

INTERNATIONAL ASSOCIATION OF INSURANCE SUPERVISORS



GUIDANCE PAPER ON THE USE OF INTERNAL MODELS FOR REGULATORY CAPITAL PURPOSES

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Guidance paper on the use of internal models for regulatory capital purposes

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1. Introduction

1. Since its inception in 1994, the IAIS has developed a number of principles, standards and guidance papers to help promote the development, globally, of well-regulated insurance markets. Central to this objective is the development of a common framework for insurance supervision that establishes a common structure within which standards and guidance on insurer solvency assessment may be developed. Standards and guidance on the issues related to the use of internal models¹ by an insurer for regulatory capital purposes, therefore, contribute towards the development of the IAIS framework for insurance supervision.

2. The IAIS recognises that the use of internal models is a significant new area of work for many insurers and an evolving area of practice for the insurance industry worldwide.

3. This paper provides guidance on the high-level framework for the use of internal models by insurers for regulatory capital purposes set out by the 17 requirements in the *Standard on the use of internal models for regulatory capital purposes*.

4. Internal models can be considered in the dual contexts of:

- a method by which an insurer determines its own economic capital² needs; and
- a means to determine an insurer's regulatory capital requirements in the context of the solvency regime, where appropriate.

¹ "Internal model" is defined at paragraph 5.

² Economic capital refers to the capital which results from an economic assessment of the insurer's risks given the insurer's risk tolerance and business plans. Refer to the IAIS *Guidance paper on enterprise risk management for capital adequacy and solvency purposes* (Oct 2008) for more discussion on economic capital, and the use of internal models for this purpose.

In either case, the quality of the insurer's risk management and governance is vital to the effective use of internal models. The use of an internal model for determining economic capital should be established before its suitability for determining regulatory capital requirements is considered. However, an insurer should not need supervisory approval, initial or ongoing, for the use of its internal model in determining its own economic capital needs or management.

5. For the purposes of this paper, the term "internal model" refers to "a risk measurement system developed by an insurer to analyse its overall risk position, to quantify risks and to determine the economic capital required to meet those risks"³. Internal models may also include partial models which capture a subset of the risks borne by the insurer using an internally developed measurement system which is used in determining the insurer's economic capital.

6. Where permitted by a supervisory regime, an internal model may, subject to supervisory approval, be used to determine the insurer's regulatory capital requirements on the basis of the insurer's specific risk profile and the defined level of safety of the solvency regime. A partial model may be approved for regulatory capital purposes where the capital requirements for the risks not covered by the model continue to be determined using a standardised approach.

7. The IAIS is aware that insurers use a variety of terms to describe their risk and capital assessment processes, such as 'economic capital model', 'risk-based capital model', or 'business model'. The IAIS considers that such terms could be used interchangeably to describe the processes adopted by insurers in the management of risk and capital within their business on an economic basis. For the purposes of this paper, the term 'internal model' will be used throughout for consistency.

1.1 Purpose of an internal model

8. One of the main purposes of an internal model is to assist the insurer in better integrating its risk and capital management processes and practices. The IAIS recognises that internal models also have other uses and purposes, and can be used for example in price setting (ie determining the appropriate premium level), as part of the asset management function or in analysing reinsurance programmes. Furthermore, there may be various inputs (or modules) which contribute to an insurer's internal model, such as those used for investment, underwriting and claims. Aligning risk and capital management is best achieved when the insurer's internal model is embedded within its strategic, operational, governance and risk management processes. Use of an internal model in this way facilitates a better understanding of the risks faced by the insurer, and leads to a closer alignment of capital within the business to meet these risks. Using internal models also allows the insurer to understand the effects of changes in business activities, such as writing new business or merging and acquiring businesses, on its risk profile and financial position.

9. The IAIS *Insurance core principles and methodology* (2003) provides a globally-accepted basis for the regulation and supervision of the insurance sector. The following Insurance core principles (ICPs) are particularly relevant for the discussion of internal models. Insurers should:

- recognise and effectively manage the risks they face (ICP 18)
- maintain overall financial resources in order to meet capital adequacy and solvency requirements (ICP 23).

