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Stress and Scenario Testing

Insights, Challenges and Opportunities

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17 November 2017

Embracing Challenges for Growth and Opportunities
58th Annual Convention of the Actuarial Society of the Philippines

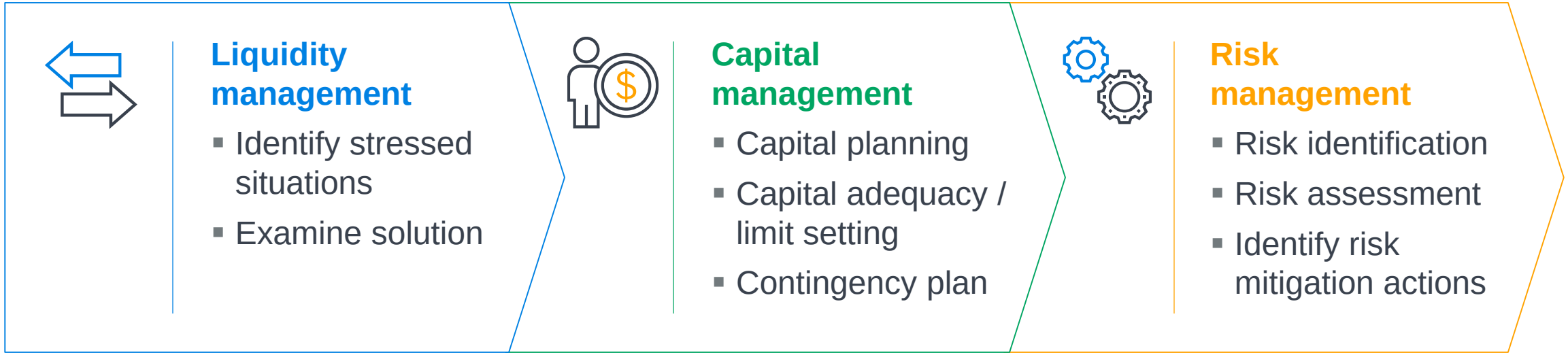
Agenda

1. Stress testing as a regulatory requirement
2. Approaches to determine stress testing scenarios
3. Developments in the Philippines
4. Case study

1. Stress testing as a regulatory requirement

Objectives of stress testing

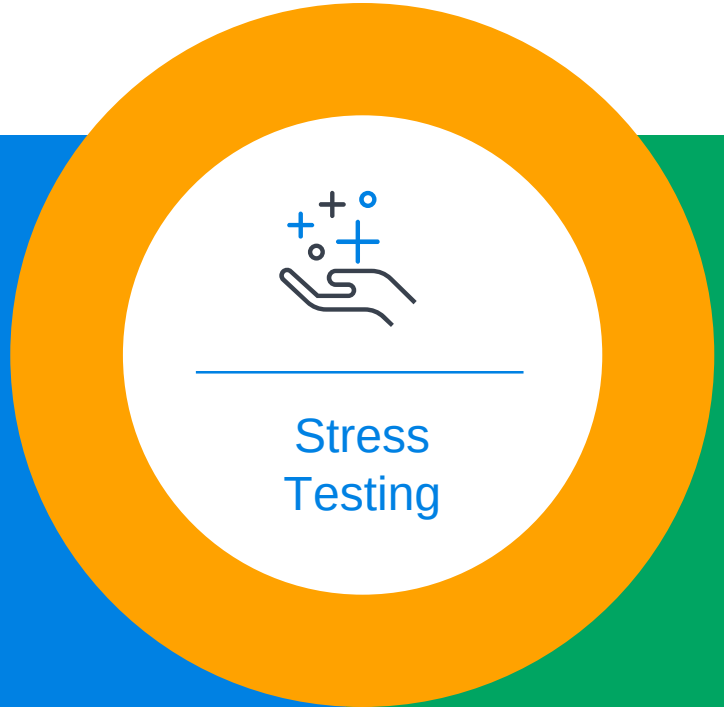
- Stress testing allows companies to examine their financial / solvency positions under stressed scenarios.
- Common objectives for using stress testing include:



Stress testing required by regulators

Regular Disclosure

- Disclose insurer's solvency position under prescribed stress scenarios annually.



More Severe Scenarios

- Some countries require regulators to perform further stress testing under with more severe shocks (e.g. ORSA under Solvency II).

The requirements for regular disclosure for some countries are highlighted in the following slides, the considerations and requirements are similar across regimes.

