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# IMIF Case Study : Advance uses of Internal Models for Asset Management

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# Agenda

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

- Introduction to IMIF
- Advance Uses of Internal Model workstream

## Capabilities & Limitations

- What are the capabilities required and their associated limitations?
- Validation and Management understanding of the Internal Model

## Model Uses for Investment

- Risk Appetite / Risk Profile Reporting
- Daily Market Risk Monitoring
- SAA & TAA
- Investment RAP
- FX Management Framework
- Future Areas for Development



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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/>



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# 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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# 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

17 October 2016

# Model Capabilities

- **Market-consistent Valuation using an Economic Scenario Generator (ESG)**
- **Total Balance Sheet Approach**
- **Optimiser**
- **Up-to-date Asset Holdings Data**
- **Reconciliation / P&L Attribution**
- **Full range loss curve**
- **Link to risk appetite**
- **Selection of calibration for ESG (one-year vs multi-year)**



# Model Limitations

- **Model Risk (CIO's expert judgment is pivotal!)**
- **Negative Interest Rates**
- **Linear correlation assumptions**
- **Index representation**
- **Reinvestment yields**
- **Granularity**
- **Limitations of the Value-at-Risk (VaR)**
- **Temporal mismatch**
- **Frequency of update of ESG**
- **Marked-to-market or Marked-to-model**
- **Planned FX movement**
- **The weighting of past losses in parameterisation**



# Validation and Management understanding of the Internal Model

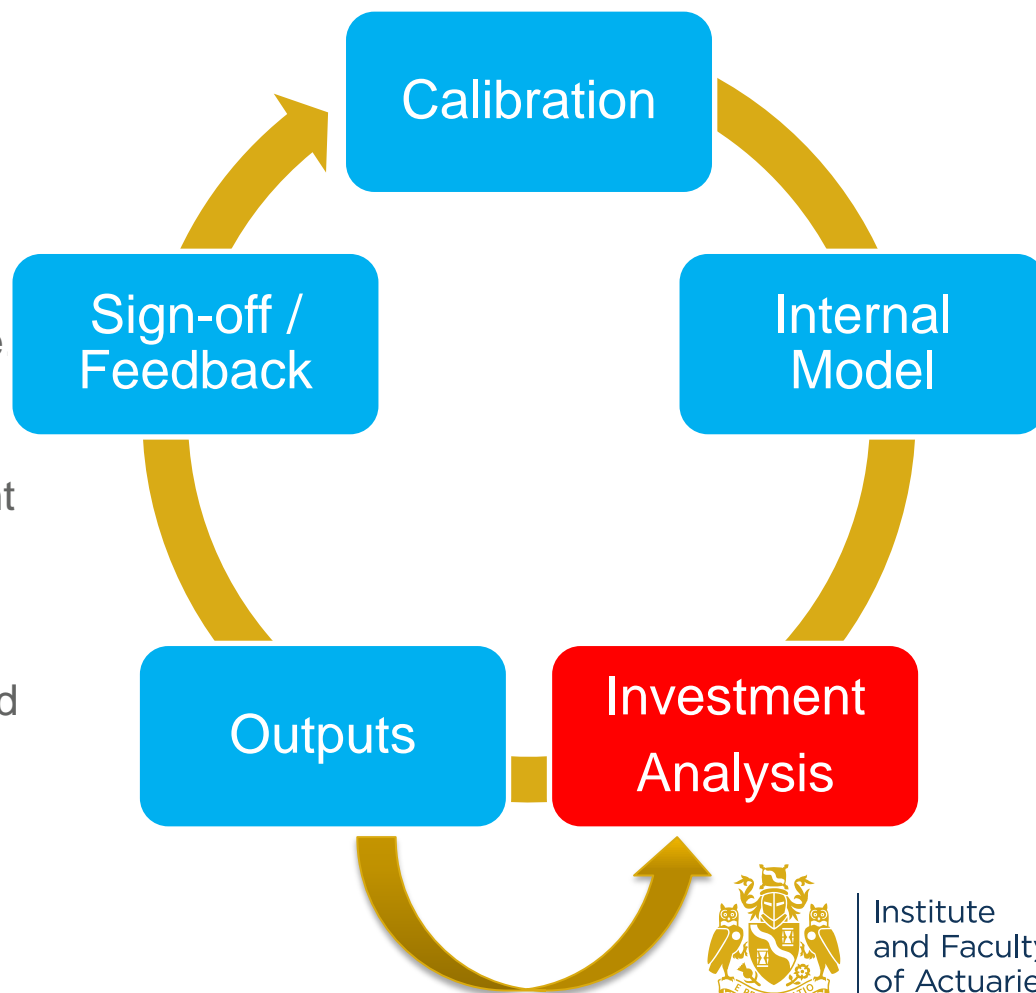
**Calibration:** The components of the Internal Model is calibrated and imported into the Calculation Kernel.