³ This concept of internal model is derived from the *Solvency II Glossary* from the Comité Européen des Assurances and the Groupe Consultatif Actuariel Européen (Mar 2007).

10. An internal model is a method by which an insurer can link these two principles and consider the potential impact of all reasonably foreseeable and relevant material risks⁴, and their interactions, on its overall financial position. The internal model may act as the main tool for quantifying the risks faced by the insurer and hence determining the financial resources necessary to meet these risks.

11. Some solvency regimes allow, or are moving to an environment which allows, an insurer to use its internal model to calculate the capital necessary to meet the regulatory capital requirements of the regime. The IAIS supports the use of internal models as an alternative to a standardised approach, such as a standard formula, for calculating regulatory capital where prior regulatory approval can be given.

12. The IAIS advocates that where the insurer has an internal model that calculates a more appropriate risk-based capital requirement than a standard approach, and the internal model is integrated into the insurer's risk management and reporting practices and procedures, the solvency regime could allow the use of such a model to determine regulatory capital requirements that are more closely tailored to the individual risk profile of the insurer. To the extent that the insurer is using the internal model within its business, more reliance can be placed on the outputs of the internal model by the supervisor.

13. The IAIS recognises the different levels of experience with internal models by supervisors and insurers around the world and acknowledges that the use of internal models is not currently achievable by less sophisticated insurers or by insurers in less sophisticated markets. Although the IAIS encourages, where appropriate, the use of internal models for solvency purposes the IAIS understands that there are a number of considerations that would need to be addressed before moving to a regulatory regime that permits the use of internal models to determine regulatory capital requirements. It is acknowledged that some supervisory regimes (such as those with developing prudential requirements) may need time to develop experience with the nature of an internal model and the processes for approval of the use of such models for regulatory capital purposes. In this regard, there are likely to be a number of pre-requisites that would need to be in place in order for internal models to be used in a regulatory regime. For example, appropriate corporate governance structures, legal frameworks and adequate competency and accountability of the relevant professionals and management needed by insurers, the supervisors and the market as a whole. Specifically, the supervisor will need to have appropriate resources before undertaking approvals to allow the use of internal models to determine regulatory capital within its solvency regime.

14. Where internal models are allowed for calculating regulatory capital in a solvency regime, the appropriateness of modelling for a particular insurer will be heavily dependent on the nature, scale and complexity of its business and the risks it bears. The approach to internal modelling should be proportionate and fit-for-purpose, subject to the supervisory requirements for approval of the internal model for determining regulatory capital⁵. The establishment and maintenance of internal models will have resource implications for the insurer and supervisor, and the relative costs and benefits of using internal models for regulatory capital purposes should be considered by both insurers and supervisors.

15. This paper focuses primarily on the insurer as a single entity and the use of internal models in this context. Where an insurer is a member of a group of companies, it is recognised that the group may have integrated risk management processes and the application of internal models may be conducted at a group level. A group level internal model captures risks across a group, including its subsidiaries, in order to facilitate risk and capital understanding across the group. Conversely, the internal model adopted by an

⁴ The IAIS acknowledges that in some instances a set of risks may be foreseeable but not necessarily easily quantifiable. In addition, supervisors and insurers have a role to play in trying to identify and analyse unforeseen risks.

⁵ Refer to section 3 for descriptions of the use test, statistical quality test and calibration test.

insurer may be a part of a broader group model. Diversification effects need to be considered when aggregating risks within an individual legal entity. There may also be diversification benefits inherent in a group structure. However issues such as fungibility of capital, and contagion risk also need to be considered in this context. Because of the additional issues associated with group-wide supervision, it is not within the scope of this paper but is the subject of separate IAIS work⁶.

2. General provisions on the use of an internal model to determine regulatory capital requirements

Requirement 1

Where a solvency regime allows the use of internal models to determine regulatory capital requirements to help improve the alignment of risk and capital management, the supervisor should establish appropriate modelling criteria to be used for that purpose, which ensure broad consistency among all insurers within the regime.

