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AUTORITÉ DES MARCHÉS FINANCIERS

EARTHQUAKE EXPOSURE RISK MANAGEMENT GUIDELINE

Initial publication: October 1998
Updated: September 2012

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Preamble

The *Autorité des marchés financiers* ("AMF") establishes guidelines setting out its expectations with respect to financial institutions' legal requirement to follow sound and prudent management practices. These guidelines therefore cover the interpretation, execution and application of this requirement.

The AMF favours a principles-based approach rather than a specific rules-based approach. As such, the guidelines provide financial institutions with the necessary latitude to determine the requisite strategies, policies and procedures for implementation of such management principles and to apply sound practices based on their nature, size, complexity and risk profile. In this regard, the guidelines provide examples of how to comply with the principles set forth in this guideline.

The AMF considers governance, integrated risk management and compliance (GRC) as the foundation stones for sound and prudent management of financial institutions and, consequently, as the basis for the prudential framework provided by the AMF.

This guideline is part of this approach and sets out the AMF's expectations regarding sound and prudent earthquake exposure risk management for damage insurers.

Introduction

Catastrophic losses which could be caused by earthquakes are a significant risk in Canada, and particularly in Québec and British Columbia. Like other risks which can significantly affect operations, this risk should be considered as part of the integrated risk management of any financial institution[1]. It should be seen as an intrinsic part of catastrophe risk management and taken into account in business continuity planning[2].

Other than these general considerations, this guideline sets out the AMF's specific expectations regarding damage insurers which issue insurance policies covering earthquake exposure risk.

Earthquake insurance is designed primarily to cover damage directly caused by initial seismic shaking as well as damage following an earthquake (tsunami, fire, etc.). This insurance is generally optional and is usually sold as an endorsement or rider to the policy covering the insured's main buildings. In addition to covering damage to property, equipment and contents, it may include other types of coverage such as additional living expenses and business interruption.

Despite the above, personal property insurance policies taken out in Québec generally cover fire following an earthquake, through an endorsement or rider or in the main policy. In automobile insurance, earthquakes are covered under a policy's optional coverage[3]. Since other products may also be exposed to earthquake risk, the AMF expects insurers to check whether any of their polices directly or indirectly offer protection against this risk and, where applicable, take it into account in assessing their overall exposure.

Based on the above definition, the AMF expects insurers who expose themselves to this risk measure and control it efficiently through sound and prudent management of their exposure[4], based on their risk appetite and risk tolerance levels[5].

The complexity associated with earthquake exposure risk management, along with the seriousness of potential losses and the difficulty of mitigating their effects, constitutes a risk which could seriously affect an insurer's financial situation and, given the public visibility of such events, its reputation. The AMF therefore expects insurers who underwrite insurance policies which could be exposed to this risk to have sufficiently developed policies and procedures to ensure that losses are dealt with and managed efficiently in the event of an earthquake.

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1 *Autorité des marchés financiers*, *Integrated Risk Management Guideline,* April 2009.

2 *Autorité des marchés financiers*, *Business Continuity Management Guideline,* April 2010.

3 Section B, Subsections 3 and 4 of Q.P.F. No. 1, as approved by the AMF.

4 In this guideline, the term "exposure" is used to designate the sums insured exposed to earthquake risk.

5 The notions of risk appetite and risk tolerance are defined in the *Integrated Risk Management Guideline* (Footnote 1).

In addition to setting forth the AMF's expectations with respect to the development of sound and prudent management practices to prepare for this risk, this guideline sets out common parameters and other factors to be considered when measuring earthquake exposure and calculating the probable maximum loss (PML) to which an insurer is exposed. This amount, used in calculating the required capital[6], is essential in assessing the insurer's capacity to handle and pay claims as well as its financial preparedness for such an eventuality. In this regard, the AMF requires insurers to report certain earthquake exposure information to it annually.