**Internal Model:** Asset simulations from ESG is aggregated with liability simulations via dependency structure

**Investment Analysis:** A separate tool is used to perform the investment 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 Uses for Investment

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# Overview

- The availability of the Internal Model and an Investment Data Repository (IDR) created a unique opportunity for AIG Europe to better embed an integrated Internal Model uses for asset management.
- These uses can be broadly categorised into five areas:

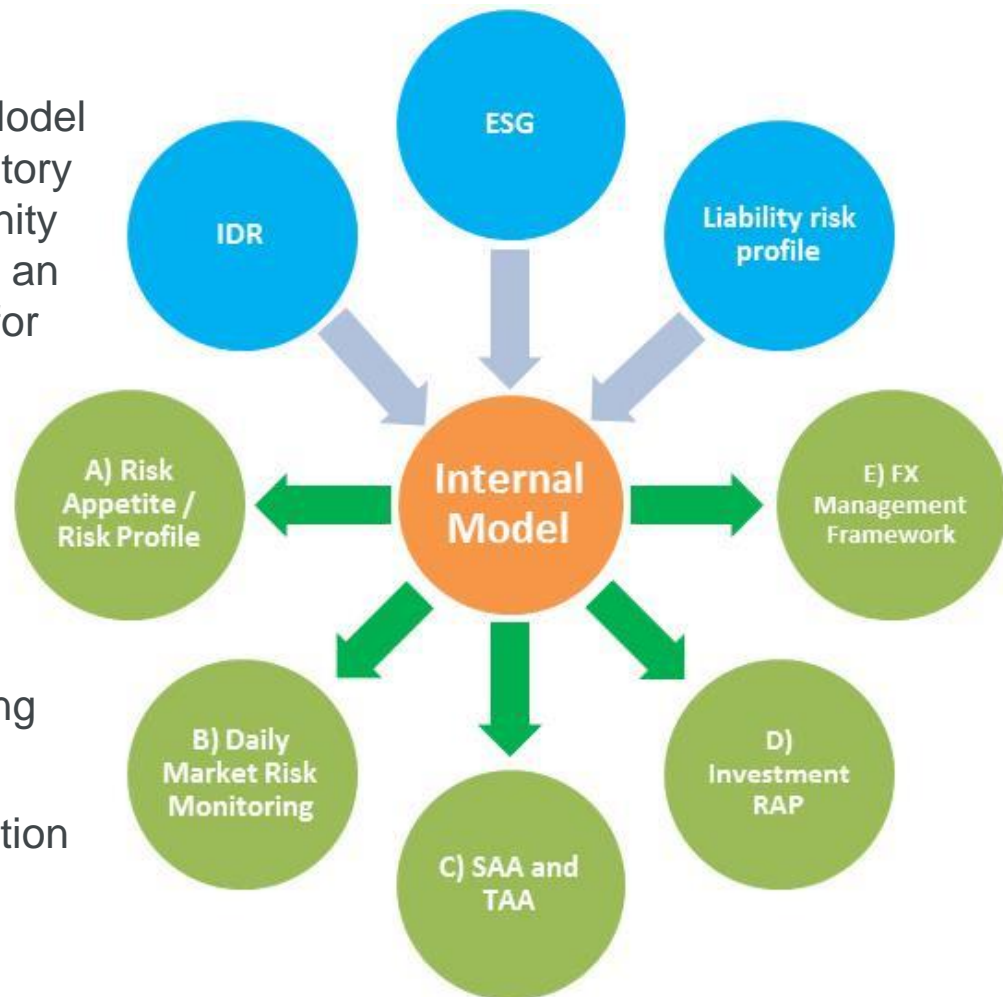
A. Risk Appetite / Risk Profile Reporting

B. Daily Market Risk Monitoring

C. Strategic Asset Allocation (SAA) & Tactical Asset Allocation (TAA)

D. Investment Risk-adjusted Profits (RAP)

E. Foreign Exchange (FX) Management Framework



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# A. Risk Appetite / Risk Profile Reporting

- AIG Europe monitors its risk appetite using the Internal Model at the 1-in-7 years and the 1-in-200 years return periods at entity and risk type levels:

- **1:7** return periods are useful as an earnings at risk indicator because insurance cycles / underwriting cycles lasts around 7 years.
- **1:200** return period to provide a link to capital requirement

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



# A. Risk Appetite / Risk Profile Reporting



- The governance process around the risk appetite reporting process is based on a cascading structure where sub-risk profiles are signed-off by relevant risk committee first, then cascaded upwards to more senior committees.