Regular Disclosure - Hong Kong

Dynamic Solvency Testing

Scenario	Descriptions	Compulsory
Base Scenario		✓
Prescribed Scenarios	▪ 6 simple scenarios Mortality and morbidity risks / Persistency risks / Drop in interest rates / Rise in interest rates / High plan growth rate / Low plan growth rate ▪ 3 compound scenarios	✓
Additional plausible adverse scenarios	▪ Operational Incidents ▪ Counterparty default events	Operational risk scenario compulsory for companies with unit linked business

Source: Actuarial Guidance Note ("AGN") 7, The Actuarial Society of Hong Kong ("ASHK")

Regular Disclosure - Singapore

Stress Testing

- In Singapore, the regulator examines also the impact on liquidity of the insurers:

Scenario	Descriptions	Compulsory
Base Scenario		✓
Short-term Scenarios	▪ Specified macroeconomic scenario ▪ Specified financial crisis scenario ▪ Specified flu pandemic scenario ▪ Specified insurance-related scenario ▪ Self-select scenario (for general insurer only)	✓ (Slight different requirements between life and general insurers)
Liquidity Scenario	▪ Specified Economic Scenario with Loss of Confidence in the Financial Institution	For life insurers only

Source: Circular No. ID 02/15, Monetary Authority of Singapore ("MAS")

Regular Disclosure – United Kingdom

Stress and Scenario Testing

- In UK, the regulator also examines the solvency of all insurers in aggregate to understand the system-wide impact:

Scenario	Descriptions	Level
Supervisory stress testing	**UK regulator may formulate macroeconomic and financial market scenarios for specific high impact firms** on a regular basis to assess their ability to meet minimum specified capital and liquidity requirements	Individual Insurer
System-wide stress testing	Undertaken by firms using a **common scenario** for financial stability purposes as a means of gauging the system-wide effects of stresses and second order effects	Aggregate of Insurers

More severe scenarios - United Kingdom

Firms' own stress testing: Reverse stress-testing

- In order to identify and consider scenarios that would lead to an insurer's business model becoming unviable, the regulator also requires the insurers to carry out **reverse stress testing**.
- Risk drivers which are most critical to insurers' business are identified and heavily shocked until the firm reaches a point of failure.
- The risk drivers could be but are not limited to the followings:

1. Credit risk	2. Market risk	3. Liquidity risk	4. Operational risk
5. Insurance risk	6. Concentration risk	7. Residual risk	8. Securitisation risk
9. Business risk	10. Interest rate risk	11. Pension obligation risk	12. Group risk

On top on regulatory requirements

Internal practice of insurers

Example 1 – MNC in Asia

Background

- This company has set up its internal economic capital for ERM purpose and applies consistently on its operations in different countries.

Application of stress testing

- As a part of the economic capital framework, economic and non-economic variables affecting the profitability / solvency of the business operation are stress-tested to determine the capital to be held by the company.
- For example, the required capital to be held with respect to interest rate curve being shocked.

On top on regulatory requirements

Internal practice of insurers

Example 2 – Global reinsurer

Background

- A reinsurance company uses the reverse stress testing approach to determine the exact scenario where its margin of solvency plus present value of profit will become zero in 3 years time, as they find the prescribed scenarios under the regulatory required stress testing not severe enough to their business.

Application of stress testing

Reverse stress testing has been employed with the following steps:

Step 1: Identify the most significant reinsurance treaty, which accounts for around 70% of its profit in the previous financial year.
Step 2: Identify the key assumptions that drive the profitability (expense, claims ratio, lapse rate)
Step 3: Determine the exact rates for the assumptions identified under Step 2 through iterations.
Step 4: Identify the probability of occurrence of this event and come up with plans to mitigate risks.

2. Approaches to determine stress testing scenarios

How Stress Testing is carried out?

1 Comprehensive

- Stress test should be comprehensive enough to capture the business of the insurer operator

2 Plausible Adverse Scenario

- Plausible adverse scenarios for stress testing should be events with probability of occurrence that is not too remote and have a significant impact on the financial position.

3 Single and Scenario factors

- Stress testing must cover sensitivities to single factor as well as scenarios of multiple risk factors and take into account second order effects.

4 Stress Test Magnitude

- Magnitude of stress test should be greater than potential losses over one business cycle.

Stress Testing and Plausible Adverse Scenarios

Key Points

Stress Testing

- **Assumptions** for stress testing must be **consistent with results** from the comprehensive **risk assessment** to ensure that they are **realistic**.
- Incorporates **future changes in risk profile** arising from planned business activities over the projection period.
- Takes into account **current business** and **economic environment**, **emerging trends** and **historical movements** in key risks.

