

**Internal models:
a reinsurance perspective**

About Insurance Europe's Reinsurance Advisory Board

Insurance Europe's Reinsurance Advisory Board (RAB) is a specialist representative body for the European reinsurance industry. It is represented at chief executive officer (CEO) level by the seven largest European reinsurance firms: Gen Re, Hannover Re, Lloyd's, Munich Re, PartnerRe, SCOR and Swiss Re, with Insurance Europe providing the secretariat.

Through its member bodies, the RAB represents around 60% of total worldwide reinsurance premium income. The RAB promotes a stable, innovative and competitive market environment. It further promotes a regulatory and trading framework that facilitates global risk transfer through reinsurance and other insurance-linked capital solutions.

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Introduction



Between them, the seven members of the Insurance Europe Reinsurance Advisory Board (RAB) have approaching a millennium of experience in managing society's extreme and complex risks. Risks have changed considerably since the 19th century, when many RAB firms were established, and those risks continue to evolve today: the negative effects of the financial crisis still ripple through Europe; climate change is increasing the frequency of extreme weather events; governments are under pressure to respond to the risks posed by ageing populations; and technological advances have exposed people and businesses to cyber risk.

Adapting to a rapidly changing risk landscape and identifying emerging risks lie at the heart of reinsurers' business models. Reinsurers play a crucial role in the real economy. They expand insurers' capacity to assume risks from businesses and individuals, supporting sustainable growth. By pooling a large number of diverse risks (both in terms of type and geography), reinsurers benefit from diversification, since not all risks will materialise at the same time.

The large variety, complex interdependencies and joint impact of risks require correspondingly sophisticated models. For this reason, most RAB firms already use their own internal models. Models for natural catastrophe risk started to be developed in the 1980s. Reinsurers have invested extensively ever since, particularly over the last 20 years, in developing models that are aimed at the holistic measurement of risk and the effects of diversification.

Internal models have proved crucial for sound risk management and business steering. This is because they create the right risk incentives and promote a better internal and external dialogue about risk exposures, thereby improving risk resilience. From the 19th century onwards, the sector has been able to weather a number of catastrophes and financial downturns, from the San Francisco earthquake of 1906 to the attack on the World Trade Center in 2001 and from the Great Depression in the 1920s to recent and current financial crises.

Modern insurance regulatory regimes, such as the European Union's Solvency II and the Swiss Solvency Test, have sought to recognise the importance of risk management and business steering within the insurance sector. Consistent with the principle of proportionality, different approaches to risk measurement are needed, depending on the size, nature and complexity of a (re)insurer's risks. A "one size fits all" approach is unworkable, as it results in an approach whose complexity is inappropriate for companies with smaller and simpler risks and leads to results that are misleading or wrong for undertakings with larger and more complex

ones. In general, prescriptive approaches and formulas are not able to reflect the complexities and nuances of larger and more complex organisations, whereas customised, well thought-out and documented approaches can and do pass the “fit for purpose” or use test. In recognition of this, both Solvency II and the Swiss Solvency Test allow internal models to be used to calculate regulatory solvency capital requirements, subject to supervisory approval. Other adjustments to the standard formula for calculating an undertaking’s risks also exist in Solvency II, such as undertaking-specific parameters. However, these are currently limited and only allow the standard formula to be adjusted for premium and reserve risks.

In the wake of the financial crisis and the efforts to make banks more resilient, there has been significant debate about internal models, particularly the methods for assessing credit risk, including the merits of internal models versus more standardised approaches.

Internal models have a number of benefits, making the risk profile of companies more transparent and enriching the dialogue between the supervisor and the undertaking. Internal models analyse risk in more detail so that the output of the model more closely reflects an undertaking’s risk profile.

Mandating the use of standard formulas or imposing supervisory overlays would threaten the progress that has been made in risk management in the insurance sector and the greater alignment of the way supervisors and companies look at risk.

RAB members are involved in a dialogue with supervisors to demonstrate the rigorous design, appropriate calibrations and robust governance underpinning their models. This publication is intended to support those discussions. It addresses the supervisory criticisms that have been levelled against internal models and explains why, for reinsurers, internal models remain the most accurate measure of risk, the best driver of good risk management and the most appropriate basis to compare risks between companies. This publication may also be useful for companies considering whether to develop a full or partial internal model.

A close-up photograph of several interlocking metal gears. The image is heavily blue-tinted, giving it a monochromatic, industrial feel. The gears are of different sizes and are positioned in a way that shows their teeth meshing together. The lighting creates strong highlights and shadows, emphasizing the metallic texture and the geometric shapes of the gear teeth. The text is overlaid in the upper left quadrant in a bright yellow color.

