


Stress Testing and Capital Modelling

C-21: Stress Testing – Making the Most of this Risk Management Tool
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Agenda

- Stress tests overview
 - What is a stress?
 - A little regulatory history
 - Stress test process
- Stress tests in conjunction with capital models
 - Why include stress scenario with a stochastic model
 - How to overlay the scenario in the model
 - Limitations
- Final thoughts
- Questions

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Definition: What do we mean by stress?

- **Sensitivity** – Given an x% change in a KPI results in a y% change in capital
- **Stress** – Severe yet plausible event
- **Scenario** – Collected set of stress to make one overall scenario
- **Reverse stress test** – A stress scenario constructed to a predetermined outcome
- **Stochastic Stress** – Severely adjust stochastic distributions for use in a stochastic capital model

Source: Lars Moomann, Munich RE, Stresses and scenarios in the context of ORSA towerswatson.com © 2015 Towers Watson. All rights reserved. Proprietary and Confidential. For Towers Watson and Towers Watson client use only. 3

Example and Scale of Scenarios

	Example	Usage
Single Factor Sensitivity	1 bp change in interest rates, small drop in equity markets	Shortcut for analytical calculations
Multi Factor Sensitivity	1 bp change in interest rates and small drop in equity markets	Shortcut for analytical calculations
Single Factor Scenario	Medium sized change in interest rates, airplane accident	Simple events without cascade of further events, supports setting risk appetite, strategy to cope with mild events
Single Factor Multi Period Scenario	Medium sized change in interest rates	Simple events going on over longer time horizon, supports setting strategy to cope with changes in economic/ business environment
Multi Factor Single Period Scenario	Mid-sized Nat Cat	Complex event, supports risk management, risk appetite and strategy setting
Multi Factor Multi Period Scenario	Changes in economic environment	Complex event, supports risk management, risk appetite and strategy setting
Multi Factor Stress Scenario	Terror event, large Nat Cat	Complex events, risk management, risk appetite and strategy to cope with catastrophic events
Multi Factor Multi Period Stress Scenario	Grave pandemic, large financial catastrophe	Complex events, risk management, risk appetite and strategy to cope with catastrophic events and changes in economic/ business environment

Complexity and Explanatory Power
↓

Source: Stress Testing and Scenario Analysis, July 2013, International Actuarial Association
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- ### Development of Stress Scenario Requirements
- 1992 – Office of Federal Housing Enterprise Oversight Stress testing
 - 1996 – Basel II banking regulations highlighted stress testing
 - 2001 – Included as a formal process in the IMF Financial Sector Assessment Program.
 - 2008 – Financial Crisis
 - 2009 – Supervisory Capital Assessment Program (SCAP)
 - 2010 – Dodd-Frank Wall Street Reform and Consumer Protection Act (DFAST)
 - 2011 – Federal Reserve Comprehensive Capital Analysis and Review (CCAR)
 - 2012 – CCAR Expanded to a much larger number of institutions
 - 2014 – Non-Bank Structurally Important Financials Institutions Included in CCAR
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- ### Fed Stress Tests: DFAST and CCAR for insurance
- DFAST (Dodd-Frank Act Stress Test)
 - Predefined Economic Scenarios
 - Companies add additional liability stresses to the economic
 - All financial institutions (bank holding companies) with total consolidated assets of \$10 billion
 - 3 scenarios: Baseline, Adverse and Severe Adverse
 - CCAR (Comprehensive Capital Analysis and Review)
 - Similar to DFAST but includes capital outflows and capital planning actions
 - Same scenarios as DFAST
 - Applies to institutions above \$50 billion in assets
- Most insurance companies won't be affected by this but can view these as good examples to follow when developing a stress testing program**
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Stress Scenarios Process

1. **Development of Stress Scenarios**
 - Macro Economic Stress
 - Asset
 - Liabilities
2. **Evaluate the financial effects of the scenarios**
 - Direct Financial (Assets)
 - Indirect Financials (Liabilities, inflation)
 - Other Knock on effects (Regulatory action, capital costs)
3. **Communication with Leadership**
 - Review outcome and results
 - Risk Appetite and tolerances
4. **Identifying and recommending management decisions**
 - Identify actions and gaps to be mitigated
 - Risk transfer / Mitigation

Source: Lars Moomann, Munich RE, Stresses and scenarios in the context of ORSA
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Understand the dependencies of a scenario

```

    graph LR
      IR[Interest Rates] --> GDP[GDP]
      IR --> INF[Inflation]
      CE[Catastrophic Events] --> GDP
      CE --> INF
      GDP --> ER[Equity Returns]
      INF --> ER
      ER --> CF[Claims Frequency]
      ER --> CS[Credit Spreads]
      ER --> RD[Reserve Development]
      GDP --> CF
      GDP --> CS
      GDP --> RD
      INF --> CF
      INF --> CS
      INF --> RD
  