# B. Daily Market Risk Monitoring

For close of business: As of 31/12/2015

USD/GBP: 1.44335

EUR/GBP: 1.26938

Cluster	AEL Inv Plan Class	Market Value GBP MM	Risk Charge (%)	Risk Charge GBP MM	Target	Amber Escalation Threshold	Red Limit Threshold	Target vs Risk Charge	Amber Escalation Threshold vs Risk Charge	Red Limit Threshold vs Risk Charge	Status
Cash & Equiv	Cash & Equiv	2,000	(1.00%)	(20)							
	<b>Total</b>	2,000	(1.00%)	(20)	0	0	0	20	20	0	OK
Level 1	ERM Risk Free	1,000	1.00%	10							
	High Grade AAA	1,000	5.00%	50							
	High Grade AA	1,000	7.50%	75							
	High Grade A	1,000	10.00%	100							
	High Grade BBB	1,000	15.00%	150							
	High Yield	1,000	22.00%	220							
	<b>Total</b>	6,000	10.08%	605	700	770	840	95	165	235	OK
Level 2	CDO - CLO	250	15.00%	38							
	RMB	250	25.00%	63							
	CMB	250	20.00%	50							
	<b>Total</b>	750	20.00%	150	200	220	240	50	70	90	OK
Level 3	Equity	125	25.00%	31							
	Real Estate	125	25.00%	31							
	<b>Total</b>	250	23.40%	63	100	110	120	38	48	58	OK
<b>Total</b>		9,000	8.86%	798	1,000	1,100	1,200	203	303	403	OK

- The purpose of the Market Risk report is to:
  - Report the 1-in-200 year market risk VaR
  - To monitor these against the market risk appetite on a daily basis

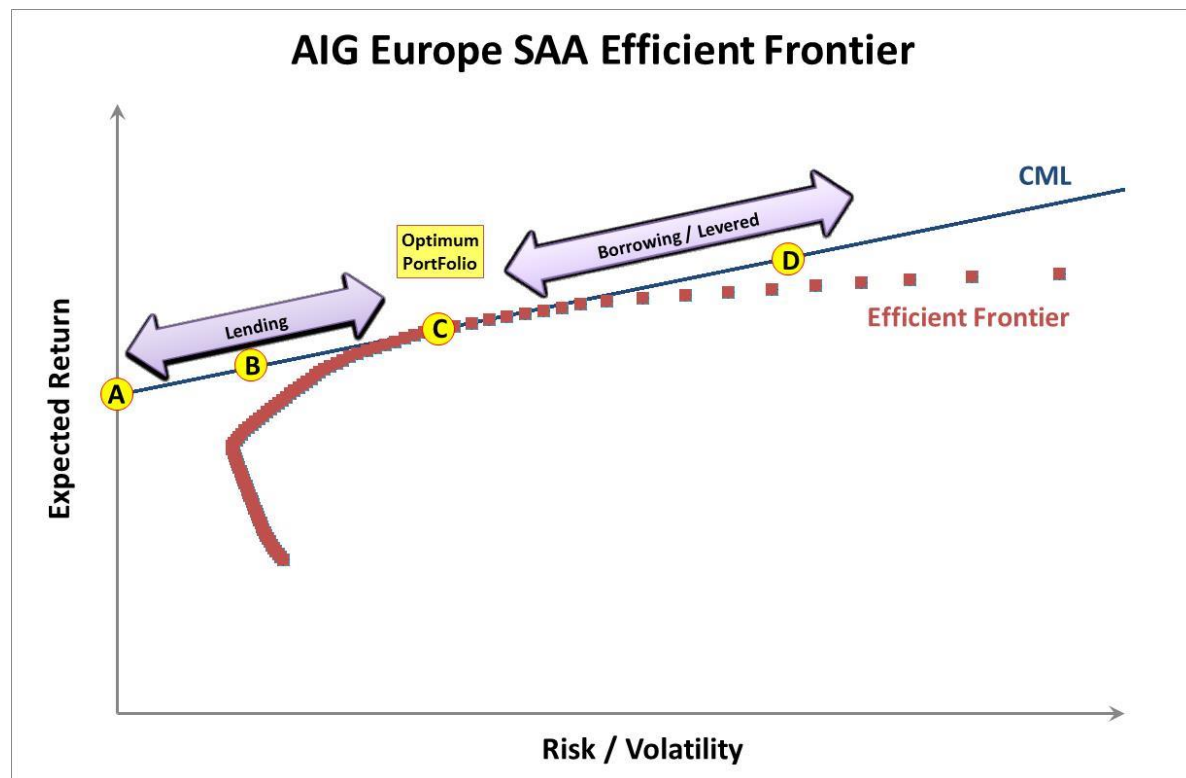
		Target Risk Profile	Amber Flag (+10%)	Red Flag/ Absolute Limit (+20%)	Current Risk Profile
<b>- Market Risk</b>	1:200	-1,000,000	-1,100,000	-1,200,000	-798,000