A. History and experience of internal model use by reinsurers

1. Specific characteristics of the reinsurance business model

Reinsurers provide a risk transfer function that allows primary insurers to smooth the impact of both major losses and peak risks; this makes insurers more attractive for investment and helps them to benefit from a reduced cost of capital. They provide a risk finance function; acting as an alternative financing source and thereby expanding insurers' capacity to assume risks from businesses and individuals. Finally, reinsurers provide an information function, helping society to price and manage risk.

The risk profile of reinsurers is generally significantly different to that of banks and direct insurers. The fundamental difference is that reinsurers are business-to-business enterprises. This makes the operational and expense structures and risks of reinsurers fundamentally different to those of direct insurers. For example, direct insurers have potentially millions of customers, whereas reinsurers have only a few thousand institutional clients. This means that reinsurers have different operational risk, underwriting risk and counterparty default risk profiles to direct insurers.

The reinsurance business model is based on the widest possible diversification of risks, lines of business and geographies. Consequently, a single event in one region will have a more limited impact on the solvency position of reinsurers than on more locally focused insurers and banks. It is very difficult to capture diversification effects, particularly those flowing from geographical diversification, in a standardised approach without making the approach very complex and less relevant for other business models.

Banking internal models cannot be easily equated with (re)insurers' models, as some commentators have suggested. Banks are primarily exposed to credit, liquidity and market risks through their roles as deposit collectors and loan providers. Credit risk arises through banks' role as loan providers, liquidity risk through the duration mismatch of long-term assets (loans) versus short-term liabilities (bank deposits) and market risk through the trading book. As clearly demonstrated during the financial crisis, there is a strong correlation between these risks and interconnectedness between banks, which explains the systemic nature of banking activities.

2. Developments in internal models

Global reinsurers have been at the forefront of the developments in internal models over recent decades. This reflects the continuous improvements in risk and

capital management practices within the financial industry, and specifically in the reinsurance sector.

Over many years, reinsurers have invested considerable effort and resources (both IT and human) in developing internal models. During this time, modelling techniques have evolved to what is now regarded as “state of the art” integrated risk management that drives risk identification, assessment, control and steering processes. Appropriately designed and calibrated internal models now represent the most advanced way in which proper economic capital assessments can be determined for global reinsurance groups.

The design of internal models has targeted the comprehensive and holistic modelling of reinsurers’ economic balance sheets and risk profiles, going beyond the separate modelling of individual risks (market, credit, underwriting and catastrophe).

An essential feature of any capital assessment methodology is the determination of post-stress capital adequacy. This requires the attachment of a probability to the emergence of a particular stress event. Full distributions of risk factors can be calibrated within internal models, taking account of all the information available. For example, a life risk calibration — be it for mortality or health risks — takes into account, as appropriate, the specifics of the local market in terms of underwriting standards, medical advances in screening and detection, as well as the level and quality of historic data on the underlying risks.

The application of an internal model depends on the availability of high quality data that is used in the calibration process. Reinsurers have built up data over long periods. These proprietary datasets, coupled with publicly available data, can be used to calibrate full distributions of underlying risks. The datasets have also augmented reinsurers’ understanding of risks and their risk management capabilities.

To illustrate this point, techniques to mine data on mortality trends using internal biometric experience data, together with the World Health Organization’s Human Mortality Database, have led to a much better understanding of the regional differences in mortality trends. This data has enabled reinsurers to model how longevity risk and mortality risk deviate from expected mortality improvements. For example, the deviation from expected mortality improvements is expected to be low in the short-term and much higher in the long-term, which is difficult to embed in a standardised approach. The data also allows internal models to capture the diversification that exists for companies with global and not just local exposures.

Another important development has been the increase in the popularity of stochastic modelling techniques rather than the deterministic approaches that were used before. Stochastic scenarios represent the impact of a large number of combinations of risk factors on an undertaking's exposures. The benefit of this approach is that it identifies the individual risks and combinations of risks that are most detrimental to the undertaking. It cannot be replicated by more simplistic approaches. Examples include non-linear exposures to catastrophe events, analysis of non-symmetric impacts such as tax or profit-sharing arrangements or the impact of combinations of risks. Internal models can quantify such impacts and assess long-term risk exposures within a dynamic framework.

The actual methods used to model risks vary between companies. For example, financial market risk can be modelled by using an "economic scenario generator", which provides random realisations of global economic variables such as gross domestic product, inflation and unemployment and then derives from this the price changes of financial market instruments in each scenario. An alternative approach is to model directly the price changes of the instruments, taking into account the corresponding dependencies. This should not be of concern from a supervisory perspective, since both approaches have their merits and the focus should be on the model outputs.

Developments in modelling techniques have led to a more integrated and centralised risk management approach and a move away from decentralised risk management. This has been crucial in establishing a holistic view of the overall risk landscape of (re)insurers. While it was possible under the decentralised approach not to recognise that market risk stemming from investments in shares was more material than underwriting risks, the integrated approach results in a clear and transparent overview of the risk landscape of the entire balance sheet. Responsibility for this oversight function is allocated to a central department that at the same time governs the internal model. This, in turn, also allows the formulation of holistic risk strategies.

