorandum to the Appointed Actuary and Property and Casualty Memorandum to the Appointed Actuary. The AMF's filing directions for the FCT report are published in the Actuary's Guide regarding the Financial Condition Testing reports of Insurers of Persons and Actuary's Guide regarding the Financial Condition Testing report of P&C Insurers.

FCT and ORSA integrated report

The actuary may prepare a single report independently on FCT or, if deemed appropriate, a consolidated report with the ORSA. The level of integration of FCT and the ORSA is a decision for the insurer to make. If the insurer chooses to maintain separate FCT and ORSA reports, FCT would be consistent with its internal target capital ratios from the most recent ORSA report. A consolidated report would include the AA's independent FCT opinion. Development of a consolidated report would consider the insurer's size and its complexity of businesses. As well, the impact of significant changes in accounting and capital regimes should be considered. If FCT and the ORSA are completed, either separately or on a consolidated basis, at the same time or similar timeframe, then the internal target capital ratios from the ORSA should be used in the FCT assessment.

Considerations supporting integration of FCT and the ORSA include but are not limited to:

- ORSA-defined internal target capital ratios, which is a key component in the development of the AA's opinion. Should the internal target capital ratios be assumed to evolve over the duration of the projection, for example due to significant growth and expansion in the insurer, it would be appropriate to assume internal target capital ratios that differ from the ones provided in the ORSA. The actuary would provide justification for internal target capital ratios that are different from the ones provided in the ORSA.
- The ORSA's usefulness in assessing the going concern or solvency nature of adverse scenarios, and in supporting the development of adverse scenarios.
- Efficiencies such as:
    - Consistent timing.
    - General reporting needs such as collection of data, analysis, management discussions, production of reports, internal and external party reviews of reports.
    - Overlapping requirements such as comprehensive stress scenario testing.
- A comprehensive view of both regulatory and own capital requirements that can better inform decision-making and management action.

Integration may encounter challenges that include but are not limited to:

- Oversight of FCT lies with the AA whereas the ORSA accountability lies with senior management with oversight provided by the board of directors.
- FCT follows a prescribed regulatory basis while the ORSA reflects own models and assumptions. The differences in bases of calculation may make efficient integration of

models and processes difficult.

- Areas of the organization responsible for FCT may differ from those coordinating the ORSA, increasing the cost of coordination and change management.

The actuary would apply judgment to the insurer's circumstances on how to integrate the FCT and ORSA reports to reduce redundancy, ensure metrics are complementary and that the report is comprehensive. Commonalities may be applicable to both an FCT-only report and a consolidated report with the ORSA:

- When there are a number of related legal entities in a group, consideration to the number of reports is needed. There are circumstances where a single FCT report covering multiple related legal entities may be appropriate. In order for this to be the case, the following conditions would generally be met:
    1. There is a common audience (or significant overlap) for all legal entities involved.
    2. The regulator(s) that supervise(s) the various legal entities agree(s) that a single consolidated report is acceptable or required.
    3. The FCT report includes the consolidated results, but also includes relevant results at the legal entity level.
- The report would include the actuary's signed FCT opinion for each regulated entity, as required by the SOP and the regulator(s).

Investigation and report

Paragraph 2520.09 of the SOP states:

> The insurer's financial condition would be satisfactory if throughout the forecast period,
>
> - Under the solvency scenarios, the statement value of the insurer's assets is greater than the statement value of its liabilities;
> - Under going concern scenarios, the insurer meets the regulatory minimum capital ratio(s); and
> - Under the base scenario, the insurer meets its internal target capital ratio(s) as determined by the ORSA.

The opinion is considered satisfactory even if corrective management actions under control of the insurer, as detailed in the FCT report, are recommended in order to meet any threshold. However, disclosure of the corrective management action(s) needed to maintain satisfactory financial condition of the insurer would be required. A not satisfactory opinion follows if any of the FCT thresholds are not met, even with corrective management actions in control of the insurer, or if thresholds are met with corrective management action under control of the insurer but the AA is not comfortable with the corrective management actions taken. The actuary would detail how the management actions were categorized into routine management actions and corrective management actions in the report.

The AA would consult the regulatory guidelines to assess when and what type of intervention may be initiated if the financial condition of the insurer is not satisfactory.

The report would identify any and all transfers assumed to occur between legal entities, including any risk-sharing agreements between legal entities or between a legal entity and a parent company, dividends to parent companies, capital infusions into legal entities, etc., whether in the base scenario or in the adverse scenarios. If a given legal entity requires a capital infusion in any of the scenarios, the report would include discussion on the likelihood of such infusions actually being made.

The report does not need to include any commentary on the development or validity of the regulatory capital framework. In most cases it will suffice to disclose the following:

- The applicable federal and/or provincial regulatory formula(s).
- For insurers subject to supervisory target capital ratios under multiple jurisdictions, the rationale for using the selected formula.
- The internal target capital ratios used in the projections and the rationale.

The report and any discussion materials presented would reflect what is important to the insurer's board of directors or chief agent. The following is an illustrative outline of possible elements of a comprehensive FCT report. Suggestions to integrate with the ORSA are also included. A consolidated report would include the guidance from OSFI's Guideline E-19 – ORSA or from AMF Capital Management Guideline.

1. Executive summary

The executive summary provides a high-level overview of the results of the FCT analysis, including the following:

- Summary of the results of the base and selected adverse scenarios. Results for the adverse scenarios would be presented before and after corrective management actions.
- Recommendations for management to mitigate or eliminate risk.
- Conclusion of the financial condition of the legal entity.
- Assessment of both internal and external events (such as recent economic event changes, acquisition of a block of business, etc.) since the previous FCT report was submitted.
- Commentary on management's action in response to the recommendations in the previous year's FCT report, if appropriate.
- Material deviations from the SOP and explanations for those deviations.
- Material findings from the external peer reviewer, if available.
- Summary of key thresholds used to assess the financial condition of the insurer including the internal target capital ratios from the most recent ORSA. Events that have occurred from the date of the FCT report to the presentation to the board of directors or chief agent that warrants a reassessment of the internal targets would be described.
- Other significant findings.

If a consolidated report with the ORSA is developed, the following would also be included:

- Commentary on consistency of results between FCT and the ORSA and possible actions with the ORSA.
- Highlights of the ORSA results and internal targets.

2. FCT opinion

The AA should include the signed opinion from the SOP paragraph 2540.03 on the future financial condition of the insurer. The opinion would reflect the particular circumstances of the insurer. The opinion is required whether or not the FCT report is consolidated with the ORSA. A decision grid is provided below to highlight the requirements for each type of opinion:

<table>
<tr><th>Scenario</th><th>Threshold</th><th colspan="3">Is the threshold test under the scenario passed?</th></tr>
<tr><td>Base</td><td>Insurer's regulatory capital ratio(s) >= Internal target ratio(s) as determined by the ORSA</td><td rowspan="3">Yes (with or without ripple effects)</td><td>Yes (with realistic plan to pass ratio)</td><td>No</td></tr>
<tr><td>Going Concern</td><td>Insurer's regulatory capital ratio(s) >= Regulatory minimum capital ratio(s)</td><td>Yes (with corrective action and actuary is comfortable)</td><td>No
Or
Yes (with corrective action but actuary is not comfortable)</td></tr>
<tr><td>Solvency</td><td>Statement value of the insurer's assets > Statement value of its liabilities</td><td>Yes (with corrective action under control of insurer and actuary is comfortable)</td><td>No
Or
Yes (with corrective action under control of insurer but actuary is not comfortable)</td></tr>
<tr><td colspan="2"></td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td colspan="2">Opinion</td><td>Satisfactory Opinion</td><td>Satisfactory Opinion subject to:</td><td>Not Satisfactory</td></tr>
</table>

The following paragraph 2540.03 of the SOP is only required when corrective management actions are necessary to meet the applicable thresholds set out in the decision grid above:

> [My report includes the identification of corrective management actions that could be taken to mitigate the effect of adverse scenarios threatening [[insurer name] [solvency]] or/and [its ability to operate on a going concern basis]].

3. Introduction

The introduction informs the user about the oversight role of FCT (and the ORSA if the FCT and ORSA reports are consolidated), as well as the purpose and scope of the report.

4. Results

The actuary would provide results of the testing performed:

- Summary of the FCT base and selected adverse scenario results. Results for the adverse scenarios would be presented before and after corrective management actions.

