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Internal Model Validation

Market Workshop

22/05/2017

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Overview

Validation report reviews - a snapshot

- Market meets minimum standards for validation, following resubmissions in February where required
- Reports have ranged from the bare minimum to a high quality
- Material issues addressed in less than a month in some cases!
- Length of the reports more manageable
- Information in the reports more appropriate
- Overall standards of validation have been improving
- Common themes/issues still exist though

Lloyd's central validation – common themes

- Validation of Lloyd's Internal Model had the following themes which agents should also be mindful of:
  - Timing: model runs and documentation preparation available prior to validation assists robust review
  - Project management and validation plan key
  - Inquisitiveness; ask questions, peer review across the actuarial and wider teams pre validation
  - Documentation; ownership and track validation / Lloyd's recommendations
  - Risk profile; pre-empt annual formal validation by considering model development through the year

Validation Review Themes

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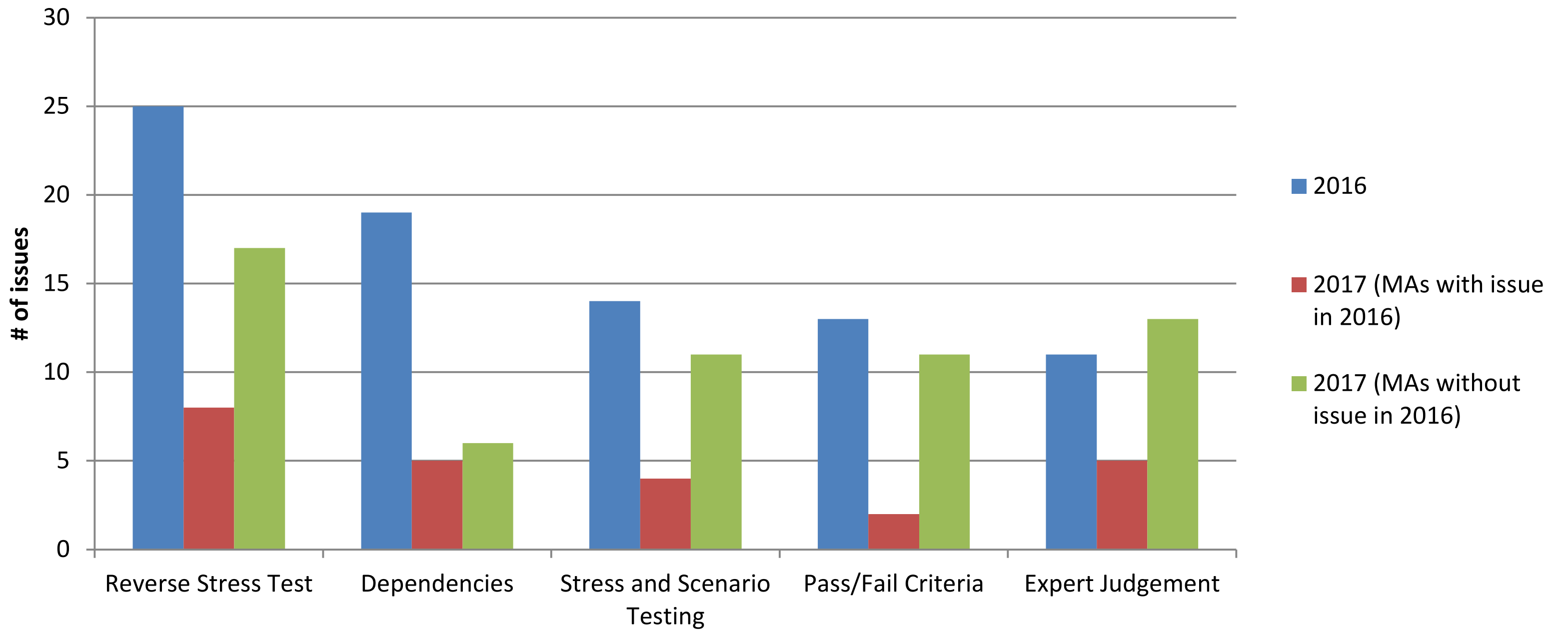
Validation report reviews - top 5 material issues

The below graphs shows the number of material issues raised during the initial 2016 YoA and 2017 YoA reviews grouped into high-level categories:



The 2017 YoA issues are split by whether the managing agent had an issue in this **category** in the 2016 YoA review or if they did not.