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# C. SAA & TAA

- Under Capital Asset Pricing Model (CAPM) theory:
  - Red dots:** the **efficient frontier**
  - The **Sharpe ratio** is the excess return per unit of risk.
  - Portfolio C:** the **Optimum Portfolio** with the highest Sharpe ratio.
  - Portfolio A:** **Risk-free Portfolio** where 100% of portfolio is in risk-free asset
  - Blue line:** the **Capital Market Line (CML)**
  - Portfolio B:** the **Lending Portfolios**
  - Portfolio D:** the **Borrowing / Levered Portfolios**
- SAA process used to test capital affordability of recommended portfolio



## C. SAA & TAA

- The Investment Analytics and Internal Model teams differ in approach to asset allocation and liability modelling:

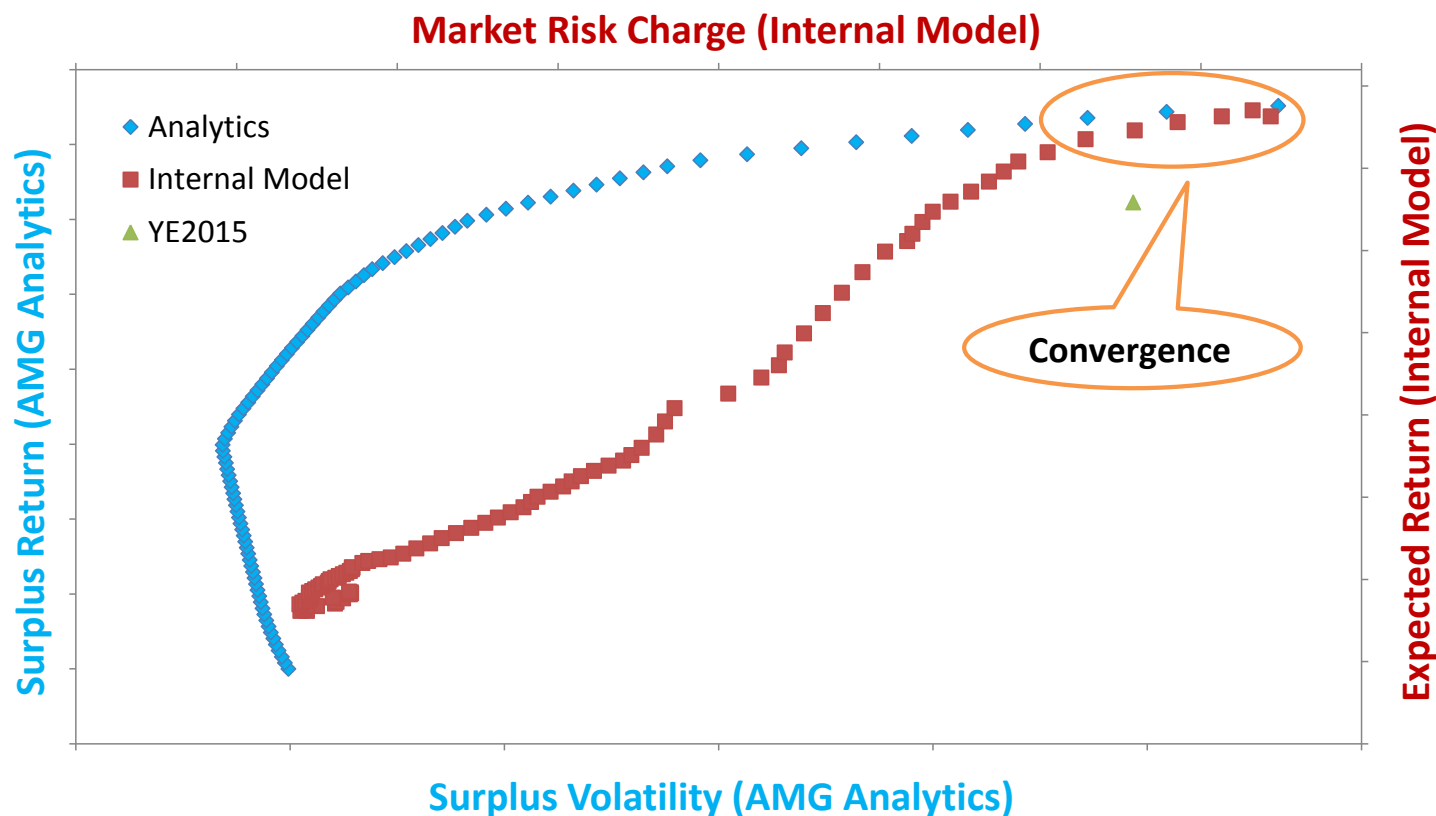
Asset Allocation	Investment Analytics	Internal Model
Basis	CAPM	SII
Return measure	Surplus Return = $E(R_{portfolio}) - E(R_{baseline})$	Expected Total Return
Volatility measure	Surplus Volatility $=SD(R_{portfolio}) - SD(R_{baseline})$	Capital

- The Analytics team model liability cashflows as negative fixed income bonds which means that only volatility due to economic variables (e.g. discounting and currency movements) are captured.
- The Internal Model improves on this by:
  - Modelling natural and man-made catastrophes explicitly;
  - Modelling reinsurance recoveries explicitly; and
  - Capturing the inherent uncertainty (parameter and process risks) of the liability itself.



