

Internal Model – Advanced Uses

Asset Management in General Insurance

Contents

Introduction	4
Insurance industry uses of internal models	5
Internal model and asset management	7
Model use description	8
Risk appetite/risk profile reporting	9
Daily market risk monitoring	10
Strategic Asset Allocation (SAA) and Tactical Asset Allocation (TAA)	11
Investment Risk-adjusted Profits (RAP), our “common currency”	13
Model capabilities to enable use	14
Model limitations	15
Conclusion	16
About the authors	17
About the Internal Model Industry Forum and IRM	18

©2016 The Institute of Risk Management.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the express permission of the copyright owner. Permission will generally be granted for use of the material from this document on condition that the source is clearly credited as being the Institute of Risk Management. IRM does not necessarily endorse the views expressed or products described by individual authors within this document.



Foreword

One of the key Solvency II principles is that insurers' internal capital models must be embedded at the heart of risk and capital evaluation and they must be used as a key input to a wide range of business and strategic decisions. However, one particular area of challenge/opportunity for the industry is about consistently identifying the capabilities insurers will need to support uses of the model that go beyond solvency calculations as well as finding ways to share best practices.

Within this context, this booklet provides a practical perspective of using internal capital models to support decisions relating to asset management in general insurance. This case study is one of a series that is being published following research by our 'Flexibility and Advanced Uses of Internal Models' IMIF workstream. I would like to thank Raphael Borrel for his leadership of that workstream, our authors Yoon-Kwong Loh, Guillermo Donadini, Jeremy Baldwin, Christophe Travalletti and Laurence Dunkling for agreeing to share their experience in this field and AIG for their support."

The Internal Model Industry Forum (IMIF) has produced a series of documents offering guidance and sharing best practice on the validation and use of insurers' internal risk models. We are a market-wide initiative aiming to ensure that these models create value for the business beyond regulatory compliance.

José Morago

IRM Chairman and Founder of the Internal Model Industry Forum

Introduction

The IMIF work-stream on 'Flexibility and Advanced Uses of Internal Models' was set up to allow insurance firms to share insights on how they use internal risk models for business purposes beyond Solvency II compliance and how these various uses are communicated and embedded into the business.

Internal risk models can potentially provide helpful input or support to a range of business decisions and processes but it is vital that their use is appropriate and their limitations – and the impact of these limitations – properly understood by all those involved. This requirement extends beyond the risk modelling team to any part of management that might use or rely on the models, and also potentially to other interested parties like board members, regulators and investors.

A recent survey conducted by IMIF asked firms how those involved with these wider business decisions understood the limitations of the internal model. The results – shown in Chart 1 below – showed that there is significant scope for better understanding.

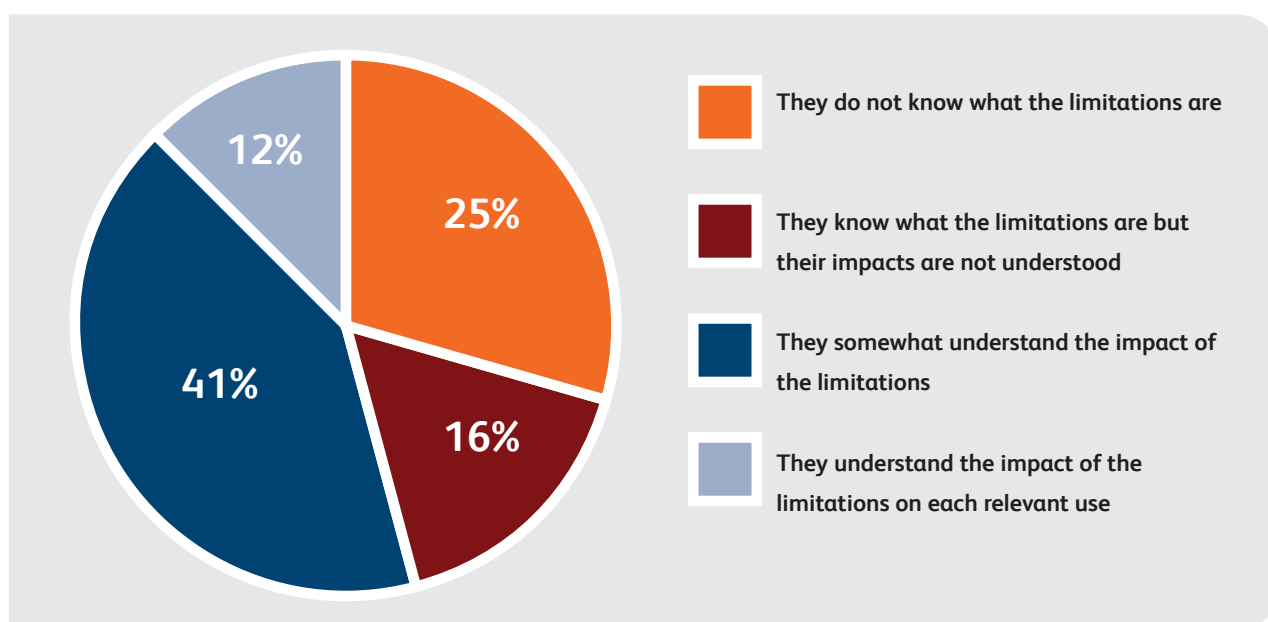


Chart 1: To what degree are the impacts of the limitations of the model on its intended use understood by all required business decision makers? (Source: IMIF 2015)

To assist in this matter this work-stream intends to publish a number of case studies that will highlight:

- model capabilities and functionalities that can be built to enable specific model uses;
- model limitations, and their impact on the model use, on the reliability of the consequent management information and on managing the resulting implications;
- practical examples of the uses of internal models

Ultimately, this work-stream will draw the key points from these case studies to publish a booklet to provide general guidance on using models for different purposes. It will also provide a framework to document the model use, and its limitations at use level. This will be available from the IMIF's web page¹.

¹ www.theirm.org/knowledge-and-resources/thought-leadership/creating-value-through-internal-models/documents-and-resources.aspx

Insurance industry uses of internal models

A survey conducted by the IMIF found a wide variation in how firms were using internal model outputs to drive business decisions for different processes. The results are summarized in Chart 2 below.