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Validation report reviews - common themes

- Reverse stress tests continue to be an issue

- Similar categories of issues but different problems
  - Now more around presentation of information

- Main challenge…to get the balance right
  - Adequate and precise report
  - More information requested by Lloyd's/PRA
  - Solution…validation pack/consider feedback
  - Solution…better sign-posting/create an index

Required tests

- There are a number of tests required to be carried out by SII directive, Lloyd's requires the following to be performed annually:
  - P&L attribution
  - Reverse stress tests

- Reconciliation of model output required by Lloyd's
  - SBF and LCR mean profit
  - Loss ratios in SBF and LCR
  - Information in LCR and supplementary questionnaire

- There were a number of examples where these tests had not been performed until requested by Lloyd's

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Reverse stress tests - purpose

- Why do it?
  - Typically, a large suite of validation tests are carried out at class/risk category level along with a set of validation tests for dependency between risk categories
  - In other words each part validated individually, not the entire model in one test
- What is the purpose?
  - Reverse stress test helps look at the overall model
  - It tests all the relationships together
- What value will it add?
  - Sense check of the modelled output
  - Identify any anomalies
  - Tie results from the model to expectations

Reverse stress tests - definition

- Expert is expected to independently estimate the severity and return period of scenario
  - This is challenging given the extreme nature of the event
  - The period predicted by the expert may not be consistent with the modelled return period
- For a combination of material risk drivers, breaking down the return periods of individual risks can aid justification of overall return period
  - E.g. a 1-in-50 reserve risk loss and a simultaneous 1-in-20 market risk loss may be considered a 1-in-100 event overall by the expert, given an element of dependency, however…
  - It is important that the return period is consistent with the basis of comparison i.e. a 1-in-200 operational loss is unlikely to be the main driver of a 1-in-200 loss overall (also important for stress & scenario tests e.g. class vs aggregate distributions)
- Scenario is then compared with individual model simulations

Reverse stress tests - challenges

- Lloyd's released an update to the validation guidance on reverse stress tests last year emphasising a difference in approach to the ORSA
  - … however there was still a wide range of interpretations…
  - … hence this remained a thematic issue
- Particular difficulties occurred in:
  - defining the point of non-viability e.g. some agents considered return periods greater than 1:1000 year
  - setting pass/fail criteria e.g. how similar does the selected simulation(s) need to be, and how close does the return period need to be to the scenario?
- Multiple iterations of resubmissions were sometimes required in order to address Lloyd's material feedback
- Individual circumstances were taken into account during Lloyd's review
- This is one of the areas which is being reviewed as part of an updated validation guidance to be released in June

Reverse stress tests ("meets minimum standards")

- Below shows a RST for a risk profile which has material cat exposure
- For simplicity, point of unviability is defined to be the uSCR = £135m
- Secondary impacts on market/credit/operational risk considered, however weakly defined.

1:200 RST	Scenario		Simulation #	
	Description	**P&L (£m)**	**12345**	**23456**
Insurance Risk			101	108
Catastrophe Risk	1:200 US GoM Windstorm net loss (£120m)		92	114
Ex-cat Premium Risk			6	-4
Reserve Risk			3	-2
Market Risk	Fall in asset values associated with large cat loss		1	8
Credit Risk	Increase in bad debt provision following failure of reinsurer		24	19
Operational Risk	Operational loss associated with large cat loss		7	3
Total		**135**	**133**	**138**

- Conclusion: simulations have been found around the 1:200 return period which are similar to the RST scenario, hence test is passed.
- Test can be developed further…

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Reverse stress tests (good practice)

- Same scenario as before, although more clearly defined quantitatively.

1:200 RST		Scenario		Simulation #	
		Description	P&L (£m)	12345	23456
Insurance Risk			90	101	108
	Catastrophe Risk	1:200 US GoM Windstorm net loss (£120m), offset by expected cat losses (£20m)	100	92	114
	Ex-cat Premium Risk	Ex-cat losses as expected, ex-cat SBF profit (£10m) offsets other losses	-10	6	-4
	Reserve Risk	Reserves run-off as expected (change to risk margin negligable over year)	0	3	-2
Market Risk		Immediate 15% fall in equity market and liquidity issues realising assets	10	1	8
Credit Risk		Failure of second largest reinsurer, with 80% loss given default	30	24	19
Operational Risk		Key underwriter leaves resulting in additional expenses	5	7	3
Total			**135**	**133**	**138**

- Conclusion: within a range of simulations (+/- 50 of the 99.5th percentile) two simulations identified as approximating the RST scenario for the two main risk categories (cat risk and credit risk), hence test is passed.