If a consolidated report with the ORSA is developed, the following would also be included:

- Discussion of the ORSA base and selected adverse scenario results.

More detailed discussion of the scenarios and the associated results would be provided in Sections 7 and 8 below.

The FCT report would take into consideration significant current events including but not limited to, an accounting basis change, regulatory capital basis change, or a pandemic. The report should describe the change and provide clarity on the implications to future projections under the base and adverse scenarios. If the actuary concludes there are no, or minimal, implications, that rationale would also be included in the report.

5. Capital management and adequacy measurement

The actuary would explain the nature of the test used to measure the financial condition of the insurer, including the following:

- Definition of satisfactory financial condition used in FCT.
- Definition of the regulatory minimum capital ratios.
- Disclosure of the internal target capital ratios as determined by the ORSA and, if they change during the projection period, the revised internal target capital ratios. Events that have occurred from the date of the FCT report to the presentation to the board of directors or chief agent that warrants a reassessment of the internal targets would be described.
- Materiality standard.

6. Background discussion

This section would provide an overview of the insurer and the economic environment during the forecast period, including such things as the following:

- Summary of the nature of the insurer's business, products, and target markets.
- Review of recent and current financial position.
- Discussion of any key events or initiatives affecting the insurer in the recent past and any associated expected future developments.
- Description of economic assumptions.
- Discussion of the current and expected market conditions.
- Discussion of prior year's FCT results, recommendations, and any corrective management

actions.

- Discussion of major risks not tested in the current year's FCT. The actuary would comment on when the risks were last tested and the reasons for not testing them in the current FCT.
- Any deviations from the SOP and explanations for those deviations.
- Any findings from the external peer reviewer, if available.

7. Base scenario

A clear description of the base scenario used in the FCT analysis would include the following:

- Description of the model or process used to project the base scenario.
- Description of main assumptions.
- Description of the internal target capital ratios.
- Discussion of consistency of the base scenario with the insurer's business plan.
- Description of capital plans, especially any capital injections or strategic initiatives.
- Discussion of key financial results, including key statement of profit and loss, and statement of financial position items, (such as roll forward of liabilities and the CSM) and capital test results. A desirable approach would be to display the results for each year of the projection.

8. Adverse scenarios

This section would provide detailed descriptions of the selected adverse scenarios posing significant risk to the insurer, as well as any modelled scenario for which the insurer falls below, or comes close to, the defined thresholds. An overview describing the process used to identify the scenarios would be useful, including a discussion of changes in the adverse scenarios selected compared to the prior year's report, where applicable. For each adverse scenario, the following items would be included, where applicable:

- Description of the risks being tested, why the risks are significant to the insurer, and how this was determined.
- Description of the key assumptions used, including valuation assumptions to be updated during the projection period to reflect the adverse scenario.
- Assessment of the nature of the adverse scenario as either going concern or solvency and rationale for the assessment. If the actuary is unable to ascertain the percentile ranking of the scenario, the actuary would disclose the reasons for being comfortable with the level of adversity of the scenario.
- Comparison to prior year's FCT, and consistency of the adverse scenario with the prior year's results, where applicable.
- Description of key financial results and the change from the base scenario.
- Description of any ripple effects (including policy owner actions, routine management actions and regulatory actions) reflected in the scenario. The actuary would report management's routine action and provide supporting information to enable the audience to assess its practicality and adequacy. This could include a discussion of the potential repercussions of these routine management actions and a quantification of their financial

impact.

- Description of any change in the capital injections or distributions from those assumed in the base scenario, and results with and without these capital changes.
- Reporting of financial results with and without the impact of corrective management actions, for each scenario where these actions are required to meet the threshold for a satisfactory opinion. The actuary would include additional disclosure regarding the corrective management actions to aid the audience in considering its practicality and adequacy.
- Discussion of any management actions (either routine or corrective) required to restore the insurers regulatory capital ratios to their internal target capital ratios. The actuary would include additional disclosure regarding these management actions to aid the audience in considering its practicality and adequacy.
- Discussion of possible regulatory actions, whether by Canadian or foreign regulators, and repercussions if the scenario results fall below the supervisory target capital ratio(s), in the absence of any change in the base scenario capital injections, capital distributions, or other corrective management actions.
- Discussion of possible reactions of rating agencies and repercussions, when applicable, if the insurer's capital is severely strained.

If a consolidated report with the ORSA is developed, the following would also be included:

- Description of the ORSA stress-testing results.
- Additional scenarios done in the ORSA and the reasoning behind those additional scenarios.
- All of the above, as appropriate on the ORSA basis.

9. Conclusions and recommendations

Overall conclusions from the FCT analysis would be presented, including a brief description and summary of the results of the base and selected adverse scenarios and highlights of the most significant risks to capital adequacy and threats to satisfactory financial condition. Any findings leading to follow-up actions would be discussed. It may also be appropriate, and consistent with best practices, to make one or more recommendations, particularly with respect to corrective management actions that are intended to better manage or mitigate risk exposures.

10. Appendices

The primary purpose of the FCT report is to inform the insurer's board of directors or chief agent, and management of potential threats to future financial conditions and possible actions that may mitigate those threats, so a qualitative report is best to achieve this end.

However, it would be desirable for the actuary to include some detailed financial results from the application of the FCT model. Typically, the model creates key elements and pages from the financial statements and regulatory capital statements for the base scenario and adverse scenarios for the forecast period, which allows users to review the FCT results in more detail.

In a consolidated report with the ORSA, the appendix to the report would also contain the methods and assumptions of the ORSA. It could also include an overview of an insurer's enterprise risk management framework.

Appendices – Discussion and analysis of risk categories

The appendices included in the FCT report describe the major risk categories that would be considered by the actuary, and possible adverse trends. For each risk category that may be considered, guidance is provided about ripple effects and possible management actions (where relevant) for life insurers and P&C insurers, respectively. The actuary would also consider the risk categories outlined in the appendices for mortgage insurers.

The actuary would assess various risk categories and identify those that are relevant to their circumstances. Appendices A and B provide more information on the risk categories that may be considered when preparing the FCT report. The actuary should assess these risk categories and identify those that are relevant to their circumstances.

It should be noted that some insurers write both life and P&C business. If both risks are material to the insurer, the actuary would consider the guidance provided in both appendices of this educational note. Otherwise, an explanation would need to be provided in the FCT report to indicate why only the life risk or the P&C risk is considered material by the actuary.

When determining a range of possible future experience, recent industry and insurer historical experience, as well as the future trends and outlook could be considered. The actuary may want to look at historical data such as CIA or other economic statistical data as a guide to help determine the possible deterioration of the risk.

Liquidity risk is the inability to meet financial commitments as they become due, through ongoing cash flow or asset sales at fair market value. The risks described in Appendix A and B could lead to an insurer's liquidity becoming constrained. The actuary would consider including a discussion in the FCT report of the implications of liquidity risk under the adverse scenarios, including potential adverse ripple effects and management responses.

The quantitative measurement of operational risk is still developing and investigations may be more qualitative in nature. Systems and internal control procedures that may function well under normal day-to-day operations may begin to break down under adverse scenarios developed as part of FCT or the ORSA. As well, business continuity plans may not consider solvency scenarios. Other sources of information that may be useful in examining operational risk may be studies by rating agencies, Society of Actuaries, and other industry organizations.

Finally, the IAA *Stress Testing and Scenario Analysis* paper is a good supplemental reference for risk areas and adverse scenarios that may be relevant for life insurers, beyond those covered here.

Appendix A – Life insurers

1. Mortality risk

Annuity and insurance contracts tend to react very differently to adverse scenarios, so the testing of mortality for these lines of business would be done separately and diversification benefits noted.

For insurance business, adverse mortality may arise from a variety of causes, including:

- An epidemic, pandemic or other catastrophe that results in an absolute increase in mortality rates, likely for a specific period of years or for certain age groups, as well as other knock-on impacts to mortality that would be experienced.
- Anti-selective lapse experience as new and more competitive products are offered, a weakening in underwriting standards, or mortality improvement assumptions that are not fully realized, resulting in a steady and continued deterioration in mortality.
- A misestimation of expected experience due to a lack of credible experience data, for example at older ages.
- For death-supported insurance policies (i.e., policies where a decrease in mortality rates increases insurance contract liabilities), a steady and continued decrease in mortality rates, arising from changes in medical treatments and/or changes in policyholder lifestyles, at a different rate than assumed.