# C. SAA & TAA

## AEL TAA Efficient Frontier



- The results showed return-volatility- capital optimisation convergence at higher return end of efficient frontier
- The actual year-end portfolio is close to this range of optimal portfolios.



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## D. Investment RAP

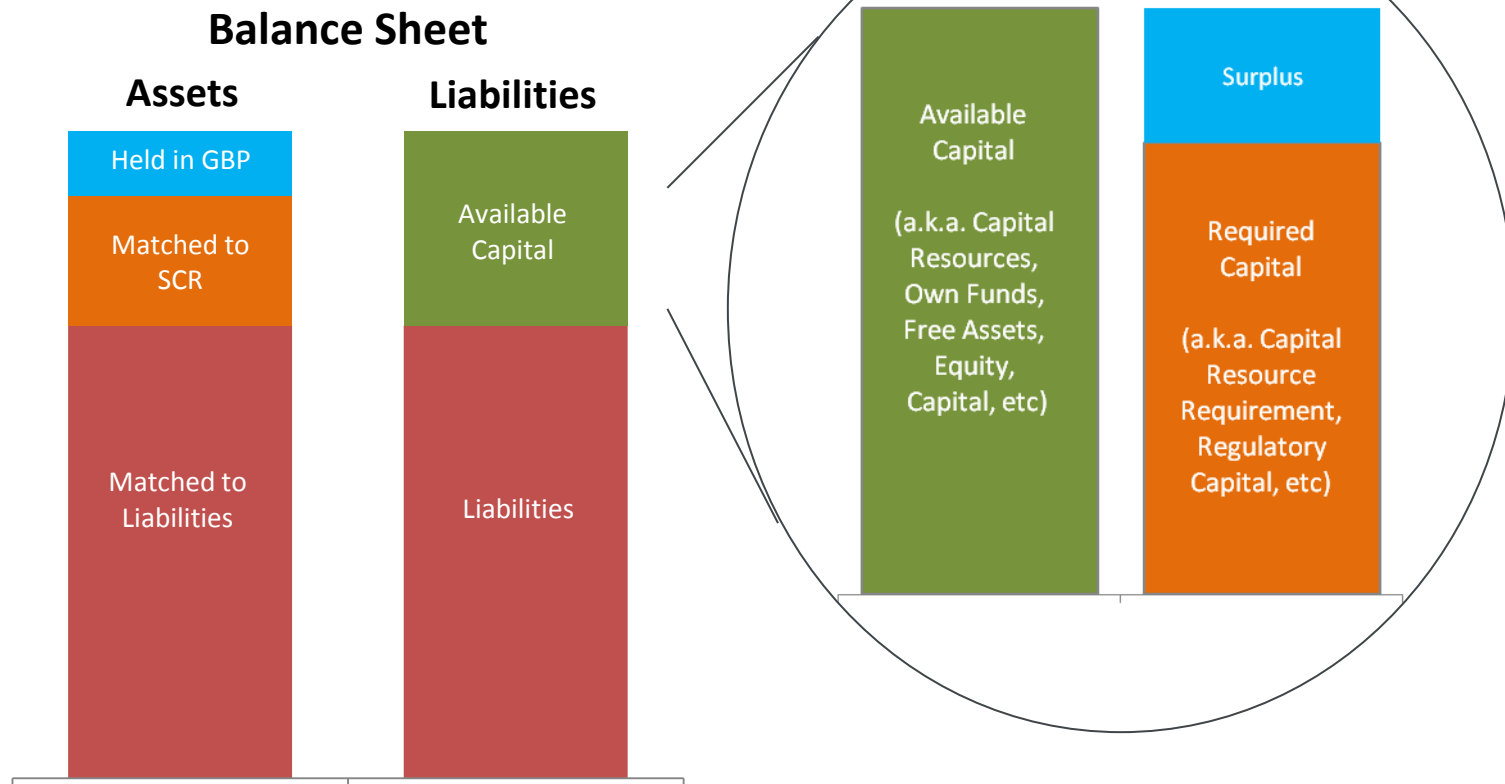
- Risk-Adjusted Profit (RAP) provides a “common currency” to measure economic profits across all AIG business.
- Using the risk charge (allocated capital to asset classes) from the Daily Market Risk Reporting work described earlier, RAP can now be applied to asset management through the following formula:

$$\text{Investment RAP} = \text{Investment Income (above the risk-free rate)} - \text{Risk Charge} \\ \% \times \text{Market Value} \times (\text{Levered}) \text{ Cost of Capital Rate}\%$$

- The investment income credited to the investment function should ideally be the return in excess of the risk-free rate. The risk-free rate should be credited to Insurance RAP. This ensures that long-tail lines are adequately compensated under Insurance RAP.



