MILLIMAN BRIEFING NOTE

Recommendations for developing a Stress and Scenario Testing framework

February 2019

Overview

This note provides high-level recommendations, based on Milliman's extensive industry experience and internal view of best practice, for insurance companies when developing or enhancing their Stress and Scenario Testing ("**SST**") framework, and is structured as follows:

1. General principles;
2. The purpose of the SST framework;
3. The risks to be covered;
4. The tests to include;
5. Methodology and calibration decisions;
6. Weaknesses and limitations; and
7. Frequency, ownership and reporting.

It should be noted that this note does not cover technical elements relating to the methodology and / or assumptions for modelling sensitivities, stresses and scenarios. It has also been drafted for use by insurance companies generally, though in practice we would expect the SST frameworks to be tailored to individual firms' business strategies, risk profiles and resources.

As such, these recommendations are intended to represent a generic roadmap that can be refined following further discussion and analysis. Milliman has considerable experience of working with clients on all aspects of their risk management systems, including the design and implementation of an effective SST framework, and we would be more than happy to engage in further conversation with you on this subject if you feel this would be useful.

1. General principles

As a first step, firms should set out the general principles governing the SST framework, for example it should be:

- Relevant to the business;
- Practicable;
- Meaningful to multiple classes of users;
- Dynamic; and
- Internally consistent across the various tests.

2. The purpose of the SST framework

The list below sets out a number of initial questions that need to be answered in order to ensure the results from the SST framework are meaningful in terms of enhancing the business's understanding of risk and informing decision making. Example answers have been provided for illustrative purposes. However, the final metrics, assessment criteria and application of results should be linked to a firm's strategic objectives and business plan and agreed by its management and Board.

The main thing to bear in mind here is that the SST framework should encompass more than just impact analysis – it should also provide a structure for drawing conclusions, agreeing next steps and taking action.

What are the metrics?

- Own funds / solvency capital requirement ("**SCR**") / solvency ratio
- Profitability / cost base
- Embedded value
- Liquidity
- Credit rating
- Pricing metrics, e.g. internal rate of return ("**IRR**")
- Qualitative impacts, e.g. reputation, response from different stakeholders

What are the metrics measured against?

- Regulatory minimum requirements
- Business strategy
- Risk appetite / capital policy
- Budget / target profitability / business plan
- Breaking point / business failure
- Peer group companies

How are the results used?

- Reporting to the Board & Committees
- Setting business strategy, risk appetite, capital policy
- Basis setting / model validation / deriving regulatory capital
- Capital & resilience planning
- Driving management actions, e.g. reinsurance, investment strategy

3. The risks to be covered

The SST framework should cover all areas of uncertainty[1] that could materially affect the metrics and results identified above, and hence the firm's ability to meet its strategic objectives and / or deliver the business plan. These areas of uncertainty include both existing material risks, financial and non-financial, and new or increasing risks expected to emerge over the business planning period.

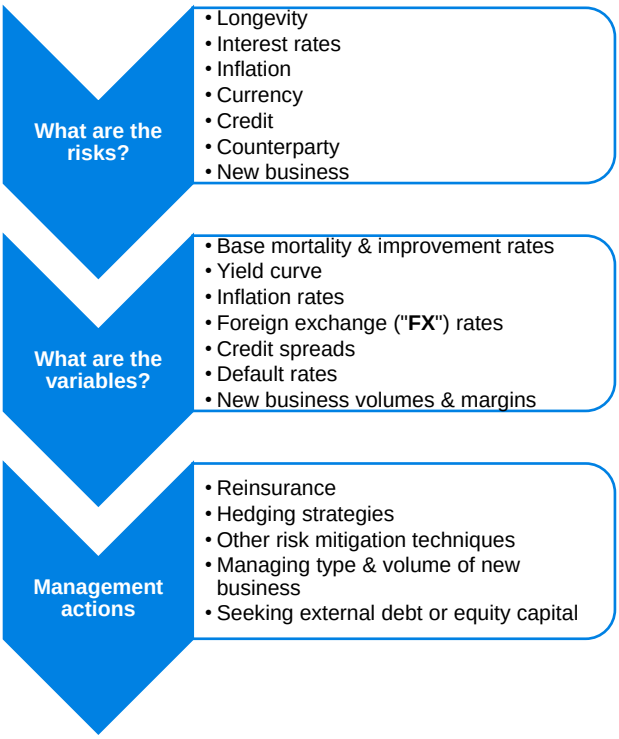
Potential management actions associated with each risk should also be considered at this stage, with a view to assessing the availability of these actions in stressed conditions, their effectiveness, and any downside to their application.

It is important to differentiate between risks that are:

- Controllable vs. non-controllable;
- Idiosyncratic vs. systemic; and
- Threats vs. opportunities.

It may also be beneficial to consider the different causes or drivers of risks as a means to assess the likelihood of risks, their interaction and any second order impacts.

The list below provides some examples of risks, risk variables, and associated management actions.



4. The tests to include

Having established general principles, the purpose of the SST framework and the risks it needs to cover (as set out in steps 1 to 3 above), the next step should be to determine the tests to include.