The integrated approach demands an explicit modelling of dependency structures between the different risk modules. This allows reinsurers to analyse risk concentrations and supports a sound measurement of diversification. Modelling also supports a forward-looking approach, allowing reinsurers to understand, analyse and steer their portfolio in order to create the most diversified and stable book of business.

3. Uses of internal models

Reinsurers have been using their internal models to inform business decisions for many years — well before the formal application of Solvency II in January 2016. By embedding their internal models into the business-steering approach, reinsurers ensure that decisions are well-founded and underpinned by a clear understanding of the associated risks.

The importance of a broad and consistent model application is clear when one considers the 2008 financial crisis. The crisis highlighted fundamental weaknesses in financial models throughout the banking system. It also highlighted that — within the banking industry — financial models were considered as tools to calculate regulatory capital requirements. The models were not embedded within organisations and, in particular, the results of the models were not used appropriately in decision-making. It is therefore imperative that the use test is recognised as important by management and is not just seen as a regulatory exercise.

For (re)insurers seeking internal model approval, the requirements of the use test place a significant onus on the board and senior management to understand and explain the output of the capital model in much greater detail than ever before. Supervisors not only require in-depth knowledge of the use of the model, but also require senior management to know other areas, such as key modelling assumptions, limitations, simplifications and diversification methodologies applied in the model. Fully embedding the model in the business ensures that the model output is understood and can be effectively used in decision-making, as well as ensuring that the model remains appropriate to the business being undertaken.

The core uses of an internal model are:

- **Business and capital planning** The internal model should be used in business planning for assessing the riskiness of possible future strategies and the variation in outcomes. For example, it should be used in product development to assess the capital requirements and risks of new products, or in mergers and acquisitions where it can be used to assess the effect of a decision on the overall risk and capital profile. Capital metrics and risk appetites can be used to help understand the risk-adjusted trade-off between different opportunities over the business-planning horizon. Output from the internal model can be used to produce these metrics, which also support the ongoing monitoring of progress against the business plan.

- **Stress and scenario testing** Stress and scenario tests are important risk management tools that can be used to assess the resilience of the business plan and to ensure that risk mitigation strategies exist for potential adverse events. Stress testing models extreme uncertainties, while scenario testing allows businesses to mimic theoretical future events to see what impact they would have on the business plan. Both are important tools and involve the use of the internal model.
- **Setting economic capital levels** Companies may want to manage their business to a higher level of capital than that assumed by the regulatory solvency capital requirement (for reasons related to ratings, for example). There is no prescribed method for calculating economic capital. It could be based on the regulatory capital requirement (for example, by increasing the confidence level from 1 in 200 to 1 in a 1000) or it could use separate assumptions (for example, assessing the risk over the time it would take to run-off liabilities to policyholders).
- **Monitoring risk appetite** A firm's risk appetite is an articulation of the level of risk that is acceptable and desirable for the business. Limits and thresholds are set to monitor the level of risk against the risk appetite. The internal model can be used to monitor these metrics.
- **Understanding risk aggregations** Catastrophe modelling is already an established practice and can be strengthened when integrated with a capital model. It is possible to use internal models to understand the impact of catastrophe aggregations on the overall capital requirements and solvency position. Risk aggregations can also occur across risk categories (for example, an increase in credit risk for reinsurers following a major market event).
- **Business pricing** When pricing business, internal models can be used in the allocation of expenses and reinsurance costs to classes of business. Each class of business can use this information in the pricing of policies, potentially finding efficiencies in their profit margins. This ability of internal models will become increasingly important to ensure an underwriting profit is still achieved in ever-more competitive marketplaces.
- **Capital cost allocation** An internal model allows capital to be allocated to business units, or classes of business, based on their weight or cost of capital. This allocation provides a useful tool for performance management and an assessment of return of capital employed, allowing for improvements in capital efficiency.

- **Optimising risk mitigation** The model can be used to optimise risk mitigation techniques by, for example, supporting the determination of the optimal reinsurance or retrocession structure for the entire business or group. This can allow cover to be expanded for growing classes of business. The internal model can also be used to control the accumulation or aggregation of risks.
- **Investment decisions** The output of the internal model can be used to provide information on the impact that possible investment decisions have on capital requirements (regulatory and economic). Firms with long-duration liabilities may use the model for their asset/liability management.
- **Remuneration** The use of internal models for risk-based remuneration helps to ensure the appropriate alignment of management incentives.
- **Regulation** Solvency II allows firms to calculate their Solvency Capital Requirement (SCR) using an internal model (full or partial). The internal model should be used to calculate the expected capital requirements over the business planning horizon (usually 3–5 years) for the purposes of the Own Risk and Solvency Assessment (ORSA). This should include a forward-looking assessment of risks to the business and it is a useful tool for understanding the risk profile.

