LLOYD'S

Internal Model Validation
Market Workshop

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Agenda

1. Introduction
2. 2020 Observations
3. Thematic Review Findings
4. Moving Forward
5. Summary

1. Introduction

It is difficult to make predictions, especially about the future
Or is it?

"As we travel more on this planet, epidemics will be more acute – we will have a germ population dominated by a few numbers, and the successful killer will spread vastly more effectively. I see the risks of a very strange acute virus spreading throughout the planet" Nassim Taleb
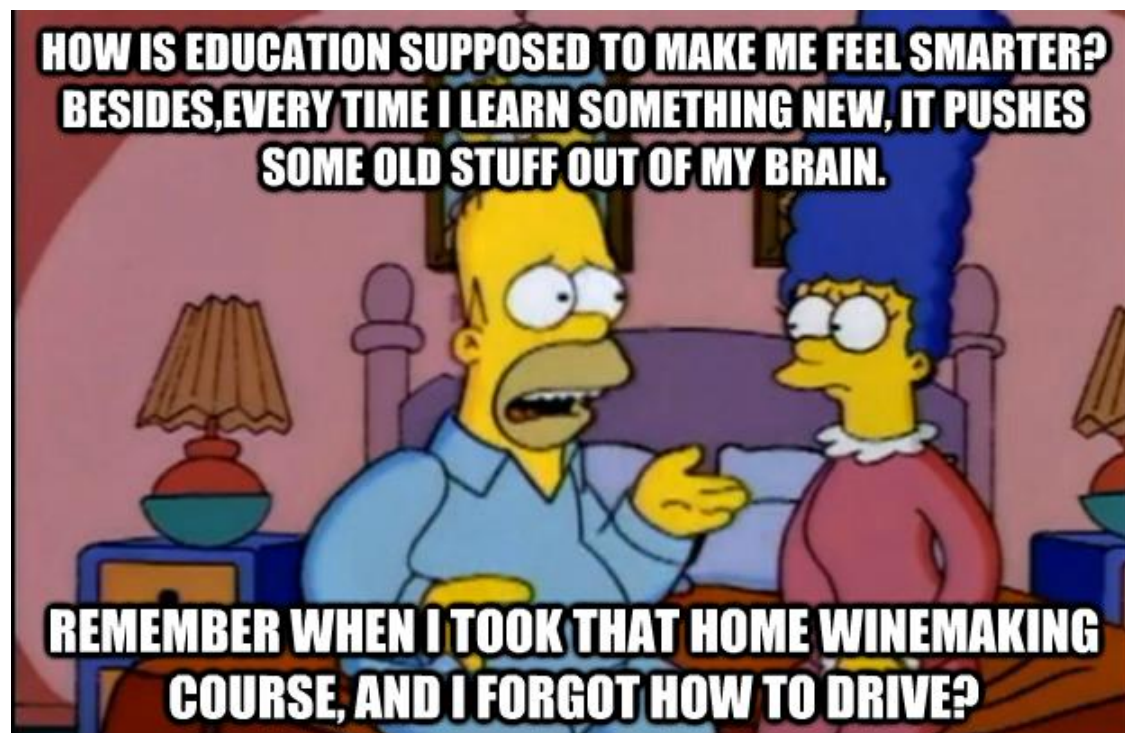
What have we learnt about our risks?

Luckily our jobs are to make clearly justified assumptions and appropriately respond to new information

Consideration of a range of areas is expected:

- Class volatility

- Class correlations

- Asset/liability links – short and longer term

- Operational risk

- Liquidity

- Stress testing

- Near miss?

This might mean that you have to review your current model change and/or validation plans in light of this – the work on risk profile appropriateness should be a priority!

How can we adapt our processes?
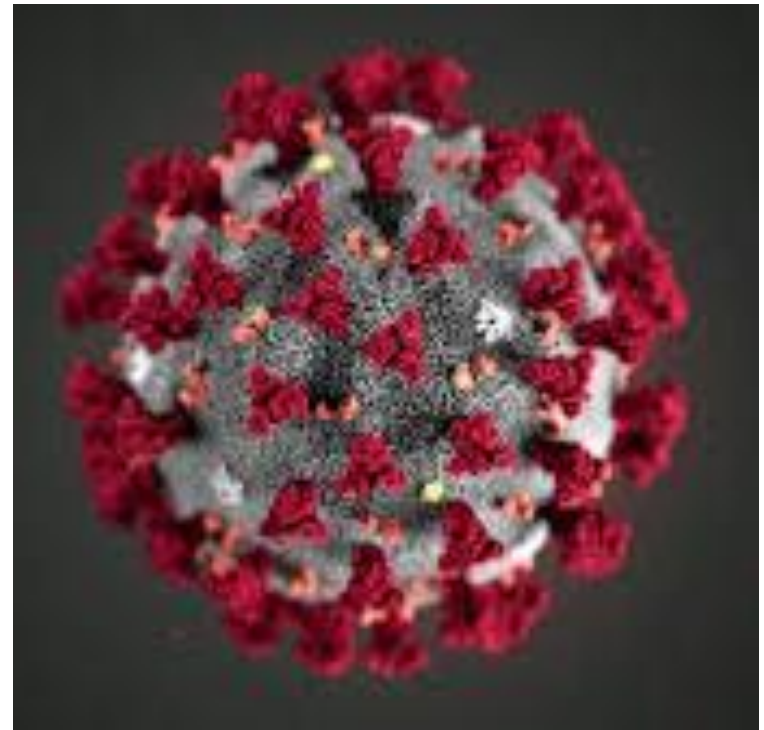
The perfect time for validation processes to be responsive

# Our Focus in 2020

What's the overall picture and what's new?

2. 2020 Observations

2020 YoA validation report reviews

Process… We tell syndicates to keep evolving and we need to do the same!

- 23 syndicates reviewed in detail
  - significantly fewer than in previous years => aim was to ensure all syndicates had a detailed review in the 3-year validation cycle

- The template continues to have 4 broad sections

- We considered a subset of the signposting template to ensure that the syndicates reviewed met validation **minimum standards**

- Reduced number of individual reviews meant a **Thematic Validation Review**, which looked at RSTs and Testing Against Experience, for a large number of syndicates

- Specific sections of validation reports continue to be used during capital review, especially the **Analysis of Change and Risk Type section** when our review throws up questions. Our review will also take into account any findings you have had.

