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# IMIF Case Study : Advance uses of Internal Models to support Reinsurance business decisions

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# Agenda

## IRM's Internal Model Industry Forum (IMIF)

- Introduction to IMIF
- Advance Uses of Internal Model workstream

## Stakeholders requirements

- What do stakeholders want from the Internal Model
- Validation and Management understanding of the Internal Model

## Model Capabilities

- Gross less recoveries model
- Claim type split

## Analysis & Limitations

- Trade-off between risk and return
- Breakeven return periods
- Breakdown of claims and recoveries by return period and claim type
- Impact on company's risk appetite
- Investigating alternative reinsurance strategies
- Data Limitations & Modelling Limitations





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# IRM's Internal Model Industry Forum (IMIF)



# Introduction to the IRM's Internal Model Industry Forum (IMIF)

- The Institute of Risk Management (IRM) set up the Internal Model Industry Forum (IMIF) in 2014 to address the key questions and challenges that insurers face in the use, understanding and validation of internal risk models.
- The IMIF work is led by a steering committee comprising modelling experts from insurers alongside representatives from Deloitte, EY, KPMG, Milliman, PWC, the Institute and Faculty of Actuaries, ORIC and the Bank of England Prudential Regulation Authority (PRA).
- A number of workstreams are undertaking research and we aim to publish the results along with other useful resources and guidance at the link below:  
<https://www.theirm.org/knowledge-and-resources/thought-leadership/creating-value-through-internal-models/documents-and-resources/>



# Introduction to the IRM's Internal Model Industry Forum (IMIF)

## Advance Uses of Internal Model workstream

- 4 publications to date with one more on Risk Management in the pipeline:



Internal Model – Advanced Uses  
Asset Management



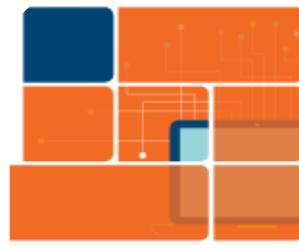
Asset Management



Internal Model – Advanced Uses  
Supporting reinsurance  
business decisions



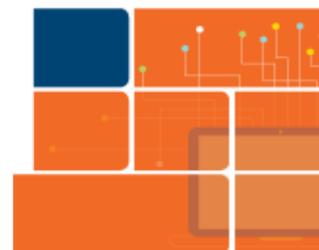
Supporting reinsurance business decisions



Internal Model – Advanced Uses  
Choices, results and capabilities  
of flood risk models for  
financial risk carriers



Choices, results and capabilities of flood risk models for financial risk carriers



Internal Model – Advanced Uses  
Pricing



Risk Pricing

Supporting risk management



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# Stakeholder Requirements

# Stakeholders requirements

## Typical Stakeholders:

- Reinsurance Team
- Underwriters
- ECM (Economic Capital Modelling)
- ERM (Enterprise Risk Management)
- Senior Management
- Board of Directors
- Regulator
- Actuarial Function Holder