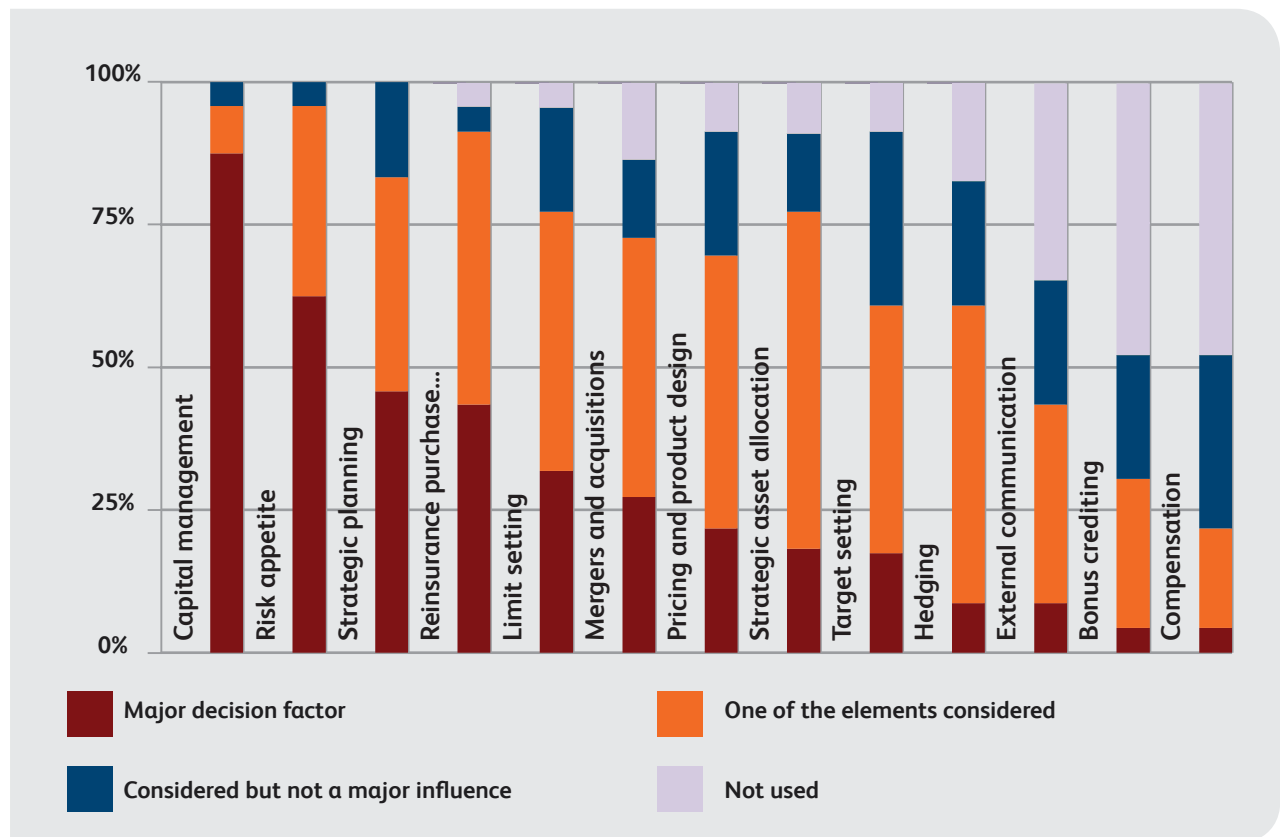
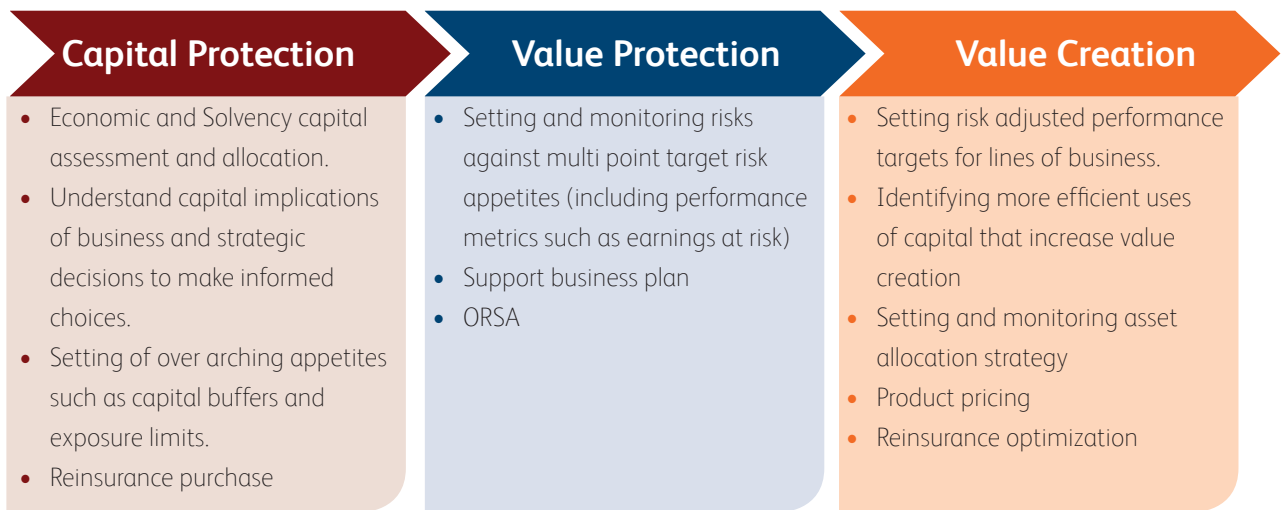


Chart 2: Rating of the importance of uses of the model in decision making (Source: IMIF 2015)

- The survey indicated, as we would expect, that most insurance firms use their internal models to drive business decisions aiming at protecting capital. This encompasses activities such as the allocation of solvency capital and the setting of over-arching risk appetites.
- The survey also showed that market leading insurance companies increasingly use their internal models for more advanced uses which can protect and add value for the business.

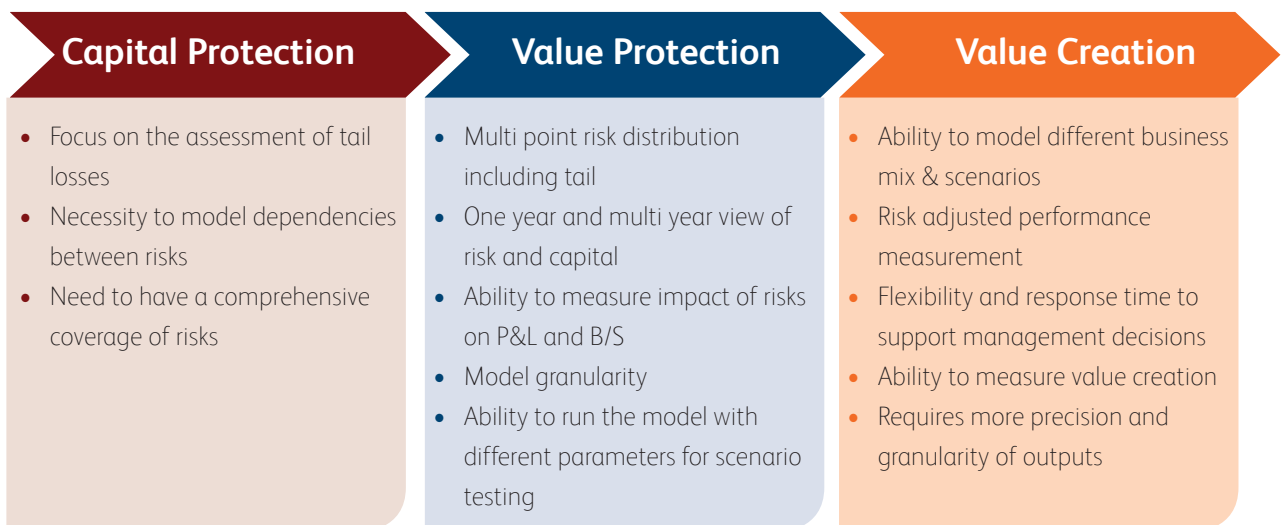
We can trace a progression of key uses of internal models that indicates three increasing levels of maturity, moving from capital protection, through value protection to value creation:



Supported by its survey and case study results, the work stream concluded that the current status quo for uses of internal models is bound by constraints that can be generalized as follows:

- The level of reliance that the management of a firm will place on a model is largely dependent on the level of maturity of this model.
- The uses of an internal model are expected to vary according to the scope, capabilities and limitations of the model.

The table below provides examples of key capabilities that can typically be expected for different model maturity levels together with the typical uses of the model.



In this case study, our authors from AIG outline how they are using their internal model to support asset management business decisions. This demonstrates how the internal model can be used for value creation.