Validation report content	Components of validation
Key validation tests	Thematic issues
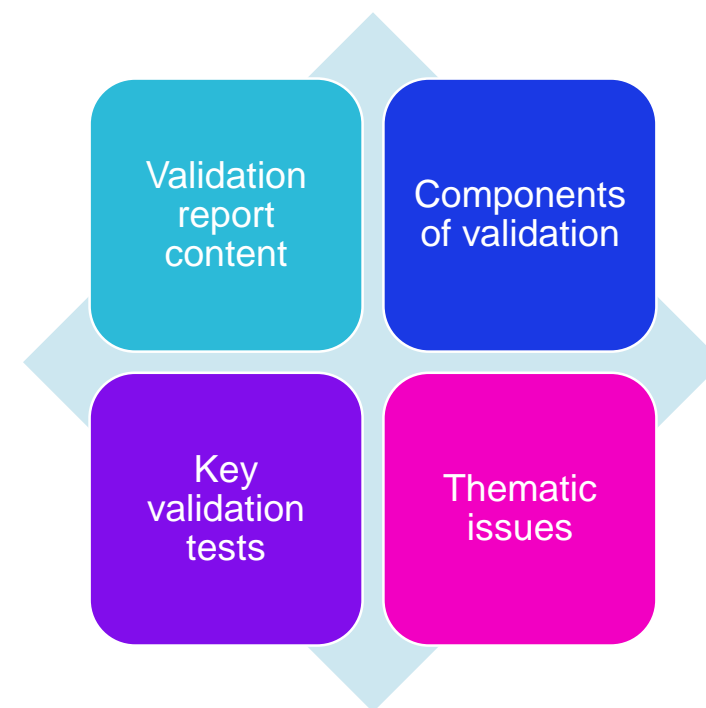
2020 YoA validation report reviews

Feedback focussed on areas of remediation

- **We continued to give prioritised feedback**
  - We didn't send out developmental points
  - Critical issues needed to be addressed immediately, and then a longer time was given to address Material issues

> **Critical** Issues: addressed immediately. Validation report does not meet Lloyd's Minimum Standards. If not resolved, these issues would result in a **Solvency II load** (for March CiL)
>
> **Material** Issues: addressed by the next submission

2020 YoA validation report reviews

High level findings

The top 5 material issues across all 2020 YoA validation report reviews:

Top 5 material issues	
1	Pass/fail criteria
2	Limitations
3	Targeted Validation
4	Range of sensitivity tests
5	Expert Judgements

- Note that Reverse Stress Tests and Testing Against Experience are excluded as they were investigated as part of the thematic reviews

- Proportionally less critical feedback given than last year

- Due to the smaller number of reviews carried out this year, there was no meaningful analysis to be drawn from the critical issues found.

2020 YoA validation report reviews

Feedback on Material Issues

There was a range of material issues that feedback was given on:

1. Pass/fail criteria

- In the vast majority of cases, pass/fail criteria are being defined
- But there are issues with the criteria used in some cases -> subjective, not clearly defined, very difficult to fail

2. Accumulations of less material limitations to a material one

- A number of syndicates have not considered this at all

3. Targeted Validation

- Failure to compare validation done with the 3-year validation plan
- Either poor quality deep dives, or relied upon out of date analysis

4. Range of sensitivity tests

- Syndicates should make clear the distinction between Type 1 and Type 2 tests & carry out a broad range of both types of test

5. Expert judgements

- Syndicates should ensure these are recorded in a log included in the validation report

quality OVER quantity

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3. Thematic Review Findings

Thematic Review of RSTs and Testing Against Experience

Basis of the review

- **Aim** of this was to:
  - Review in more detail areas of validation that most often receive material/critical feedback in order to assist syndicates in improving this area of validation
  - Improve our own guidance
  - Use as the basis of forming best practice

- **High level overview** of RST / Testing Against Experience

- Detailed review of **at least one** RST and one Testing Against Experience per syndicate and one syndicate per managing agent

- Based on **submitted documentation** only
  - Note that there is work to be done on completing the signposting templates!

- Segmented the form of each test into various steps to identify how well each was addressed.

- **Overview** of results (at this Validation Briefing) and **individual syndicate** feedback
  - Aim to identify good practice and common issues, so Market as a whole can benefit from feedback.

Thematic Review of RSTs and Testing Against Experience

Basis of the review – categorisation of feedback

The analysis and feedback was classified as:

- **Critical (C)**: fails to demonstrate that Minimum Standards have been met and must be addressed imminently.

- Material (M): has to be addressed by 2021 SCR submission. This may relate to areas where it is not clear that the testing is sufficiently robust to meet Lloyd's Guidance.

- Developmental (D): potential areas for improvement have been identified which may assist future development of the test.

- - : Testing appears in-line with Lloyd's Guidance and no developmental issues have been identified.

Reverse Stress Tests

Why do we do them?

- Modelling of capital should include risks that could threaten viability of the business

- A type of scenario test to check that modelling captures scenarios that Management consider could make the business unviable:
  - Does model capture the nature of events that might threaten the business?
  - Is the model calibration consistent with independent experts' views of the risks?

- Useful real world assessment of risk

- Solvency II requirement to carry out RST

Reverse Stress Tests

Overview

- Top-down test

- Looks at overall model

- The process for carrying out an RST may look like:
  1. Start with Management considering what could make the business unviable
  2. Independent assessment of the return period of the unviability scenario
  3. Ensure model captures the events considered and that modelling is consistent with the independent assessments.

- Should be refreshed to reflect any risk profile evolution or change in management view.

- Refer back to the ORSA.