Requirement 2

The supervisor should also set out for which of the different levels of regulatory capital requirements - including the Prescribed Capital Requirement (PCR) and the Minimum Capital Requirement (MCR) - the use of internal models is allowed. If internal models are allowed for determining the MCR, particular care should be taken to ensure that the strongest supervisory action that may be necessary if the MCR is breached can be enforced, for example, if the internal model is challenged in a court of law.

16. One of the main purposes of an internal model is to better integrate the processes of risk and capital management within the insurer. Resulting from this are two separate uses of an internal model. Firstly, to determine the economic capital needed by the insurer and secondly, if an insurer has regulatory approval, to determine the amount of the insurer's regulatory capital requirements⁷. As a basic principle the internal model should use the same methodologies to determine regulatory and economic capital.

17. Where the solvency regime allows a range of standardised and more advanced approaches, including internal models, an insurer should have a choice as to which approach it adopts⁸, subject to satisfying certain conditions established by the supervisor on the use of internal models for regulatory purposes (as discussed in section 3).

18. Regardless of the approach used by an insurer for regulatory capital purposes, the IAIS considers that all insurers should be undertaking their own risk and solvency assessments (ORSA)⁹. To carry out its ORSA, an insurer should apply a methodology that is best suited to the nature, scale and complexity of the risk profile of its business. The use of an internal model is one method which an insurer could apply, where practicable, and indeed

⁶ The IAIS Insurance Groups and Cross-sectoral Issues Subcommittee will advance further work on group-wide supervision. The IAIS IGSC and Solvency and Actuarial Issues Subcommittee are also developing a joint Issues paper on group-wide solvency assessment.

⁷ Refer to the IAIS *Standard and Guidance paper on the structure of regulatory capital requirements* (Oct 2008) for discussion on regulatory capital requirements.

⁸ There are a number of considerations that the insurer would also have to make before deciding to invest in constructing an internal model, one of which is cost. The IAIS is not advocating that all insurers must have an internal model (although their use is encouraged where appropriate).

⁹ Refer to the IAIS *Standard and Guidance paper on enterprise risk management for capital adequacy and solvency purposes* (Oct 2008) for discussion on own risk and solvency assessments.

larger and/or more complex insurers would generally be expected to use internal models to carry out this assessment. For insurers not having an internal model the assessment may start with the calculation of the standard regulatory capital formula, adjusting this where necessary to take account of specific aspects of its business risks.

19. Where there is a choice of approach in a solvency regime, it is inappropriate for an insurer to be able to adopt a process of 'cherry-picking' between those approaches¹⁰ – for example, by choosing to use its model for regulatory capital purposes only when the model results in a lower capital requirement than a standard formula. The IAIS encourages the use of internal models where appropriate as a more realistic, risk-responsive method of calculating capital requirements, but discourages any 'cherry-picking' practices by insurers.

20. In particular, where the risk profile of an insurer which is using a standardised approach for calculating its regulatory capital requirements is such that the assumptions underlying this approach are inappropriate, the supervisor may use its powers to increase the insurer's capital requirement, or to require the insurer to reduce the risks it bears. However, in such circumstances the supervisor should also consider encouraging the insurer to develop a full or partial internal model which might enable its risk profile to be better reflected in its ORSA and regulatory capital requirements.

21. Where the supervisor is aware that an insurer has an existing internal model but has not sought approval to use it to calculate the regulatory capital requirement, the supervisor should discuss this decision with the insurer.

22. Effective use of internal models by an insurer for regulatory capital purposes and within its ORSA should lead to a better alignment of risk and capital management by providing incentives for insurers to adopt better risk management procedures which can:

- produce regulatory capital requirements that are more risk sensitive and better reflect the solvency regime's target criteria; and
- assist the integration of the internal model fully into the insurer's strategic, operational and governance processes, systems and controls.

23. Irrespective of whether it is used for regulatory capital purposes, an insurer's internal model should be considered by the supervisor in the context of its assessment of the insurer's management of risk and capital. In addition to providing information on the insurer's ability to meet the regulatory capital requirements, an internal model could be used by the supervisor to help it understand an insurer's business and financial position, including the effects of strategic decisions on risk and capital management¹¹.

