Welcome to Milliman’s Virtual Lunchtime Briefing

- The briefing will begin in a few minutes.

1st July 2020
Virtual Meeting Best Practices

- Mute: Keep yourself on mute at all times.
- Video: Keep your video turned off. Only presenters will be on video.
- Q&A: Use the chat function within the meeting for questions.

Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00pm – 12:02pm</td>
<td>Welcome</td>
<td>Rob Frize</td>
</tr>
<tr>
<td>12:02pm – 12.25pm</td>
<td>Recovery Planning</td>
<td>Eamonn Phelan</td>
</tr>
<tr>
<td>12.25pm – 12.50pm</td>
<td>Modernising Actuarial Systems</td>
<td>Joseph Sloan</td>
</tr>
<tr>
<td>12.50pm – 1.15pm latest</td>
<td>Q&amp;A session</td>
<td>Rob Frize</td>
</tr>
</tbody>
</table>

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Recovery Planning for Insurers

Eamonn Phelan

1 JULY 2020
Agenda

- New requirements
- Contents of a recovery plan
- Recovery planning practical challenges and solutions

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The Isle of Man Corporate Governance Code
Changes on the way

**Financial Management (S.11)**
An insurer must evaluate at appropriate intervals in advance its risks, options and where appropriate, intentions under possible scenarios where the insurer would need to recover from severely adverse circumstances (including its hypothetical insolvency).

**Risk Management (S.36) continued**
The board of an insurer must take any action necessary to ensure that the insurer has a properly considered approach in respect of possible recovery scenarios.

**Risk Management (S.36)**
The board of an insurer must review at appropriate intervals, and at least annually, the insurer’s risks, options and, where appropriate, intentions in possible recovery scenarios.

**In Other Words…**
Insurers must evaluate their recovery risks, options and intentions

- It is a board responsibility to review this at least annually
- It must be a properly considered approach
Recovery plan contents
Contents of a recovery plan
IAIS Application Paper

Three key elements:
- Credible options to cope with a range of severe stress scenarios, including both idiosyncratic and market-wide stress
- Scenarios that address capital shortfall and liquidity pressures
- Processes to ensure timely implementation of effective recovery options in a range of severe stress situations

Contents of a recovery plan:
- Executive summary – Helpful to use tables and flow charts to summarise
- Description of the insurer or group – including operational structure and functions/services that are significant for the continuation of the business
- Trigger framework
- Governance
- Recovery options – “The core of the recovery plan is the menu of options”
  - The range of recovery options would usually include actions to raise capital or other funding, increase liquidity, reduce costs, and enhance risk mitigation
- Communication strategy
- Stress scenarios

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Contents of a recovery plan

EIOPA Opinion

- “In a pre-emptive recovery plan, an insurer sets out the possible measures it could or would adopt to restore its solvency position following a (significant) deterioration” – EIOPA Opinion on recovery and resolution framework, July 2017

- EIOPA considers that pre-emptive recovery plans should, at least, contain:
  - A strategic analysis with a description of the entities covered by the plan
    - Detailed description of the insurer’s legal structure, business model and core business lines. If relevant, a description of the essential functions whose disruption could harm the financial stability and/or relevant economy should be included.
  - Identify a set of possible recovery options to be used across a range of stress scenarios
    - Consider severe stress scenarios to the extent that these are not already covered in the ORSA
    - Combine adverse systemic and idiosyncratic conditions and identify the available recovery options and their feasibility in the stressed scenario
    - Include an assessment of the necessary steps and time needed to implement the recovery measures if needed, including the risks associated with the implementation of the measures
    - Determine whether any preparatory actions might be needed to ensure that the recovery measures can be implemented in an effective and timely manner
    - Include a communication plan covering the communication strategy of insurers with the authorities, public, financial markets, staff and other stakeholders

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Contents of a recovery plan
CBI Consultation Paper 131 – June 2020

“Pre-emptive recovery planning will inform strategic decision-making processes during a crisis - developing a strategy during an extreme stress can limit the scope of the planning, the detail of the review, and the efficacy of decision making.”