Reverse Stress Testing (RST)

Results of Review

Reverse Stress Testing (RST)	Percentage of Syndicates at feedback level				
	-	D	M	C	Total
The model validation process should include a reverse stress test, identifying the most probable stresses that would threaten the viability of the syndicate.	95%	0%	5%	0%	100%
The RST should specify an estimate for the return period, with rationale, for syndicate unviability.	16%	35%	46%	4%	100%
The RST scenario should be specified in terms of the contributions at a suitably granular level (e.g. from each risk category or class).	70%	19%	9%	2%	100%
Secondary impacts (knock-on effects) should be assessed both qualitatively and quantitatively, in addition to the primary drivers of loss.	51%	26%	21%	2%	100%
The pass/fail criteria should be clear, objective and pre-defined.	28%	18%	53%	2%	100%
The test result should be consistent with the test specification and sufficient detail should be given to justify the result.	44%	18%	37%	2%	100%
Overall assessment of the RST.	56%	5%	35%	4%	100%
Total (% of comments)	51%	17%	29%	2%	100%

Positive findings:

- RST is in line with minimum standards

- Improvements seen in recent submissions.

Reverse Stress Tests

Some issues (1)

- ## Setting Pass / Fail criteria
  - These were not always set using objective measures.
  - If a return period is being tested, a pre-defined collar of eligible simulations should be specified around return period.
  - It may help to separate the RST into component tests:
    - Test that the combination of primary event and secondary impacts is captured
    - Objective quantitative tests on the overall capital loss or contributions from risk category components, depending on the form of the independent return period that has been specified
  - Consider the behaviour of losses from material risk categories that would not be expected to be impacted by the RST scenario

- ## Ensure the test is truly independent
  - Rationale for unviability is often not clearly stated
  - Determine the loss for unviability and then determine the return period associated with that loss
  - Does not have to be loss of total SCR
  - Rely on Management input to independently test the scope of the model
  - Do not start with a loss of the SCR amount and then state that the return period is 1:200
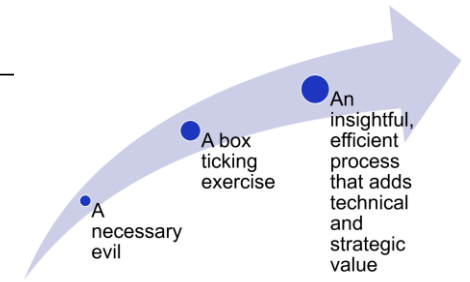
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Reverse Stress Tests

Some issues (2)

- **Granularity of the test**
  - Not always clear what is being tested
    - An overall loss of £100m of capital from any cause vs a loss of £100m arising specific causes
  - Define the scenario at a suitably granular level
  - Look for a simulation that has the characteristics of the scenario
  - The lack of clarity in the test specification means it can be unclear that a test result is consistent with the test specifications
  - Risk category level -> contribution to capital vs standalone?
  - Room for improvement on test documentation
  - Secondary impacts are not always fully considered

Evolution of Validation

Suggestions for improving usefulness of RSTs

A
necessary
evil

A box
ticking
exercise

An
insightful,
efficient
process
that adds
technical
and
strategic
value

Review the RST process!

- Make sure tests are updated to reflect changes in risk profile (review business plans, ORSA…)

- "Richer" story-telling from Board / Underwriters etc. to develop RSTs (*or other scenarios*) – help provide a framework for modelling actuaries to develop their understanding of risk and ensure models reflect key drivers:
  - Consider secondary impacts across all risk categories and other components of risk -> help validate difficult areas such as dependencies.
  - Help communication with key stakeholders. How does the model capture risks -> what can it help measure / understanding -> may help development of model use.
  - Clarity over independent return periods –> can this improve robustness of testing / validation of model components?

- Differences in opinion on return periods is an opportunity to develop understanding:
  - It is not necessarily the case that the model or independent view is right or wrong, but understanding the basis of each view / uncertainties may help improve modelling
  - Identify areas where there is uncertainty, for which additional testing (e.g. Type 2 sensitivity testing) is appropriate.

- Contribution to capital by risk type

Testing Against Experience

Overview and Objectives

- To test the scope and calibration of the Internal Model against experience.

- The experience used may relate to the syndicate's own historical data or other relevant data.

- The model forecasts are compared to actual outcomes and differences should be analysed to inform calibration of the Internal Model:
  - Are the causes of volatility in the experience captured in the model?
  - Is the modelled volatility consistent with that seen in the history?
    - Might expect that the modelled volatility would be greater than the history, as the model should include allowance for Events Not in Data (ENIDs).
    - Lloyd's Validation Guidance states that Backtesting should describe how ENIDs have been taken into account.

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Testing Against Experience

Results of Review

Testing against experience or "Backtesting"	Percentage of Syndicates at feedback level				
	-	D	M	C	Total
The results and the key assumptions of the internal model should be tested against experience and other appropriate data.	96%	0%	4%	0%	100%
Backtesting should be applied to aggregated results and appropriate single elements of the results.	86%	4%	11%	0%	100%
Justification should be given for the selection of experience data used for the backtest in terms of relevance, completeness and any adjustments made.	40%	28%	32%	0%	100%
The pass/fail criteria should be clear, objective, pre-defined and sufficiently robust to identify potential issues.	61%	16%	23%	0%	100%
The test result should be consistent with the test specification and sufficient detail should be given to justify the result.	26%	33%	40%	0%	100%
Overall assessment of the Backtest.	67%	4%	30%	0%	100%
Total (% of comments)	**63%**	**14%**	**23%**	**0%**	**100%**

Positive findings:

- Testing Against Experience is being used extensively for Premium Risk and Reserve Risk.

- Pass / Fail criteria usually include some objective measure.

- Testing meets Minimum Standards and usually complies with Guidance, but there are areas which could be improved.

Testing Against Experience

Some issues

- Justification for the data used
  - Has all relevant experience been included? If not, explain why.
    - If historical data are limited (e.g. new syndicate) what other data could be used?
  - Has relevance of data been discussed
    - Risk profile changes?
    - External data?
  - Have any exclusions or adjustments to the experience data been justified?