For annuity business, adverse mortality may arise from a variety of causes, including:

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

The actuary would consider whether such adverse mortality will be temporary or permanent in nature. Where appropriate, the impact would be reflected through a recalculation of insurance contract liabilities to reflect a change in the best estimate mortality assumptions.

The actuary would consider possible adverse ripple effects such as changes in sales levels and/or persistency following any pricing or benefit adjustments.

Possible management actions could include the following:

- For adjustable products, changing premiums and/or benefits (delay before management actions, partial adjustment for the adverse mortality experience).
- Adjusting the price of new business.
- Seeking reinsurance solutions.

2. Morbidity risk

Adverse morbidity includes the following:

- Increases in incidence rates for disability, medical, dental, critical illness, and other coverage.
- Decreases in the rate of claim termination.

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

- A prolonged high-unemployment recessionary environment leading to sharply increased incidence rates and/or low claim termination rates for disability.
- An epidemic or pandemic, with lasting and longer morbidity impacts.
- An increase in mental health claims.
- Mortality improvement from improved treatment of diseases, as an example, can prolong life, but still require disability, medical and critical illness coverage.
- Increases in the diagnosis rate of critical illnesses, from improved diagnostic technologies.
- Court rulings that limit the insurer's ability to adjudicate claims.
- Retrenchment of government social security programs.
- Escalation in dental and medical costs.
- Misestimation of expected experience due to a lack of credible experience data.

The actuary would consider possible adverse ripple effects, such as the following:

- Constraints to rate increases if the industry reacts slowly in implementing renewal rate increases.
- Rate guarantees that limit or delay required rate increases.
- Increases in anti-selective lapses that dampen or nullify the effect of rate increases.
- Adverse publicity/reputation damage arising from claim or underwriting practices, leading to decreased sales of new business.

Possible management actions could include items such as the following:

- Increasing premium rates.
- More active claims management.

3. Persistency and lapse risk

Generally, persistency risk exists when cash value does not equal the policy liability. When cash value is higher, the risk is that lapses will exceed those assumed. When the policy liability is higher, the risk is that lapses will be less than those assumed. In examining the persistency and lapse risks, it is prudent to assume that both these adversities may happen concurrently. Generally, the appropriate level of lapses would be assessed for each product line.

Causes of adverse persistency and lapse include the following:

- Premium changes, including amount and payment pattern.
- Dividend scale changes.
- Changes in distribution system.
- A new product introduced to the market by a competitor.
- Changes in underwriting and/or qualification criteria for preferred/select classes.

- Changes in competitor's premium rates.
- Changes in economic environment, such as much higher interest rates than when the policy was first purchased.
- A lack of confidence in the insurer that may be caused by a sudden downgrade by external rating agencies, combined with extensive publicity.
- A misestimation of expected experience due to a lack of credible experience data.
- Policyholder attitude towards the need for insurance.
- In the case of reinsurers, the ability of direct insurers to recapture risk ceded under a reinsurance treaty.

Adverse ripple effects for persistency and lapse risk could include the following:

- Worsened mortality or morbidity in the cohort remaining, which may be caused by anti-selection.
- Mismatch of asset and liability cash flows.
- Increased unit expenses.
- Worsened liquidity risk (for example, a "run on the bank" situation).
- Reduction in insurer's new business while, at the same time, the insurer could not proportionately reduce its expenses.
- Inability to borrow or renew any external capital or debt.
- Unexpected shift to less profitable or more capital-intensive mix of business.

Possible management actions could include items such as the following:

- For adjustable products, changing premiums and/or benefits, considering the practicality and adequacy of this action.
- Adjusting the price of new business.
- Seeking reinsurance solutions.

4. Market and credit risk

In consideration of market and credit risks, the actuary may want to review available historical data. Adverse scenarios may arise from a variety of sources, including the following:

- Changes in future rates of interest and inflation.
- Increases in losses from defaults on debt securities.
- Poor returns and/or declines in value of equities or real estate.
- Counterparty 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.

- Poor returns and/or declines in the value of a subsidiary.
- Fluctuations in currency values.
- Market value deterioration in segregated fund assets.

The actuary would test the impact of potential adverse scenarios on liabilities and equity across all lines of business in aggregate.

When there is a mismatch between the cash flow pattern of assets and liabilities, there will be a need to reinvest positive cash flows, and to borrow or liquidate assets to fund negative cash flows. Future rates of interest can vary substantially and can adversely affect equity. As a result, the value of derivatives will also be impacted. Where they are used as hedges, they will help mitigate adverse impacts.

In assessing the impact of changes in interest rates, the actuary would consider both the current mismatch position as well as any possible mismatch in the future. This will depend on the maximum position allowed by the insurer's investment policy and the most aggressive position that has been taken in the past by the insurer.

Parallel and non-parallel shifts in the yield curve, both on a sudden and a gradual basis, would be considered. Stochastic modelling as well as deterministic scenarios could be considered. The actuary could also examine additional deterministic scenarios or more extreme tail results under stochastic modelling, including the possibility of negative interest rates.

Changes in future interest rates will affect not only future rates of reinvestment and market values, but also the pattern of the cash flows. For example, this can occur with asset-backed securities, callable bonds, and on policies with cash surrender values.

Future interest rates may also affect the spread that can be achieved on both new business and the fixed interest rate business where rate resets are being made.

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

Future interest rate levels will also affect the amount and mix of new business for guaranteed fund and segregated fund products. Interest rate levels will also affect the number of surrenders, transfers between funds, and shifts between portfolio average and new money products. The movement and financial exposure will depend on surrender charges and market value adjustments embedded in these products. Particular consideration would be given to assessing the effect of a "run-on-the-bank" scenario.

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

- The impact on the proportion of fixed income assets and the duration of those assets, and that of key competitors.
- Actions of competitors.
- The ability and willingness of management to maintain or change:
    - dividend scales for participating insurance,

    - premiums and/or policy values for adjustable business.
- Reviewing premiums and charges for universal life products.
- The ability to change the interest rates credited to the investment accounts due to the minimum interest rate guaranteed for universal life products.
- Related policyholder actions such as surrender levels and potential litigation.
- The impact on the level of new sales.

For segregated funds, drops in market value 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 following:

- 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 such as resets that will affect the risk.
- The existence of volatile funds, fund-switching privileges, guarantees on a "per policy" basis, or high management expense ratios (MERs).

The actuary may consider an integrated scenario in which a combination of the following events occurs:

- A drop in the market value of debt securities resulting from an increase in the yield curve.
- A decline in equities caused by a significant drop in the S&P/TSX index or any other significant stocks index.
- A significant decline in the value of real estate.
- An adverse change in currency values.
- An increase in defaults on debt securities.
- A significant decline in the value of the largest subsidiary.
- A significant increase in mortality, morbidity and/or adverse change in lapse rates.

The actuary would consider how to reflect the effect of such events in determining insurance contract liabilities and also consider expected pricing actions. The ripple effects could vary depending on whether the results are insurer-specific or industry-wide. The following are possible adverse ripple effects:

- Exposed risk positions as a result of counterparty default.
- A rating downgrade of the insurer that leads to decreased sales and increased surrenders.
- Liquidity issues or forced asset liquidation risk issues caused by large sustained credit-related losses either through defaults or severe asset downgrades.
- Counterparty defaults on derivatives.
- Reduced availability of derivatives used for hedging strategies.
- Decreased policy owner dividends that could lead to higher surrenders.

- Increased disability claims frequency and severity due to deterioration of economic conditions.

Possible management actions may include the following:

- A shift in the investment strategy.
- Dynamic hedging programs.
- A review of premium rates and/or targeted business or product mix.

5. Inflation risk

Inflation can pose a significant risk to an insurer in many ways: a sustained increase in disability, pension or other benefits that are linked to the consumer price index or similar price indices; a sudden increase in drugs and health care costs covered by health insurance policies; and an increase in absolute expenses and in unit operating costs. Inflation rates and market interest rates tend to be correlated. A high-inflation scenario would normally be assumed to accompany a high-interest scenario, but consideration would be made to a scenario where this does not occur.