# Validation and Management understanding of the Internal Model

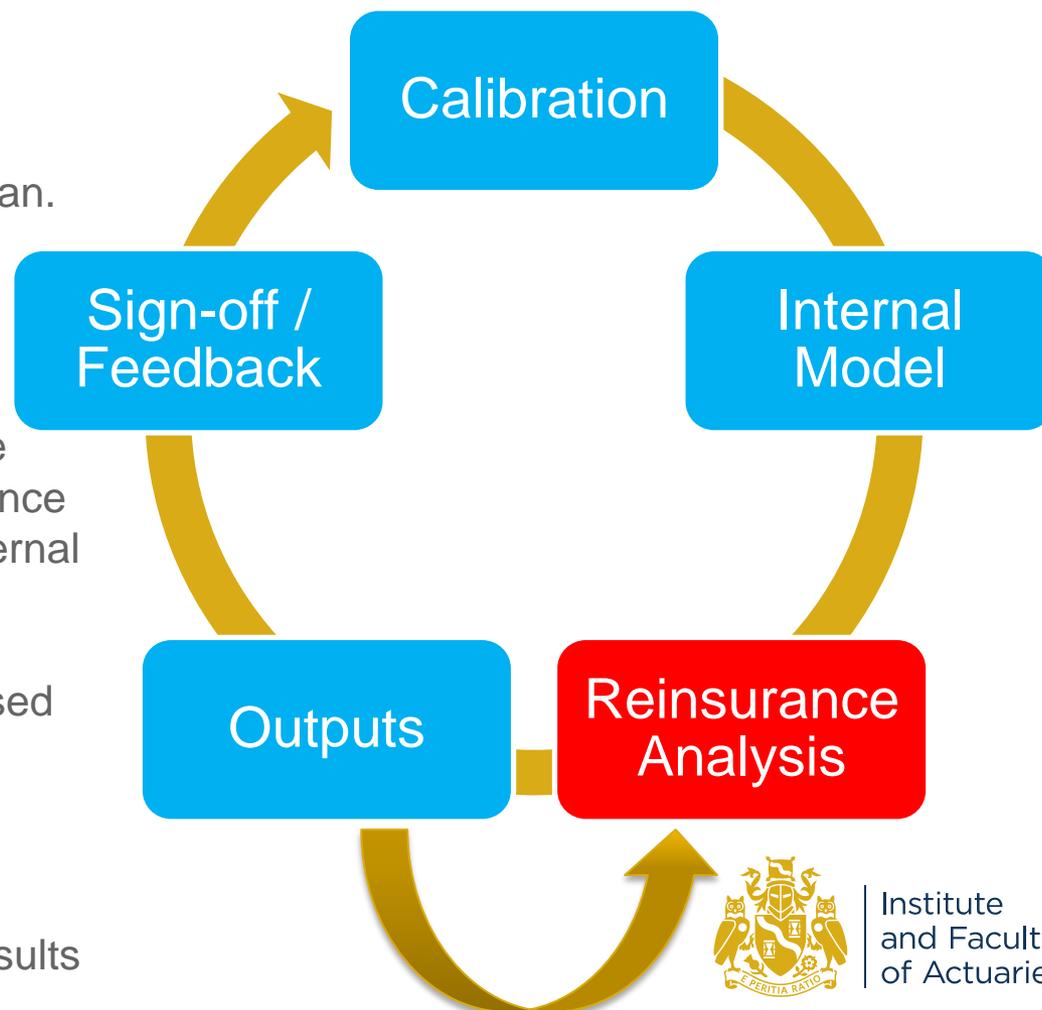
**Calibration:** The gross claims are dependent on the calibration of the Internal Model and the Business Plan.

**Internal Model:** Calculates reinsurance recoveries

**Reinsurance Analysis:** A separate tool is used to perform the reinsurance analysis using outputs from the Internal Model