The AMF adheres to principles and orientations promoting sound and prudent management practices and, as authorized under *An Act respecting insurance*[7], gives insurers this guideline setting out its expectations with respect to the management and assessment of earthquake risk. In accordance with its power to intervene, the AMF may ensure that an insurer's approach complies with the principles and benchmarks set forth in this guideline and, where applicable, require that corrective measures be taken.

[6] *Autorité des marchés financiers*, *Guideline on Capital Adequacy Requirements, Property and Casualty Insurance*.

[7] *An Act respecting insurance,* R.S.Q., c. A-32, sections 325.0.1 and 325.0.2.

Scope

This guideline applies to insurers holding a licence to practice damage insurance in Quebec, i.e. the following legal persons or companies governed by *An Act respecting insurance*:

- property insurance companies;
- mutual insurance companies;
- federations of mutual insurance companies.

As regards mutual insurance companies that are members of a federation, the standards or policies adopted by the federation should be consistent with—and even converge on—the principles of sound and prudent management detailed in this guideline.

Unless the context requires otherwise, the generic term “insurer” refers to all entities covered by the scope of this guideline.

Coming into Effect and Updating

This guideline replaces the Sound Management and Measure of Earthquake Exposure Guideline which had been in effect since October 1, 1998[8].

With respect to the legal requirement of insurers to follow sound and prudent management practices, the AMF expects each insurer to develop strategies, policies and procedures based on its nature, size, complexity and risk profile, and to ensure the adoption of the principles underlying this guideline as of January 1, 2013.

In connection with its role regarding the implementation of sound and prudent management practices, the AMF may verify whether such a framework exists and whether it enables the insurer to satisfy the requirements prescribed by law.

The Earthquake Exposure Risk Management Guideline is being established with a view to harmonizing it with standards applicable to federal financial institutions and takes into consideration the use of models and data quality in order to reflect the evolution of industry risk management practices.

Although this guideline will come into effect on January 1, 2013, financial institutions will have a one-year transition period to allow them to make the necessary changes by January 1, 2014.

This guideline will be updated based on developments and in light of the AMF's observations in the course of its supervision of insurers.

[8] *Autorité des marchés financiers*, *Sound Management and Measurement of Earthquake Exposure,* October 1998.

1. Earthquake Exposure Management

The AMF expects insurers to set up appropriate policies and procedures to ensure sound and prudent earthquake exposure management, supported by effective governance by the Board of Directors[9] and properly implemented by senior management.

The AMF considers the Board of Directors and senior management to be ultimately responsible for decisions made and actions taken with respect to integrated risk management, and in particular earthquake exposure risk management. They are therefore responsible for efficient governance and adequate implementation. This is especially important given the highly unforeseeable nature of losses from earthquakes and their potentially catastrophic results for a financial institution.

Policies and procedures

Taking into consideration the roles and responsibilities assigned to them[10] as well as the nature, size and complexity of the insurer's activities, the Board of Directors and senior management should set up policies and procedures documenting the main features of the insurer's approach to managing its earthquake risk exposure. In particular, earthquake policies and procedures should include:

- the risk appetite and risk tolerance for earthquake insurance;
- data management practices;
- data aggregation and the necessary reporting to the establishment on earthquake exposure;
- appropriate understanding of the earthquake models used, including considerations for model limitations, uncertainties and non-modelled classes of business;
- identification and estimation of relevant PML factors;
- the nature and adequacy of financial resources available in relation to the PML;
- contingency plans to ensure adequate claim handling resources and continued efficient operations;

[9] A reference to the board of directors can also include a board committee, such as a board committee established to examine specific issues.

[10] *Autorité des marchés financiers*, *Governance Guideline*, April 2009.

- consideration of potential increases in claim and operating costs due to the emergency and the temporarily short supply of resources which often follows a catastrophe.

Role of the Board of Directors and Senior Management

In addition to ensuring that earthquake policies and procedures are set up, the Board of Directors should see that they are properly implemented. The AMF expects the Board of Directors to assess their relevance annually in connection with the insurer's overall integrated risk management.