Internal model and asset management

AIG Europe Limited (AEL) is one of the largest pan-European insurance company and the largest US-based property and casualty insurer in Europe. In 2015, AEL wrote £3.5b in net written premiums across all major general insurance classes with a particular focus on commercial lines which accounts for 76 % of total net premiums written. AIG Europe uses its internal model to support various enterprise-level, profit centre and business function decision making. The Asset Management Group (AMG) is the investment function of AIG which operates on an arm's length basis as a separate entity from the insurance business. AMG is one of the key users of the internal model and is one of the key supporters of the capital team alongside other departments such as Reinsurance, Data Science and Finance.

For most general insurance companies, their capital requirement will be driven by the same risks which they undertake to generate profits. As underwriting profits and investment returns forms the bulk of an insurer's profits, this means that insurance risk and market risk are the key risk drivers of a firm's capital requirements. It is therefore pivotal that the risk-reward trade-off for these two risks are optimised. Whilst there is acceptance that it is more difficult to optimise insurance risk due to various factors, including the fact that unlike investment assets there is no single quoted price for any particular general insurance liabilities, it has been market practice to optimise a firm's market risk using computer models since the introduction of modern portfolio theory in the 1950s. An internal model constructed on a total balance sheet approach therefore provides an enhanced platform to perform such modelling as it would have a more accurate and complete model of the insurer's liabilities.

We recognised the need to monitor our market risk on a more frequent basis as asset values fluctuate in real time and are therefore more volatile than our liabilities. For this reason, we have embedded a daily market risk monitoring report which reports the 1-in-200 year value-at-risk (VaR) of our £9bn portfolio of investible assets by asset categories and is benchmarked against our market risk appetite to ensure that management has sufficient time to react before our risk appetite is breached.

Our annual Strategic Asset Allocation (SAA) is a cooperative effort between AMG's Analytics team, the capital team and various other functions of the company. As an independent unit, AMG's Analytics team already has the capability to perform the SAA exercise on its own. However the internal model adds value to the process by quantifying its impact on capital and to provide a more accurately view of our company's insurance risk profile through its capability to:

- Model natural and man-made catastrophes explicitly;
- Model reinsurance recoveries explicitly; and
- Capture the inherent uncertainty (parameter and process risks) of the liability itself.

As a pan-European insurance company AIG Europe is exposed to liabilities denominated in multiple currencies. With improved modelling capabilities, we implemented a FX Management Framework in 2015 which moved beyond asset-liability matching to also address the currency risk associated with AIG Europe's excess assets. Using the internal model, we hold surplus assets in a risk balanced allocation across our major currencies. The primary purpose of this is to significantly reduce AIG Europe's capital surplus FX volatility. This ensures that AIG Europe would have sufficient EUR and USD assets to meet exposure to potential non-GBP adverse losses.

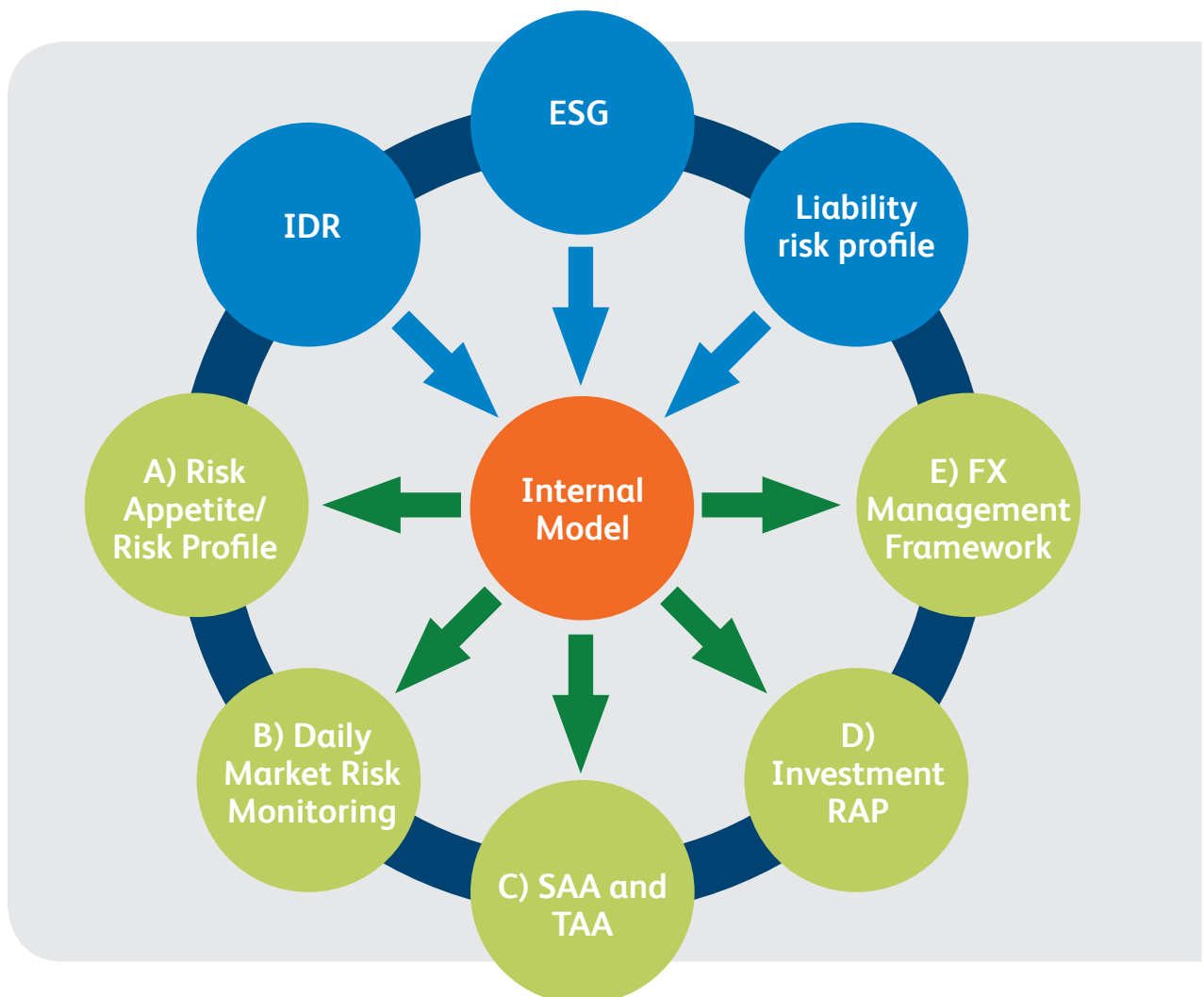
Model use description

In late 2013, the internal model moved from a project-based workstream to a business-as-usual approach. The existence of the internal model represents a significant leap in asset-liability modelling capability for the firm as both asset and liabilities are stochastically modelled under a total balance sheet approach. Before this, the Investment Analytics team modelled liability cashflows as negative fixed income bonds which means that only volatility due to economic variables (e.g. interest rates and FX movements) are captured but not the inherent uncertainty (parameter and process risks) of the liability itself. Since then, AIG has embedded various asset management uses which are interlinked with the internal model as the central analysis tool.

At around the same time, the asset management function completed the roll-out of the Investments Data Repository (IDR). IDR is the global data warehouse for master data across the firm's asset portfolio. It is the "single version of the truth" for investment assets and is assembled from numerous sources.