**Outputs:** The analysis is summarised and presented to committees (Governance process)

**Sign-off / Feedback:** We obtain committee sign-off / feedback of results



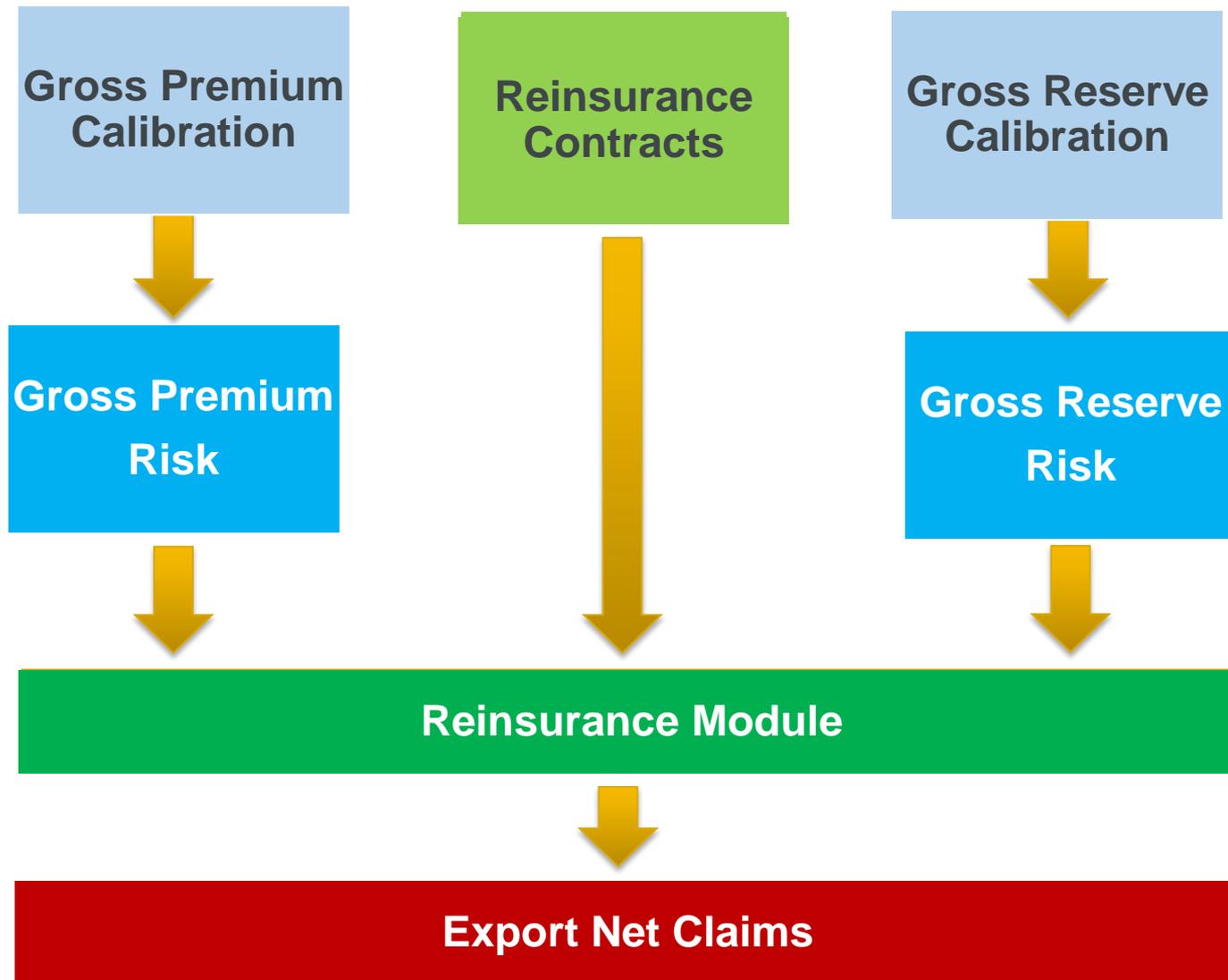


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# Model Capabilities & Limitations

ertise  
ponsorship  
Thought leadership  
Progress  
Community  
Sessional Meetings  
Education  
Working parties  
Volunteering  
Research  
Shaping the future  
Networking  
Professional support  
Enterprise and risk  
Learned society  
Opportunity  
International profile  
Journals  
Support