The actuary would consider possible adverse ripple effects, such as the following:

- A decrease in real rates of return.
- A rapid and sustained increase in market interest rates.
- Constraints to rate increases as the industry reacts slowly in implementing renewal rate increases.
- Rate guarantees that limit or delay required rate increases.
- Decrease in the rates of disability claim termination when inflation is higher than wage increases or when inflation occurs during a recession or a period of rising unemployment.

Possible management actions may include the following:

- Implementing rate increases, where possible.
- Reviewing the extent of the coverage and cost containment features.
- Reviewing the asset mix to increase real rates of return.
- Reviewing policies, procedures, and staffing to control costs.

6. Reinsurance held risk

Reinsurance held risk is defined as the risk to a ceding insurer that arises from a reinsurer's failure to meet its obligations, or from a change in market conditions causing an increase in reinsurance premiums, inadequacy of limits, or otherwise inadequate or unaffordable coverage.

The primary risks for a ceding entity are outlined below.

- **Insolvency of a reinsurer –** the ceding entity's exposure in the case where its principal reinsurer(s) become(s) insolvent would 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 of a reinsurer's insolvency may be mitigated by the following provisions:

- The right of offset of amounts owing under all treaties between the companies.
- The preferred position insurers will have relative to other creditors.
- The right of recapture in the event of the reinsurer's failure.
- Access to amounts on deposit or assets in trust (or other similar arrangements) with the insurer, or letters of credit in respect of an unregistered reinsurer.

It would normally be appropriate to assume that the business previously ceded to the insolvent reinsurer could be successfully reinsured elsewhere, but possibly on less favourable terms. However, there may be certain unique features regarding the business involved that would make securing such replacement difficult.

- **Increases in reinsurance premiums –** where a reinsurer takes market-wide action impacting all of its insurers operating in similar markets, such action would not necessarily pose competitive issues, as these insurers would all be faced with an increase in reinsurance premiums, possibly requiring repricing in a large segment of the marketplace. However, market-wide increases in rates may further adversely impact a particular insurer if it is operating with lower capital margins. In addition, where a reinsurer's action is targeted to one specific insurer because of poor experience, necessary repricing could affect the level of sales.
- **Reduction in reinsurance capacity available for the financing of new business –** this could result in an increase in reinsurance costs and/or constraints on the amount of new business growth of the insurer, including risk acceptance of writing new business without reinsurance.
- **Disputes over policy conditions –** the actuary could consider a dispute over reinsurance policy conditions which results in a principal reinsurer denying coverage for a significant class of business or category of claims; for example, terrorism exclusions.

Possible management actions may include the following:

- Electing to recapture the business ceded under a reinsurance treaty.
- Renegotiate terms and/or restructure the deal with the reinsurer.

7. Business volume and mix risk

One of the uncertainties facing an insurer is the volume of new business 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. It may be equally important to examine both higher-than-expected and lower-than-expected levels of new business production. Even in the case where total business volumes have been estimated accurately, new business risk may still be present if the mix of business sold is different from expected.

There are several events that could lead to a significant reduction in premium volume written by an insurer or a change in the mix of business sold, including the following:

- A financial rating downgrade of the insurer or an affiliated company (particularly the parent), or some other event (including cyber or operational risks) similarly damaging to the insurer's reputation.
- Entry of a new and strong competitor into an area where competition was previously weak,

and/or increased competitiveness in the market due to higher use of advertising by competitors.

- Loss of a key distributor or even an entire distribution channel previously responsible for the production of a significant portion of an insurer's business.
- Loss of a key client, such as a large group client representing a significant portion of an insurer's group portfolio.
- External factors, such as changes in tax laws or the economic environment, that impact the demand for different products or the demographic mix of customers.

The most significant impact of lower-than-expected sales would be that the insurer is not able to cover its expenses, particularly when there is a large element of overhead and fixed expenses associated with marketing, underwriting, policy issue, and sales functions.

Other adverse ripple effects could include the following:

- Higher lapse rates on existing business.
- Poorer claims experience on the remaining business.
- Poorer coverage of maintenance expenses (resulting from both lower current sales as well as higher lapses on existing business).
- Ripple effects on associated lines of business to the affected line of business (for example, distribution channels primarily involved in one line of business may contribute to significant future sales in another line).

Possible management actions could include items such as the following:

- Reviewing bonuses paid to agents and brokers.
- Diversification into more than one line of business.
- Control over non-variable expense levels.
- Maintaining contingency action plans to be implemented in case one of these events occurs.

When the insurer has written a greater amount of new business sales than expected, this could lead to severe capital strain for the insurer. Events that could lead to a significant increase in premium volumes written by an insurer include the following:

- Unexpected success in a new product area or in beating previously stronger competition.
- Exit of a competitor from a product or market.
- Rate increase implemented by other companies leading to a fire sale for products still in the market at lower rates.
- Tightening of product features by other companies in the market.
- Change in reinsurance arrangements leading to a higher-than-expected risk retention on new business.

Adverse ripple effects could include the following:

- Problems with management control over policy issue, underwriting, field expenses, financial

reporting, etc., due to rapid growth (leading to future problems in claims and expenses as competition eventually catches up and volume levels return to normal).

- Future expected lapses, mortality, or morbidity could be different if sales are driven by old-generation products.

Possible management actions would include the following:

- Putting capital-raising plans in place with a parent company or with external sources.
- Improving operational readiness to handle the increased volumes of business.
- Reviewing rates and underwriting guidance.
- Reviewing the use of reinsurance to mitigate the need for additional capital.
- Withdrawing a product or a line of business.

A change in the business mix sold, compared to what was expected, may lead to an unexpected change in the risk profile of the insurer. For example, a shift in mix towards life annuities compared to life insurance could lead to an increase in longevity risk versus mortality risk, or vice versa. Many of the ripple effects and possible management actions described above for business volume would also be applicable to business mix.

Normally, the base scenario would incorporate the new business projections of the insurer's business plan and associated expense levels. Alternate scenarios would be heavily dependent on the specific insurer, varying in particular with the kind of market the insurer serves and the distribution channel employed to reach it. However, any alternate scenario would reflect not only the change in new business levels, but also the impact on expense coverage and any other possible ripple effects.

8. Expense risk

Expense assumptions are unique in that management has a greater level of influence here than on other assumptions. Even insurers who, historically, have aggressively managed expenses to budgeted targets may face major expense issues in some situations such as an unexpected variation in new business growth, litigation, or other developments. Insurers practicing strict management of budgets to meet expense levels included in pricing may have different results from insurers that manage budgets to other measures. The extent to which the insurer has demonstrated effective actions towards managing expenses in the past would be a consideration in how closely to relate expense levels under adverse scenarios to expenses in the base scenario. The actuary would also consider impacts related to directly attributable or non-directly attributable expenses, and their implications on the financial statements.

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

- **Inflation** – a severe inflationary environment may cause a rapid increase in absolute expenses and in unit costs. It is also possible to have future expense increases due to internal factors unrelated to future interest rates and inflation rates.
- **Technological obsolescence** – new technologies may emerge that deliver significant cost, delivery, or service benefits for those who can achieve economies of scale. For companies that do not make use of new technologies, expenses may rise relative to the early adopters

of such technology. Such a scenario would also include the sales and termination impacts of technological obsolescence.

- **Court-awarded damages/data security or recovery** – potential high costs can result from court-awarded damages to plaintiffs relating to such matters as market conduct or the costs related to data security and recovery due to a cyberattack or breach. Resulting ripple effects include damaged industry reputation, litigation impacts, ratings downgrades, lower sales, and higher terminations.
- **Industry or guarantee fund 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.
- **Company structure** – holding-company expenses may be allocated to subsidiary companies based on historical or projected relative profits. This could lead to a major change in the level of expenses 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 that has several insurance companies or business units that provide services to one another, the impact of cross-billing would be considered.
- **Mergers and acquisitions, or assumptions of new business** – reductions in unit expenses after a merger, acquisition, or assumption of a new block of business may be delayed or lower than projected in the base scenario. Possible ripple effects could include:
  - Changes in product pricing.
  - Low sales.
  - Higher lapses.