Pass/fail criteria

- Pass/fail criteria are the basis for which conclusions are reached from validation test outputs (usually pass / pass with limitations / fail)
- They are required to highlight possible limitations of the internal model and/or validation process for escalation
- Hence they need to be clear and robust in order to work effectively (i.e. so that limitations are not overlooked)
- Generally the criteria for quantitative tests are becoming more objective. However, criteria for qualitative tests remains a challenge
- If all tests result in passes, the validation process adds limited value…
  - No model is perfect!

Pass/fail criteria (examples of weak criteria)

- Backtest: Test is failed where the 99.5th percentile of distribution does not capture historic experience (approx. 10 years worth)
  - The threshold-level should be proportionate to the quantity of data analysed
- Sensitivity test: Test is failed when uSCR does not move in the expected direction
  - The criteria should specify the expected magnitude of the movement as well as the direction when identifying material assumptions, i.e. a two-sided range
- Stress & scenario test: Test is failed if return period is not in line with business expectations
  - Return periods should be specified for each stress/scenario (along with severity) prior to comparison to model output
- Pass/fail criteria defined such that the test passes for many different assumptions
  - Difficult to justify selection

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Pass/fail criteria (examples of strong criteria)

- Sensitivity test: Test is failed if movement is outside of 5-10% increase for ultimate underwriting risk or 0-5% increase for uSCR
  - E.g. increase in large loss frequency/severity, attritional CoV/ULR, change in distributions etc.
  - Rationale behind the threshold selected is included.
  - Explanation of the outcome. Why the result is acceptable to the validator.
- Stress & scenario test: Test is failed if scenario is +/- 20% of modelled output at estimated return period
  - E.g. if modelled output was a 1:6 year event in comparison to a 1:50 estimate from the expert this would be treated as a fail

Report format & content

- There is a balance to be struck between brevity for the board and ensuring that the board can gain sufficient understanding and comfort in respect of validation process and results
- Lloyd's also requires a greater level of technical detail to be provided
  - Reference should also be made to previous validation relied upon
- Over time there has been a shift to shorter board reports with additional technical appendices or a separate report provided for regulatory review.
- However the board report should still include:
  - A summary of the testing carried out
  - Test results which have been escalated
  - Validation of SCR(1) as well as SCR(Ult)
  - Key expert judgements & model/validation limitations
- We also expect to see details of how any feedback received from Lloyd's (and other stakeholders) have been considered as part of the latest validation cycle

2017 Timetable

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Changes to capital submissions

- Timetable
  - Quantitative major model changes will be reviewed over summer
  - Market Bulletin Y5083 announced two separate deadlines for 2018 YoA capital and planning submissions
- LCR
  - No changes
- Analysis of Change
  - No changes
- Supplementary Questionnaire
  - New tab to allocate capital between YoA. This will be compared against the allocation produced by member modeller for member capital setting
  - More quantitative claims information on Cyber

	Capital Structure
Group 1	Syndicate with spread member capital and Managing Agents with Special Purpose Arrangements (SPA)
	Syndicates with member consolidation requirements
	Managing Agents with multiple syndicates – where at least one is required to submit on 6th Sept (see above)
Group 2	Syndicates with members who have Letter(s) of Credit (LoC)
	Syndicates with dedicated single member corporate capital

Key dates recap

Submission	Deadline
3 year targeted validation plan	23 June
Major model change reviews	1st June – 15th August
LCR (Group 1)	13 September
Validation report (Group 1)	22 September
LCR (Group 2)	2 October
Validation report (Group 2)	9 October
Final sign-off (Group 1)	20 October
LOC (Group 1 and 2)	10 November
Final sign-off (Group 2)	20 November
Coming-into-line (year-end)	1 December