<table>
<thead>
<tr>
<th>Draft Regulations</th>
<th>Draft Guidelines</th>
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<tbody>
<tr>
<td>• Review at least annually and on any material organisational or financial change</td>
<td>• Sets out links with recovery planning, with the insurer’s SoG, ERM framework and ORSA</td>
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<tr>
<td>• Board assessed and approved</td>
<td>• Allows for proportionality – nature and scale of insurer but also its systemic importance</td>
</tr>
<tr>
<td>• Confirmation of internal reviews</td>
<td>• Insurers shouldn’t rely on a group recovery plan</td>
</tr>
<tr>
<td>• Monitoring of recovery indicators</td>
<td>• Breakdown of strategic analysis into core business lines, key services, and critical functions</td>
</tr>
<tr>
<td>• Confirmation that the trigger framework can operate reliably under financial stress</td>
<td>• Indicator framework – capital, liquidity, profitability, reserving, market-based, macroeconomic</td>
</tr>
<tr>
<td>• Detailed requirements on plan contents:</td>
<td>• Impact and feasibility assessments for recovery options</td>
</tr>
<tr>
<td>✓ Plan governance</td>
<td></td>
</tr>
<tr>
<td>✓ Strategic analysis</td>
<td></td>
</tr>
<tr>
<td>✓ Recovery indicators</td>
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</table>
Credibility and Feasibility of Recovery Options

The insurer must assess the feasibility of the recovery options. The key factors that might influence an option’s feasibility are:

a) *past experience* in implementing similar measures;

b) estimated *timeframes* for executing recovery options; and

c) *potential risks and impediments* to timely and effective implementation of recovery measures, as well as possible mitigating actions and concrete preparatory measures that can be undertaken to eliminate identified risks and impediments.
Recovery planning: Practical challenges
Recovery Planning: Practical Challenges at a glance

- Obtaining buy-in from all stakeholders
- Defining the scope of the recovery plan
- Spending too much time on the scenarios which could get you into difficulty (the relatively easy part) and not enough on the solutions or ‘recovery options’ (the relatively hard part)
- Generating a shortlist of possible recovery options / not having sufficient expertise in relation to recovery options
- Assessing the feasibility of options in times of stress
- Quantifying the potential impact of recovery options
- Defining the point at which action would be taken

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Challenge 1: Obtaining buy-in from all stakeholders

Common challenges:
- Are there reasonable scenarios that would lead to severe adverse financial distress?
- Does recovery planning add any value?

Solutions:
- Premise of recovery planning is that a breach has occurred – removes any potential for optimism bias or failure to identify an unexpected scenario. The scenarios are more helpful in terms of exploring credibility / feasibility of recovery options in specific scenarios
- Point to past failures of insurers
- Point to examples of how recovery planning can add value
- Explanation of clear regulatory expectations in this area
### Challenge 2: Defining scope of the recovery plan

Solution: Focus on recovery; focus on solvency but don’t ignore liquidity; include operational continuity

<table>
<thead>
<tr>
<th>Recovery vs Resolution</th>
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<tbody>
<tr>
<td>• Regulator authors any resolution plan, and the insurer authors the recovery plan.</td>
</tr>
<tr>
<td>• Some insurers have been requested to produce elements of resolution plans in the past (e.g. Prudential public part available online).</td>
</tr>
<tr>
<td>• CBI has requested some insurers to address aspects of resolution depending on situation.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Solvency vs Liquidity Issues</th>
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<tbody>
<tr>
<td>• Primary focus is on breaches of capital requirements.</td>
</tr>
<tr>
<td>• However, guidance also recommends adverse scenarios should include those in relation to liquidity pressures.</td>
</tr>
<tr>
<td>• Liquidity not always a key risk for certain insurers.</td>
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<tr>
<td>• Proportionate approach but consideration needs to be given to liquidity where it is relevant.</td>
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<table>
<thead>
<tr>
<th>Operational vs Financial Continuity</th>
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<tbody>
<tr>
<td>• Scenarios focus on financial difficulty.</td>
</tr>
<tr>
<td>• However, must ensure both financial and operational continuity throughout recovery.</td>
</tr>
<tr>
<td>• IAIS guidance: include an overview of the insurer including operational business structure, functions and/or services that are significant for the continuation of business</td>
</tr>
<tr>
<td>• CBI requesting information regarding both financial and operational continuity as part of recovery planning.</td>
</tr>
</tbody>
</table>
Challenge 3: Spending too much time on the scenarios and not enough on the solutions (recovery options)

Solution: “Begin with the End in Mind” – Stephen Covey

- What would my options be if we were to get into financial difficulty?
- How would these options work in particular scenarios?
- What governance/operational processes would be needed to execute the plan?
Challenge 4: Generating a shortlist of recovery options

Solution: Know your full menu of possible recovery options, conduct research, seek expertise

Examples of possible recovery options:

- Group finance & Off Balance Sheet Capital
- Cost reductions & Staff Pension Schemes
- Reinsurance, Longevity Transfer & Cat Bonds / Swaps
- Restructuring, M&A
- Repricing & Reviewing charges/benefits
- Closure to New Business, Solvent Run-Off
- ALM, Hedging & Asset Allocation
- Subordinated Debt & Hybrid Capital
- (P)IM, USPs & Unit under-funding
- Equity Capital
- Suspension of Dividends
- Liquidity Options

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Challenge 5: Assessing feasibility of options under stress