Plausible Adverse Scenarios

- Insurer operators should get **input** from **wide range of possible sources** to generate and select the plausible adverse scenarios.
- Must be **comprehensive** taking into consideration the **company's risk profile, quality of risk management** and **operating environment.**
- Scenarios should also reflect the degree of **uncertainty** and **credibility** of supporting data and input.
- Insurer operators should ensure that **systems**, **methods** and **parameters** used in the simulations and the resulting scenarios are **appropriate** if scenarios are generated using simulation methods.

General approaches to determine scenarios

From market-wide to company-specific, from the historical event to the future

Scenarios for stress testing

As a key input to stress testing and also the overall ERM process, scenarios can be constructed by looking at the historical events, macro-economy, individual portfolio, and the operation of the company.

Scenarios Construction for *known risks* - Variables

Scale

- Global event
- Market-wide event
- Group specific
- Company specific

Driver

- Single risk factor
- Multi risk factors
- Event

Timeframe

- Instantaneous
- Single period
- Continuous

Internal risk identification for unknown risks

General approaches to determine scenarios

Explanatory Power

Complexity and Explanatory Power

Scale	Driver	Timeframe
Company specific	Single risk driver	Instantaneous
Group specific	Multi risk drivers	Single period
Market specific	Event	Continuous
Global event		

- Once decided the scale, driver and timeframe, we could then use different approaches to construct realistic risk scenarios.

Approaches to construct scenarios

For known risks

Event driven

- Historical event
- Synthetic event
- Multi-events

Risk driver driven

- Single risk driver scenario
- Multi-risk drivers scenario

Statistical approach

- Monte-Carlo simulation

Reserve stress test

- Based on specific risk drivers identified to be the key drivers, with stress level severe enough to give raise to a specific amount of financial loss (common to use the point where the solvency ratio of the company is zero)

Approaches to construct scenarios

Event driven approaches – example

Event driven

- Historical event
- Synthetic event
- Multi-events

Historical event

- Developed based on a historical event, for example the financial crisis of 2007-2009 or H5N1 pandemic.

Synthetic event

- Based on hypothetical conditions that may not be observed recently but can be tailored to specific situations, even in form of a “forward-looking” scenario.

Multi-events

- A mix of impacts from more than one event which could be historical or synthetic.
- Another way is to assume an event will lead to a cascade of further events which bring adverse impact to the company over a period of time. In this case, management actions / policyholders’ behavior can be assumed or assessed.

Approaches to construct scenarios

Risk driver driven approaches – example

Risk driver driven

- Single risk driver scenario
- Multi-risk drivers scenario

Single risk driver scenario

- More common for regulatory purpose, for example under Hong Kong Dynamic Solvency Test, one of the scenario is 15% deterioration in mortality / morbidity rates.

Multi-risk drivers scenario

- Capture the interaction between risk drivers, another scenario under the Hong Kong Dynamic Solvency Test is a combination of:

  (1) 15% deterioration in mortality / morbidity rates
  (2) 15% fall in bond yield
  (3) 25% fall in equity index

Approaches to construct scenarios

Statistical approach – example

Statistical approach

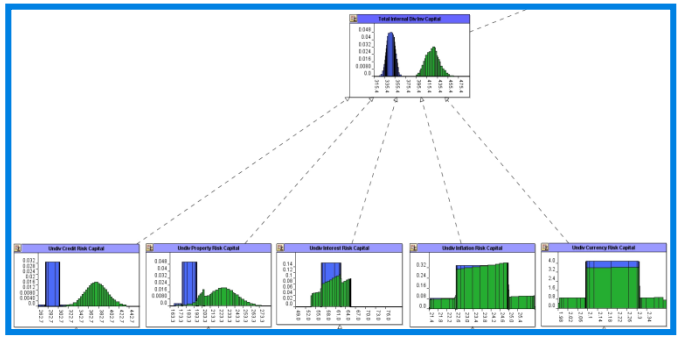
- Monte-Carlo simulation

Step to perform Monte-Carlo simulation

- **Step 1:** Simulate repeatedly a random process for selected financial variable(s) covering a wide range of plausible situations.
- **Step 2:** Using the output from Step 1 as an input, calculate the output from known, pre-specified probability distributions.
- **Step 3:** Calculate a range of possible portfolio values and calculate the corresponding risk metrics (e.g. VaR / CTE).