2.1 Criteria for the use of an internal model to determine an insurer's regulatory capital requirements

24. Where a supervisory regime allows the use of internal models to determine capital requirements, the supervisor should determine modelling criteria, based upon the level of safety required by the solvency regime, to be used by an insurer adopting an internal model for that purpose. These criteria should ensure broad consistency between all insurers within the solvency regime being based on the same broad level of safety requirements applied to the overall design and calibration of the standardised approach to determining regulatory capital requirements¹². Discussions with the insurance industry in a jurisdiction may also assist in achieving consistency. The supervisor should set out for which of the different

¹⁰ Refer to paragraph 29 in relation to 'cherry-picking' in the particular context of partial internal models.

¹¹ Refer to the IAIS Standard and guidance on Enterprise Risk Management for Solvency and Capital Adequacy purposes.

¹² Refer to section 6 and Requirement 13 in the IAIS *Guidance paper on the structure of regulatory capital requirements* (Oct 2008).

levels of regulatory capital requirements the use of internal models is allowed and determine the modelling criteria for each level. In particular, when considering whether an internal model may be used in determining the MCR, the supervisor should take into account the main objective of the MCR (i.e. to provide the ultimate safety net for the protection of policyholders) and the ability of the MCR to be defined in a sufficiently objective and appropriate manner to be enforceable.

25. As outlined in the Cornerstones paper, the IAIS does not wish to prescribe a specific solvency regime which is compulsory to all IAIS members. Notwithstanding, supervisors will need to determine the appropriate modelling criteria to be used by insurers to meet the solvency regime's regulatory capital requirements, and the insurer's internal models will need to be calibrated for that purpose. The IAIS notes that some solvency regimes which allow the use of internal models to determine regulatory capital requirements currently set a confidence level for regulatory purposes, which is comparable with a minimum investment grade level. Some examples of modelling criteria include a 99.5% VaR¹³ calibrated confidence level over a one year timeframe¹⁴, a 99% TVaR¹⁵ over one year and a 95% TVaR over the term of the policy obligations. Different criteria apply for PCR and MCR.

26. If an internal model is used for regulatory capital purposes, the insurer should ensure that its regulatory capital requirements determined by the model are calculated in a way that is consistent with the objectives, principles and criteria used within the solvency regime. For example, the insurer may be able to apply the confidence level specified in the supervisor's modelling criteria directly to the probability distribution forecasts used in its internal model. Alternatively, depending on the insurer's own modelling criteria for its economic capital, an insurer may have to recalibrate its internal model to the modelling criteria required by the supervisor in order to use it for regulatory capital purposes. This will allow internal models to have a degree of comparability to enable supervisors to make a meaningful assessment of an insurer's capital adequacy, without sacrificing the flexibility needed to make it a useful internal capital model in the operation of the insurer's business. Further elaboration is provided in section 3 under the 'calibration test'.

27. It is noted that, due to the insurer-specific nature of each internal model, internal models can be very different from each other. Supervisors, in allowing the use of an internal model for regulatory capital purposes, should preserve broad consistency of capital requirements between insurers with broadly similar risks.

2.2 Partial Internal Models

28. The IAIS supports the use of partial internal models within the solvency regime. A partial internal model typically involves the use of internal modelling to substitute parts of a standard formula for the determination of regulatory capital requirements. For example, an insurer could decide to categorise its insurance contracts along business lines for modelling purposes. If the regulatory capital requirements for some of these categories are determined by modelling techniques, while the capital requirements for other categories are determined using a standard formula, then this would constitute the insurer using a partial internal model to calculate regulatory capital.

¹³ VaR – Value at Risk – an estimate of the worst expected loss over a certain period of time at a given confidence level.

¹⁴ This is the confidence level required by insurers in the UK when undertaking their Individual Capital Assessment and is the level expected in Australia for those insurers that seek approval to use an internal model to determine their MCR. It is currently envisaged in the European Solvency II project as the level for the calculation of the risk-based Solvency Capital Requirement.