This list is not exhaustive, nor is it the case that all of the uses are relevant for all reinsurers.

4. Impact of internal model use on capital adequacy and comparability

Internal models have contributed to making capital assessments for reinsurers more risk sensitive and reliable, making the allocation of capital more effective and efficient. Risk factors with large exposures are modelled with more granularity to obtain better results, while risks with little exposure can be modelled in less detail. Internal models also allow for a better understanding and mitigation of key sensitivities to different parameters, risks and economic scenarios.

Internal models address limitations that exist in standard approaches, such as an inadequate recognition of diversification, missing risk factors and deviations from market-standard characteristics.

In this way, internal models increase the comparability of capital levels between (re)insurers and help to improve transparency in the insurance sector. In contrast, standardised approaches hinder comparability, as they typically cannot capture differences in business profiles. Take this simple example:

Example 1: Motor market differences

The characteristics of motor insurance differ significantly between the UK and Germany. The historical volatility of loss ratios in the UK has been much higher than in Germany. The Solvency II standard approach captures the volatility of motor business using a single parameter. Consequently, the parameter can either fit a UK motor insurer, a German motor insurer or an insurer with some business in both the UK and Germany. It cannot be appropriate for all three at the same time.

Concerns that internal models will result in a “race to the bottom”, with the sector’s overall levels of capital adequacy being depleted over time are unfounded. Internal models are subject to a rigorous internal and external approval process at the outset and then for any major subsequent changes. They are also subject to robust governance surrounding modelling methods, data use, processing and reporting. Once internal models are well-established, evidence indicates that minor model changes lead to both increases and decreases in solvency requirements.

B. Benefits of using internal models for prudential purposes



1. Holistic understanding of risks

The principle of pooling risk is fundamental to the concept of insurance and is particularly important for reinsurers. The balance sheets of large multinational reinsurers are typically exposed to a variety of risks (see Figure 1). Internal models represent the most practical way in which the diversification effects and risk concentrations within a globally diverse portfolio can be appropriately captured.

In order to steer towards profitable and sustainable business in a complex risk landscape, reinsurers need a holistic understanding of all the risks to which they are exposed. A holistic approach is important in order to identify any interactions and interdependencies between risks.

Reinsurance risks depend on the nature of the underlying risk and insurance market, as well as the specifics of the reinsurance treaty. Internal models can reflect the risk profile of reinsurance portfolios at the appropriate level of granularity and ensure that the aggregation structure accurately represents the dependence between individual risk factors at that level.

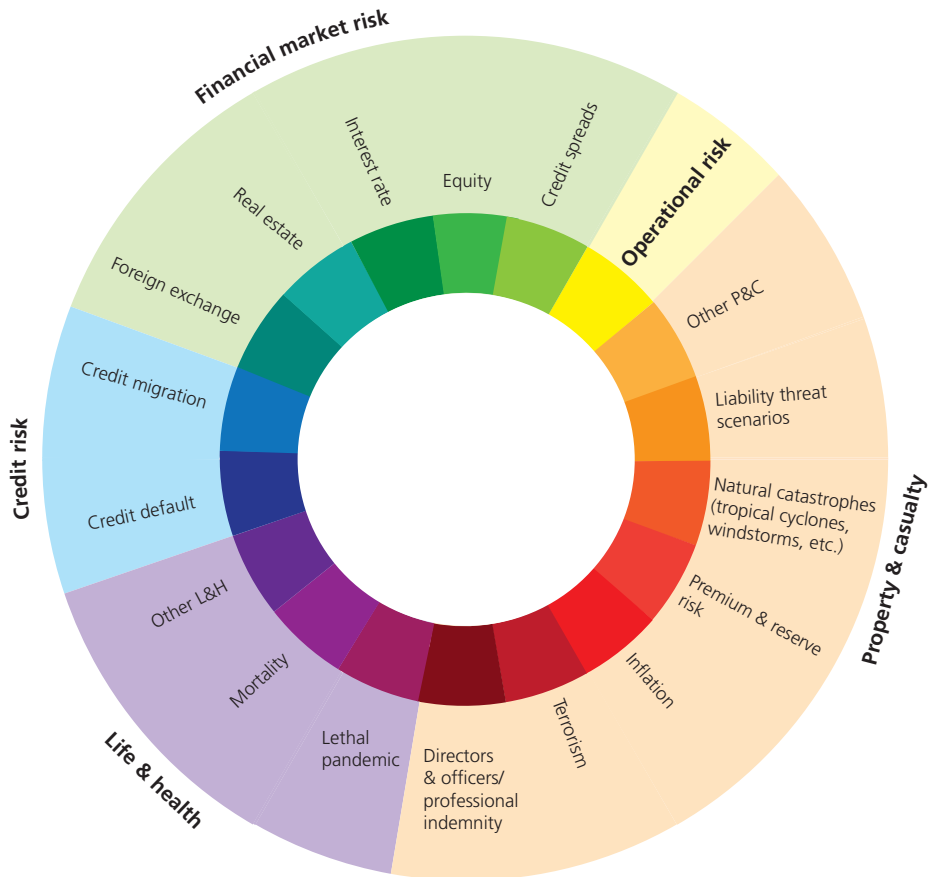
The necessity of standard formula-type methods to identify a limited number of risk classes by risk type or region will result in an arbitrary allocation of risks to certain classes with consequences for the calibration and aggregation of those risks. Grouping heterogeneous risks into similar risk classes will lead to inaccurate calibration and aggregation of the underlying risks and most reinsurers take a more holistic approach by quantifying the joint impact of all risks on their balance sheet.