- Are pass / fail criteria clear, objective, pre-defined and sufficiently strong to identify potential issues?
  - Some form of objective test is usually included, but this was not always clear
  - Statistical tests are preferable
  - How robust is the test?
    - Want test to encourage comparison / investigation of model vs experience
    - May be acceptable not to pass if reasonable justification can be given (e.g. historical event was extreme, change in risk profile)

- Consistency between model output and historical data
  - 1-year movement compared to ultimate volatility
  - Carried reserves with margins vs best estimate reserves volatility
  - Catastrophes included or not
  - "Cat years" excluded, resulting in a limited test – rather exclude events than whole years

Testing Against Experience

Some issues (2)

- Has backtesting been applied sufficiently widely?
  - What about Credit Risk or Operational Risk?

- Insufficient detail given to justify the result
  - "Probably due to …" is not ok!
  - Reapply test to "as-if" data if PwL/Fail is a result of risk profile change

- Explain unusual features of the analysis, even if result is a pass
  - QQ plots sometimes used to help with this

- No comment on the impact of ENIDs on the testing

- Consequences of test result not clear
  - Good practice to record what happened in test summary
  - If this is being done, make sure there is a clear reference to where this is documented

Testing Against Experience

Example – the most important test against experience this year will be COVID-19 losses

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- Major loss return on COVID-19 received at beginning of May. Questions on internal model:

5) Have loss estimates been back-tested against the Internal Model? If so, please provide the net return period, in total and by class of business where available [one-year modelling basis].

6) How well do you consider this risk to be captured within the Internal Model? In particular, please make reference to: class volatilities, class dependencies, risk type dependencies (i.e. operation, insurance and market). Do you complete any stress/scenario testing?

- Wide variety of responses, but the highlights are:
  - Fewer than half of syndicates have provided return periods, even though most do not think that the loss has been adequately captured in their model

  → **Carrying out testing against experience on this in July/August is too late as the model and parameterisation won't be able to respond appropriately to the results.**

  - The quality of the backtesting was variable, ranging from syndicates testing against:
    - Their total net (1-year) premium risk distribution to
    - Specific pandemic drivers or man-made catastrophes modelled.

  - Around 1/3 of responses stated that the risk is adequately captured in the internal model as it currently stands – however some of these responses were based on testing against experience with limitations

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| Basis | RSTs | Testing Against Experience Overview | Testing Against Experience Findings | Testing Against Experience Examples |

Testing Against Experience

Example – the most important backtest this year will be COVID-19 losses

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Syndicate has £10m estimated COVID-19 losses, £200m 1-year SCR: 5% loss

"The loss is immaterial and adequately captured in the model".

Not a valid conclusion as comparison is too general and expected levels of other risks (at the very least) need to be taken into account.

Please note that 1-year risk should be used, not ultimate!

Premium risk stress is £150m: 7% loss

Stress has been compared against

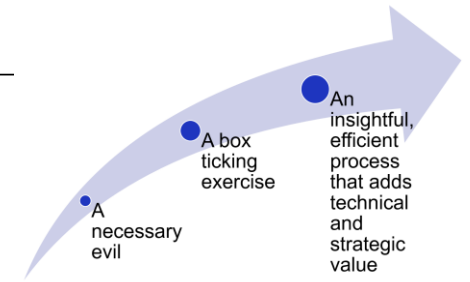Non-Catastrophe premium risk stress is £50m: 20% loss

More valid comparison

Further breaking down of losses needed –

- What are the return periods for individual classes?

- What about man-made catastrophes / any specific drivers for events like these?

- What about the return periods for the losses in the specific classes occurring simultaneously? Feedback loop for dependencies.

- Major loss return ONLY considered premium risk losses – what about other risk types?

Evolution of Validation

Suggestions for improving usefulness of Testing Against Experience

A necessary evil

A box ticking exercise

An insightful, efficient process that adds technical and strategic value

In most cases, models have been validated over several years. Validation should not be a tick-box of reapplying old tests with limited new information. Still do the tests, but consider what can be done to add more value / get new insight.

- Make sure that tests are updated to reflect changes in risk profile and modelling methodology.

- Want the statistical framework test, but also useful to investigate / comment on the comparison of historical data and model output even if the test is passed. e.g. "shape" of observations, outliers - what wider insight can they give?

- Extend testing:
  - Other risk categories
  - Can the data be analysed at different levels to assess model parameterisation in more detail?
  - Risk profile changes – test with raw and adjusted data. "We no longer write that business…" – Why did you stop writing it? – What lessons learned? – Could similar things arise from current business?

4. Moving Forward

What do you need to do next?

1. Review your BAU processes

- **New Requirement for LCR – Analysis of Change**
    - Analysis of Change document will be required for LCR going forward (not part of validation report)
    - Specific requirements as well as good practice examples to be included in the SCR Guidance
    - Timelines: first draft was shared in April, second draft to be circulated via CALM soon, final version available on website in June.
    - Syndicates to work out what work is to be performed by first line and where validation needs to be involved.

- **Reduce you workload – so that you have time to concentrate on the real issues/questions your Board is interested in**
    - Time of crisis is a good time to take a step back and think about what matters → where are you adding value?
    - Lloyd's will require you to be compliant with the minimum standards – but we will be pragmatic in other respects. Important points:
        - Justify your approach clearly in the report
        - Quality over quantity – don't need to perform hundreds of validation tests – but perform the ones you do to a high standard

What do you need to do next?

1. Review your BAU processes

- Validation is a Solvency II requirement, but:
  - You can focus on model changes instead of doing from-ground-up validation every year
  - Minimum standard requires testing of **key assumptions** and testing of **material components and risks** – not everything
  - So, e.g. sensitivity testing and SSTs of **key** assumptions is required – re-evaluate what that means. If an assumption has tested as immaterial in the past and the risk profile hasn't changed – why should you re-run that annually? Use deep dives to re-affirm these results.
  - Use your risk profile to determine your focus and effort required by using the top-down view of what areas contribute materially to your SCR.
  - Reduce work on deep dives as we are going into the second round of the 3-year validation cycle – so take another look at the plan you have made!
    - Think about what you can "recycle"
    - Think about what you should delay to free up time. We will be pragmatic
    - Set out your 3-year validation plan clearly in your validation report and where you have amended it due to recent events.

    (This was a topic in last year's briefing – please refer back to slides there!)