Example: Stock price simulation

- **Model:** Geometric Brownian Motion (GBM) model
- **Formula:** Change in stock price = $\Delta S_t = S_t\left(\mu\Delta t + \sigma\varepsilon\sqrt{\Delta t}\right)$



The risk metrics on portfolio values can be calculated when the different asset prices are simulated.

Approaches to construct scenarios

Reverse stress test – example

Reserve stress test

- Based on specific risk drivers identified to be the key drivers, with stress level severe enough to give raise to a specific amount of financial loss (common to use the point where the solvency ratio of the company is zero)

Difference with ordinary stress testing

- Stress testing

- Reverse stress testing

Example

- An insurer is concerned about its exposure to equity given they have recently launched a flagship high-equity whole life product.
- The insurer uses reverse stress testing to identify the equity market movement such that this block of business starts to be loss making.
- The probability of this event and corresponding risk mitigation plan can then be identified.

Approaches to construct scenarios

For unknown risks

- Apart from the known risks which companies could determine how to shock the corresponding variables, there are also some risks are unknown and happen in rare occasions (“Black swan events”)
- For example, there are some risks that are usually not quantified but could bring huge losses, including:
  1. Operational risk
  2. Strategic risk
  3. Reputational risk
  4. Regulatory risk
- Without going into some very sophisticated approaches, it is also efficient to capture these risks during the risk identification process as a part of company’s ERM frameworks. Common approaches used to identify risks include:
  1. Brainstorming
  2. Independent group analysis
  3. Delphi technique
  4. Focus groups

3. Developments in the Philippines

RBC development

- Regulators interested in protecting the rights of the policyholder and ensuring that the insurer maintains appropriate liquidity and solvency positions to meet maturing liabilities arising from claims and acceptable level of risks.
- Insurance Commission improving regulatory framework in the Philippines through the revised RBC2.
- While Pillar 1 on quantitative requirements being implemented, Pillar 2 (governance and risk management requirements) and Pillar 3 (disclosure requirements) being developed.
- Solvency requirements: transition from 95.5% confidence interval in 2017, to 97.5% in 2018 and 99.5% in 2019.
- More stringent capital and reserve requirements could significantly bring down the RBC ratio and require a capital build-up or additional capital infusion.
- However, market conditions can deteriorate quickly, combined with policyholder reactions can have severe impact of balance. For example, fall in equities combined with a mass lapse scenario.
- Capital levels can act as financial incidence points, with set management procedures if these levels are breached

Capital Management Plan (“CMP”)

Key elements in a CMP

1 Define capital thresholds

- Triggers for the Company to take action to ensure adequate capital levels are maintained at all times
- Capture important capital levels such as target and minimum capital levels.
- Based on other forms of triggers such as earnings deterioration, single large losses or specified market event.
- Be determined based on internal management criteria or other objective of the company (i.e. to achieve a certain level of financial strength for financial purposes).

2 Define corrective actions

- Should include steps to reduce the level of inherent risk or increase the capital available.
- Corrective actions must be specific, actionable and realistic