The availability of these two technology implementations 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:

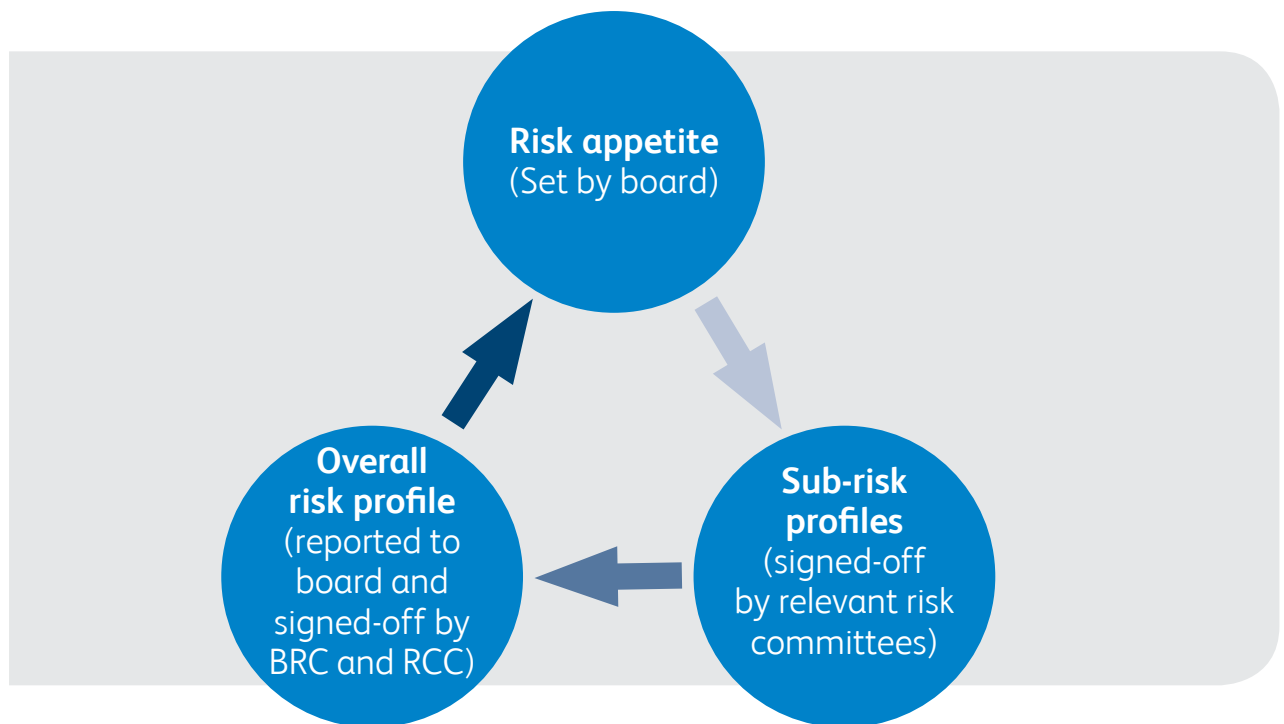
- A. Risk appetite/risk profile reporting
- B. Daily market risk monitoring
- C. Strategic Asset Allocation (SAA) & Tactical Asset Allocation (TAA)
- D. Investment Risk-adjusted Profits (RAP)
- E. Foreign Exchange (FX) Management Framework



A. Risk appetite/risk profile reporting

AIG Europe monitors its risk appetite using the Internal Model. Target (Green) 1:7 and 1:200 risk levels are set for each risk type, as well as Escalation (Amber) and Limit (Red) levels. These limits are reported against appetite using the economic capital model. The risk appetite is reported in line with frequency of model runs, with a move towards quarterly reporting.

Position against risk tolerances is reported to the AIG Europe Board, with AIG Europe's position against risk limits and sub-risk limits signed off by the Board Risk Committee (BRC), Risk & Capital Committee (RCC) and relevant risk committee respectively.



A breach of the Escalation trigger (Amber), results in reporting to the relevant committee, and remediating actions being taken over the following 6 months to bring the risk profile within target (Green). A breach of the Limit trigger (Red) is immediately reported to the relevant committee, with immediate remediating actions being taken to bring the risk profile within target (Green).

B. Daily market risk monitoring

The purpose of the Market Risk report is to:

- Report the 1-in-200 year market risk VaR at the European entity, asset cluster and portfolio level.
- To monitor these against the market risk appetite which is a sublimit of AIG Europe's risk appetite framework.
- And to do so on a daily basis as asset market values changes in real time, as opposed to liability movements which is updated on a quarterly basis by Corporate Actuarial.

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

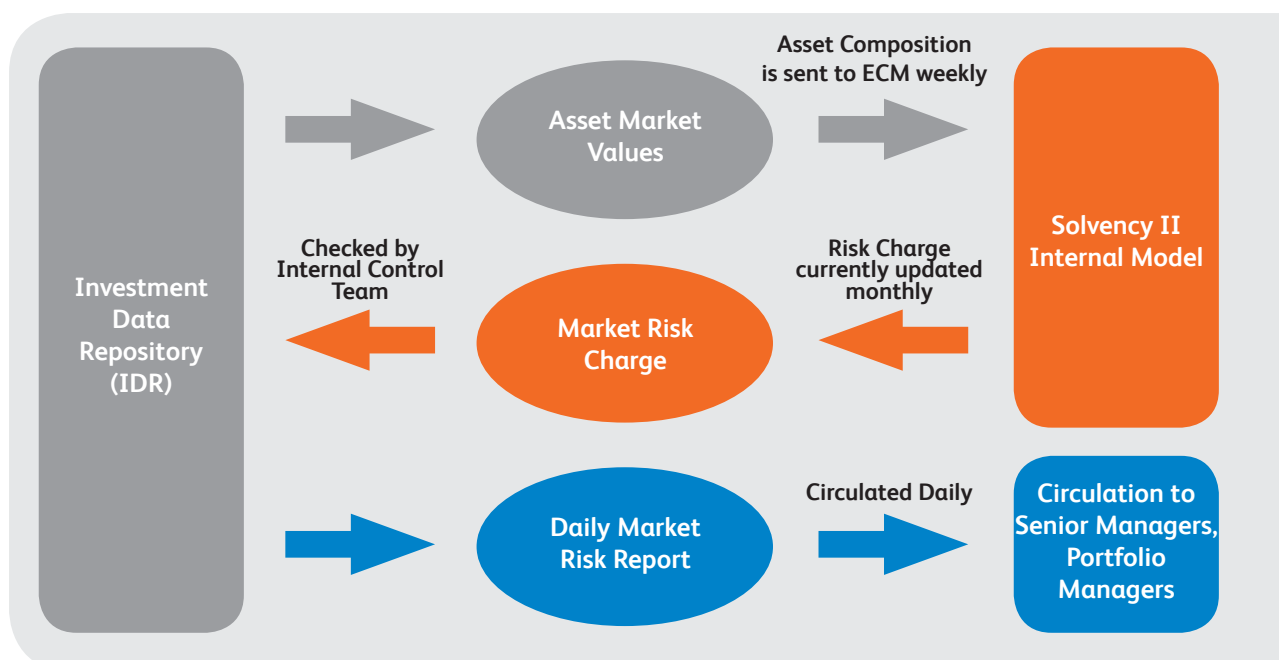
USD/GBP: 1.44335

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)							
	Total	2,000	(1.00 %)	(20)	0	0	0	20	20	20	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							
	Total	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							
	Total	750	20.00 %	150	200	220	240	50	70	90	OK
Level 3	Equity	125	25.00 %	31							
	Real Estate	125	25.00 %	31							
	Total	250	23.40 %	63	100	110	120	38	48	58	OK
Total		9,000	8.86 %	798	1,000	1,100	1,200	203	303	403	OK

* Figures are purely for illustration purposes.