What do you need to do next?

2. Make a new plan for the 3-year validation cycle

- We have now completed a full 3-year validation cycle (first year was 2018 YoA)

- Syndicates' 3-year plans have generally been adhered to, and deviations from the plan documented in the validation report (on the whole)

- Syndicates should reflect on the validation carried out over the last 3 years and consider the following:

- Have all key areas of the model had a deep dive validation?

- How has the validation plan evolved over the 3 years?

- What does a "good" deep dive look like?

- The responses to these questions should feed into the new 3-year plan

- We will not review these 3-year plans separately, but would expect them to form part of syndicates' validation reports.

- Syndicates that have not implemented a 3-year cycle should reconsider this, as "doing everything" doesn't necessarily mean "everything will be done well".

What will Lloyd's do to support you?

- We will not require a separate submission of your 3-year validation plans

- We will publish a slimmed-down version of the sign-posting template to support you reviewing yourself against the minimum standard
  - In order for you to remove test/work but still comply with the minimum standard

- We will be pragmatic when it comes to you delaying deep dives and redirecting resource.

- If you have received material feedback and you think there is a lot of additional work involved in addressing it, please get in touch. In general, feedback is meant to be constructive and enhance the quality of the tests your perform – not adding significant amounts of work.
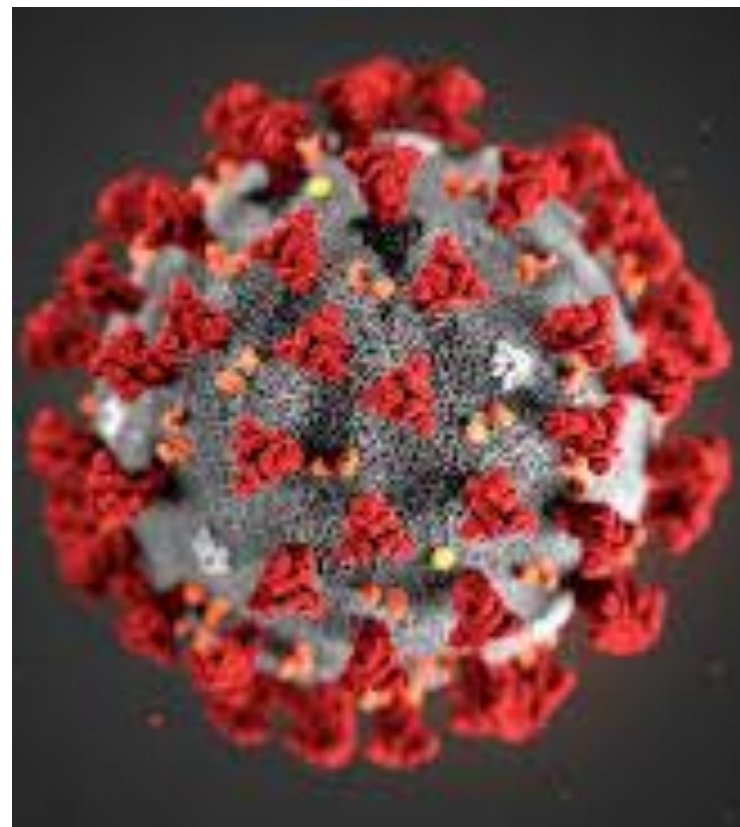
Times are weird and pragmatism is important – "Carole Baskin did it" won't be acceptable as justification though!
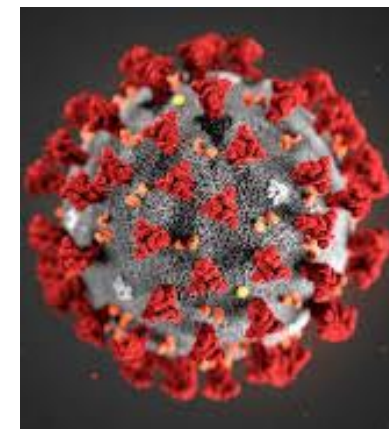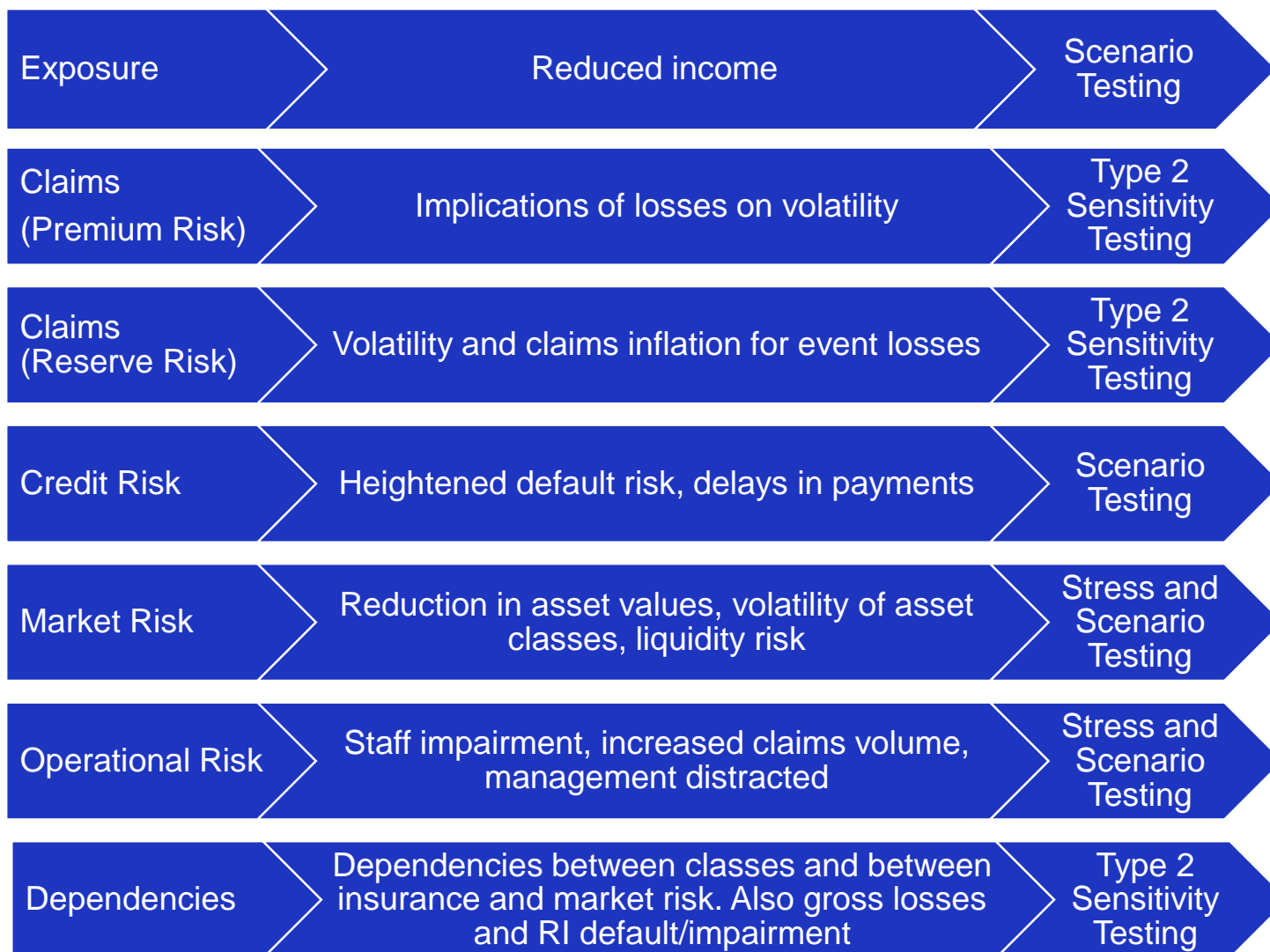
What do you need to do next?