When assessing the joint impact of several risks, one has to model the interrelationship (or dependency structure) between them. What matters most in a solvency context is the tail dependence, ie the possible occurrence of events when large losses arise at the same time from multiple sources and accumulate to form an even larger loss. The interrelationships between risks may serve to reduce their impact (diversification) or may increase their effect (concentration).

There are many ways to model dependencies and the degree of sophistication an undertaking applies has to be commensurate with the potential impact. More granular modelling approaches are generally used for the material risks that have the largest exposures.

The simplest approach — which underlies most standard formulas — is to calculate the risk of single portfolios (typically defined through lines of business

Figure 1: Variety of risks to which reinsurers are exposed



or organisational units) and to aggregate them using a correlation matrix. Dependencies in standard formulas are typically defined between risk types, eg market risk, credit risk, insurance risk. This simple approach has, however, at least two major deficiencies:

- Dependencies between portfolios arise because several portfolios might be exposed to the same risk factor and the risk factors themselves could be dependent too. Thus, the correlation between portfolios is dependent on the underlying exposure, which makes the calibration of a correlation matrix very challenging. Therefore, it is impossible to come up with a standardised correlation matrix that is appropriate for all companies.

- Tail dependency cannot be captured appropriately through correlations¹. When the distributions of the underlying risk factors are heavy-tailed, the correlation approach often leads to an incorrect aggregation, often understating the risk.

Internal models do not need to rely on one standard approach to model dependencies. In particular, unlike standard formulas that tend to only capture the co-movement of losses through correlation, internal models can deal with causal relationships between risks in an appropriate manner.

While combining individual risks in particular may require expert judgement to calibrate the joint distributions, such techniques can ensure that the specifics of the individual risks are captured when combined with other risks. This essential role was notably underlined by the head of the European Insurance and Occupational Pensions Authority (EIOPA), Gabriel Bernardino, on the route to implementing Solvency II: "Internal models will be more risk-sensitive, will better capture individual risk profiles and will provide a better alignment between the truly underlying economic risks and the capital requirements placed on insurance companies by Solvency II"².

Here are two examples to illustrate this:

Example 2: Mortality risk and longevity

Data on mortality trends, including the World Health Organization's Human Mortality Database, shows that the relationship between mortality and longevity, namely the diversification between term assurance or whole of life and annuities, is mainly driven by the difference between the ages of the underlying policyholders and cannot simply be expressed by a pre-defined correlation between risk modules.

¹ Embrechts, P., McNeil, A. and Straumann, D. "Correlation and dependence in risk management: Properties and pitfalls", 1999

² Speech at J.P. Morgan European Insurance Conference, London, 2 June 2015

Example 3: Financial market risk and mortality risk

There is a consensus between experts that pandemic influenza — like the 1918 Spanish flu — could have an adverse impact on global financial markets. For (re)insurance companies that are exposed to both mortality risk and financial market risk, the correct aggregation of these two risk classes is a key task, as the resulting capital requirements will depend on how this specific dependence could be modelled.

Considering available information and using expert judgement, an internal model could deal with this problem in a straightforward way. In a first step, the excess mortality rates caused by the pandemic and the financial market risk factors are generated independently of each other. In a second step, the financial market risk factors could be adjusted to be a function of the excess mortality (the more severe the pandemic, the larger the effect on asset prices).

The latter step obviously involves a large degree of expert judgment, but the advantage of the described approach is that the assumptions would be transparent (eg “an excess mortality of x causes equity prices to fall by y ”) and provides a good platform for challenge. In a standard approach, one can only debate the diversification benefit between a life and a financial market portfolio; there is absolutely no basis to decide why one number would be more accurate than another.

This example deals with a situation where the dependency could be described through a functional relationship. The pandemic is expected to cause most asset prices to fall but the opposite is obviously not true. In simple, correlation-based approaches, one can only capture the co-movement of the losses from different sources, but there is no way to take into account the causality.