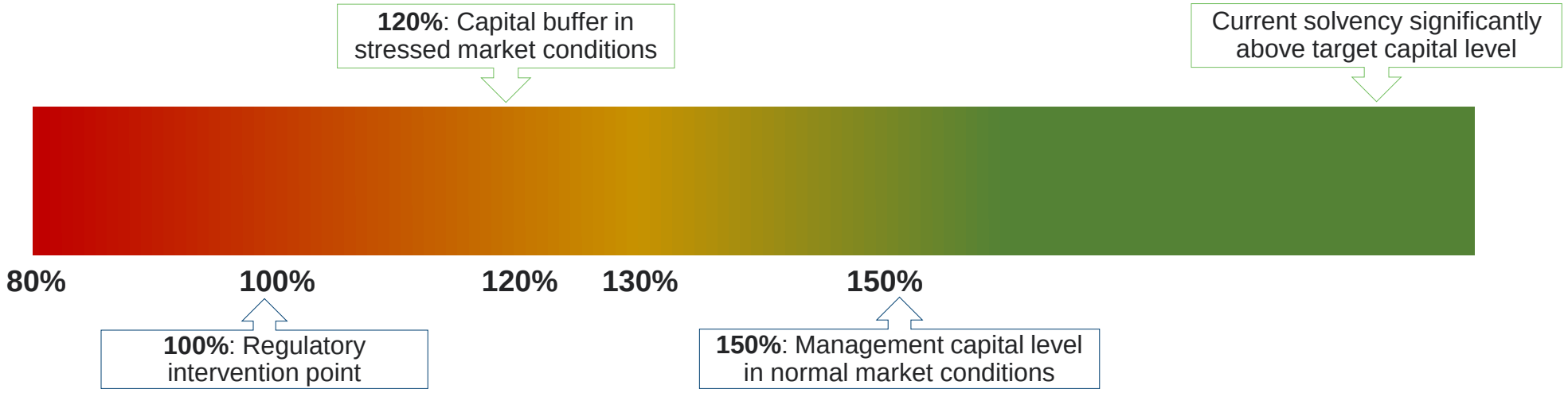
3 Effectiveness of corrective actions

- It must be shown that the Company is able to carry out the corrective actions in the context of the scenarios giving rise to the trigger.
- Intensity of the corrective actions must increase with extent to which threshold is breached.

4. Case study: Use of stress testing

Use of stress testing is assessing capital levels

Management to define capital levels in accordance with its risk appetite…



In the example above, the different capital levels are:

- Regulatory intervention for conventional insurers (100%): if solvency fall below 100% of RBC capital, regulatory intervention can start.
- Stress capital buffer (120%): management chooses to maintain a buffer above the regulatory capital level, to absorb the impact of experience variances and operation incidents.
- Management capital level (150%): under normal market conditions, management chooses to maintain at least 150% of RBC capital level, allowing a minimum buffer of +30% to absorb stress impacts.

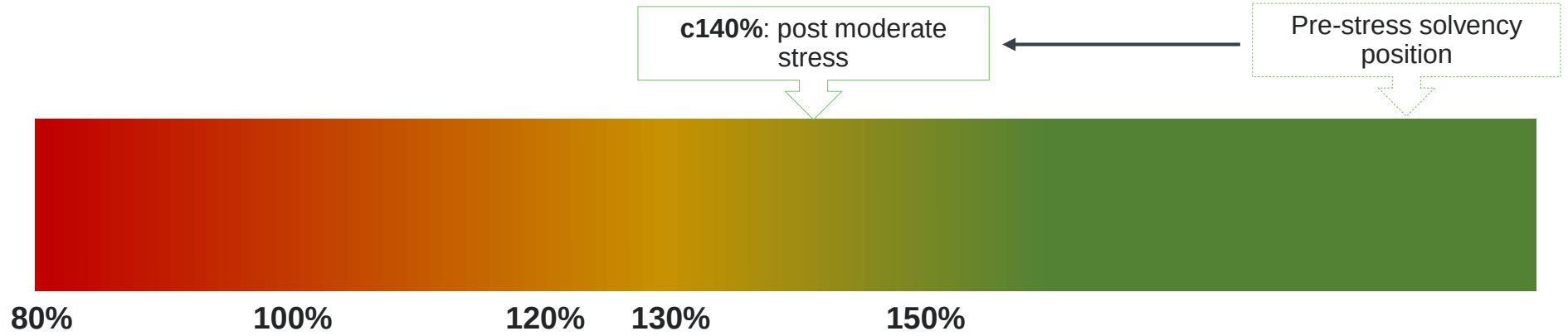
Purpose of stress testing: Moderate stress scenario

The purpose of stress testing should define the severity and parameters of stress and scenarios tested.

Moderate stress scenarios

- Reflective of realistic adverse stresses that can impact a company's balance sheet
- Should be reflective of the nature of the company's activities
- Driven mostly by macro-economic shocks with some allowance for insurance risk shocks

- Assess viability of business plan
- Resilience of balance sheet to endure short-term market volatility
- Assess impact on shareholder dividends, management bonuses and other liquidity requirements
- Determine need for implementing any management actions