Senior management is responsible for implementing and overseeing compliance with policies and procedures throughout the organization. As earthquake exposure risk should be managed on a continuous basis, efficient management of earthquake exposure may require internal reporting more frequent than once per year. Such management should also cover the entire organization and take related risks into account, such as operational risks as well as insurance, reinsurance and investment risks.

Moreover, the Board of Directors and senior management should ensure that appropriate internal controls are in place to ensure on an ongoing basis that operations are efficient and comply with the policies and procedures. In addition, considering the nature of earthquake risk (low frequency/high impact), control mechanisms should, where applicable, be appropriately aligned with management, employee and broker/agent compensation programs.

While all oversight functions are expected to contribute to this effort, the AMF considers that the role of the actuarial function, where it exists, is particularly important in reviewing models used to determine exposures, the adequacy of reinsurance programs to mitigate these exposures and the pricing of earthquake insurance.

2. Earthquake Exposure Data

The AMF expects earthquake exposure data to be appropriately captured and regularly tested for consistency, accuracy and completeness.

The data required to run earthquake models goes beyond the data traditionally used to rate insurance policies. As a result, improving data consistency, accuracy and completeness is one area where an insurer's efforts can significantly reduce the uncertainty inherent in earthquake exposure measurement. Good data facilitates the management of this risk, and in particular risk transfer, pricing and monitoring against limits as well as catastrophe modeling.

Data Integrity and Verification

An insurer's earthquake policies and procedures should reflect a strong commitment by senior management to obtain consistent, accurate and complete data to estimate the insurer's exposure to earthquake risk. Management must understand and place a high priority on the quality of data and its timely capture. Data quality needs to be considered within the context of the assumptions and requirements of the earthquake model(s) used. If necessary, new processes should be put in place to improve data quality.

Responsibilities for the accuracy of data should be clearly defined, both within the insurer and in dealing with outside parties. For example, intermediaries such as brokers and agents are often responsible for data collection. In such a case, insurers should have policies and procedures in place to ensure that data collection meets the insurer's quality standards.

As data quality is often impacted by a trade-off between completeness and accuracy, the insurer should implement a quality control process around data collection and entry including the adoption of criteria to measure data completeness and accuracy. Processes may include:

- scoring data quality at the time of underwriting;
- conducting remediation of sources providing inadequate data;
- developing and implementing safeguards to prevent or reduce data entry errors; and
- investing in technology to improve data quality.

The AMF expects insurers to have processes in place to verify that their database is accurately reflecting all the data received. While the quality of individual risk data is often the key driver of overall data quality, an aggregate analysis and assessment of the overall data quality of a portfolio/group of risks may be the most appropriate approach when the insurer has limited access to the underlying policy processing system. This will be the case more particularly for assumed reinsurance portfolios. Accordingly, reinsurers should have processes in place to evaluate the quality of data submitted by their cedants. A similar situation may occur during block transfers of insurance policies from one insurer to another.

Management also needs to understand the data limitations and the level of possible errors in the data. While complete and explanatory data is the objective, it will be difficult or impossible to achieve this in practice. Management must therefore understand the possible impact of data limitations on the results projected by the model and make prudent adjustments to the model estimates.

Data should be subject to periodic (at least annually) review by individuals independent of those responsible for data collection and data quality. While the insurer may use reinsurance brokers for this independent review, this work should extend beyond the regular review of data prior to submission to reinsurers to include a specific report that acknowledges that their work is being done to support the insurer's compliance with this guideline. Although less frequent, external review of the insurer's data management, quality and reporting can add value by providing independent benchmarking.

These reviews should cover the completeness and accuracy of the exposure data as well as the processes applied and the steps taken to achieve the desired quality level. In this regard, documentation of the testing and sign-off from the reviewers should be obtained. Testing, which should ensure that errors and erroneous entry and transcription are not occurring, could include:

- aggregating data by key occupancy, type of construction and geocode of insured buildings and reviewing statistics such as the percent of data with known attributes, the amount of bulk coding and the most frequently observed values;
- comparing year-to-year exposure changes;
- using historical loss experience to identify specific portfolio coding issues and behaviour vs. model construction and assumptions;
- running data quality sensitivity tests as a regular part of the portfolio risk analysis process and incorporating them into risk decision-making.