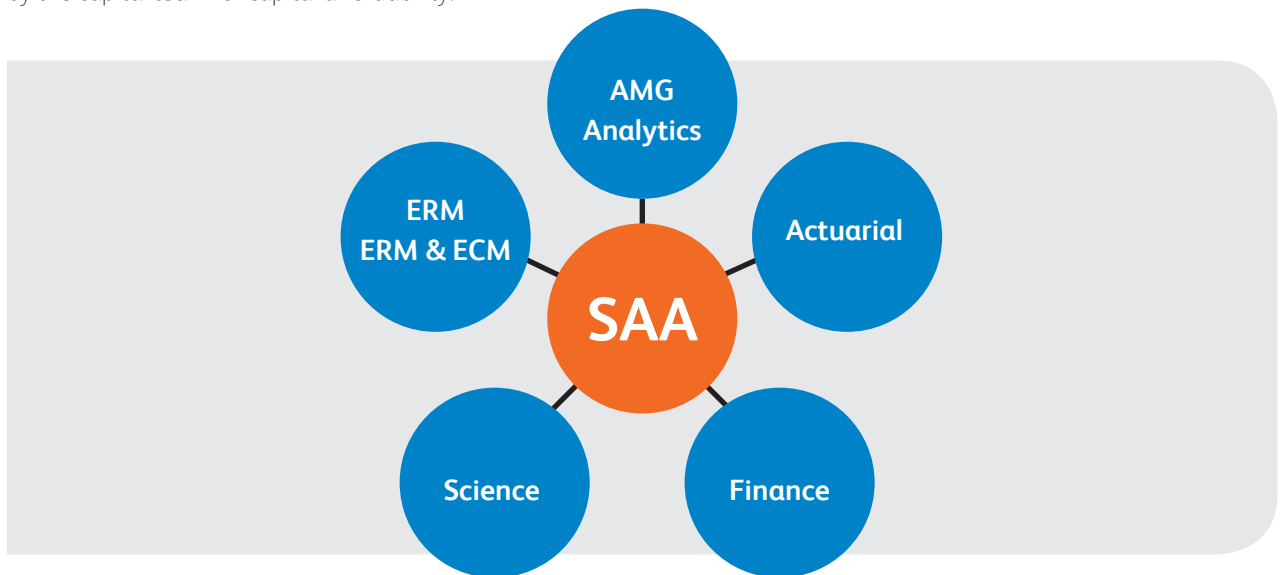
As an embedded risk report, the Market Risk report is automated to minimise manual interventions within IDR which is circulated to senior management and portfolio managers on a daily basis. Asset prices are updated daily and made available in the report the next day (i.e. a T+1 basis) whereas the market risk charge is updated on a monthly basis.



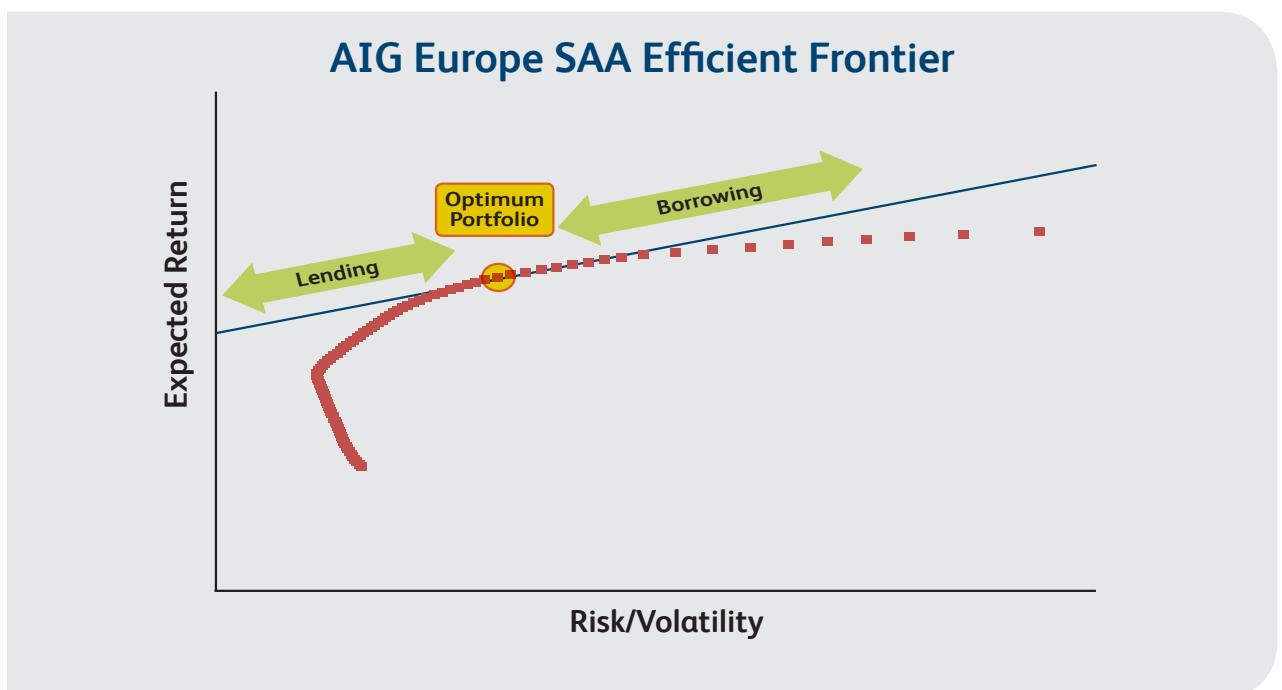
C. Strategic Asset Allocation (SAA) and Tactical Asset Allocation (TAA)

Strategic Asset Allocation: Trade-off between risk and return

Our annual SAA is a co-operative effort between AMG's Analytics team, actuarial, finance, science, ERM and the capital team. The Analytics team would first perform their modelling to generate a set of efficient portfolios which is then checked by the capital team for capital affordability.



Under Capital Asset Pricing Model (CAPM) theory, an efficient frontier is a set of portfolios such that no other portfolio exists with a higher expected return but with the same level of risk. It assumes that the risk-return profile of a portfolio can be optimised – an optimal portfolio displays the highest return earned in excess of the risk-free rate per unit of volatility. This is traditionally the portfolio with the highest Sharpe ratio that is on the efficient frontier. Traditionally the Sharpe ratio is based on the standard deviation. Using the internal model we have modified this approach to be based on the market risk charge derived through the process set out above.



Tactical Asset Allocation: What do you do when interest rates and credit spreads start to rise?

That was the question which was posed by senior management towards the second half of 2015 just before the Federal Reserve raised US interest rates for the first time since 2006 on 16 December 2015.

Working with the Investment Analytics team, we recommended a portfolio under a rising interest rate and credit spread scenario which is optimised on both an internal measure and on SII capital. First the Analytics team generated a set of efficient portfolios under the specified scenario. The same set of portfolios is then run through the internal model to test for convergence.