# Gross Less Recoveries Model



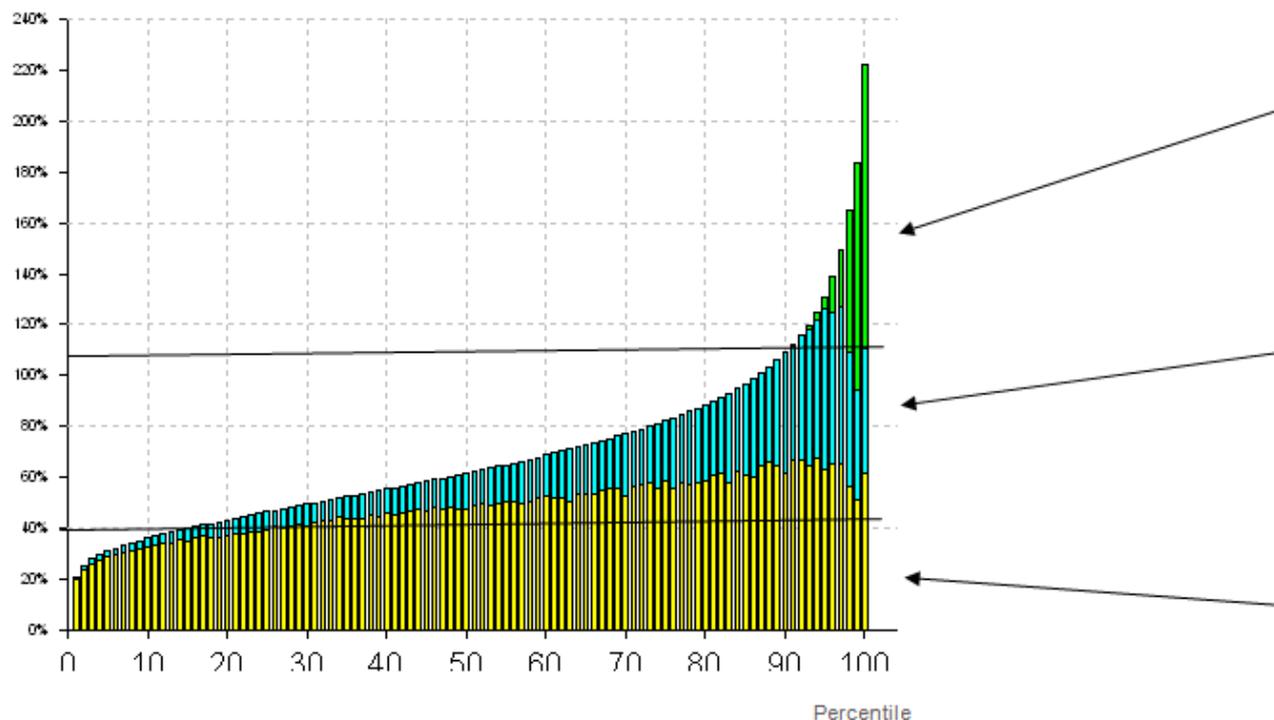
# Model Capabilities

- Gross less recoveries
- Frequency – severity
- Reconciliation / P&L Attribution
- Full range loss curve
- Granularity
- Link to risk appetite
- Dependency
- Benchmarking



# Claim type split

Gross Loss Ratio Energy On Shore by claim type



## CAT losses.

Very extreme losses that only affect the tail of the distribution.

## Large losses

Atypic claims, whose severity range is more volatile.

## Attritional losses

Homogeneous « frequency » claims, whose severity within a fixed and stable range.

Main contributor to the global incurred volume.



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# Model Limitations

## Data Limitations

- Not able to model small lines of business or sub-sections separately
- Not able to model new lines of business which have not been parameterised
- Not all lines of business have an attritional / large claim split
- Unmodelled perils

## Modelling Limitations

- Not able to model cross-country contracts which covers countries not included in the Model.
- Certain feature of reinsurance contracts are difficult to model:
  - Indexation clause
  - Hour clause (for Catastrophe XOL)
  - reinstatement premiums that are pro rata as to time
  - Sliding scale commissions
- Fixed rates of FX specified in reinsurance contracts