Recovery options which seem reasonable during normal conditions may not be feasible during times of stress:

- Availability of desired option
- Counterparty strength during times of macro-induced stress
- Lack of liquidity in the market
- Parent also under stress
- …
## Challenge 6: Quantifying the potential impact of recovery options

Solution: Decide on proportionate approach, document data / assumptions used, seek expertise

<table>
<thead>
<tr>
<th>High Level approach</th>
<th>Point in time approach</th>
<th>Scenario projections approach</th>
</tr>
</thead>
</table>
| • Use a combination of assumptions, expert judgement and approximate calculations to estimate the impact of the recovery option. | • Take a point in time balance sheet/capital position (e.g. YE19)  
• Stress this position such that solvency coverage is less than 100% (YE19*)  
• Recalculate the position following implementation of the recovery option (YE19**).  
• The difference between YE19* and YE19** is the impact of the recovery option. | • Model severe adverse multi-year scenarios showing e.g. breach of SCR (or breach of lower capital thresholds) if not already in ORSA.  
• Then model the scenario following implementation of the recovery option(s) to determine the impact. |

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Challenge 7: Defining point at which action would be taken

Trigger Framework
- Capital
- Liquidity
- Asset quality
- Profitability
- Market
- Macro-economic
- Operational

Systemic Scenarios
- Fall in financial markets
- Persistent low interest rates
- Catastrophic event
- Longevity shock

Idiosyncratic Scenarios
- Adverse move in assets
- Mass lapse
- Counterparty failure
- Rogue trader severe loss
- Major cyber attack

Solution: Leave scope for judgement as there is a balance between prompt action ensuring continuous compliance and potentially temporary / short-term fluctuations

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For more information:


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Actuarial Models

- **Benefits of enhancing Actuarial models:**
  - Reduce costs through automation and harmonisation
  - Risk mitigation
  - Allow for high value resources to do high value work
  - Ability to meet demands from regulators
  - Access to information faster
  - Improved accuracy
Traditional Actuarial Process

1. Obtain Data
   - Policyholder Database
   - Other Databases
   - Excel
   - CSV
   - Market Data

2. Clean + Reformat
   - Proprietary Model Reformat
   - Excel 1
   - Excel 2

3. Explore / Check
   - Excel
   - MI / BI

4. Model
   - Database
   - Proprietary Model
   - Excel
   - Out-of-Model Adjustments

5. Summarise Results
   - Results Database
   - Summary Spreadsheets

6. Make Decisions using results

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Example of a Modernised Actuarial Process

1. **Obtain Data**
   - Policyholder Database
   - Other Databases
   - Excel
   - CSV
   - Market Data

2. **Clean + Reformat**
   - Python

3. **Explore / Check**
   - Python

4. **Model**
   - Python

5. **Summarise Results**
   - Python
   - MI / BI

6. **Make Decisions using results**
   - Automated Summary
   - Audit Trail / Run log

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What is Python?

- General purpose programming language
- Relatively easy to learn
- High level & concise
- Highly Extensible
- Batteries Included
- Open-Source
Trends

Google Trends Keywords 2013 - 2020

- Matlab Data Science
- Python Data Science
- R Data Science
- SAS Data Science

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Case Study 1: Replacing an existing IFRS valuation process using Python

- Previous process:
  - Discounted cash-flow model, Access database and Excel
  - 4 days to complete monthly valuation

- Steps involved in the migration
**Case Study 1: Build Data File**

- **Jupyter notebook**
  - Pandas
  - Numpy
  - Parquet

- **Features:**
  - Loads quickly – 300k rows 200 columns
  - Audit trail
  - Documentation
  - Summary / graphs
  - Automatic checks
  - Output to Excel
  - Current month vs previous month
  - There are no hidden steps or manual interventions

```python
# Import necessary libraries
import pandas as pd
import numpy as np
import os
import time

# Set display max columns
pd.options.display.max_columns = 1000
```

**Steps required**

**Update the following for the current valuation:**

1. Extract location and file name
2. Prices location, file name and valuation date
3. Output folder location and file name
4. If any new product has two coverages, add it to the “double coverages” list

```python
# Define file paths
base_folder = "C:\D\AAA working\Monthly Valuations\December 20XX\"  
prices_folder = "C:\D\AAA working\Monthly Valuations\December 20XX\"  
prices_file_paths = (  
"C:\D\AAA working\Monthly Valuations\December 20XX\prices\Prices_20XX.xlsv",  
"C:\D\AAA working\Monthly Valuations\December 20XX\prices\Prices_20XX.xlsv",  
"C:\D\AAA working\Monthly Valuations\December 20XX\prices\Prices_20XX.xlsv")
```