Key: Red = Market Black = Lloyd's

Targeted Validation Plan

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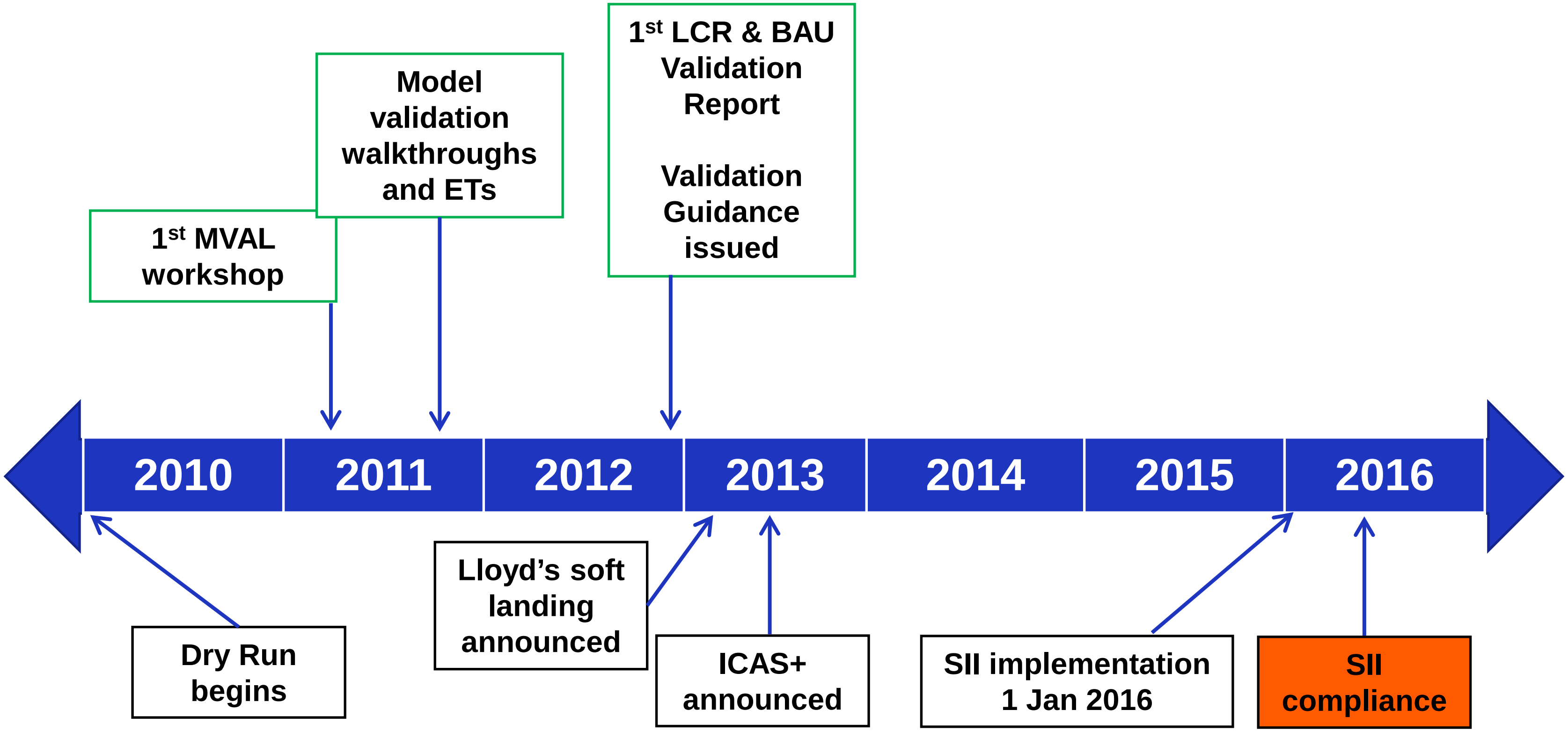
So how did we do?



We have come a long way since 1 Jan 2010…..

Is it time for a change?

Way forward

- Targeted validation
  - Carry out risk based validation
  - Focus on areas that are material
  - A multi year plan to ensure other areas are not ignored
  - Provision for exceptional circumstances
- Top-down validation and board involvement
  - Continue progress and ensure validation report follows a top-down approach
  - This would aid board understanding
  - And increase board involvement
- Major model change/capital reviews
  - Evolution of the process to take into account market feedback and improve efficiency
  - Continuous interaction with Lloyd's via reviewers, committees
  - Timely communication always helps!