There are two key differences between the optimisation performed by the internal model and the New York-based Investment Analytics team:

1. The analytics team plots efficient frontiers based on trade-offs between:

- Surplus Return = $E(R_{portfolio}) - E(R_{baseline})$
- Surplus Volatility = $SD(R_{portfolio}) - SD(R_{baseline})$

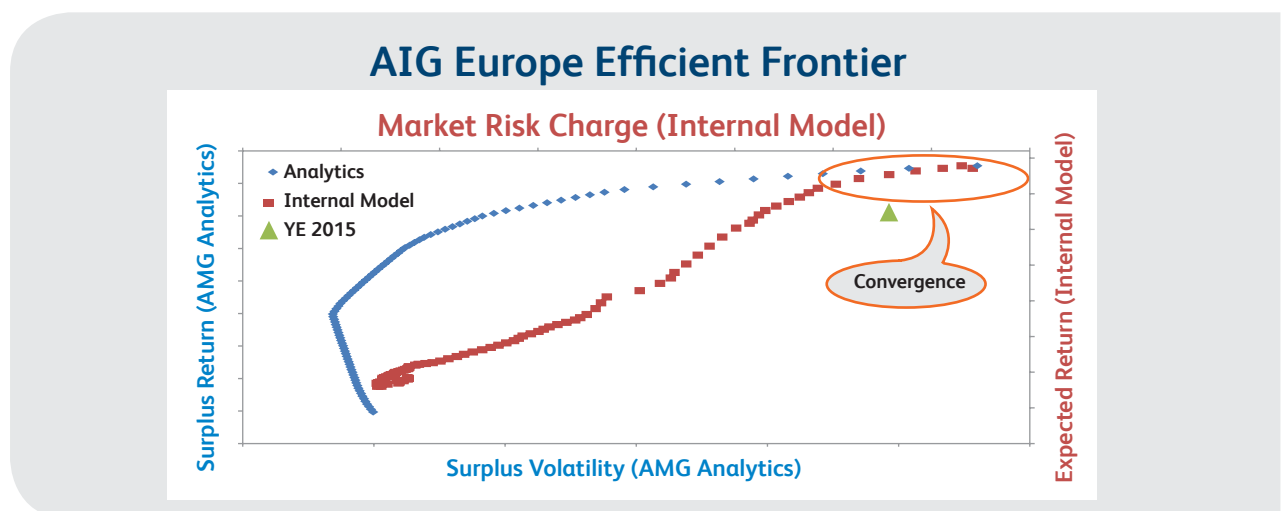
Whereas the internal model optimises with respect to expected return and capital;

2. The Investment Analytics team models 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.

The results showed that the efficient frontier created under the constraints of an increasing interest rate environment is mostly inefficient under a capital metric. However, more importantly, the portfolios towards the tail end resemble an efficient frontier. This implies that there is an optimisation convergence within this range on two different optimisation metrics. Coincidentally the risk-return position of the actual year-end portfolio is close to this range of optimal portfolios.



The end result is that the recommended portfolio is optimised on both SII capital and the internal surplus volatility measure. The recommended portfolio has a shorter duration and increased allocation to floating rate structured products and European High Yield bonds.

D. Investment Risk-adjusted Profits (RAP), our “common currency”

AIG has developed a global Risk-Adjusted Profit (RAP) framework for the purpose of ensuring an adequate return is provided to investors, commensurate with the risk taken on the business. RAP helps to identify areas of the business for growth, and those to be cut back, by making an allowance for the relative riskiness of each segment in budgeting and performance measurement processes. It incentivises effective risk management processes.

Perhaps more importantly, RAP provides a “common currency” to measure economic profits across all AIG business. Building on the daily market risk reporting work described earlier, RAP can now be applied to asset management through the following formula:

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

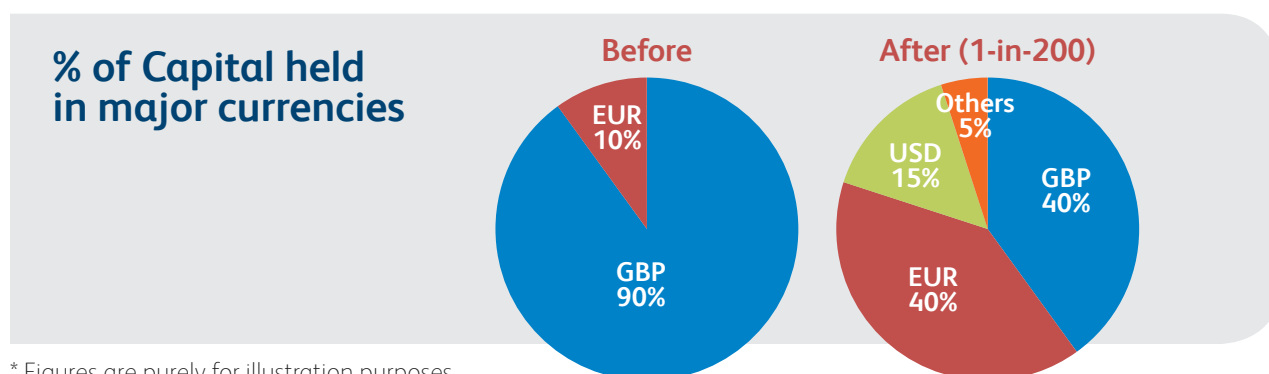
When used together with the SAA process, this is another metric which can be used to provide a numerical comparison between portfolios.

E. Foreign Exchange (FX) Management Framework

AIG Europe holds its net asset position (capital resources) in each major currency in proportion to the currency breakdown of its business risk’s contribution at the capital setting percentile, as calculated by AEL’s Internal Model. The primary purpose of this is to significantly reduce AIG Europe’s capital surplus FX volatility.

AIG Europe does not optimise its currency risk with respect to the Standard Formula requirement as this would require us to hold all of our assets in excess of liabilities in our reporting currency, namely GBP, rather than in the currencies of the underlying liabilities. This approach to modelling currency risk has been described as being “counter-intuitive” by an EIOPA QIS5 report.

As shown below, moving to such a framework 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).



* Figures are purely for illustration purposes

This FX Framework has been rolled out across AIG such that each regulated insurance entities would be required to hold capital in each currency to match the binding capital requirements arising in that specific currency.

Model capabilities to enable use

In order to ensure that the model is fit for its purpose, a range of model capabilities are desirable and these are set out below:

Capabilities	Description	Comments
Market-consistent valuation using an Economic Scenario Generator (ESG)	An ESG is a stochastic model of which produces a consistent set of key economic variable simulations (e.g. interest rates, inflation, FX rates) and translates those into the level of the market and asset prices for each model point.	Asset and liabilities are required to be measured at fair value under Solvency II. This is achieved through the use of an ESG to project changes to asset and liability values due to changes in key economic variables.
Total Balance Sheet Approach Model (Economic basis)	Both assets and liabilities should correspond to risk drivers in the same model	For instance, when the ESG simulates a decrease in interest rates, the model should project a decrease in liabilities and increase in asset prices simultaneously. This requires an accurate net of reinsurance liability risk profile. Please read our previous case study on reinsurance here: https://www.theirm.org/media/1685695/IMIF-reinsurance-case-study-v10.pdf
Optimiser	Enables you to construct the Efficient Frontier	A mean variance optimiser (MVO) derives the weights for each asset class of a portfolio that provides the maximum expected return for a given level of risk; or, conversely, the minimum risk for a given expected return.
Up-to-date Asset Holdings Data	Market or book value of your company's asset holdings	The main challenge which needs to be addressed here is that such data needs to be accurate and frequently available. At AIG, the introduction of IDR effectively addressed these challenges.
Reconciliation / P&L Attribution	Financial statement distribution generated by the internal model has to be reconciled to business plan	In order to aid the communication of any investment analysis, the mean of simulated results should be reconciled back to the business plan as we would have to show results gross and net of a particular treaty.
Full range loss curve	The availability of the full range of simulated results by asset categories are ideally required	As opposed to capital setting, which focuses on the 99.5th percentile, investment analysis will focus on more than just one particular percentile therefore most analysis will require the full range of simulated results.
Link to risk appetite	Assess impact on risk appetite	As asset values change in real time, it is important to check regularly to ensure that the total limits written remain within the corporate risk appetite which is linked to the capital management of the insurance undertaking as part of their risk management, reporting and regulatory supervision process.
Selection of calibration for ESG (one-year vs multi-year)	To satisfy Solvency II's requirement to assess capital over a one-year time horizon	To model interest rates, there are two main methods to calibrate the curves. Most general insurers would use the point-in-time method (i.e. implied by option prices), as opposed to the through-the-cycle (i.e. observed movements through many economic cycles). Market risk will be more dependent on market conditions by selecting the point-in-time method. This method makes the model more applicable for the coming year, but less stable over time as it is reliant on the state of the economy rather than a long running average.