**Import Datafiles and Fund Prices**

```python
# Import single df
def import_single_df(file_path):
    df = pd.read_csv(file_path, sep=";", parse_dates=True, infer_datetime_format=True, skip_blank_lines=True, na_values="*", index_col=0)
    return df
```

**Calculate Unit Reserves**

```python
# Calculate unit reserves
def calc_unit_reserves(df, fund_df, n_funds_in_datafile):
    for i in range(1, n_funds_in_datafile + 1):
        # Calculate unit reserves
```

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Case Study 1: Discounted Cash-Flow Model

- Jupyter notebook – user interface
- Pycharm
  - Locked down the code!
  - Version control
  - Looks a lot like other modern development environments
- Run and test code
- Examine variables

- Useful tools
  - Numba – speed!!!
  - Pandas
  - SQLite

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Case Study 1: IFRS Model on Python: Main Features (1/2)

- Fully automated workflow for monthly valuation

- Time to produce monthly results:
  - BM
  - AM

  “BM” – Before Migration
  “AM” – After Migration

- 80% reduction in discounted cash flow model run times
  - Pandas
  - Numba: Ultra-fast calculations (3 million policies in 1 hour)
Case Study 1: IFRS Model on Python: Main Features (2/2)

- Fast model build:
  - Reduction in lines of code (1000 lines of Python vs 8000 in original model)

- Accessible data file

- Automated checks and analysis reports

- Interaction with other languages and software e.g. SQL, Microsoft Excel/Access

- Data storage
  - File sizes are very small – save large volumes of policy-level data without overloading servers

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Case Study 2: Solvency II Asset Look-through on Python

- **Previous process**
  - 500+ asset files to look through the asset data and calculate the appropriate standard formula shocks to use
  - Manual and time-consuming process in Excel – 1 week to complete

- **Revised process**
  - Single Python script
  - 1 hour to do the full end-to-end calculation

- **Python is a great tool for this type of work:**
  - Large data set
  - Identifying data quality issues
  - Speed
  - One location for calculations
  - Informative output
Benefits and Challenges of using Python for Actuarial Models

Benefits

- Time improvements
- Greater end-to-end capability
- Faster run times
- Handle much more data
- Better output
- Risk mitigation
- Flexibility with working with other systems and software

Challenges

- Investment in skills
- Development time
- Less user-friendly interface
- Solutions can require “outside of the box” thinking

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Key Takeaways

- Overcoming technology-related anxiety
- New technologies will open new doors
- Setbacks will occur and clever solutions are required
- Identifying smarter and more efficient ways to work engages the workforce
Improving Actuarial Models

BENCHMARKING
- Modelling best practices
- Assessing model maturity
- Model gap analysis
- Technical reviews

MODEL BUILD
- New products and portfolios
- Change in regulation
- Mergers and consolidation
- Replace legacy systems
- Internal model design and build

GOVERNANCE AND CONTROL
- Control data input and output
- Monitor assumptions
- Creating objective modelling frameworks
- Control existing and emerging model risks
- Model change control

MODEL VALIDATION
- First- and second-line model validation/testing
- Data validation and quality assessment
- System and process validation
- Internal model validation

AUTOMATION
- Model performance and efficiency review
- Data analytics solutions
- End-to-end process build
- Efficient profit attribution and analysis of change

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For more information:


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Joseph Sloan
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Q&A session
Appendix

Background information on recovery planning
When a firm is no longer viable or likely to be no longer viable, and has no reasonable prospect of becoming so

- Regulators typically heavily involved
- Measures to write down obligations

Financial Stability Board (FSB) Definitions

**Recovery Plan:**
“Identifies options to restore financial strength and viability when the firm comes under severe stress”

**Resolution:**
“When a firm is no longer viable or likely to be no longer viable, and has no reasonable prospect of becoming so”
IAIS Definitions
International Association of Insurance Supervisors

**Recovery Plan:**
“a plan that identifies in advance options to restore financial strength and viability if the insurer comes under severe stress”

**Resolution:**
“Any action by an authority, with or without private sector involvement to deal with serious problems in an insurer or insurance group that imperil the viability of the insurer or the insurance group.”
“Recovery planning can also be a useful tool for other insurers, to make crisis management and thinking about recovery options a more explicit part of enterprise risk management.”

—IAIS October 2018
“Recovery planning is, therefore, an important part of the overall risk management process of insurers and should be considered a governance arrangement within the meaning of the 2015 Regulations”

— Ed Sibley, Deputy Governor, CBI, 27 September 2019
Recovery and Resolution Regime (EIOPA)

- Finance
- Legal
- Risk
- Operations / IT
- Actuarial
- HR & PR

Identifying barriers to resolution
Information Gathering
Liaising with regulator

Resolution Plan

Drafted by the company
Drafted by the regulator

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