9. Government and political issues risk

When the government makes changes to its policies or regulations, the implementation of such changes usually takes a considerable amount of time. This gives an insurer time to analyze the impact and take appropriate actions, if necessary. However, some changes can occur in a very short period and cannot be foreseen. There may also be cases where changes are effective retroactively without any grandfathering provisions. In such cases, the adverse scenario may be modelled in the first year if the scenario is plausible in that time period.

The actuary would likely focus on changes that are being discussed or proposed by government entities. However, in some situations it may be beneficial to consider other changes, particularly for certain lines of business that have a greater sensitivity to political intervention, and if those lines of business are material to the insurer.

Examples of adverse events:

- An increase in premium tax rates.
- An increase in taxation rates for corporations (income tax or capital gains tax).
- A prolongation of temporary taxes.
- New restrictions on registered retirement savings plans or registered retirement income

funds that would have a direct impact on the level of new business for those products.

- Entry of new competitors into the life insurance industry (e.g., due to revisions to the Bank Act) that affect the amount of new business and 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 a new or modified public health care policy, which could decrease new sales or in-force business (e.g., the introduction of pharmacare).
- A change in regulatory solvency standards that increase the capital requirements.
- A reduction in the government's need to borrow funds, which could affect the volume 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.
- Impact of cost shifting between public and private sectors or changes in coverage under public insurance plans.
- A change in law or regulation directly affecting an important product line (e.g., a change in tax law affecting the position of the policyholder, 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, a restriction on information that may be used in underwriting).
- A change in legislation that restricts the use of some distribution channels.
- Benefits, premiums, or rate adjustments subject to regulation.
- Geopolitical conflict leading to supply chain disruptions and inflationary pressure.

For a specific scenario, possible adverse ripple effects may include the following:

- Increased litigation costs.
- Forced liquidation of assets due to cash flow strains.
- Increased regulatory monitoring.
- Increases in the insurance contract liability.
- Increases in reinsurance rates and/or non-availability of reinsurance of new business.

10. Off-balance-sheet items risk

There are numerous off-balance-sheet items that may place an insurer at risk. Often these items arise from new or evolving industry practices that, in future years, do get recognized on the balance sheet by the Chartered Professional Accountants of Canada (CPA Canada), the CIA, or regulators. The actuary needs to be aware of emerging risks that may be relevant to the insurer during the forecast period and assess their potential threat to the insurer's solvency.

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

- **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. Marketability 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 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 a 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 an insurer may be exposed, such as tax, litigation, etc. The actuary would 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 there is a call on assets pledged.
- **Capital maintenance agreements** – an insurer could be exposed to capital maintenance agreements it must honour for its subsidiaries (e.g., if an insurer has to guarantee a certain capital level in a subsidiary).
- **Employee and senior management benefits and liabilities not listed on the balance sheet (e.g., pension plans, stock option plans)** – this carries the risk of increasing costs.

11. Related companies risk

The related companies risk is the risk that the life insurer may run into financial difficulties as a result of its subsidiaries' or any other related entity's financial difficulties. The related companies risk may also arise from a decision made by the controlling company that may be unfavourable to the affiliate. For an insurer, being a part of a financial organization can be a potential source of strength, but it can also pose risks, particularly as a result of contagion. This risk could be integrated into other risk categories as a ripple effect and/or corrective management action or be considered as a separate scenario.

Factors to be considered include, but are not limited to, the following:

- The impact on the insurer if financial support is no longer guaranteed by the parent, or the insurer is unable to access additional capital or is obliged to continue to repatriate funds.
- The effect on the insurer of an impaired parent or affiliate within the group (e.g., the impact on funding sources available, such as lines of credit, intra-group funding, or access to external capital).

- The effect on the insurer of the inability to sell or close in a timely manner a subsidiary that is in financial difficulty (e.g., where the subsidiary shares the same brand, systems, and other infrastructure as the insurer).
- The implicit support of group companies through the reallocation of group overheads towards the insurance entity.
- The pressure on the insurer to support other group members financially (e.g., capitalizing subsidiaries to meet their local regulatory capital and reserve requirements).
- The pressure on the insurer to comply with group requirements rather than the firm's own strategy (e.g., with respect to investment mix).
- The effect on the insurer of a high degree of dependence on group resources (e.g., through intra-group outsourcing) to support the insurer's critical operations.
- The effect on the insurer of a downgrade in the rating of the group or of other reputational issues.

12. Climate-related risks

Climate-related risk could be considered a risk category of its own or may form the basis for an integrated scenario reflecting the other risk categories.

Climate-related risks are not limited to risks arising from localized climate events such as wildfires and floods. They also include larger-scale impacts related to climate change adaptation. In general, this risk category consists of physical and transition risk, as outlined below:

- Physical risk, which arises from an increase in frequency and severity of climate events, that could disrupt critical operations, threaten the value of investments, and/or increase insurance risks.
- Transition risk, which is driven by a shift towards a lower carbon footprint economy, could stem from current or future government policies, changes in investor or consumer sentiment, technological advancements, or climate-related litigation.

OSFI's currently draft Guideline B-15: *Climate Risk Management* could be considered as a supplemental reference for any climate-related risk scenario.

The actuary would consider the occurrence of a combination of these risk factors. Given that the timing and impact of climate change is uncertain, the actuary would apply judgment in forecasting climate change impacts and determining the forecast period for a climate-related risk scenario. Considerations would include the potential timing and magnitude of physical versus transition risk, and the need to incorporate the vast majority of the scenario impacts on the financial condition of an insurer.

Examples of how climate-related risks could be reflected in an FCT adverse scenario include:

- Increase in mortality or morbidity rates driven by climate events and its knock-on impacts such as increase in pandemics and infectious diseases.
- Increase in lapse rates or decline in new business from either disruption caused by climate events or disruption caused by shifting toward a greener economy.

- Increase in credit, market, and liquidity risks due to increased costs of climate change adaptation.
- Increases in operational risk due to damage to infrastructure.
- Increase in reputation risk.

Possible management actions may include the following:

- Changes to asset mix and/or investment strategies.
- Reviewing the target mix by line of business or geographic location/jurisdiction (e.g., reviewing concentration risk).
- Reviewing type of products offered.

13. Technology and cyber risk

Technology risk has been a rising risk and is becoming more significant to insurers over time due to rapid technological advancements and digitization. The risks associated range from reputational, to operational and financial. Studies have shown an increase in costs associated with data breaches, such as lost business, fines, and reputational damage. This poses threats to how insurers do business in managing policyholder relationships, ensuring proper and adequate processes are in place to prevent a cyber event, and increasing scrutiny of existing IT systems whether developed in house or by a third party.

The actuary would consider possible adverse ripple effects, such as the following:

- Disclosure of data breach, and possible reputational damage and fines as a result.
- Increase in lapses and/or recapture due to reputational damage following an incident.
- Decline in new business.
- Increases in operational risk and risk management costs due to increase in IT security, training of staff, and strengthening of company-wide protocols.
- Increase in expense due to operational improvement, legal costs and possible policyholder settlements and payouts.

Possible management actions may include the following:

- Implementation of sound protocols and procedures to reduce risk of future data breach, including governance, risk management and compliance programs.
- Stress test current protocols to identify enhancements for improving response time in case of an incident.
- Invest in cybersecurity and IT infrastructure to combat possible risks and exposure to a cyber event and ensure compliance with existing legislation.
- Consideration of provisions in risk and capital models to account for cyber events.
- Purchasing cyber insurance to mitigate against losses arising from future attacks.

Appendix B – Property and casualty insurers

1. Claim frequency and severity risk

An insurer's financial condition may be sensitive to increases in claim costs (including loss adjustment expenses). Future claims costs can differ significantly from the base scenario due to the following:

- **Single catastrophic event –** consider natural disasters (e.g., earthquakes, windstorms, floods, and hail), human-made events (e.g., terrorism), or any other single event affecting multiple policyholders that could have a material impact.
- **Single large claim –** consider the effect if policies/accounts with the largest probable maximum loss or maximum exposed policy limits (if more appropriate) have a full loss event.
- **Multiple catastrophic events –** consider two or more events affecting multiple policyholders where the joint probability of the events is approximately equal to the probability of a single catastrophic event.
- **Multiple large claims –** select a size of claim that would be considered large by the insurer, generally smaller than the insurer's net retention. Using historical claims trended to current levels and adjusted for the insurer's current exposure, the actuary would estimate the frequency and severity distribution of these claims. The cumulative distribution may be estimated using assumed distributions or simulation techniques. The cumulative distribution would be constructed for net and gross claims.
- **Other frequency and severity –** model the loss experience or frequency and severity of claims. Since catastrophes, large claims, and adverse development are considered in other scenarios, the actuary could remove unusual claims from the data prior to their analysis. It is generally recommended that the variability of the normal accident year or underwriting year results, or the combined frequency and severity distribution, be examined. The actuary may assume a distribution of claims and determine the appropriate adverse scenario.
- **Social inflation –** social inflation refers to the claims inflation resulting from changes in the likelihood of claimants bringing suit, the size of awards, the standards of liability, or the attitudes of claimants towards settlement of their claims. A significant sustained increase in the rate of social inflation would tend to lead to increases in the ultimate number or severity of unpaid liability claims and increases in the number or severity of future liability claims (both those related to the runoff of the unearned premium and those related to future new and renewal business). It would not normally be linked to a change in market interest rates.