3. Spend your time on "Focus Areas" – i.e. questions your Board is interested in

- **COVID-19 will be a key focus for 2020**

  - Opportunity for syndicates to illustrate an update to their validation plan in response to market issues!

  - Expect validation to consider COVID-19

  - Expect syndicates to re-consider their model change plans – if you submit a model with a lot of change but COVID-19 impact hasn't been considered in full, we will question the prioritisation

  - Expect syndicates to make an allowance for the uncertainty. So, e.g. the exact impact of COVID-19 might not be clear in July yet – so it will have to be estimated (prudently to allow for uncertainty)

  - Expect syndicates to look at the impact on a variety of areas – underwriting risk, dependencies, reserving risk, market risk etc.

  - Expect syndicates to consider the appropriateness of assumptions in the model, given the Solvency II balance sheet may be materially different from prior years, e.g. the level of profit in the unearned premium.

Focus Areas of validation for the 2021 YoA review

COVID-19 – Areas to consider for first line and validation*

Exposure	Reduced income	Scenario Testing
Claims (Premium Risk)	Implications of losses on volatility	Type 2 Sensitivity Testing
Claims (Reserve Risk)	Volatility and claims inflation for event losses	Type 2 Sensitivity Testing
Credit Risk	Heightened default risk, delays in payments	Scenario Testing
Market Risk	Reduction in asset values, volatility of asset classes, liquidity risk	Stress and Scenario Testing
Operational Risk	Staff impairment, increased claims volume, management distracted	Stress and Scenario Testing
Dependencies	Dependencies between classes and between insurance and market risk. Also gross losses and RI default/impairment	Type 2 Sensitivity Testing

*loosely based on CIGI presentation "Unlock the value of IM Validation" by Wendy Kriz and Nasir Shah, Barnett Waddingham

Focus Areas of validation for the 2021 YoA review

COVID-19 – Areas to consider for first line and validation

- **Think more widely about the "post-COVID" age**

  - COVID-19 is also a "near miss": What if the death rate had been higher? What if government measures hadn't been implemented or followed as stringently?
    - → Stress and Scenario testing is important

  - What is the likelihood of future pandemics in a globalised world?
    - → What is the "appropriate" return period for COVID-19 and "near misses"?

  - What is the wider impact of the pandemic on social behaviours and globalisation?
    - → Short-term impact on business plans for next year (e.g. reduced premium income)
    - → Longer-term impact on certain industries, e.g. aviation industry and travel industry

  - Has the impact of COVID-19 told us something about other tail events?
    - → What impact do economic events on claims from certain classes?
    - → "Large catastrophes usually only result in a temporary economic shock" – does that still hold true?
    - → Dependencies between classes – which classes have exhibited a link in COVID-19? What about other "known unknowns" – could there be secondary impacts from other tail events that we have missed?
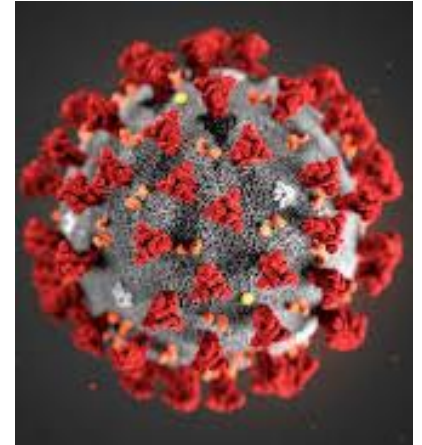
What will Lloyd's do to support you?

Assessment of the impact of COVID-19

- If first line analysis finds that the model is understating, for example, certain dependencies, but there isn't time for a appropriate model change before the LCR submission, we will accept management adjustments to allow for this in a pragmatic way.