An appropriate timeframe for updating the portfolio exposure data and model results should be selected.

The AMF generally expects senior management to understand the data requirements of the model(s) they are using and develop and document a plan to address all concerns identified in the reviews.

3. Use of Earthquake Models

The AMF expects insurers to have a sound knowledge of the assumptions and methodologies underlying earthquake models and use a high degree of caution that reflects the significant uncertainty in such estimates.

Prudent use of catastrophe models to measure earthquake exposure risk is an important component of sound earthquake exposure risk management. This is one reason why the principles set out in this guideline make numerous references to it. Furthermore, the inherent uncertainty associated with catastrophe modeling requires the prudent use of results, and it is critical that all users of the output of catastrophe models be conscious of this uncertainty. Accordingly, the sound governance of this risk and use of other risk management techniques, such as risk limits, risk transfer and risk avoidance[11], should also be considered by the insurer. References in this guideline to these alternatives are as important as the guidance on the use of catastrophe models.

Use of Models

Insurers are expected to utilize sound earthquake models as part of their earthquake exposure management. Considering that earthquake-related PMLs are derived from a complex set of variables and related assumptions, catastrophe models are an essential tool in providing a systematic approach to such estimates.

However, while earthquake models continue to be refined as new information emerges, they have significant limitations and a high degree of inherent uncertainty. This uncertainty is demonstrated by the material differences observed when model estimates are compared to actual events and by the wide range of results from model to model.

Nevertheless, when users appropriately consider model limitations and uncertainties, they provide a basis for PML estimation and reinsurance arrangements. Models further enhance their value as a risk management tool when they are also used to monitor earthquake exposure accumulations and to assist in underwriting decisions.

Sound Practices for Use of Earthquake Models

Earthquake models are available through a variety of means. They may be licensed from various commercial vendors and maintained in-house or run by third parties, such as a reinsurance broker, on behalf of the insurer. Some insurers have also developed their own in-house models. In any event, in order to ensure that earthquake models are appropriately used, insurers are expected to:

- adequately document their use, including how the use of earthquake models fits within their earthquake risk management process, including PML estimates and, where applicable, how models are used to monitor exposure accumulations and make underwriting decisions;

- understand current modelling alternatives and why the model used is appropriate for their insurance portfolio;

[11] For example, by using concentration limits by geography.

- ensure there are adequately qualified staff to appropriately run the models on a regular basis when earthquake models are used in-house;
- have a sound understanding of the key assumptions, methodologies and limitations underlying the model used, including:
  - how each setting impacts PML estimates. In this regard, insurers will need to justify why selected assumptions established and recommended in the model have been varied;
  - ability to handle related factors such as demand surge, fire following and business interruption;
  - how changes in portfolio characteristics influence PML variability;
  - modelled losses versus non-modelled losses;
- understand inherent model uncertainty and how this is addressed in determining capital adequacy and related reinsurance arrangements;
- ensure that the granularity and quality of data used is appropriate for the model;
- be able, when more than one model is used and they produce materially different results, to explain the results of their efforts to identify the key reasons for the differences and explain how this work is reflected in parameterization and adjustments (if any) to the particular model(s) chosen as the basis for PML.

Model Versions

While the use of an earthquake model is important, it represents only one element in an insurer's risk management framework for earthquake exposure. While models continue to be refined, they retain inherent uncertainty. To counter the inherent uncertainty in models, insurers should consider the use of more than one model.

Insurers should implement material updates to commercially available models in a timely manner. More specifically, it is expected that within one year of the release of any material change in a model, the revised model will be used, or an explanation provided for why not. Insurers are to identify the model(s) and version they are using.