Model limitations

Even the best models represent a simplified version of reality and its outputs would require significant sense checks by subject matter experts and stakeholders. In a world of increasing modelling capabilities, a balance has to be achieved whereby model outputs and expert judgements work hand-in-hand to achieve better decision making results. Therefore, it is important to not treat an internal model like a black box and to continuously seek to understand its capabilities and limitations. In our opinion, the best way to avoid over-reliance on models is to actively use a model and to gain feedback on its result.

Nevertheless the principle of proportionality has to be observed as the time (and cost) of further development may outweigh the benefits. A range of common limitations are set out below, with a link to the affected model capabilities set out above.

Limitation	Link to Model Capabilities	Comments
Model Risk	Links to all model capabilities	Model risk exists where there is an over-reliance on models when making business decisions which then leads to unexpected losses due to a model's limitations and simplification. Conversely, the failure to use existing models and over-relying on expert judgements instead can also be viewed as type of model risk.
Negative Interest Rates	Market-consistent Valuation using an Economic Scenario Generator (ESG)	Several major Central Banks has been forced to break the zero-bound view and adopt negative interest rates. Therefore it is irrational to impose a zero-bound view (i.e. no negative interest rates) on interest rate paths simulated by ESGs. ESGs have the ability to simulate negative interest rates through its Libor Market Model+ (LMM+) module which AIG Europe has now adopted.
Linear correlation assumptions	Market-consistent Valuation using an Economic Scenario Generator (ESG)	The dependency structure of most ESGs assumes that correlations are linear, meaning that the same correlations apply to economic variables in all circumstances. In reality, the performance of asset classes becomes significantly correlated under extreme stress. If the option to apply a different dependency structure is not available in the ESG, the standalone simulated distributions for asset classes could be exported into the firm's capital modelling platform where such modelling would be more easily performed.
Index representation	Market-consistent Valuation using an Economic Scenario Generator (ESG)	Certain asset categories are only modelled through indexation by ESG providers. Often we would have to assume that the equity or real estate series available within the ESG (e.g. FTSE100 index, UK house price index) are representative of those held by the company.
Reinvestment yields	Market-consistent Valuation using an Economic Scenario Generator (ESG)	In modelling future performance, the assumption that re-investment of insurance-generated cash flows will occur at the current portfolio yield is often made. If there is a strong view on yield direction over the modelling time horizon, then this should be incorporated into the re-investment modelling
Granularity	Market-consistent Valuation using an Economic Scenario Generator (ESG)	Asset holding might have to be grouped together into a model point depending on the capabilities of the ESG. Often the credit spread model is aligned to reflect the average grade of bond and duration of a portfolio.
Limitations of the Value-at-Risk (VaR)	Total Balance Sheet Approach Model (Economic basis)	The limitations of VAR are well documented. Practitioners have come up with various ways to address its shortcomings depending on the purpose of its use. Users are advised to investigate if using a Tail-VAR (TVAR) or a transformed method would be better suited for the work they are undertaking.
Temporal mismatch	Total Balance Sheet Approach Model (Economic basis)	As assets values are available on a daily basis whereas liability values are only available quarterly, there would usually be a mismatch with regards to the timing of data and parametrization updates.
Frequency of update of ESG	Up-to-date Asset Holdings Data	An ESG update is a time-consuming exercise and this is often an issue about resourcing. Therefore, up-to-date asset values are often more readily available than an updated ESG. Therefore, the ESG should at a minimum be updated an annual basis. However, the speed with which the economic landscape changes can be rapid. Given sufficient resourcing, ESGs for general insurers should move towards a quarterly update.
Marked-to-market or Marked-to-model	Reconciliation / P&L Attribution	Where a marked-to-market value is unavailable, a marked-to-model value needs to be obtained either through a discounted cash flow model or through scenario analysis. This is usually necessary for private placements, real estate, structured products, certain derivatives and other exotic instruments where a quoted price is usually not readily available.
Planned FX movement	Reconciliation / P&L Attribution	The view about future rate movements may or may not be included within the ESG output. The standard setting of most ESGs is to allow for a planned FX movement reflecting the provider's view of the future changes in pairwise currencies. However this could be overwritten in the internal model through scaling mechanisms. A "no planned FX movement" approach" helps provide consistent messaging internally about planned profit over the year in the same way the business plan doesn't plan for a profit or loss from currency. This is not an unreasonable approach as currency risk is an unrewarded risk.
The weighting of past losses in parameterisation	Full range loss curve	Historical-simulation models differ primarily in the span of time they include and the relative weights they assign to the immediate and more distant past. These differences become critical in periods of stress. The longer the look-back period, the more conservative the model; but the model also becomes less reactive to recent events. Put another way, the shorter the look back, the more likely it is that the model will provide early-warning signals – though these more reactive models also create faster change in front-office risk limits, making compliance more challenging.

Conclusion

As set out in this paper, various market risk analysis could be performed which not only utilises the capabilities of the ESG, but other parts of the internal model to ensure that the overall risk profile of the company, particularly on the liabilities side, is captured. This ensures that the risk reporting and asset allocation, amongst other work, pays sufficient regards to asset-liability matching beyond the mean. For instance, there is an on-going global implementation of an FX framework which will see AIG entities hold capital in each currency at the capital setting percentile. This ensures that we will have sufficient funds in our major currencies if adverse events, such as catastrophes, were to occur without the need to force sell to maintain liquidity.

Furthermore, whilst risk-adjusted profit or economic profit frameworks already exist in most companies, in one form or another, they are usually only applied to assess its insurance business when it could be expanded to investment and reinsurance etc. Together, they form a useful “common currency” which is understood company-wide hence allowing for a meaningful comparison between initiatives in different functions.

Authors

Raphael Borrel manages the Solvency Experts Group on LinkedIn, a large non-commercial European network of Solvency II interested parties. He is an experienced risk strategy, risk transformation and regulation consultant with over 15 years of experience within financial services covering both banking and insurance industries. He has extensive experience in designing and implementing Solvency II components. He currently focuses on assisting companies to operationalize their business strategy using advanced risk appetite and risk management frameworks.



Raphael Borrel

Yoon-Kwong Loh, ERM Capital Actuary, works in AIG's Economic Capital Modelling function which is an ERM department. With a background in both consulting and direct company capacities, YK has covered key aspects of the actuarial function for a general insurer including capital modelling, reserving, and pricing. He qualified as a Fellow of the Institute of Actuaries (FIA) in 2013 and has a first class honours degree from City University, London.



YK Loh

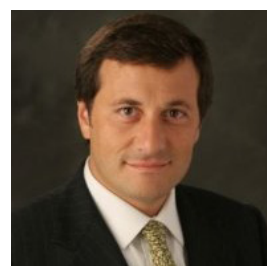
Laurence Dunkling is the Head of Model Uses at AIG. He is a Fellow of the Institute of Actuaries (FIA) and was a member of the Institute's Solvency II Technical Provisions working party. Together with YK, he specialises in helping the business find practical uses of the internal model.