- We will use the focus area return to highlight to syndicates where we have questions on their major loss return and direct attention to the areas we will focus on in our review.
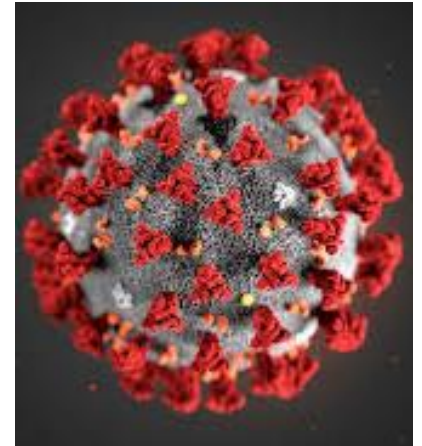
Focus Areas of validation for the 2020 YoA review

Validation of modelled loss ratios

- Historical track record shows that actual performance is usually worse than plan

- Loss ratios used in the model should be appropriate, based on track record, and so may be different to those in the business plan

- More syndicates uplifted their modelled loss ratios in 2020 compared to 2019…

Combined ratio			
	SBF to model self-load	Lloyd's uplift	Total uplift
2019	1.0%	1.5%	2.5%
2020	2.6%	0.4%	3.0%

   …leading to overall lower Lloyd's loadings in 2020 compared to 2019 in respect of this area.

- Progress has been made, but there is still more to be done for 2021…

- 2019 YoA experience shows deterioration against plan that is much worse than the 2.5% accounted for in uplifted modelled loss ratios

Focus Areas of validation for the 2020 YoA review

Validation of modelled loss ratios

Lloyd's tests are simplistic in nature and do not take into account sufficiently specific information that should be considered by syndicates and their validators

- Validation of modelled loss ratios evidence should be provided as part of the LCR validation submission

Expectation on:

- How sensitive is the SCR to changes in loss ratio assumptions – in particular rate change assumptions, and how has this been tested?

- If the loss ratios used in the model are different from the plan, what is the capital impact of using the different versions?

- How does the actual loss ratio for a previous year compare to the expected loss ratio for that year?

- If there was a big difference in actual vs expected by class, how has this fed back into the estimated loss ratio?

Focus Areas of validation for the 2020 YoA Review

Opening balance sheet: TPs

- Historically, rolled forward technical provisions from Q2 to Q4 were often lower than actual Q4 technical provisions, across multiple prior calendar years

- The 2020 business planning and capital setting showed progress was made to understand this risk…

- …with aggregate Lloyd's loadings lower in 2020 compared to 2019 in respect of this area by c.45%

- Progress has been made, but validation should be embedded to ensure year-on-year appropriate opening technical provisions

Lloyd's tests are simplistic in nature and do not take into account sufficiently specific information that should be considered by syndicates and their validators

- Validation analysis should be documented and submitted with the LCR Validation report, including:
  - Appropriateness of methodology to roll forward the technical provisions
  - Key assumption changes and how these were validated
  - Actual versus expected analysis

COVID-19 impact: consideration of appropriateness of modelling assumptions, given that the SII balance sheet may be materially different from prior years, e.g. level of profit in unearned premium

Focus Areas of validation for the 2020 YoA Review

Casualty Classes

- The "Dear Chief Actuary" letter by the PRA highlighted weakening of case reserves and inadequate claims inflation allowance as key issues

- Changing claims environments is leading to higher claims inflation and in particular "social inflation" is an issue for these classes, making claims severity harder to predict, which leads to additional uncertainty on the volatility

  → should be taken into account in parameterisation for reserving and premium risk, as well as in dependency between the risk types

- Increased level of class actions also increases difficulty in predicting claims frequency

  → greater risk of clustering in the tail, which invalidates the Poisson frequency assumption

- Issues are most prevalent in the US, however it might not be restricted to US business

Focus Areas of validation for the 2020 YoA review

Model Completeness

- Lloyd's Exposure Management collected model completeness questionnaire in 2019 to establish market practice across a variety of "non-modelled" areas

- Model completeness questionnaire to be re-issued in 2020, plan to issue in late May for collection in July

- Scope of return is reduced focussing on
  - US Flood (as a secondary peril to US Wind)
  - Contingent Business Interruption
  - US Wildfire
  - US Severe Convective Storm
  - Social Inflation

- Return will now include a strong focus on evidencing that appropriate validation has been completed

- Where syndicates cannot demonstrate that they either:
  - Have no material exposure, or
  - Have the peril adequately represented in their model,

  a capital loading will be applied by Lloyd's Exposure Management to the SCR.

What is Lloyd's focussing on for 2021 YoA review?

- **We will continue to do minimum standard compliance reviews**
  - We will rely on syndicates' self attestation for this going forward, with Lloyd's only reviewing a sample every year
  - Signposting template will relate to minimum standards compliance

- **Validation Reports will be used heavily in the SCR reviews –**
  - The analyst will review the findings of the validation report
  - When we have questions during the review, we will consult the validation report and check the work that has been carried out in the area

- **We will focus more on Thematic Validation reviews. This could be a mix of "validation tools review" (like the RST / testing against experience above) and/or modelling themes**

- **COVID-19 will be on the list next year – Lloyd's is open to feedback regarding where else the market would see value in thematic reviews**

5. Summary

Summary

- Lloyd's has given the market material feedback on validation reports with the aim of improving the **quality** of validation.

- Reconsider your model change and validation plans that you have set out this year in the light of recent events. Make sure that you have sufficient time to look at the focus areas – redirect resource as needed.

- Any changed plans should **not** impair the **quality** of your validation – only the **quantity**.

- We will be relying on self attestations to form the basis of a minimum standard compliance review – so make sure you still comply with MS14.

- COVID-19 will take centre stage in reviews – and should also feature heavily in your work.

- Key focus on making sure your capital submitted reflects the risk profile and addresses key risk areas – in the worst case as management adjustments.

5. Appendices

Useful Links

Model Validation Guidance & Workshops:

https://www.lloyds.com/the-market/operating-at-lloyds/solvency-ii/information-for-managing-agents/guidance-and-workshops/model-validation

Minimum Standards (updated January 2020):

https://www.lloyds.com/market-resources/requirements-and-standards/minimum-standards

Reverse Stress Tests

Minimum Standards: MS14 - Validation

VAL 4.4 Required tools

- the model validation process shall include a reverse stress test, identifying the most probable stresses that would threaten the viability of the syndicate;

Clarification:

2	Reverse stress test	Determine the level of loss which would lead to unviability and work backwards to determine the scenario(s) which might lead to that level of loss

Reverse Stress Tests

Guidance: Validation Guidance July 2019

Extract from Lloyd's Guidance Section 3.5 for a possible approach to formulating the RST:

- describe the cause of unviability;
- identify the largest drivers of risk to the syndicate;
- generate plausible events within these drivers which could cause significant losses;
- assess the return period and severity of the primary event similarly to scenario testing;
- consider the possible secondary impacts (across all risk categories), and likelihoods given occurrence of the primary event;
- offset any mean profit contributions (if not impacted); and/or
- combine these judgements to assess a combined return period, and loss split by risk category, for the reverse stress to be used for comparison to model output.