# E. Foreign Exchange (FX) Management Framework

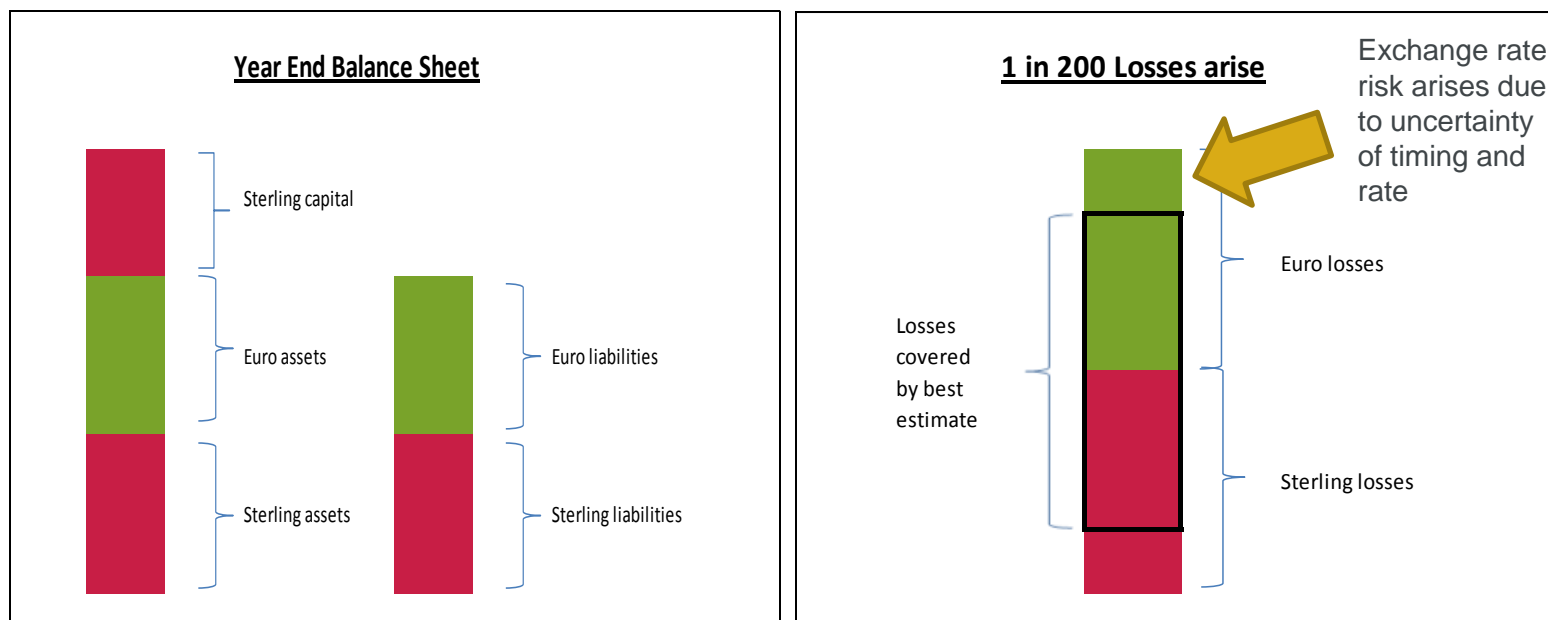


- It is increasingly common for Internal Model firms to work out its currency allocation using the Internal Model.
- This is more meaningful compared to an optimisation under Standard Formula which would require firms to hold its equity capital in its reporting currency only.



# E. Foreign Exchange (FX) Management Framework

The standard formula penalises firms for not holding capital in reporting currency. However, in a 1 in 200 event losses will arise in the currency of the liability.