¹⁵ TVar – Tail Value at Risk – the VaR plus the average exceedence over the VaR if such exceedence occurs.

29. Partial internal models are often used to smooth an insurer's transition to full use of an internal model, or to deal with instances such as the merger of two insurers, one of which uses an internal model, and the other which uses a standard formula. Given the potential complexity of a full internal model, a partial internal model could be a satisfactory target provided its scope is properly defined (and approved by the supervisor). As discussed above, there could be a tendency for an insurer to adopt a 'cherry-picking' approach in the use of internal models. This particularly applies where partial modelling is allowed. Supervisors should place the onus on the insurer to justify why they have chosen to only use internal models for certain business lines, and should encourage the extension of the scope of the model or development of a full internal model.

30. The guidance in this paper should be applied to both partial and full internal models. Partial models should therefore be subject, as appropriate, to the full range of tests applicable to full models: the 'statistical quality test', 'calibration test', and 'use test' (see section 3). In particular, an insurer should assess how the partial internal model achieves consistency with the modelling criteria specified by the supervisor for regulatory purposes. As part of the approval process for regulatory capital use, an insurer should be required to justify the limited scope of the model, and why it considers that using partial internal modelling for determining regulatory capital requirements is more consistent with the risk profile of the business than the standard formula. The insurer should clearly document the reasons behind its decision to use partial internal models. If, for example, this is to ease transition towards full internal models, the insurer should outline a transitional plan, considering the implications for risk and capital management of the transition. Such plans and use of partial internal models should be reviewed by the supervisor, who may decide to impose certain restrictions on the partial model's use for calculating regulatory capital (for example, introducing a capital add-on during the transitional period).

3. Initial validation and supervisory approval

Requirement 3

Where an insurer calculates its regulatory capital requirements using an internal model, the use of the internal model for that purpose should be subject to prior approval by the supervisor.

Requirement 4

In constructing its internal model for regulatory capital purposes, an insurer should adopt risk modelling techniques and approaches appropriate to the nature, scale and complexity of the risks incorporated within its risk strategy and business objectives.

Requirement 5

In reviewing an insurer's internal model for regulatory capital purposes, the supervisor should require the insurer, as a minimum, to subject the model to three tests: 'statistical quality test', 'calibration test', and 'use test'.

Requirement 6

The onus should be placed on the insurer to demonstrate that the model is appropriate for regulatory capital purposes. The insurer should be able to demonstrate the results of each of the three tests.

3.1 Approval of the use of an internal model for determination of regulatory capital requirements

31. In solvency regimes where an insurer has the option to use an internal model approach for calculating its regulatory capital requirements, the model used for that purpose should be subject to prior supervisory approval. The onus should be placed on the insurer to provide evidence that the model is appropriate for regulatory capital purposes. The IAIS considers that an insurer should not need supervisory approval for the use of internal models in determining its own economic capital needs.

32. The supervisor may prescribe requirements which will allow it to assess different models fairly and facilitate comparison between insurers within its regime. However, the IAIS regards overly prescriptive rules on internal model construction to be counter-productive in creating models which are risk-sensitive and useful for insurers. Therefore, although a certain level of comparability can be achieved by the calibration requirements, full and effective comparison across supervisory regimes to align best practice may be best achieved by dialogue between national (or intra-national) supervisors and industry.

33. The supervisor should ensure that in granting approval for the use of an internal model to calculate regulatory capital requirements, it has sufficient confidence that the results being produced by the model provide adequate and appropriate measures of risk and capital. Although the supervisor may encourage insurers to develop internal models that better reflect their risks as soon as possible, this should not lead to models being approved until there is confidence that they are calibrated correctly. The supervisor may therefore feel it necessary to evaluate an internal model over a specified period of time, for example a few years, prior to approval. For supervisors, approval of an internal model could require considerable expertise (depending on the sophistication of the model) which may need to be developed. In addition, it may be necessary to introduce different supervisory powers to allow the approval of internal models.