2. Incentivising good risk management

Reinsurers thoroughly and carefully select the methods and parameters to calibrate their model to ensure that the risks can be steered accurately from an internal perspective. The internal model calibration process forces the reinsurer to individually assess all risks and to establish proper procedures that guarantee that the calibration processes are transparent and well-documented. As a result, the reinsurer establishes a unified framework to measure and monitor risks.

Hence, the calibration process improves the reinsurer's understanding of risks and underlying exposures. The reinsurer furthermore derives additional information to validate the calibration process, eg scenario analysis and stress tests. These instruments can later be used within the regular risk management processes and to extend the existing risk-management toolkit.

In addition, the calibration process requires the knowledge of a substantial number of employees and is strongly anchored in the risk culture of the reinsurer. Technical experts provide analysis to support the calibration, senior management participates in the related discussions, and decisions in the committees are taken on a well-documented and transparent basis. On top of that, the validation process ensures that all calibration choices are independently challenged.

Reinsurers invest significant resources in their internal model. They are therefore incentivised to make use of the model in as many areas as reasonably possible, again embedding the risk management culture in the entire enterprise. It is unlikely that the same level of risk management awareness is created when an external standard formula is used, given that in the case of standard formulas responsibility for risk quantification rests with the supervisor.

In the process of model calibration, reinsurers will allocate their resources to areas that are most relevant to the undertaking. In this way, the model calibration will positively shape the whole risk management organisation and culture.

An internal model leads to a common understanding and language regarding risks. Therefore, it will foster a harmonisation of all risk-related processes, such as performance measurement, asset allocation, risk monitoring and capital management.

Internal model calibration and validation create significant requirements for high quality, granular data, which fosters good data management and data quality

processes. This is likely to improve risk management beyond internal model applications. The collection and assessment of external data to complement internal data also supports risk management processes.

Internal models encourage reinsurers to consider risk and capital upfront, before decisions are made creating pressure on the model quality and this leads to ongoing model improvements. In contrast, the standard formula is a calculation for compliance purposes and therefore cannot be used in an active way for decision-making.

In contrast to internal models, the standard formula can often disincentivise good risk management. For example, the treatment of currency risk in the standard formula incentivises companies to hold capital in their reporting currency rather than the currency in which the risk resides.

3. Supporting financial stability

The use of internal models by reinsurers has had a positive impact on financial stability in a number of respects:

- Models have contributed to society's knowledge and understanding of risks. For example, reinsurers have invested heavily in natural catastrophe modelling — updating and refining techniques and collaborating with universities and scientific institutions in order to understand extreme weather and climate risks.
- Internal models are a more sophisticated means by which to understand and quantify risk aggregations (for example, the accumulation of casualty risks across portfolios and markets).
- Unlike crude measures of risk, which foster a herding mentality and can lead to all companies undertaking similar action at the same time, internal models treat risk in a more bespoke way and can incorporate new developments more easily and flexibly. The obvious market-wide political compromises embedded in the standard approach mean that standard formulas will tend to evolve more slowly than economic and financial evolutions.
- By ensuring that capital requirements reflect risks, internal models enable reinsurers to continue to play an important stabilising role for the financial industry and the economy.

4. Enhancing supervisory scrutiny and risk dialogue

It is already evident to undertakings that have prepared and submitted internal models to their supervisors that the whole process of interaction and dialogue with supervisors has brought substantial benefits to internal risk assessment, management and governance procedures and has, in some cases, led to improvements in the internal models.

The process of applying for an internal model to be used for supervisory purposes has entailed substantial work over a period of years, passing through multiple iterations. Some reinsurers commenced work on their internal models several years prior to their submission to supervisors. During this period there has been frequent dialogue between reinsurers and their supervisors on the differing elements of the proposed internal model.

The range of legally prescribed issues to be addressed by an internal model has required reinsurers and their supervisors to engage in much broader exchanges of information and views than was previously the case. It has also facilitated a more structured dialogue between reinsurers and their supervisors around risks.

This dialogue has occurred with many different departments within reinsurers, including risk management, actuarial and corporate governance. It has increased the level and range of discussions with personnel within the undertaking, increasing supervisors' exposure to and understanding of the diverse roles being discharged, as well as enabling the practitioners in these areas to have direct discussions about their roles and work.

This dialogue has been of value to both companies and supervisors. Reinsurers have had to provide detailed information on a regular basis about their work in the various areas addressed by the model. They have also had to respond to often robust supervisory challenges. This, in turn, has further fostered a culture of enhanced internal controls, better governance oversight and improved documentation. It might be speculated that these positive trends might not have occurred to the same extent or at the same speed without the discipline of external pressure and accountability.