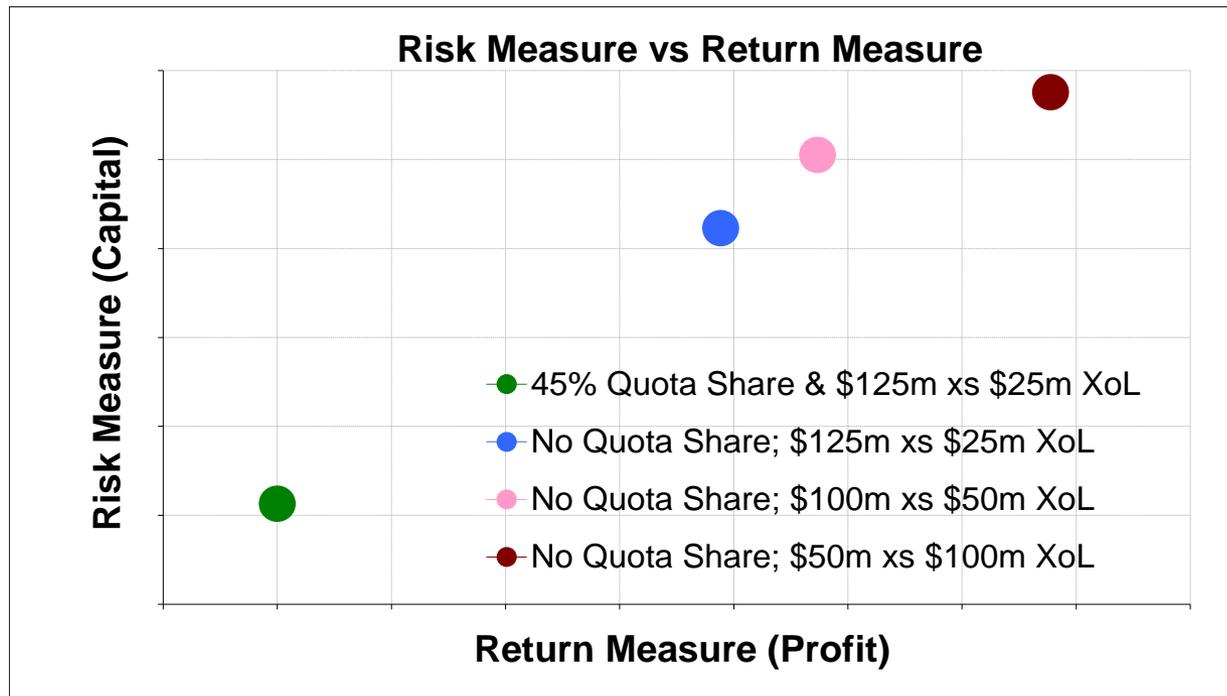


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# Reinsurance Analysis

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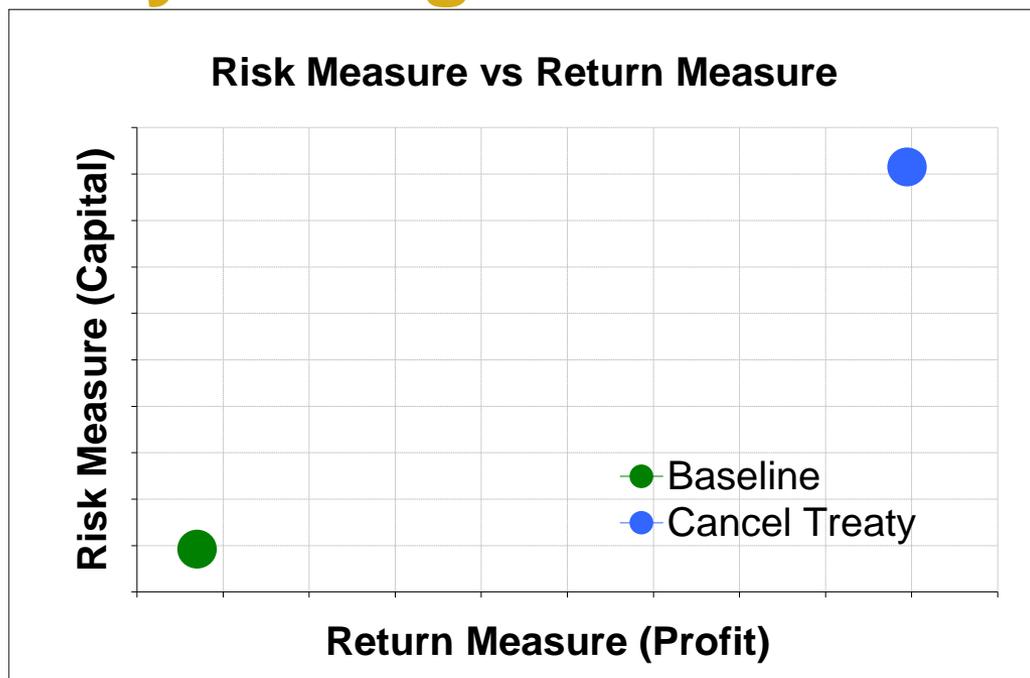
# Trade-off between risk and return



- The diagram above illustrates an example of trade off between risk and return (P&L profit) for multiple combinations of quota share and excess of loss for a line of business.
- As expected, we observe that the reduction of reinsurance coverage increases the risk retained by the company while simultaneously increasing the profit measure due to the savings in reinsurance premium.