Most SST frameworks will comprise four categories of testing:

- **Sensitivity testing** is used to identify how sensitive the business is to small changes in key variables over a short timeframe (1 day to 1 year). Typical applications include model validation, assumption setting and business forecasting.
- **Scenario testing** is used to investigate the potential effect of alternative conditions or circumstances in relation to a firm or its external environment, which could plausibly arise over the business planning period or medium term. This would be expected to form part of a firm's ORSA process, with consideration given to:
    - likelihood;
    - single vs. multi-factor shocks;
    - instantaneous shocks vs. sustained stresses;
    - post-stress assumptions, for example recovery rates;
    - second order impacts, for example operational implications; and
    - changes to policyholder behaviour and / or management actions.
- **Stress testing** is used to analyse the impact of severe risk events or material deteriorations in experience, typically in relation to a single risk and between a 1-in-50 and 1-in-200 year level. This category of testing would be expected to cover all material quantifiable risks to which a firm is exposed and inform its regulatory capital requirements. Certain stress tests may go further than those for regulatory capital purposes, for example by considering not only the impact on own funds but also changes to the risk margin and SCR.
- **Reverse stress testing** is used to investigate the extreme and hopefully improbable events or circumstances that would lead to challenges to, or failure of, the business

[1] It is worth noting that some areas of uncertainty may not be readily quantifiable, in which case it may be more appropriate to investigate risks by alternative means.

model. As with scenario testing, this would be expected to form part of a firm's ORSA process.

It is important that all tests performed tell you something useful about the business. As the universe of potential tests is enormous and the resources that can be dedicated to SST will always be limited, you won't be able to investigate everything. Rather there needs to be a mechanism by which the key stresses and scenarios are identified and prioritised, and a balance is struck between the tests included being comprehensive, and being relevant and manageable.

5. Methodology and calibration decisions

Determining the methodology and calibration to apply for each test requires careful consideration, and a number of areas are worth mentioning in particular:

- Consideration should be given to what level of granularity is appropriate. For example, should changes to interest rates vary by term, will a parallel shift in the yield curve suffice or should both be used?
- To allow different risks to be ranked and compared, the degree of movement applied to a particular variable should be consistent across different sensitivity or stress tests within the same exercise. This happens already for the SCR calculation, but may also be useful at other probability levels.
- In order to identify any asymmetry and / or non-linearity, for example in relation to interest rate and longevity movements, sensitivity tests will need to be two-sided (i.e. favourable and non-favourable) and multi-level (i.e. different levels of change).
- When assessing the impact of stresses and scenarios on the financial position, the firm must decide what basis or balance sheet to consider, for example Solvency II Pillar 1 or ORSA (which might have a different risk margin calculation).
- For feasibility, high level assumptions, for example the assumption that markets are perfectly correlated, are likely to be required for most stresses and these will need to be documented.
- Model complexity can vary considerably, and the firm will therefore need to consider what simplifications or heuristic techniques may be applied, and whether simple spreadsheet models, proxy models (for example, Least Squares Monte Carlo) or full actuarial models are most appropriate, for the different types of tests.

6. Weaknesses and limitations

Any gaps or weaknesses of the SST framework, for example risks that aren't covered, areas of material uncertainty or applications to which it is unsuitable, should be clearly communicated and documented. A list of planned developments and improvements should also be logged, with details of agreed delivery dates and responsible individuals.

Regular reviews of the SST framework to identify new weaknesses and limitations, and to check that any previously requested development has been implemented satisfactorily, should be conducted. For example, this might be carried out by the Risk Committee on an annual basis.

7. Frequency, ownership and reporting

The frequency with which the various tests are performed would normally be driven by their application. For example, certain sensitivity and stress tests are likely to be conducted monthly or quarterly to feed into normal risk monitoring and valuation processes, while other scenario and reverse stress tests may be limited to an ad-hoc or annual basis, as part of the ORSA and business planning processes.

It may also be useful for the SST to have a multi-year cycle, for example with some of the tests run every other year.

Roles and responsibilities relating to the individual tests should be clearly defined – who is responsible for performing, reviewing and approving the test results, and who uses them and how? More widely, the SST framework as a whole should have an owner and a range of individuals responsible for providing input to its development and maintenance.

The Risk Committee would be expected to be prominently involved, steering the process from design through to delivery and challenging the scope and coverage, assessment criteria, and findings and conclusions. The Board would also be expected to review and challenge the results. Clear reporting lines should be set out, for example results might first be reported by the Risk Function to the Risk Committee, with immediate escalation to the Board in the incidence of breaches in risk appetite or tolerance limits.

Initial steps for developing an SST Framework

Development of an SST framework is likely to be a gradual process but, to progress quickly, firms should identify 'easy wins' from the steps set out in this note and implement these first.

Most firms will have existing resources and models which can be leveraged, and simple models could also be developed relatively quickly to cover some of the tests (for example, single-factor, instantaneous shocks, with no allowance for non-linearity, second-order impacts or management actions). More complicated testing can then be explored and implemented in due course.

Maintenance of a detailed development log and adherence to an agreed timeline of updates, as described above, will be important - it will inform and safeguard the future evolution of the SST framework and help with the resourcing and financial planning necessary to achieve this.

How Milliman can help

Milliman consultants have considerable experience helping a wide variety of firms to develop their SST frameworks. We are therefore well-placed to benchmark firms' approaches against the rest of the industry, and provide further insight and advice on any of the areas covered in this note in a way that is tailored to clients' individual circumstances and needs.

We would be happy assist you with planning the development of an effective SST framework and / or with the implementation process should this be considered helpful.

If you have any questions or comments on this paper, or on any other aspect of your risk management practices and framework, please contact any of the consultants below or your usual Milliman consultant.

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