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Targeted validation plan

- Submission of a 3 year plan by 23rd June 2017
- First attempt, no template required to complete. But…
  - Board should have sight of the plan
  - Not expected to be too technical…hence detailed description of tests not expected.
  - Important to define the objective
  - Important to describe criteria/rationale for identification of material risks
  - Description of targeted validation should not be restricted to risk categories. Class level information is equally important!
  - Consider differences between validation of modelling methodology, parameterisation and assessment of output
  - Provisions for more detailed validation under exceptional circumstances or following a major model change i.e. identify triggers for increased validation above current plan
  - Scope of individual deep-dive reviews should retain flexibility as initial findings can be used as the basis for further investigation
- Consult Lloyd's if in doubt…
  - Further details can be found in Market Bulletin Y5076

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Targeted validation plan - examples

- Standard tests summarised by year

- It is no longer required to perform every test every year (although you may wish to)

# of tests	Year			
Risk Category	Y0*	Y1	Y2	Y3
Underwriting	33	27	26	29
Catastrophe	14	14	14	14
Reserving	28	22	24	23
Market	14	6	14	6
Credit	8	8	4	4
Operational	6	3	3	6
Dependencies	12	10	7	9
Total	115	90	92	91

* Complete set of tests performed

- Example rationale:

- Cat risk high materiality so all tests performed annually
- For underwriting/reserving risk tests for material classes performed annually while some tests can be cycled
- Market/credit/operational risk medium-low materiality so full suite of tests only performed along with deep-dive (Y2, Y1, Y3 respectively)
- Dependencies full suite of tests performed across 3 years

- Focus on model output so likely to be concentrated over summer

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Targeted validation plan - examples

- Deep-dive categorisation and rotation over 3 years

Risk categories	Modelling methodology	Parameterisation	Output
Premium	Deep-dive/materiality	✔	✔
Reserve	Deep-dive/materiality	✔	✔
RI credit	Deep-dive	✔	✔
Dependency	Deep-dive	✔	✔
Market	Deep-dive/exceptions	✔	✔
Operational	Deep-dive	✗	✔

- Example deep-dives:
  - Risk-driver analysis of dependencies
  - Cat model update/comparison
  - Reserving risk net:gross ratio
  - Claims inflation assumptions
  - PPOs
  - Risk margin alternative methods
  - 1-year emergence patterns
  - Alternative dependency structures
  - Liability/asset granularity analysis
  - Independent RI recovery calculation
  - Review of ESG outputs/assumptions
  - Etc.

- Explain the reason for not doing a deep dive!

Targeted validation plan - FAQs

- Can the deadline be pushed back?
  - No. It would result in delay in Lloyd’s feedback which would leave less time to address any concerns prior to submission in September.
- What is the definition of a deep-dive, and how does this relate/differ to what we already do?
  - It is a detailed level of review of a model component beyond standard validation tests, and may not be very different to what is already done. There is unlikely to be any reduction in work. Objective of the plan is to ensure the validation process every year focusses on material areas.
- What are the requirements for independence from the capital model e.g. the link to model development?
  - Same as before i.e. work can be reviewed by someone independent.

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Targeted validation plan - FAQs

- What level of review are Lloyd's planning to carry out, i.e. are we likely to have to amend the plan significantly?
  - Lloyd's review to ensure the validation activity to be carried is appropriate to identify any material limitations in the model that might lead to understated capital.
- What are the requirements for board oversight (both for the plan and the deep-dives submitted to Lloyd's)?
  - Board should have sight of the plan prior to submission to Lloyd's.
- We already think our validation process is robust given our risk profile, and want to continue to carry out our current tests on an annual basis, is it still a requirement to carry out deep-dives on non-material model components?
  - If certain areas of the model are not planned to be validated over several years, adequate justification should be provided.

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Targeted validation plan - FAQs

- Do we need to produce separate reports for deep dives?
  - Depends on your process and ease of signposting. There is the option to either include it in the validation report or a separate report.
- Do we need to carry out P&L attribution and RST?
  - Yes. Even if the scenarios are not updated, it is expected that it is run on the modelled output prior to submission.
- Are any syndicates exempt from submission?
  - Yes - new syndicates with a new model/ new syndicates on benchmark model/syndicates who need to run the full suite of tests following change in process/Lloyd's feedback/any other relevant reason.

Questions?

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