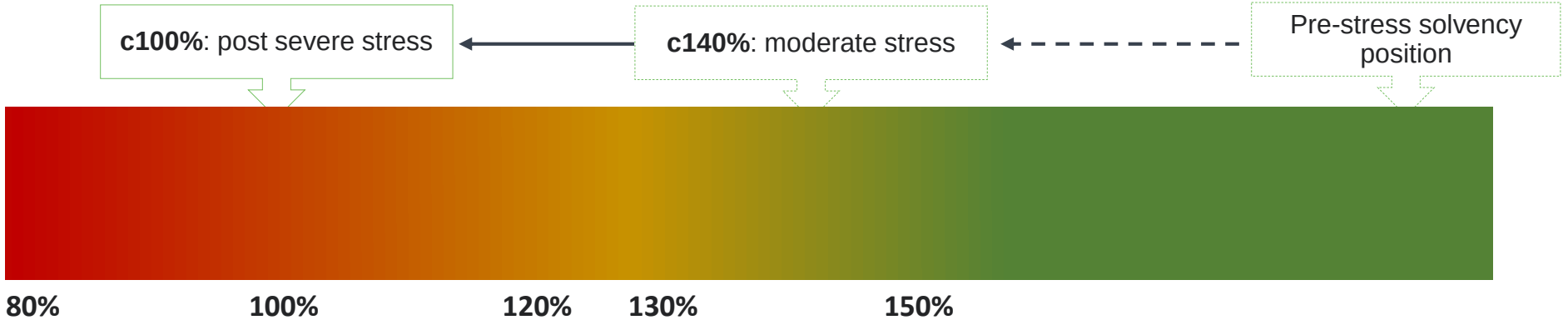
Purpose of stress testing: Severe stress scenario

The purpose of stress testing should define the severity and parameters of stress and scenarios tested.

Severe stress scenarios

- Driven by combined market and non-market shocks reflecting policyholder behavior too
- Idiosyncratic scenarios that reflect activities undertaken by the firm
- Reflective of past financial crises
- Reverse stress testing – define business failure points and assesses scenarios that would breach such points

- Assess resilience of a firm's balance sheet
- Feasibility and credibility of a firm's management actions under stress conditions
- Ability of a firm to restore solvency in stressed conditions
- Develop and assess reasonableness of financial restructuring plan required by regulator
- Assess management information and communication requirements under such conditions



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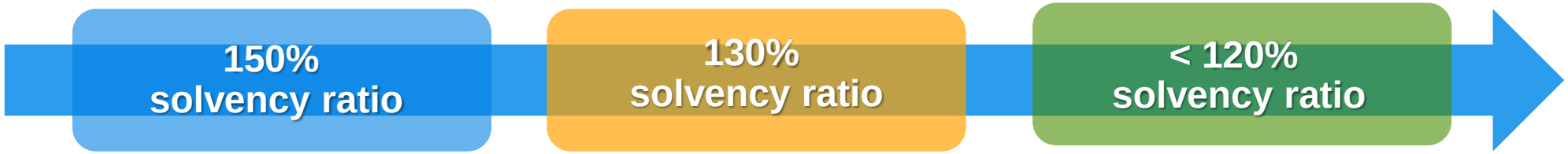
Practical experience

- Not instantaneous shocks
- However, market conditions can deteriorate quickly, combined with policyholder reactions can have severe impact of balance. For example, fall in equities combined with a mass lapse scenario.
- Capital levels can act as financial incidence points, with set management procedures if these levels are breached



- triggers regular solvency monitoring and reporting to management
- Actions such as reserve releases, reduction in expenses to be considered

- Quorum of senior management to meet regularly
- Assess corporate finance actions to implement together with credibility of each
- Actions such as ALM, reinsurance

- Strategic actions to be considered
- Engage with regulator and prepare regulatory response

Recap

1. Stress testing as a regulatory requirement
2. Approaches to determine stress testing scenarios
3. Developments in the Philippines
4. Case study

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Any questions?

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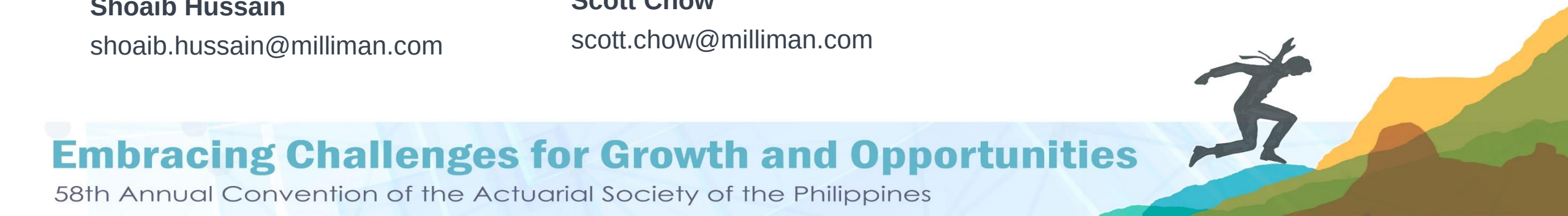

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