Possible adverse ripple effects may include the following:

- Insolvency of one or more reinsurers accumulating to a significant portion of the insurer's reinsurance held coverage.
- Increase in the insurance contract liabilities related to current reinsurance contracts held (e.g., swing-rated contracts, variable commission, reinstatements premiums).
- Loss of reinsurance held coverage for remainder of term.
- Increases in reinsurance held rates or non-availability at the next renewal.

- Post-event inflation (i.e., a significant temporary increase in the cost of labour and materials) following a catastrophe resulting in increases to the ultimate cost of unpaid claims as well as future claims.
- Post-event inflation in regions not directly affected by the catastrophic event.
- Forced sale or liquidation of assets.
- Increased Property and Casualty Insurance Compensation Corporation (PACICC) assessments resulting from failure of other insurers.
- Rating agency downgrade.

Possible management actions may include the following:

- Reviewing reinsurance held coverage, type, or contract terms at renewal.
- Implementing rate increases, where possible.
- Restricting writing in hazard-prone areas.
- Reviewing the target mix by line of business or geographic region/jurisdiction.
- Reviewing the type of products offered, such as writing more subscription policies.
- Selling or reinvesting assets.

2. Liability for incurred claims risk

The estimation of the liability for incurred claims (LIC) is dependent on various assumptions. Actual results may vary significantly from expectations.

Where the underestimation of liabilities for incurred claims results from legislative change(s), this scenario would normally be covered under government and political issues risk.

Examples of adverse scenarios to which an insurer's financial condition may be sensitive include the following:

- **Selection of inadequate loss development factors,** especially for new products or lines subject to legislative changes for which long-term development patterns are not available.
- **Class actions, new case-law and other mass torts,** effective retroactively.
- **Change in mix of business** where a shift to longer-tailed lines of business may result in adverse development if selected loss development patterns do not reflect the shift.
- **Claims paid faster than assumed** in the base scenario, especially if large claims are paid earlier.
- **Adverse change in the actual yield curves used for discounting the insurance contract liabilities** compared to what was assumed in the base scenario.

Possible methods to determine the adverse scenario include the following:

- Modelling the loss development factors with a statistical distribution and estimating the unpaid claims with factors at the desired adverse scenario percentile.
- Analyzing the insurer's history of actual-to-expected development of LIC. This would generally be done for all lines of business combined, although an analysis by lines of business

may be appropriate for an insurer where the mix of business has changed significantly over the years. It may be appropriate to use industry data for a new insurer, or if the insurer has a significant volume in new lines of business. In estimating the adverse scenario, the actuary may want to fit a distribution to the historical runoff data.

Stress testing may be useful to determine the magnitude of an understatement of LIC or of an unanticipated large payment that would result in a financial condition deemed not satisfactory for the company.

Possible adverse ripple effects may include the following:

- Decreases in the reinsurance contracts held assets or increase in the insurance contract liabilities related to current reinsurance contracts held (e.g., swing-rated contracts, variable commission, reinstatements premiums).
- Reduced CSM or increased loss component from onerous groups or from groups that may shift from being non-onerous to being onerous.
- Increase in the loss component in connection with future new and renewal business.
- Forced sale or liquidation of assets.
- Rating agency downgrade.

Possible management actions may include the following:

- Settling claims faster by minimizing litigation or fast-tracking claims handling.
- Reviewing reserving and claim settlement guidelines.
- Implementing rate increases, where possible.
- Reviewing the target mix by line of business or geographic location/jurisdiction.

3. Inflation risk

Fulfilment cash flows are quite sensitive to inflation. Inflation in the insurance environment will generally be positively correlated with the general rate of inflation, as measured by the consumer price index (CPI). There will, however, be changes in costs that will affect the insurance environment differently than the overall economy.

Claim costs may be affected by price increases extraneous to the insurance business. This excludes the effect of social inflation that is covered through claim frequency and severity risk. Changes in inflation may be due to the following:

- **A significant, rapid, and sustained increase in the general rate of inflation –** in this scenario, inflation will lead to increases in the fulfilment cash flows (LIC and LRC) as well as various related expenses. It would normally, but not always, be linked to a rapid and sustained increase in market interest rates.

  A scenario considering sustained inflation will tend to be based on a significant increase in trend over inflation projected in the base scenario. Ideally, the increase would be applied over the entire projection period.

  A possible method to determine an adequate level of increase in the inflation trend would be

to look at historical changes in the CPI over a multiple-year time period. The length of time considered would ideally be long enough to capture a large range of situations that can be applied to the projection period. The level of change in market interest rate would be based on the reasoning described in risk category 6 (market and credit risk).

- **A significant temporary increase in the cost of labour and materials following a catastrophe or other major event –** in this scenario, the fulfilment cash flow would increase following a catastrophe or other major industry event that did not directly affect the insurer. This scenario differs from the ripple effect for catastrophic event(s) in risk category 1 (claim frequency and severity risk) because the increased cost affects claims that were not the result of the event.
- **A severe recession in the economy –** in this scenario, economic conditions may lead to increases in the ultimate number of, and cost of, claim settlements and loss adjustment expenses, for both current and future claims. This may be linked to a sustained increase in general inflation, unemployment level, or market yield curves.

Possible adverse ripple effects may include the following:

- A rapid and sustained increase in market interest rates.
- Increase in operating expenses.
- Increase in the insurance contract liabilities related to current reinsurance contracts held (e.g., swing-rated contracts, variable commission, reinstatements premiums).

Possible management actions may include the following:

- Reviewing reinsurance held coverage, type, or contract terms at renewal.
- Implementing rate increases, where possible.
- Reviewing the target mix by line of business or geographic location/jurisdiction.
- Reviewing the type of products offered.
- Selling or reinvesting assets.
- Adjusting the insurance to value or cost calculator.

4. Volume and mix of business risk

An insurer's financial condition may be affected by differences between actual business volume, type, or mix, and the respective assumptions in the business plan.

There are several categories of events that could have considerable impact on the volume, type, mix, and profitability of business written by an insurer. Some of these events are related to the underwriting and marketing environment and can result in unexpected reductions or increases in insurance revenue. Inadequate pricing may also trigger significant changes in the business volume or mix of business and is likely to compound the effect of scenarios triggered by other events. Any significant change in business volume resulting from government or political actions would be considered under risk category 7 (government and political issues risk).

Stress testing may be useful to determine the magnitude of change in business volume that would result in a not satisfactory financial condition for the insurer. Consideration would be given to the

assumptions in the base scenario, and vulnerability of the insurer to the selected event given its size, marketing plan, and strategies.

Adverse scenarios arising from business volume risk include the following:

Business volume significantly lower than the base scenario

Lower business volume can be the result of lost business, reduced or inadequate rate level for some market segments, and/or uncompetitive pricing in some market segments.

Some events resulting in a significant reduction in business volume include the following:

- Entry of a new and strong competitor into a market.
- Increased competitiveness in a market.
- Loss of a key distributor or even an entire distribution channel.
- Loss of a key client.
- Action by any influential entity (consumers, distributors, rating agencies, etc.) that affects the insurer's reputation or growth negatively.
- Inability to implement planned premium rate increases.
- Non-competitive premium rates.