The use test has meant that governance procedures and structures within companies have had to be revisited — and often revised — to ensure that requirements are satisfied. This, in turn, has meant that members of the board and senior committees within an undertaking's structure have been compelled to be familiar

with the internal model and its use. This knowledge is tested by supervisors, with board members and others being interviewed and required to demonstrate their knowledge. The required standards have forced firms to mobilise very significant resources across different areas of the business.

The requirements surrounding model validation are set out in Article 124 of Solvency II. They include an obligation on undertakings to have a regular cycle of model validation, which includes monitoring the performance of the internal model, reviewing the ongoing appropriateness of its specification and testing its results against experience. This obligation guarantees that the process of dialogue between undertaking and supervisor is not occasional and infrequent but will be regular, planned and structured, even after the process of submission and approval of an internal model is complete. The use of an internal model includes the ongoing discipline of regular exchanges of views. A dialogue will also be needed when the reinsurer envisages a major change to the assumptions or practices outlined in the internal model, since this requires supervisory approval.

Such regular interaction arising from discussion of the internal model not only benefits the undertaking, it deepens the supervisor's knowledge of the risk management, governance and business operations and characteristics of the undertaking. As the supervisor's knowledge increases, so does its capacity to challenge and interact more effectively with the undertaking. Thus the quality of supervision should be enhanced.

For the above reasons, preparation and use of an internal model has served to enhance the quality of supervisory scrutiny and risk dialogue between undertakings and their supervisors. Those benefits will continue in the future.

5. Costs associated with internal models

While a number of benefits flow from using internal models to calculate solvency capital requirements, the implementation of an internal model requires significant human and IT resources. Involvement of the board and senior management is needed from an early stage so that the output of the model is understood. For some companies whose risks do not deviate materially from the standard formula, the development of a full or partial internal model may not justify the cost.

C. The future for internal model use



1. Regulatory trends

Some of the recent regulatory trends related to internal models are of great concern.

At international level, the development of an International Capital Standard (ICS) by the International Association of Insurance Supervisors (IAIS) has postponed discussions on the allowance of supervisory internal models to a later stage in the process. It is understood that the issue of internal models will be put back on the table as part of ICS 2.0. This is a significant backwards step in the efforts to create globally comparable capital standards.

One of the overarching objectives for the ICS is comparability³. Our experience tells us that standardised approaches are not capable of achieving this goal. This is because standardised approaches need to be simple enough to be applicable to all companies. As a consequence, it is not possible for a standardised approach to be sufficiently granular to reflect correctly the specific risks faced by each undertaking and to capture all the diversification effects between the different risk types and geographies on the balance sheets of the cohort of internationally active insurance groups (IAIGs). As such, any standardised approach will be forced to make a vast number of simplifying assumptions and will be wrong for many (if not all) IAIGs. This is because the risks of some companies will be understated, while the risks of others will be overstated. This means that while two firms may have a solvency ratio of 100%, one will be much better capitalised for its risk profile than another. Moreover, one-size-fits-all assumptions — by not taking into account the specific characteristics of reinsurers — give a misleading view of their capital need. Therefore, while calculation steps are comparable, the solvency positions are not.

This is further exacerbated by the risks of divergent implementation in different jurisdictions trying artificially to tailor a general standard model to their market.

Internal models help to make companies' risk profiles transparent and comparable. By requiring firms to assess their own risk to a certain confidence level, meaningful comparisons can be drawn between the different outcomes. Solvency ratios can then be used to understand the underlying risk profile of reinsurers, from

3 ICS Principle 1: The ICS is a consolidated group-wide standard with a globally comparable risk-based measure of capital adequacy for internationally active insurance groups (IAIGs) and global systemically important insurers (G-SIIs) and ICS Principle 5: The ICS aims at comparability of outcomes across jurisdictions and therefore provides increased mutual understanding and greater confidence in cross-border analysis of IAIGs among group-wide and host supervisors

the characteristics of certain treaties to the aggregation structure of risks and diversification across regions and risks. They can also be used to accurately estimate and reflect the risks underwritten in different forms (for example through insurance-linked securities) and to allow for an appropriate coverage of the risks, independently of their form.

Until recently, supervisory regimes in Europe had accepted the important role that internal models play in advanced solvency frameworks, with both Solvency II and the Swiss Solvency Test allowing the use of internal models to calculate solvency for regulatory purposes. However, discussions at national supervisory level within EU member states and at EIOPA on supervisory overlays to internal models in the form of benchmarks, early warning/appropriateness indicators and standard formula corridors and scope limitations (eg partial models) put this progress at risk and undermine the many benefits of internal models that have been set out above.