34. The supervisor should use, at a minimum, the 'statistical quality test', 'calibration test' and 'use test', as the basis of its approval process. While a broad range of internal model approaches may be suitable for internal economic capital assessment purposes, and this should not be subject to supervisory approval, supervisors may want to place requirements on the internal model approaches that would be regarded as acceptable for regulatory capital purposes. In approving the use of an internal model for calculating regulatory capital requirements, the supervisor should consider the primary role of the model as part of the insurer's risk management procedures. Any requirements imposed by the supervisor on the approval of a model for use in determining regulatory capital requirements should not prevent the model from being sufficiently flexible to be a useful strategic decision making tool which reflects the insurer's unique risk profile. Consistent standards for the approval of an insurer's internal model should be applied by the supervisor, regardless of whether the model is developed in-house by the insurer or by an external party.

35. The 'statistical quality test' and the 'use test' are envisaged to be more insurer-specific measures which should allow the supervisor to gain an understanding of how a particular insurer has embedded its internal model within its business. The 'calibration test' would be used by the supervisor to assess the results from the internal model in comparison to the insurer's regulatory capital requirements and to those of other insurers.

36. In addition, the insurer should review its own internal model and validate it so as to satisfy itself of the appropriateness of the model for use as part of its risk and capital management processes¹⁶. As well as internal review, the insurer may wish to consider a regular independent, external review of its internal model by appropriate specialists.

3.2 Statistical quality test

Requirement 7

An insurer should conduct a 'statistical quality test' which assesses the base quantitative methodology of the internal model. As part of this test process, the insurer should be able to demonstrate the appropriateness of this methodology, including the choice of model inputs and parameters, and should be able to justify the assumptions underlying the model.

Requirement 8

The insurer should ensure that the determination of the regulatory capital requirement using an internal model addresses the overall risk position of the insurer as required by the solvency regime and that the underlying data used in the model is accurate and complete.

37. Given the importance of an embedded internal model to an insurer's risk management policy and operations, an internal model would generally be constructed to deliver a probability distribution of the required risk capital rather than a "point estimate". A range of approaches could constitute an effective internal model for risk and capital management purposes, and supervisory regimes should encourage the use of a range of different approaches appropriate to the nature, scale and complexity of different insurers and different risk exposures. There are several different techniques to quantify risk which could be used by an insurer to construct its internal model. In broad terms, these could range from basic deterministic scenarios to complex stochastic models. Deterministic scenarios would typically involve the use of stress and scenario testing reflecting an event, or a change in

¹⁶ Validation should be carried out by a different department or personnel to those that created the internal model to facilitate independence.

conditions, with a set probability to model the effect of certain events (such as a drop in equity prices) on the insurer's capital position, in which the underlying assumptions would be fixed. In contrast, stochastic modelling often involves simulating very large numbers of scenarios in order to reflect the likely distributions of the capital required by, and the different risk exposures of, the insurer.

38. The IAIS recognises that there are numerous methodologies which an insurer could use as part of its stress and scenario testing. For example, an insurer may decide to model the effect of various economic scenarios, such as a fall in equity prices or a change in interest rates, on its assets and liabilities. Alternatively, an insurer could consider a run-off approach, where the effect of various scenarios on a specific portfolio of business as it is run-off is examined. The insurer should use scenarios which it regards as most appropriate for its business. Where the internal model is used for regulatory capital purposes, the onus is on the insurer to demonstrate to the supervisor that the chosen methodology is appropriate to capture the relevant risks for its business. Overall capital requirements derived from an internal model can be highly sensitive to assumptions on the effect of diversification across risks. Supervisors and insurers should therefore give particular consideration to aggregation issues. Further discussion on risk modelling techniques and methodologies can be found in the *IAIS Guidance paper on stress testing by insurers* (Oct 2003).