Possible adverse ripple effects may include the following:

- An increase in insurance service expense. Examples of potential drivers include a soft market, inadequate pricing, or lost business that is relatively more profitable than the retained business.
- Higher expenses (for example, more advertising costs to counter a very aggressive competitor).
- A shift in portfolio mix. For example, the business lost could have a very different average premium or could be primarily from a specific market segment.
- An increase in reinsurance held costs as a percentage of insurance revenue.
- Forced sale or liquidation of assets.

Possible management actions may include the following:

- Reducing personnel or slowing down hiring.
- Identifying other distributors for the insurer's product(s).
- Implementing rate increases, where possible.
- Changing reinsurance held coverage, type, or contract terms at next renewal.
- Underwriting actions in markets subject to increased competition.
- Changing the target mix of business of future lines of business.
- Adjusting the investment portfolio to mitigate cash flow strains.

Business volume significantly higher than the base scenario

An increase from the planned business volume can be the result of unexpected new business or inadequate (i.e., too competitive) rate level for some market segments.

Some events resulting in a significant increase in business volume include the following:

- Withdrawal or failure of major competitors from a market.
- Appointment of a key distributor.
- Unexpected new business from a large client.
- Any action by any influential entity (consumers, distributors, rating agencies, etc.) that affects the insurer's reputation or growth favourably.
- Unexpected success in a new product area, or against previously stronger competition.
- Premium rates set too low compared to the competition.

Possible ripple effects may include the following:

- Less favourable loss experience on new business due to inadequate pricing.
- A shift in portfolio mix since the new business could have a much different average premium or could be primarily from a specific market segment.
- Higher expenses (hiring of employees, increased overtime, etc.) in the short term as well as in the long term.
- Increased PACICC and pool assessments.
- Increased reinsurance held costs.

Possible management actions may include the following:

- Underwriting actions (e.g., restrictions on new business, withdrawal) in unprofitable markets.
- Implementing rate increases, where possible.
- Reviewing the distribution channels.
- Reducing certain types of expenses (for example, advertising costs).
- Reviewing reinsurance held coverage to mitigate capital strain.

5. Reinsurance held risk

Reinsurance held risk is defined as the risk to a ceding insurer that arises from a reinsurer's failure to meet its obligations, or from a change in market conditions causing an increase in reinsurance held rates, inadequacy of limits, or otherwise inadequate or unaffordable coverage.

Adverse scenarios arising from reinsurance held risk include the following:

- **Reinsurer insolvency** – the impact of a reinsurer insolvency would be reflected by assuming that a portion of the amounts receivable or recoverable from the failed reinsurer would not materialize. The impact may be mitigated by right of offset to amounts owing under all treaties between the two entities, by the preferred position insurers will have relative to

other creditors of a failed reinsurer, by the special termination clause in the event of failure, and by any amounts on deposit or in trust with the insurer, or letters of credit in respect of an unlicensed reinsurer. It would normally be appropriate under this scenario to assume that the business currently ceded to the failing reinsurer could be successfully reinsured elsewhere (possibly on less favourable terms), unless there is something unique about the business involved that would make securing such replacement reinsurance difficult.

Reinsurer insolvency can be due to the circumstances of a specific reinsurer (such as undervaluation of older liabilities), or it could be systemic to the industry due to a major global event or series of global events (e.g., terrorist attack, natural disaster, etc.).

In developing this scenario, the actuary would take into account the following considerations:

- Affiliated versus non-affiliated reinsurers – the actuary may be better able to assess the likelihood of insolvency if a reinsurance arrangement consists of an inter-company pooling agreement or reinsurance with an affiliated company, as opposed to external reinsurance.
- Rating of reinsurers – reinsurers with weaker rating from rating agencies could be more likely to fail than reinsurers with stronger rating.
- Registered versus non-registered reinsurers – although non-registered reinsurers may have deposits in Canada covering known liabilities, access to funds to cover unknown liabilities may be more difficult to secure.
- Concentration of reinsurance held – this involves the failure of a reinsurer with a significant share of the ceded liabilities.

Stress testing may be useful to determine a plausible scenario. The exposure to the reinsurers would be calculated in terms of insurance liabilities, including incurred but not reported (IBNR), but less amounts payable to, and security held from, the same reinsurers. The actuary may evaluate the impact of default of some of these reinsurers based on level of participation, financial stability, and rating.

- **An increase in reinsurance held rates or a reduction in reinsurance held commission** – this scenario considers situations where reinsurance action is systemic in nature, due to the overall insurance environment. This is in contrast with ripple effects considered in risk categories 1, 2, and 4, where the reinsurer action is taken in response to situations unique to the insurer, such as poor experience.
- **Reduction in capacity** – this scenario contemplates a reduction in the availability of reinsurance held over the forecast period.
- **Disputes over policy conditions** – the effect on an entity of disputes with reinsurers may be similar to the effect of reinsurer insolvency. To differentiate between these scenarios, however, the actuary would consider a dispute that results in a principal reinsurer denying coverage for a significant class of business or category of claims, such as a terrorism occurrence.

Possible adverse ripple effects may include the following:

- Increase in reinsurance held rates arising from the need to obtain replacement coverage.
- Reduced availability of reinsurance held.

Possible management actions may include the following:

- Changing the reinsurance held structure.
- Diversifying participants on the reinsurance held program.
- Retaining a greater proportion of business to decrease the reinsurance held cost.
- Changing reinsurers.
- Reducing primary policy limits.

6. Market and credit risk

Changes in economic conditions have the potential to significantly impact an insurer's financial situation. For example, rapid changes in yield curves, exchange rates, and economic growth rates can affect the insurer's financial condition by leading to concomitant changes in the following:

- The market value of debt and equity securities.
- The default rates on debt securities.
- The match between cash flows from assets and liabilities.
- The creditworthiness of derivative counterparties.

Adverse scenarios in respect of deterioration of asset values may come from a variety of sources, including the following:

- A significant change in the yield curve.
- An increase in the default rate on debt securities.
- A decrease in the returns and/or value of equities.
- A decrease in the returns and/or value of real estate.
- A decrease in the returns and/or value of subsidiary.
- A significant change in foreign exchange rates.
- A decrease in the returns and/or value of other major asset categories.

The actuary may consider integrated scenarios involving a combination of these events. For example, in the event of a severe market shock, the creditworthiness of derivative counterparties may go down at the same time the exposure in the re-margining agreement goes up. A period of market turbulence or a shock to market liquidity would be among the scenarios considered.

In selecting appropriate assumptions to determine the adverse scenario, the actuary may want to refer to the CIA's *Report on Canadian Economic Statistics*. For example, the actuary may base an assumption on the largest one-year decline in equities, or the largest three-year average increase in yield curve. The actuary should be mindful of the fact that the future economic environment is correlated with the current economic situation when selecting its assumptions.

Alternatively, the actuary may use a stochastic model for economic changes if one is available.

Possible adverse ripple effects may include the following:

- Forced sale or liquidation of assets.
- Significant positive or negative cash flows impacting the insurer's liquidity position.
- Negative change on derivative positions.
- Default by counterparty on derivatives.
- Rating agency downgrade.
- A liquidity crisis caused by large, sustained default losses.
- Increase in the frequency or severity of claims due to the deteriorating economic conditions.
- Change in the yield curve used for calculating insurance contract liabilities.

Possible management actions may include the following:

- Selling or reinvesting assets.
- Changing the investment strategy.
- Repositioning derivative tools.
- Reducing the amount of business underwritten.
- Reducing costs through layoffs, consolidation of branch offices, or other similar actions.

7. Expense risk

Scenarios arising due to expense risk are not common for most P&C insurers but may be significant for an insurer that is just starting up or winding down operations, or for lines of business where the main driver of the cost comes from expenses other than claims costs (e.g., surety or title insurance).

Expense assumptions are unique in that management has a greater level of influence here than on other assumptions. Even insurers who, historically, have aggressively managed expenses to budgeted targets may face major expense issues in some situations such as an unexpected variation in new business growth or litigation. Insurers practicing strict management of budgets to meet expense levels included in pricing may have different results from insurers that manage budgets to other measures. The extent to which the insurer has demonstrated effective actions towards managing expenses in the past would be a consideration in how closely to relate expense levels under adverse scenarios to expenses in the base scenario. The actuary would also consider impacts related to directly attributable or non-directly attributable expenses, and their implications on the financial statements.