When using vendor software to determine its PML, it is important for an insurer to understand the model as well as its purpose, use and limitations. The model documentation should provide sufficient detail to understand the mathematical basis, model methodology, parameters, inherent limitations and specific insurer modelling refinements used.

Where an earthquake model has been developed in-house, it is expected to be updated on a regular basis and periodically tested for functionality and comparative PML results against other commercially available models.

Model Validation

Model validation provides important information on the performance of models.

An important element of this process is to ensure that the model prudently captures risks based upon actual events. This analysis should demonstrate that, over a sufficient historical period, the model-based measurement of capital is consistent with actual losses. To the extent that insufficient data exists to validate the model, an alternative but suitable solution should be found and used for validation.

For example, the insurer could compare the few major historical earthquake events to the losses produced by similar events in the model and assess any divergences. Given the limited number of major historical earthquakes in Québec and more broadly in Canada, it may also be helpful to consider the performance of the vendor models compared to earthquakes in other parts of the world.

The insurer could also compare the modelled tail losses to market prices for equivalent reinsurance coverage. This test is not a validation of the model per se but, rather, will serve as a source for further investigations. An outcome might be that the risk is treated more conservatively than the vendor model would show.

The adjustments and refinement of model parameters, including loadings for non-modelled risks or costs, should be robust and reflect the results of the model validation process.

The model validation process should be well documented, and should clearly identify any limitations of the model or the data in assessing risk and discuss how such any material deficiencies are mitigated.

4. PML Estimates

The AMF expects PML to properly reflect the total expected ultimate cost of losses to the insurer, including considerations for data quality, non-modelled exposures, model uncertainty and exposures to multiple regions.

While models are an essential tool in assisting insurers in the management of their earthquake exposures, they are limited in their capabilities. This creates a significant degree of uncertainty in their results. As such, while insurers are required to develop PML estimates in accordance with this principle, they are also encouraged to consider other exposure limitation techniques, such as concentration limits by geography, occupancy and/or construction type.

Data Quality

It is important for an insurer to understand the possible impact of data limitations on the results projected by a model and to make prudent adjustments to the model estimates. While upward PML adjustments may be necessary for data quality, it should be understood that a large adjustment to the PML for data quality is not a substitute for appropriate data capture.

Non-modelled Exposures and Risks

Many risks cannot be adequately considered, or are difficult to adequately consider, within an earthquake model. Accordingly, the AMF expects insurers to take an inventory of exposures and risk factors relevant to their business and identify those that are not included in the model used. These non-modelled exposures and risk factors may include:

- exposure growth between the date of the data and the end of the year;
- business interruption;
- other insurance categories, such as automobile and marine insurance;
- claims handling expenses;
- insufficient insurance;
- guaranteed replacement costs;
- increased risk of seismic shock after a major earthquake;
- blanket coverage and coverage extensions or clauses, such as debris removal.

These exposures and risk factors may be relatively small individually, however, their accumulation may be significant and need to be considered as part of an insurer's earthquake PML.

Model Uncertainty

Models calculate PML by converting from the location specific estimate of ground motion to damage levels, leading to secondary uncertainty. Many vendor models now automatically recognize this uncertainty in generating results. There are other sets of assumptions in the earthquake models that are in a continuous process of being updated and refined. When considering its PML as estimated by the model as a measure of the potential financial impact on the insurer, senior management needs to consider factoring in a margin of safety to reflect the uncertainty of these additional assumptions.

Exposure to Multiple Regions

PMLs have historically been based on the larger of the PMLs for British Columbia or Québec, the two provinces with the greatest exposure to earthquake risk, to ensure compliance with capital requirements. Although this approach is acceptable for insurers operating in only one of these provinces, which is the case for most Québec incorporated insurers, this approach ignores earthquake exposure elsewhere, which can have a material impact on the exceeding probability curve. The traditional approach could therefore understate the PML for insurers.