Such supervisory approaches disconnect an undertaking's regulatory capital measure from its actual risk profile, making it no longer an internal view of risk. They start from the (false) implicit assumption that risk profiles are sufficiently homogenous within the insurance sector for it to be possible to easily compare them directly (through benchmarks) or indirectly against a representative insurer (standard formula corridors). As has already been argued, this is not the case. The insurance business model is liability driven. Attempts to compare market risks in isolation without understanding an undertaking's liability profile or vice versa are not meaningful. Internal models better take into account the interaction between assets and liabilities and how they affect an undertaking's risk profile. Similarly, a risk that may be material in the overall context of one undertaking's risk profile, justifying a more granular approach, may be immaterial for another undertaking.

Supervisory overlays result in companies having to manage according to multiple views. This is to some extent unavoidable (given the differences between accounting, regulatory, rating agency and tax approaches). However, further views should be avoided, as they present many challenges for companies and have several drawbacks from a supervisory perspective. For companies, it will invariably result in conflicting indicators from a risk management perspective, especially if the views that need to be taken into account are contradictory. Senior management will be forced to take action in response to measures that have no bearing on their actual risk, while their own risk assessment may suggest that a very different course of action is appropriate.

This is at odds with the regulatory trend observed in some markets towards senior management accountability, since responsibility will revert to the supervisor to ensure that overlays create the right risk incentives, rather than putting that responsibility where it should be, namely with boards.

So, what is the future for internal model use? The answer is simple. Advanced regulatory frameworks must recognise that standardised approaches may result in reasonable proxies for risk for small and medium-sized companies without complex risks, but that they have significant limitations for internationally active companies and specifically reinsurers.

The rapidly changing global risk landscape is only expected to increase the demand for insurance, particularly in developing countries, with a corresponding increase in the demand for reinsurance expected as a result. Regulators and companies have a common interest in embracing these developments in order to close the protection gap. However, in order for this to be done in a prudentially sound way, regulatory frameworks must be sufficiently flexible so that they can be easily tailored to the specific situation of local markets and capture the changing risk profile of global reinsurers. Internal models are sufficiently adaptable to be able to reflect the evolving risk landscape and local markets. An important example here is climate risk, where advancements in technology have improved insurers' understanding of the frequency and impact of natural catastrophes, as well as of the prevalence of climate-sensitive diseases with high geographical sensitivity. Internal models can easily adapt to these advancements without the need to constantly amend legislation.

A rigorous supervisory approval process, coupled with appropriate governance requirements and a requirement to show that the internal model is embedded throughout the business, should help to address supervisory concerns with internal models, without undermining their benefits.

The IAIS should begin to integrate an internal model framework within ICS 1.0, collecting and analysing all data that is available to understand the outputs of internal models and how these can foster comparability between IAIGs globally. The ICS should include general principles for designing and using internal models, which can then be implemented in the same way across jurisdictions. This will reinforce confidence in these sophisticated risk and capital management tools.

Similarly, within Europe, both companies and supervisors need time to adapt to solvency frameworks that allow for greater use of internal models. The process for reviewing and approving an internal model is a lengthy but worthwhile process for both supervisors and companies, giving supervisors a much greater insight into an undertaking's risks than would be the case with a standardised approach and embedding good risk management at all levels throughout companies.

An internal model regime that is subject to robust governance and checks and balances does not require supervisory benchmarks, indicators and guardrails, which will only serve to make the understanding of risk less transparent and more complex. Instead, supervisors should continue to engage in discussions on internal models that encourage a robust risk dialogue and ensure that reinsurers can continue to identify, price and manage risk in a prudentially sound way.

Conclusions



Modern solvency regimes like Solvency II and the Swiss Solvency Test have the potential to use the risk assessment capabilities of (re)insurers by allowing use of their internal models to determine regulatory capital requirements. While the resource demands of internal models are self-evident, these costs are for many companies significantly outweighed by the substantial benefits of internal model use in terms of companies' and supervisors' understanding of risks. Further, the diversity of internal model approaches compared to a framework where all reinsurers are obliged to use a standard model approach increases financial stability.

Like all risk measures, models need to be adapted over time to reflect the emerging risk landscape. However, they are a much more flexible tool for this purpose than standard approaches, which frequently reflect market-wide political compromises and therefore may be more difficult to update.

There are no shortcuts to the process of reviewing and approving an internal model. Supervisory overlays, including benchmarks and indicators, will not give supervisors the information they need to understand a company's risks, nor will they improve the transparency or accountability of the insurance sector. The RAB discourages the development of such measures and instead encourages EIOPA and national supervisors to maintain a dialogue on the experiences in national markets of internal model approval. This will prove invaluable in improving the supervisory dialogue between companies and their supervisors and also between supervisors within a college, making sure that discussions — however difficult — focus on the real issues at risk.

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Insurance Europe's Reinsurance Advisory Board

Secretariat:

rue Montoyer 51

B-1000 Brussels

Belgium

Tel: +32 2 894 30 00

Fax: +32 2 894 30 01

www.insuranceeurope.eu/reinsurance-advisory-board