39. Where an internal model is established to assess risks at a modular level, i.e. on a risk-by-risk basis, in order to conduct an overall risk assessment the insurer should aggregate the results for each of these risks both within and across business lines. Several methods exist to aggregate the separate results allowing for diversification effects. The IAIS considers that an insurer would generally be expected to decide how best to aggregate and account for the risks to the whole of its business. The determination of overall regulatory capital requirements by the internal model should consider dependencies within, as well as across, risk categories. Where the internal model allows for diversification effects, the insurer should be able to justify its allowance for diversification effects and demonstrate that it has considered how dependencies may increase under stressed circumstances. Further discussion of risk management issues can be found in the *IAIS Guidance paper on enterprise risk management for capital adequacy and solvency purposes*.

40. Internal models need high quality data in order to produce sufficiently reliable results. The data used for an internal model should be current and sufficiently credible, accurate, complete and appropriate. Hence, a 'statistical quality test' should examine the appropriateness of the underlying data used in the construction of the internal model. A 'statistical quality test' would include the examination of the aggregation of data, the modelling assumptions and the statistical measures used to construct the internal model. This could include an annual (or more frequent) experience analysis of the various items that are being measured (claims, lapses, etc) updated for the additional data available together with a scrutiny of data from previous periods to determine whether this data continues to be relevant. Older data may no longer be relevant possibly due to changes in risks covered, secular trends or policy conditions and guarantees attaching. Similarly, new data may not be of substantive use when modelling items that require a long-term view of experience (such as testing the predictions of cashflows for catastrophic events).

41. An insurer may not always have sufficient reliable data in-house. In instances where an insurer lacks fully credible data it may rely on industry or other sufficiently credible data-sources to supplement its own data; for example, a new company may lack its own historical data and so could use market data sources in constructing its internal model. Some supervisory regimes have published national data which may be of some use.

42. Another possible source of data may be from reinsurers - whose data pool is typically larger and covers a wider spectrum of the market. It is, however, important to consider that such industry data may not be entirely appropriate for all insurers. Reinsurers often only receive data in aggregated form and sometimes are only informed of larger claims or from

smaller insurers whose market may not be applicable for all or many insurers. Therefore, any data not specific to the insurer would need to be carefully considered before deciding it was appropriate for use as the basis for an insurer's 'statistical quality test'. Even where deemed appropriate, it may still be necessary to adjust the data to allow for differences in features between the data source and the insurer.

43. As part of the 'statistical quality test', the insurer should be able to demonstrate that the base quantitative methodology used to construct its internal model is sound and sufficiently reliable to support the model's use, both as a strategic risk and capital management tool, and to calculate the insurer's regulatory capital requirements, if appropriate. The methodology should also be consistent with the methods used to calculate technical provisions.

44. A 'statistical quality test' should also include a review of the internal model to determine whether the assets and products as represented in the model truly reflect the insurer's actual assets and products. This should include an analysis of whether all reasonably foreseeable and relevant material risks have been incorporated, including any financial guarantees and embedded options. Insurers should also consider whether the algorithms used are able to take into account the action of management and the reasonable expectation of policyholders. Testing should include future projections within the model and, to the extent practicable, 'back-testing' (the process of comparing the predictions from the model with actual experience).

3.3 Calibration test

Requirement 9

An insurer should conduct a 'calibration test' to demonstrate that the regulatory capital requirement determined by the internal model satisfies the modelling criteria specified by the supervisor.

45. As part of a 'calibration test', where an internal model is used for determining regulatory capital, the insurer should assess the extent to which the output produced by its internal model is consistent with the modelling criteria defined for regulatory capital purposes, and hence, confirm the validity of using its internal model for that purpose. As part of this process, an insurer should conduct stress and scenario testing to determine the effect of shock events on its capital position.

46. The 'calibration test' should be used by the insurer to demonstrate that the internal model is calibrated appropriately to allow a fair, unbiased estimate of the capital required for the particular level of confidence specified by the supervisor. Where an insurer uses different modelling criteria than those specified by the supervisor for regulatory capital purposes, it may need to recalibrate its model to the supervisor's modelling criteria to achieve this.

3.4 Use test and governance

Requirement 10

The insurer should ensure that the internal model, its methodologies and results, are fully embedded into the risk strategy and operational processes of the insurer (the 'use test').