Additional information in Appendix A: RST FAQs

Reverse Stress Tests

Thematic Review Feedback Template

Reverse Stress Test		
Category	**RAG Rating / Feedback Level**	**Feedback**
The model validation process should include a reverse stress test, identifying the most probable stresses that would threaten the viability of the syndicate.	-	
Specific RST reviewed		
The RST should specify an estimate for the return period, with rationale, for syndicate unviability.	-	
The RST scenario should be specified in terms of the contributions at a suitably granular level (e.g. from each risk category or class).	-	
Secondary impacts (knock-on effects) should be assessed both qualitatively and quantitatively, in addition to the primary drivers of loss.	-	
The pass/fail criteria should be clear, objective, pre-defined and sufficiently robust to identify potential issues.	-	
The test result should be consistent with the test specification and sufficient detail should be given to justify the result.	-	
Overall assessment of the RST.	-	
Additional feedback	-	

Testing against experience

Minimum Standards: MS14 - Validation

VAL 4.2 Experience

Managing agents shall ensure that appropriate testing of the internal model against experience is undertaken.

Managing agents shall:

- test the results and the key assumptions of the internal model against experience and other appropriate data to the extent that data are reasonably available;
- apply the tests to aggregated results and appropriate single elements of the results;
- identify the reason for any significant divergence between assumptions and results; and
- ensure actuarial and statistical methods are tested against current data and market practice based on a detailed understanding of the model.

Testing against experience

Minimum Standards: MS14 – Validation (MS Guidance)

MS Guidance

3	Back test	Compare actual results with modelled distribution – do they fall within the range expected by the model?

- Many of the validation processes and tools described are mandatory under level 2 guidance, including …backtesting. It is strongly recommended that these tests should be applied to every major risk module of the standard SCR formula in order to validate the model including comparison against the standard SCR calculation. The use of the model for 'risk ranking' should also inform agents as to which risk areas should be tested as a priority.

Testing against experience

Minimum Standards – MS 14: Validation   (MS Guidance)

The testing of results of the internal model against experience is used to assess the variances between forecasts made by the model and actual outcomes. Where actual outcomes may not be directly available, the model forecasts may be compared to those made on the basis of a comparable data set. Such datasets may include, for example, market level data, data from other parts of the group, or data based on other business deemed to have similar characteristics.

Managing agents should justify why the chosen comparable data set is appropriate. The reliability of the test depends on the selection of data used and specific attention to the data selection will increase the comfort managing agents obtain from the test.

This type of test against experience, or "back-testing", can be used to find various kinds of discrepancies. The objective of the analysis is, for example, to determine whether differences come from omission of material risk factors from the model, whether they arise from errors from other aspects of the model specification such as the dependency structure including the assumptions of linearity, or whether the discrepancies are purely random and thus consistent with acceptable performance of the model.

One way to use back-testing is to test statistically the hypothesis that the observed frequency of exceptions equals the expected frequency, subject to the availability of adequate data. Managing agents should use back-testing widely, as it offers useful information about the model which is relatively easily understood by directors and other model users.

Testing against experience

Guidance: Validation Guidance July 2019

Extract from Lloyd's Guidance Section 3.6:

- Consideration of ENIDs
- Relevance of history
- Aid communication
- Wide use of comparisons

3.6 Testing against experience

Testing against experience includes goodness of fit tests and comparisons between model outputs and historical results ("backtests").

In general, the claims history may be too limited to provide conclusive evidence for the optimum assumption or method. By definition, the claims history will not initially include "Events Not in Data" (ENIDs). However, as time elapses, some ENIDs may 'emerge' within the data. Whilst this may be the case, agents must not rely on these 'emerged' ENIDs within the parameterisation process as by definition, ENIDs will not be present within the claims history.

In many instances, the portfolio will have changed over time. In these cases, there may be good reasons for excluding some parts of the history from the tests against experience. However, such exclusions should be based on objective reasons relating to unique characteristics of the risks, not simply on underwriting results. Conversely, it should also be recognised that a limited history may not capture the full tail risk of any portfolio; there may therefore be reasons, based on expert judgement, for model risk exceeding that indicated by the data. Lloyd's will not accept agents taking a one-sided approach of excluding unfavourable history as being irrelevant, while not making allowance for tail risk that may not be reflected in the experience.

Finally, tests against experience can assist in communication of model outputs to management by linking them with recent results.

Lloyd's recommends that comparisons to past experience are made wherever this is available. These comparisons should include clear explanations, based on expert judgement, of the relevance of this experience to the current risks. They should also describe how ENIDs have been taken into account (the PRA Supervisory Statement SS5/14 gives more information on ENIDs).

Example: A test which results in a test failure compares the modelled output to historical experience. As a result, the validator analyses the historical information over the past 20 years and adjusts data for rate changes, reinsurance changes and business mix. The validation test is run again, and the result is significantly different.

The detailed analysis to explain the failure would have been sufficient, but the managing agent improves it further by adjusting the data and re-running the test.

Testing Against Experience

Thematic Review Feedback Template

Testing against experience or "Backtesting"		
Category	**RAG Rating / Feedback Level**	**Feedback**
The results and the key assumptions of the internal model should be tested against experience and other appropriate data.	-	
Backtesting should be applied to aggregated results and appropriate single elements of the results.	-	
Specific Backtest reviewed		
Justification should be given for the selection of experience data used for the backtest in terms of relevance, completeness and any adjustments made.	-	
The pass/fail criteria should be clear, objective, pre-defined and sufficiently robust to identify potential issues.	-	
The test result should be consistent with the test specification and sufficient detail should be given to justify the result.	-	
Overall assessment of the Backtest.	-	
Additional feedback	-	