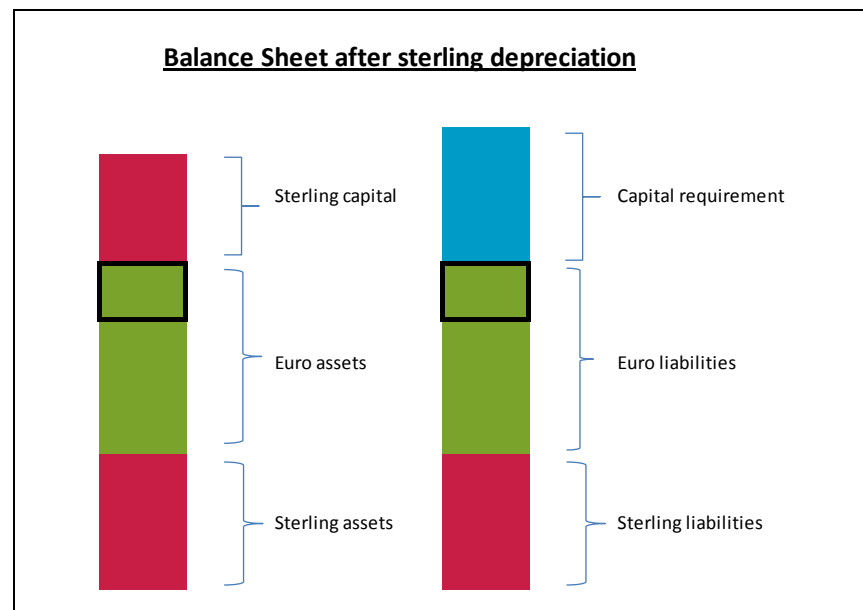
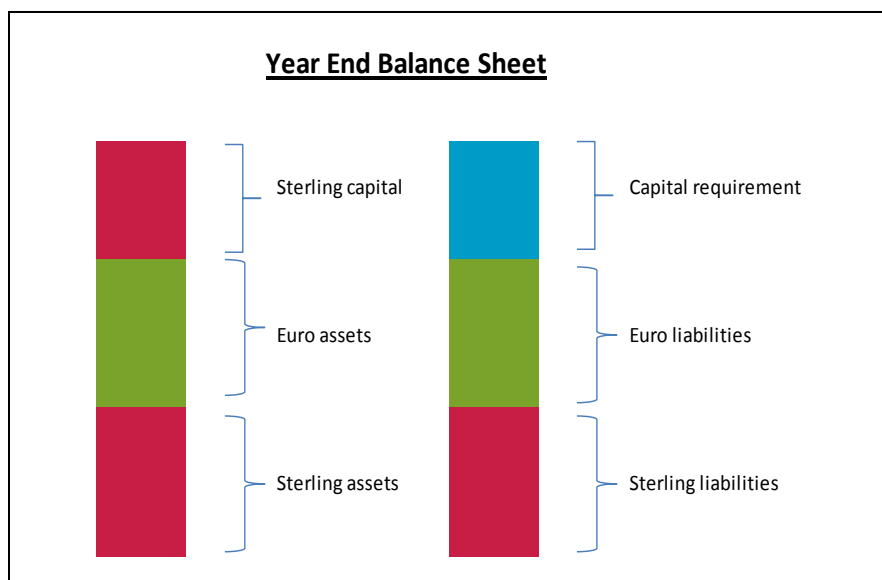
Capital should be held in the proportion to the currencies of the unexpected losses.



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# E. Foreign Exchange (FX) Management Framework

Holding capital in the currency of the risk also protects firms against exchange rate movements impacting solvency ratios.

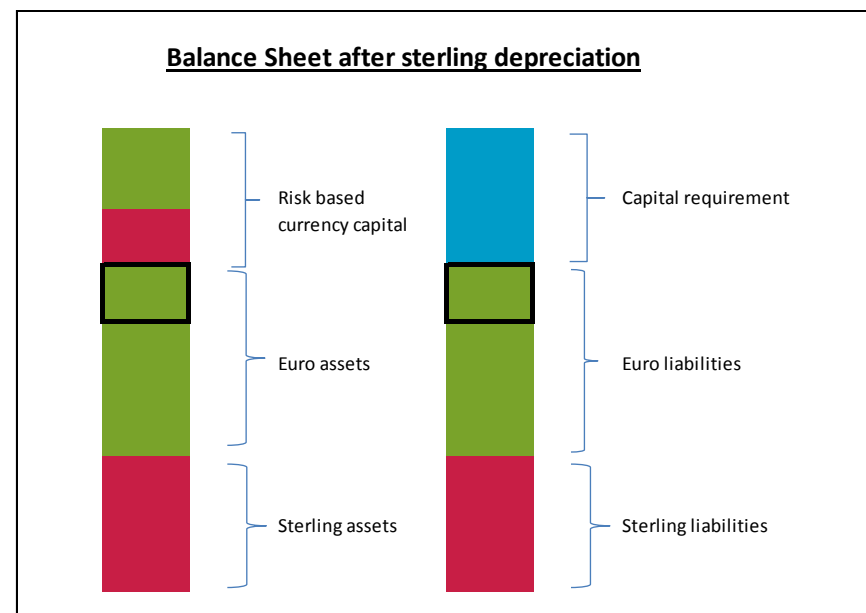
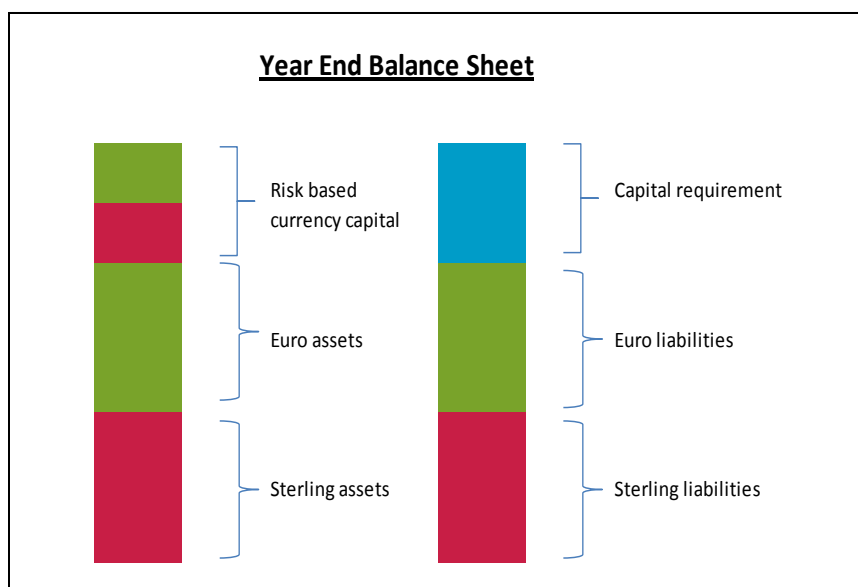