# Case Study Background

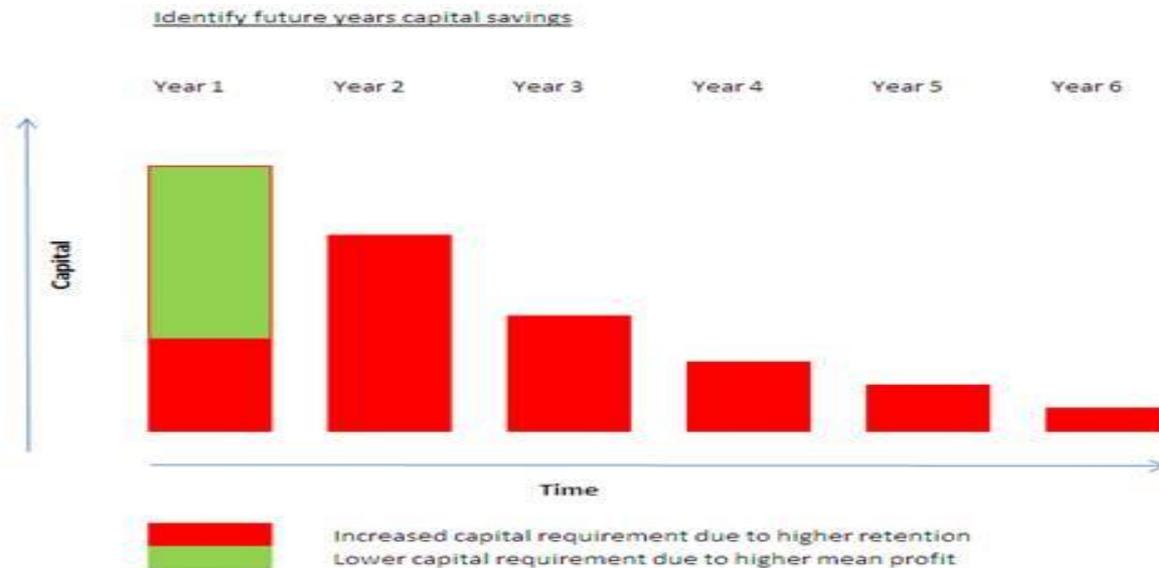


- Q: To understand the impact that a specific treaty cancellation would have on the company's P&L and risk profile.
- The use of internal model outputs identified a positive economic impact over the longer term despite some breaches in risk appetite.
- The cancellation was approved by Management and ultimately the Risk & Capital Committee (RCC) and Board Risk Committee (BRC).



# Measure of risk

- Solvency II models determine capital requirements over a one-year period. Reinsurance will provide protection for several years (both for premium risk and reserve risk). The benefit from the reinsurance must be assessed over several years.
- The impact of reinsurance on reserve risk will be different depending on whether the reinsurance is proportional or non-proportional.
- In this example where a treaty is being cancelled, the increase in capital in the first year is the net impact of the tail claims now retained offset by the additional profit generated by not paying the reinsurance premium.