The AMF therefore expects insurers to take account of excess risk which may result from exposure to more than one region. For a Canadian branch of a foreign insurance company, commitments should include risks located in Québec which have been underwritten outside Canada and which are excluded from the data indicated on the insurer's P&C-2.

5. Financial Resources and Contingency Plans

The AMF expects insurers to have an adequate level of financial resources[12] and appropriate contingency plans to successfully operate through a major earthquake.

PML refers to the threshold dollar value of losses beyond which losses caused by a major earthquake are unlikely. Throughout this section, it includes adjustments for data quality, non-modelled exposures and risks and model uncertainty as outlined in the previous section.

Financial Resources

Earthquake policies and procedures should quantify an insurer's willingness to take on earthquake insurance risk and outline how the insurer's financial resources cover its gross PML[13]. Insurers should refer to the Guideline on Capital Adequacy Requirements[14] in order to determine if they meet the regulatory test of financial preparedness for earthquakes. The following represent financial resources that could be used to support the insurer's earthquake exposures:

[12] Pursuant to sections 275 and 275.3 of the *Act respecting insurance,* R.S.Q., c. A-32.

[13] For regulatory purposes, gross PML is used to calculate earthquake exposure. It is the PML amount after deductibles but before catastrophic and other reinsurance protection.

[14] *Autorité des marchés financiers*, *Guideline on Capital Adequacy Requirements, Property and Casualty Insurance*.

(a) Capital and Surplus

The Guideline on Capital Adequacy Requirements specifies the maximum retention that can be supported within the insurer's capital.

(b) Earthquake Reserves

This amount is the result of the voluntary earthquake premium reserve and the earthquake reserve complement which may be required in covering an insurer's exposure to this risk. The Guideline on Capital Adequacy Requirements provides details about earthquake reserves.

(c) Reinsurance

While most insurers will use a catastrophe reinsurance treaty, other reinsurance, such as surplus, quota share or excess of loss (per risk or aggregate) treaty may provide substantial coverage for some insurers. When an insurer includes non-catastrophe reinsurance in its determination of available financial resources, it needs to be prepared to demonstrate that it has appropriately considered per event limits and other circumstances, terms and conditions that would otherwise exhaust coverage provided by these other types of reinsurance. In the case of whole account reinsurance, insurers may need to use a full stochastic model.

Formal reinsurance agreements, evidenced by written documents between related insurers, constitute an acceptable traditional mechanism which insurers may use to manage their insurance exposure, including their earthquake risk exposure. Note, however, that other supporting financial arrangements, such as letters of credit or guarantee facilities, cannot be used.

Reinsurance programs and agreements should be arranged following the reinsurance guideline[15]. Insurers that participate in a global catastrophe reinsurance program must consider:

- on-going protection for Canadian operations (e.g., exhaustion of layers or program by other events);
- adequacy and recoverability if other regions are impacted by the same event.

(d) Financing

Insurers can enter into innovative financing transactions designed to hedge their risk for a catastrophic event. In some cases, these are standby capital market financing facilities that become operative when a catastrophe occurs. Insurers should be aware that prior approval from the AMF is required before these instruments are used to ensure that they can be recognized as a financial resource under the Guideline on Capital Adequacy Requirements.

[15] *Autorité des marchés financiers*, *Reinsurance Risk Management Guideline,* April 2010.

Contingency Plans

In accordance with the Business Continuity Management Guideline, insurers must have contingency plans in place to ensure continued efficient business operations in the case of a catastrophe, including an earthquake. The contingency plan should address the key elements of claims management, such as alternative communications links, availability and adequacy of claims and adjustment service personnel, and off-site systems back-up, that also includes reinsurance records.

Supervision of sound and prudent management practices

In fostering the establishment of sound and prudent management practices within financial institutions, the AMF, as part of its supervisory activities, intends to assess the degree of compliance with the principles set forth in this guideline in light of the specific attributes of each insurer. Similarly, it will examine the effectiveness and relevance of the strategies, policies and procedures adopted by insurers as well as the quality of supervision and control exercised by their boards of directors and senior management.