In this case, solvency ratios fall as the capital requirement increases due to sterling depreciation but the capital remains constant.



# E. Foreign Exchange (FX) Management Framework

Again, a more matched position would be to hold capital in proportion to the currencies of the unexpected losses.



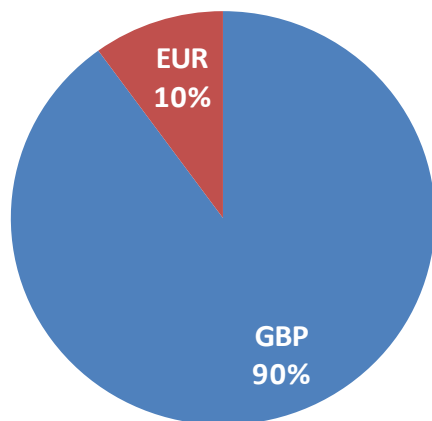
While this position protects balance sheet strength, it does add earnings volatility.



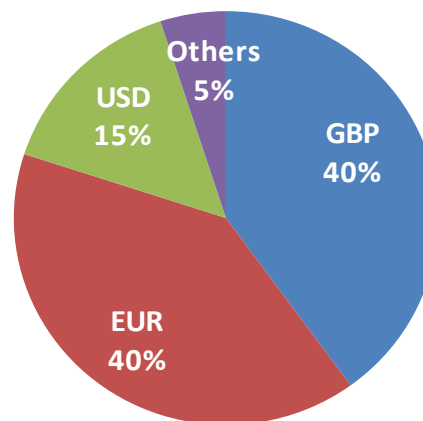
# E. Foreign Exchange (FX) Management Framework

% of Capital held in major currencies

Before



After (1-in-200)



- Ensures that AIG Europe would have sufficient EUR and USD assets to meet exposure to potential non-GBP liabilities from adverse losses e.g. (catastrophe) exposure gained through the UK branch of Lexington, our US-based surplus-lines insurance company.
- As it involved a significant reduction in our GBP holdings, it would also act as a natural hedge against currency volatility due to Brexit (the UK exiting the EU).



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# Future areas for development

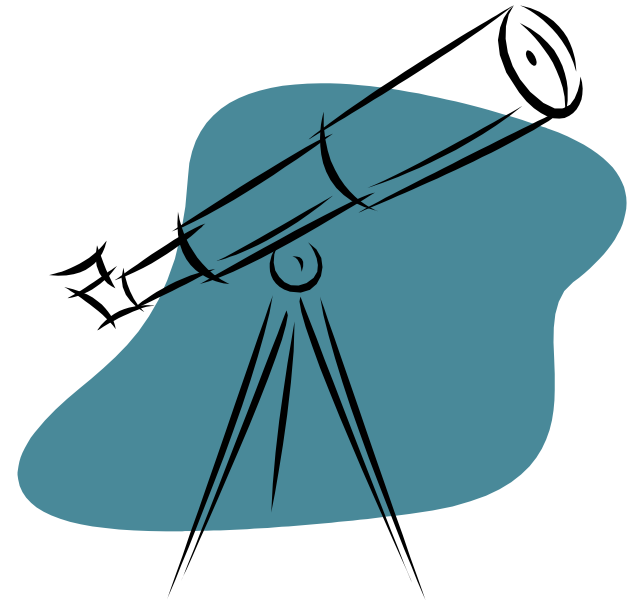
## Risk based Asset – Liability matching

Firms already match assets and liabilities by cash-flow, duration and currency.

Additional risk mitigation could be achieved by constructing portfolios which match claim liability inflation.

These portfolios would be created specifically to reduce the financial losses that may arise from inflationary increases to reserves.

A lower expected return on these assets (than compared to other portfolios with the same level of **market** risk) might be acceptable if overall risk to the balance sheet can be reduced.



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# 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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