Laurence Dunkling

Guillermo Donadini, AIG Europe Limited CIO

Mr. Donadini is responsible for developing strategic asset allocation and managing investment portfolios for AIG in Asia Pacific, Europe and Japan. He also held responsibilities within AIG as Chief Investment Officer for Europe and for Latin America, in both cases actively engaged in developing investment strategies for the property and casualty, life and pensions investment portfolios. He has been also Chief Investment Officer in Colombia and Argentina. Outside AIG, Mr. Donadini worked for MetLife Investments Ltd. as Chief Investment Officer for Europe, Head Trader and Head of Research for ING Bank and as a Senior Investment Analyst at M&S Consulting, an Argentina based economic think tank. Mr. Donadini was born in 1966 and received a BA in Economics from Buenos Aires University and a MA in Economics from Universidad del Centro de Estudios Macroeconomicos de Argentina.



Guillermo Donadini

Jeremy Baldwin, AIG Asset Management (Europe) Limited CIO is responsible for developing strategic asset allocation and managing investment portfolios for AIG in Europe. He is also Chairman and Chief Investment Officer of AIG's UK based pension plans. Prior to his current role, Mr Baldwin was Co-Head of Investment Grade and Emerging Market credit research. Prior to working for AIG, Mr Baldwin worked in a number of roles as a Global Fixed Income Portfolio Manager. Mr Baldwin is an Associate Member of the Chartered Institute of Management Accountants, and holds a BA (Hons) in Accounting & Finance from Nottingham Business School.



Jeremy Baldwin

Christophe Travelletti, is the Head of Market Risk for AIG Europe, Middle East and Africa. Prior to his current role, he was a market risk officer at AIG Financial Products focusing on interest rate, FX, equity and commodity derivatives. Prior to joining AIG, he was a member of the research and development team of Morgan Stanley Capital International in Geneva and worked on the development of new equity indexes. Mr Travelletti received an MA in telecommunications and an MA in financial mathematics from the Swiss Federal Institute of Technology of Lausanne. He is also a CFA charter holder.



Christophe Travelletti

The Internal Model Industry Forum

This document has been produced by the Internal Model Industry Forum (IMIF). The Institute of Risk Management (IRM) set up the IMIF in 2014 to address the key questions and challenges that insurers face in the use, understanding and validation of internal risk models. It is designed to work in a collaborative way to develop and share good practice to ensure that these models add value to the organisation and support regulatory compliance. IMIF now has over 300 members and we have run a series of Forum meetings to explore key issues. A number of workstreams are also undertaking research and we aim to publish the results along with other useful resources and guidance.

The IMIF work is led by a steering committee comprising modelling experts from insurers alongside representatives from EY, KPMG, LCP, Milliman, PWC, the Institute and Faculty of Actuaries and the Bank of England Prudential Regulation Authority.

As the leading organisation promoting education and professional development in all aspects of risk management, IRM is pleased to be able to support this industry initiative to share good practice

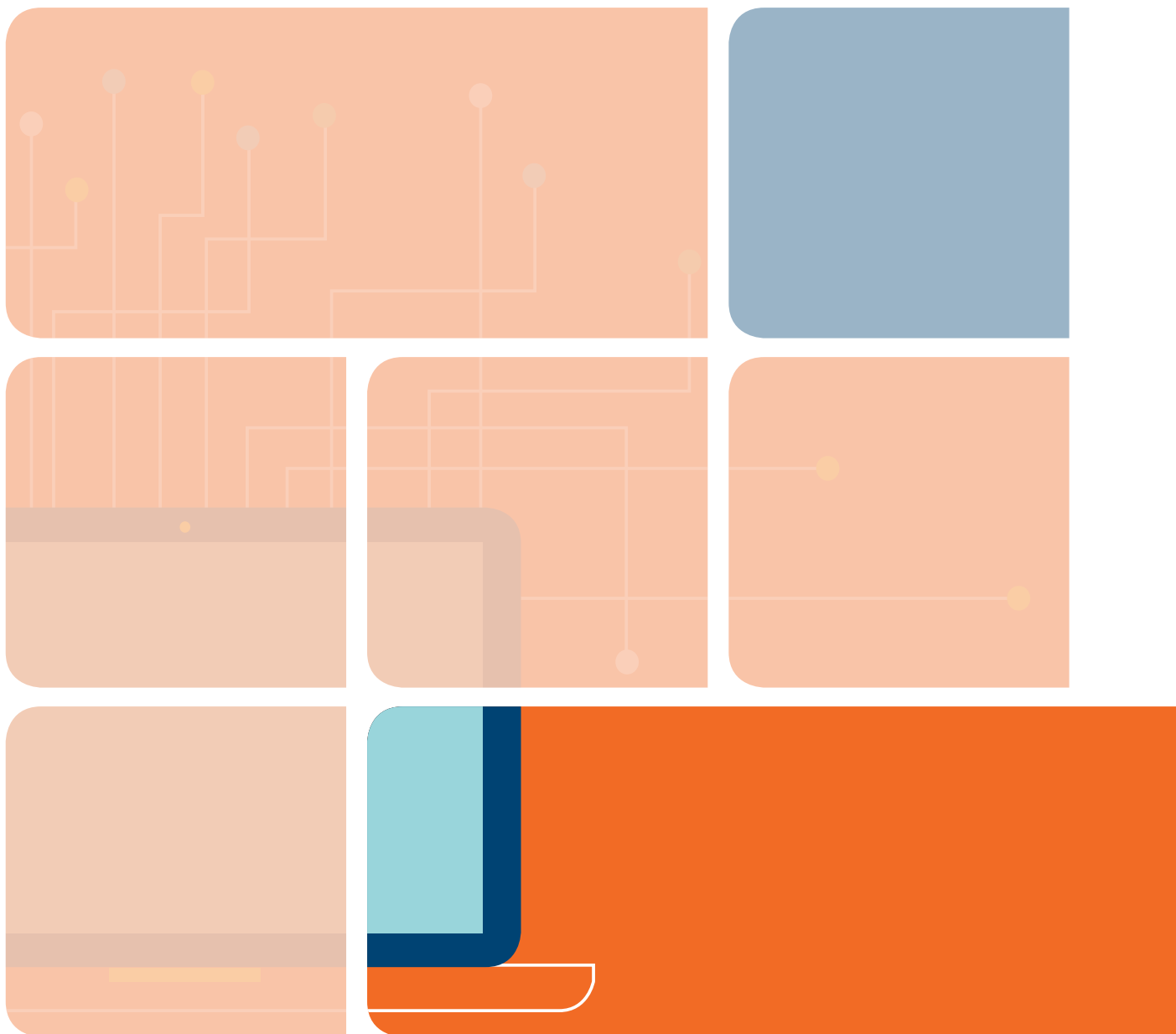
More information about the IMIF and its work can be found on the IRM website www.theirm.org

The logo for the Internal Model Industry Forum (IMIF) is located in the top right corner. It consists of a teal square containing the text "Internal Model Industry Forum" in white, with "Internal Model" on the first line, "Industry" on the second line, and "Forum" on the third line.

Who are the IRM?

This work has been supported by members of IRM, which has provided leadership and guidance to the emerging risk management profession for over 25 years. Through its training, qualifications and thought leadership work, which includes seminars, special interest and regional groups, IRM combines sound academic work with the practical experience of its members working across diverse organisations worldwide. IRM would like to thank everyone involved in the IMIF project.

The IRM logo is located in the bottom right corner. It features the lowercase letters "irm" in white, set against a dark blue square background.



IRM

T: +44(0) 20 7709 9808

E: enquiries@theirm.org

www.theirm.org

Institute of Risk Management

2nd Floor, Sackville House

143-149 Fenchurch Street

London

EC3M 6BN

United Kingdom

Internal
Model
Industry
Forum

irm