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

- **Inflation** – a severe inflationary environment may cause a rapid increase in absolute expenses and in unit costs. It is also possible to have future expense increases due to internal factors unrelated to future interest rates and inflation rates.
- **Technological obsolescence** – new technologies may emerge that deliver significant cost,

delivery, or service benefits for those who can achieve economies of scale. For companies that do not make use of new technologies, expenses may rise relative to the early adopters of such technology. Such a scenario would also include the sales and termination impacts of technological obsolescence.

- **Court-awarded damages/data security or recovery** – potential high costs can result from court-awarded damages to plaintiffs relating to such matters as market conduct or the costs related to data security and recovery due to a cyberattack or breach. Resulting ripple effects include damaged industry reputation, litigation impacts, ratings downgrades, lower sales, and higher cancellations or non-renewals.
- **Company structure** – holding-company expenses may be allocated to subsidiary companies based on historical or projected relative profits. This could lead to a major change in the level of expenses 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 that has several insurance companies or business units that provide services to one another, the impact of cross-billing would be considered.
- **Mergers and acquisitions, or assumptions of new business** – reductions in unit expenses after a merger, acquisition, or assumption of a new block of business may be delayed or lower than projected in the base scenario. Possible ripple effects could include:
  - Changes in product pricing.
  - Low sales.
  - Higher cancellations and non-renewals.

8. Government and political risk

The implementation of a government's policies or regulations usually takes a long time. This normally allows an insurer time to analyze the impact(s) and take the appropriate actions. Time for analysis and action may not be available where implementation of changes occurs quickly, is not foreseen, or is made retroactively effective. In these cases, the adverse scenario may be modelled in the first partial year modelled if the scenario is plausible in that time period.

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

- A rate freeze or rollback of rates by a government body or regulator on lines of business and jurisdictions in which rates are subject to regulatory approval.
- A change to regulations regarding use of rating variables that may impact the adequacy of rates and availability of insurance on lines of business and jurisdictions in which rates are subject to regulatory approval.
- A change to legislation that prescribes levels of insurance coverage, such as automobile accident benefits.
- An increase in taxation rates or rules for corporations, such as income tax, capital gains tax deductions, or offshore income.
- Nationalization or privatization of a line of business in a jurisdiction.
- A change to legislation that creates or restricts distribution channels.

- A change in regulatory solvency standards that could increase the capital requirements for P&C insurers.
- Political instability that leads to confiscation of assets, closure for new business, exchange controls, etc., particularly in foreign jurisdictions.
- Geopolitical conflict leading to supply chain disruptions and inflationary pressure.

Possible adverse ripple effects may include the following:

- Higher than expected fulfilment cash flows.
- Increased litigation costs.
- Reduced availability of insurance to the public.
- Increased volume of industry pools resulting in increased assessments.
- Increased regulatory monitoring or filing of rates.
- Forced sale or liquidation of assets.
- Problems with reinsurance held coverage.
- Increase in the insurance contract liabilities related to current reinsurance contracts held (e.g., swing-rated contracts, variable commission, reinstatements premiums).
- Increased reinsurance held rates or non-availability at the next renewal.

Possible management actions may include the following:

- Reducing the volume of business written by restricting sales or broker force, freezing new business, or withdrawing from the geographic location/jurisdiction or line of business.
- Creating or expanding a separate company or distribution channel.
- Reviewing the target mix by line of business or geographic location/jurisdiction.
- Reviewing reinsurance held coverage, type, or contract terms at next renewal.

9. Off-balance-sheet items risk

There are numerous off-balance-sheet items that may adversely affect an insurer's financial condition. Often these off-balance-sheet items arise from new or evolving industry practices that, in subsequent years, do get recognized on the balance sheet by the CPA Canada, the CIA, or regulators. Therefore, the actuary needs to develop awareness of any emerging risk that may be relevant to the insurer during the forecast period and assess its potential threat to the insurer's financial condition.

Possible scenarios of off-balance-sheet items and their related risks include the following:

- **Structured settlement –** when a P&C insurer purchases an annuity to satisfy a structured settlement, it is exposed to the credit risk associated with the insolvency of the insurer selling the annuity.
- **Contingent liabilities or losses –** there are a variety of contingent liabilities to which an insurer may be exposed, such as tax, litigation, etc.
- **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 are discussed in more detail below:
    - 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 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.
- **Pension underfunding –** the insurer could be exposed to the potential impact of unfunded liabilities.

Possible adverse ripple effects may include the following:

- Forced sale or liquidation of assets.
- Significant positive or negative cash flows, affecting the insurer's liquidity position.

Possible management actions may include the following:

- Selling or reinvesting assets.
- Changing the reinsurance held strategy.
- Repositioning of derivative tools.
- Reducing costs through layoffs, consolidation of branch offices, or other similar actions.

10. Related companies risk

It is possible that adverse scenarios in a related company may have a concomitant impact on the insurer's financial condition. The choice of adverse scenarios for this risk will tend to be based on actual company organizational structures. Related company risk may also be considered in creating integrated scenarios with other risk categories.

In this context, an insurer's financial condition may be sensitive to the following:

- **A reduction in reliance on the parent company for financial support –** typically, such a situation would arise when a group's financial resources are needed to support a financially impaired parent or affiliate company.

- **An increase in the provision of financial support to the parent –** in this situation, funds the company expected to have for its own purposes are now needed to support other entities in the group.
- **A high level of dependency on group operational resources –** this situation would consider disruptions in services (computer systems, actuarial, etc.) provided by related companies.
- **A rating agency downgrade reflecting difficult financial conditions at the group level.**

Possible adverse ripple effects may include the following:

- Management focus on group rather than company priorities, potentially delaying remedial action.
- A need to provide for service disruptions.
- Regulator action to protect local policyholders.

Possible management actions may include the following:

- Finding alternative sources of funds for operational support.
- Implementing rate increases, where possible.
- Reviewing reinsurance held coverage purchased to mitigate capital strain.
- Reviewing the target mix by line of business or geographic location/jurisdiction.
- Reviewing type of products offered.
- Selling or reinvesting assets.

11. Climate-related risks

Climate-related risk could be considered a risk category of its own or may form the basis for an integrated scenario reflecting the other risk categories.

Climate-related risks are not limited to risks arising from localized climate events such as wildfires and floods. They also include larger-scale impacts related to climate change adaptation. In general, this risk category consists of physical and transition risk, as outlined below:

- Physical risk, which arises from an increase in frequency and severity of climate events, that could disrupt critical operations, threaten the value of investments, and/or increase insurance risks.
- Transition risk, which is driven by a shift towards a lower carbon footprint economy, could stem from current or future government policies, changes in investor or consumer sentiment, technological advancements, or climate-related litigation.

The actuary would consider the occurrence of a combination of these risk factors. Given that the timing and impact of climate change is uncertain, the actuary would apply judgement in forecasting climate change impacts and determining the forecast period for a climate-related risk scenario. Considerations would include the potential timing and magnitude of physical versus transition risk, and the need to incorporate the vast majority of the scenario impacts on the financial condition of an insurer.

The actuary would consider possible adverse ripple effects, such as the following:

- Increased frequency of catastrophe events.
- Increased severity of catastrophe events.
- Affordability and availability of reinsurance which may imply an increase in the retention for the primary insurer and/or increase in reinsurance premiums.
- Disruption in the supply chain from climate-related events resulting in increased severity for non-catastrophe related claims.
- Changes in regulation impacting future claims severity (e.g., rebuilding with eco-friendly materials, costs to rebuild in a non-hazard prone area).
- Changes to insured products (e.g., new electric vehicles).
- Increase in credit, market, and liquidity risks due to increased costs of climate change adaptation.
- Increases in operational risk due to damage to infrastructure.
- Increases in general expenses to support climate-change mitigation actions.
- Increase in reputation risk.

Possible management actions may include the following:

- Reviewing reinsurance held coverage purchased to mitigate capital strain.
- Finding alternative sources of reinsurance.
- Implementing rate increases, where possible. Reviewing the target mix by line of business or geographic location/jurisdiction (e.g., reviewing concentration risk).
- Reviewing type of products offered.
- Selling or reinvesting assets.

12. Technology and cyber risk

Refer to Technology and cyber risk in Appendix A. Risks associated with cyber insurance products offered by P&C insurance companies could either be considered as part of the technology and cyber risk category, or the other insurance risk related categories (e.g., frequency and severity and liability for incurred claims).