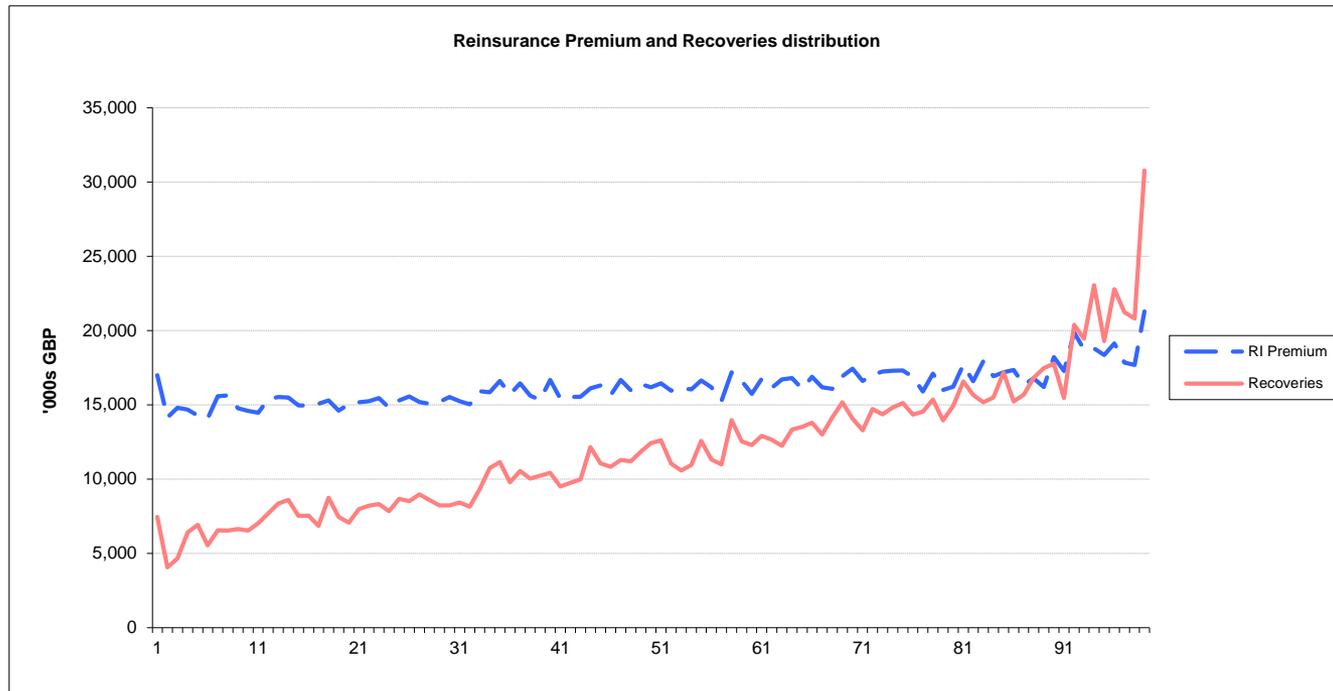
# Economic View

			Baseline (£m)	Cancel Treaty (£m)
A	Benefit in year 1	Treaty Premium net of commission (at the mean)	16.1	
B		Recoveries (at the mean)	11.9	
C = B - A		Profit (Loss) from treaty - before cost of capital	(4.2)	
D = -C		Profit (Loss) compared to base		4.2
E		Treaty Premiums net of commission (1 in 200)	22.3	
F		Recoveries (1 in 200)	38.4	
G = F - E		Increased (Decrease) in Required Capital	16.1	
H = G		Increased (Decrease) in Required Capital compared to base		16.1
I	Multiplier for successive years – reserve risk factor		1.25	
J = H x I	Ultimate Capital Increase (Decrease)		20.1	
K	Cost/(saving) of capital for change @ 6.5%		1.3	
L = D - K	Total economic profits (loss) compared to base		2.9	

- At the mean, we suffer an economic loss of £4.2m as the treaty premium is higher than the expected recoveries of £11.9m.
- In the long run, after factoring in cost of capital on the ultimate increase in capital, the economic benefit from the cancellation of this treaty is £2.9m = £4.2m - £1.3m
- Improvement in return on capital is 14% = £2.9m / £20.1m



# Breakeven return periods



- Compare reinsurance premium against recoveries to obtain breakeven point
- The graph above shows that the break-even point of this treaty is around the 92nd percentile.
- This means that losses greater than a 12.5 year event (the 92nd percentile equivalent) needs to occur in order for this treaty to breakeven
- Consider non-financial benefits e.g. relationship, expertise



# Impact on company's risk appetite

		Target Risk Profile	Amber Flag (+10%)	Red Flag/ Absolute Limit (+20%)	Current Risk Profile	Risk Profile after cancellation
Total Entity	1:7					Increase
	1:200					Increase
- Insurance Risk	1:7					Increase
	1:200					Increase
-- Premium Risk	1:7					Increase
	1:200					Increase
-- Reserve Risk	1:7					Increase
	1:200					Increase
-- Natural Catastrophe Risk	1:7					Increase
	1:200					Breached
-- Man-Made Catastrophe Risk	1:7					Breached
	1:200					Increase
- Market Risk*	1:7					Unchanged
	1:200*					Unchanged
- Credit Risk	1:7					Increase
	1:200					Increase
- Operational Risk	1:7					Increase
	1:200					Increase
- Pension Risk	1:7					Unchanged
	1:200					Unchanged

- cancelling the treaty results in a breach of the:
  - 1:200 amber threshold for natural catastrophe risk; and
  - 1:7 year amber threshold for man-made catastrophe risk.