```

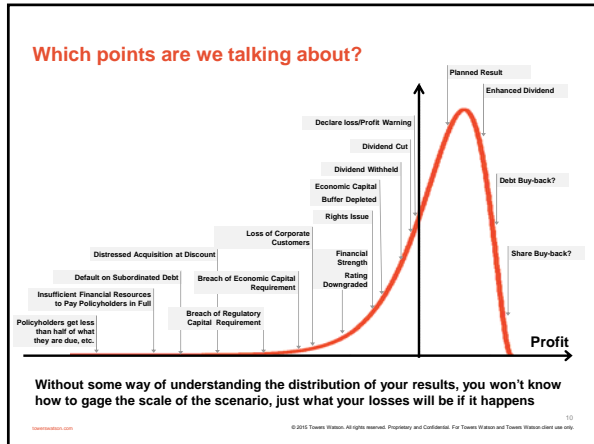
- Scenario need to be developed in conjunction with the assumed effects of the scenario
- They also provide an excellent way of capturing very remote probability events (Catastrophe and Severe Financial Stress)

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Communication, Risk Appetite and Management Actions

- Stress and scenario testing can be easier to discuss with management than probabilities and stochastic results
- It is critically important to view the results of the stress test in conjunction with management and their overall risk appetite
- The stress results will only tell you how you did in those events and won't tell you how much capital you should hold, especially if you have not specified the scenarios well
- With proper scenarios it can give management good information for planning actions and deciding what risk options to use going forward
 - Risk Transfer, reinsurance, contingent capital, exposure management
 - De-risking the business
 - Allow the business to prepare options before getting into a crisis

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Selecting Scenarios

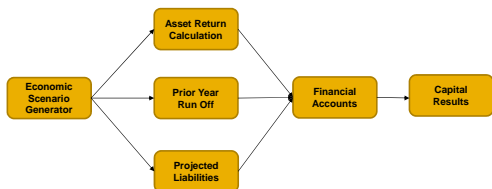
- Scenarios can be compared against the stochastic distribution used by the capital model

	Values			Percentiles vs ESG		
	Baseline	Adverse	Severe	Baseline	Adverse	Severe
12/31/2016						
CPI	2.3%	4.0%	1.9%	88.4	98.3	79.8
Prime Rate	5.4%	7.5%	3.2%	91.4	99.9	3.3
10 Year Treasury	4.0%	5.4%	1.9%	94.6	99.8	24.6
Equity Returns	1.3%	-1.3%	9.9%	50.4	36.3	87.9
12/31/2017						
CPI	2.4%	3.6%	1.6%	71.5	88.3	52.1
Prime Rate	6.2%	8.4%	3.2%	83.9	98.2	3.2
10 Year Treasury	4.3%	5.8%	2.3%	89.7	98.5	36.3
Equity Returns	1.3%	1.3%	6.9%	49.1	49.3	76.5

- Stress Test and Capital models**
- The capital model provide an ideal source for developing and calculating your stress results, provided the model allows for deterministic runs
 - Using stress scenarios eliminates discussion around probability of certain events, allowing companies to focus and evaluating then risk and prioritizing events for further study
 - Most capital models should allow for sensitivity testing of the parameters and distributions, and can work with stressing the same distributions
 - A model should also be capable of running a specific scenario through the financial statements and results
 - Using the same model for both stochastic simulations and deterministic stress tests will ensure consistency between the calculations
 - The distributions and parameters developed for the capital model should be an input to the scenario development process
 - Does not have to be a stochastic capital model

Standard Capital Modeling Process

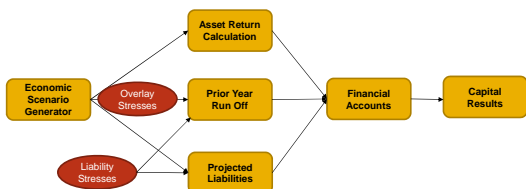
- A stochastic capital model will already include integration of the economic scenarios with the asset results and the liabilities
- Model logic should allow for sensitivity testing and entering stress scenarios in addition to running stochastic scenarios



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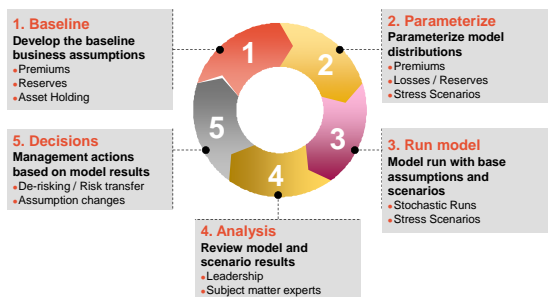
Integration of the scenario

- Depending on the model, you should have options to use a fixed scenarios and have those scenarios flow through model logic
- Liability scenarios need to include effects on the premiums and expenses and not just losses to most accurately reflect the stress



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Integration of scenario and capital modelling processes



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Integration with the Capital Model

- Using the capital model with stress scenarios provides for a consistent frame work for evaluating risk
- Economic scenarios can be generated from the economic scenario generator and compared with selected stress scenarios
- Eliminates duplication of effort for calculating model results
- Provides consistent processes for inputs and output managements
- View the scenario in context with the simulated results
- Provide management with more context around both the scenarios and the simulated results

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Final thoughts

- Stress tests are a useful tool for evaluating how a company will perform in a specific scenario or under a specific set of
- They will tell you how much capital you need to survive the specified scenario
- They will not tell you how much capital you need to hold, a stochastic capital model along with management risk appetite is necessary
- The stress scenarios can be used to test events and scenarios that may not be common in a simulation, they also can provide year-to-year consistency
- They should be included as part of any capital modelling and risk management program at a company
- ORSA reports may rely heavily on scenarios for communicating results even in the capital model is not stochastic

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Any Questions?

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