# Other Useful Metrics

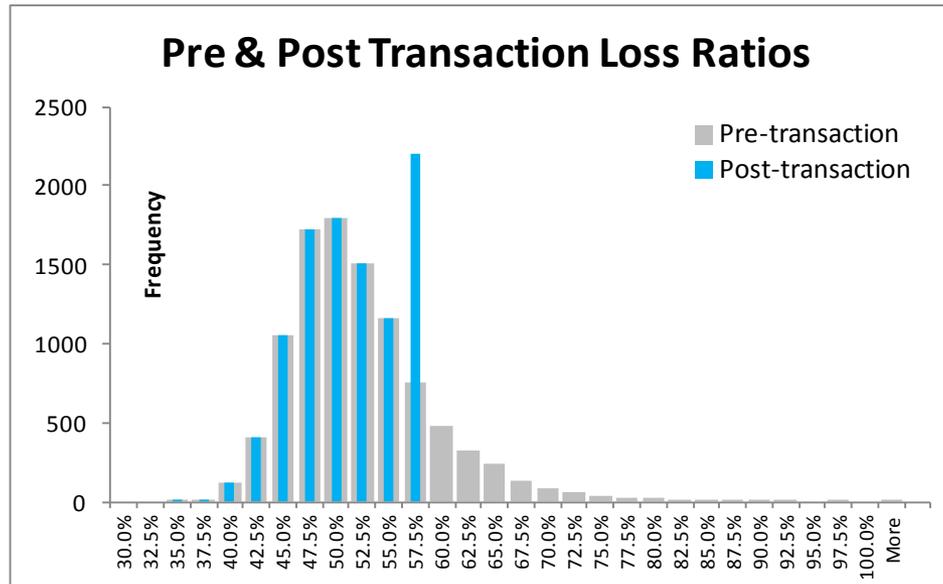
Probability of layer being exhausted, with various numbers of reinstatements	No Reinstatement	1 Reinstatement	2 Reinstatement	3 Reinstatement	4 Reinstatement	Probability at least one claim hitting the layer
\$5 xs \$20	60%	20%	10%	0%	0%	70%
\$5 xs \$25	40%	10%	0%	0%	0%	60%
\$10 xs \$30	30%	0%	0%	0%	0%	40%
\$10 xs \$40	20%	0%	0%	0%	0%	30%
\$25 xs \$50	10%	0%	0%	0%	0%	20%
\$25 xs \$75	0%	0%	0%	0%	0%	10%
\$50 xs \$100	0%	0%	0%	0%	0%	0%
INF xs \$100	0%	0%	0%	0%	0%	0%

Important to base decision on a range of metrics therefore the Calculation Kernel needs to have the capability to produce these. Examples of other metrics:

- Probability of layer being exhausted, with various numbers of reinstatements (Useful when deciding number of reinstatements)
- Probability at least one claim hitting the layer
- P&L by percentile / type of claim:
  - Premium (Pre-treaty premium, RI premium, reinstatement cost)
  - Expenses (various commission)
  - Claims (Pre-treaty claims, Recoveries, Net Claims, P&L for cedent & reinsurer)
  - Loss ratio (cedent & reinsurer LR or combined ratio)



# Investigating alternative reinsurance strategies



- An Internal Model could be adapted to price aggregate reinsurance contracts such as stop loss contracts and adverse development covers
- It utilises the Internal Model's dependency structure to calculate the recoveries across multiple lines.
- As at YE2015, AIG Property Casualty has implemented stop loss contracts across c. 30 countries worldwide using its group model to price these contracts.



# Appendix: Links to IMIF publications

All IMIF publications and guidance are at the link below:

<https://www.theirm.org/knowledge-and-resources/thought-leadership/creating-value-through-internal-models/documents-and-resources/>

Advance Uses of Internal Model workstream publications (led by Raphael Borrel):

1. Choices, results and capabilities of flood risk models for financial risk carriers (Sebastian Rath)

<https://www.theirm.org/media/1665395/IMIF-flood-risk-case-study-v10.pdf>

2. Supporting reinsurance business decisions (YK Loh, Laurence Dunkling)

<https://www.theirm.org/media/1685695/IMIF-reinsurance-case-study-v10.pdf>

3. Asset management (YK Loh, Guillermo Donadini, Jeremy Baldwin, Laurence Dunkling, Christophe Travelletti)

<https://www.theirm.org/media/2293319/imif-asset-management-in-general-insurance.pdf>

4. Risk pricing (Gemma Dawson)

[https://www.theirm.org/media/2185612/IMIF-Risk-Pricing-Case-Study\\_final-25-08-16.pdf](https://www.theirm.org/media/2185612/IMIF-Risk-Pricing-Case-Study_final-25-08-16.pdf)

5. Supporting risk management (Parth Patel)



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**Questions**

**Comments**

**Any Questions?**

The views expressed in this presentation are those of the presenters.



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