Requirement 11

The insurer's board and senior management should have overall control of and responsibility for the construction and use of the internal model for risk management purposes, and ensure that there is sufficient understanding of the model's construction at appropriate levels within the insurer's organisational structure. In particular, the board and senior management should understand the consequences of the internal models outputs and limitations for risk and capital management decisions.

Requirement 12

The insurer should have adequate governance and internal controls in place in respect to the internal model.

47. In considering the use of an internal model for regulatory capital purposes by an insurer, the supervisors should not merely focus on its use for that narrow purpose, but should consider the wider use of the internal model by the insurer for its own risk and capital management.

48. The 'use test' is the process by which the internal model is assessed in terms of its application within the insurer's risk management and governance processes. In order for the insurer's internal model to be most effective it should be genuinely relevant for use within its business for risk and capital management purposes.

49. Where an insurer decides to adopt a higher confidence level than the level required for regulatory capital purposes for its own purposes, for example, in order to maintain a certain investment grade rating, then 'calibration' testing should also be conducted by the insurer to allow the insurer to determine the level of capital needed at this higher level. The insurer should then assess whether holding this amount of capital is consistent with the insurer's overall business strategy.

50. The insurer should have the flexibility to develop its internal model as an important tool in strategic decision making. An insurer should therefore have the flexibility to use the most appropriate risk measure and modelling techniques in its internal models. It may be beneficial if the insurer is able to demonstrate why it has chosen a particular risk measure, and it should include in its internal model an appropriate recalibration or reconciliation, if necessary, between the modelling criteria used in the model for its own risk and capital management purposes and those set by the supervisor for regulatory capital purposes. Differences between the economic capital and the regulatory capital requirements should be explicit and capable of being explained by the insurer to its board and the supervisor.

51. The 'use test' is a key method by which the insurer can demonstrate that its internal model is integrated within its risk and capital management, and system of governance processes and procedures. As part of the 'use test', an insurer should examine how the internal model is used for operational management purposes, how the results are used to influence the risk management strategy and business plan of the insurer, and how senior management are involved in applying the internal model in running the business. An insurer should demonstrate to the supervisor that an internal model used for regulatory capital

purposes remains useful and is applied consistently over time, and that it has the full support of and ownership by the board and senior management.

52. The insurer's senior management should take responsibility for the design and implementation of the internal model, in order to ensure full embedding of the model within the insurers' risk and capital management processes and operational procedures. The methodology used in building the model should be compatible with the overall enterprise risk management framework agreed to by the board and senior management. Although the board and senior management may not be able to de-construct the internal model in detail, it is important that the board has overall oversight of the model's operation on an ongoing basis, and the level of understanding necessary to achieve this. The board and senior management should also ensure that processes are in place to update the internal model to take into account changes in the insurer's risk strategy or other business changes.

53. Various business units within the insurer may be involved in the construction and operation of the internal model, such as risk management, capital management, finance and actuarial departments, depending on the size of the insurer. The technical ability of staff involved in the construction and operation of the internal model should be an important consideration for the insurer. For a model to pass the 'use test' it would be expected that an insurer would have a framework for the model's application across business units. This framework should define lines of responsibility for the production and use of information derived from the model. It should also define the purpose and type of the management information available from the model, the decisions to be taken using that information, and responsibilities for taking those decisions. The 'use test' should also ensure the adequacy of systems and controls in place for the maintenance, data feeds, and results of the model. The IAIS notes that internal models may require significant IT resources and costs, which should be a consideration for the insurer in developing its models.

54. The IAIS considers that governance processes and communication in respect of an internal model are as important as its construction. An internal model should be subject to appropriate review and challenge so that it is relevant and reliable when used by the insurer. The key elements and results from the internal model should be understood by the key personnel within the insurer, including the board, and not only by those who have constructed it. This understanding should ensure that the internal model remains a useful decision-making tool. If the internal model is not widely understood, it will not be achieving its purpose and adding value to the business. The 'use test' is key in ensuring the relevance of the internal model to the insurer's business.

3.5 Documentation

Requirement 13

The insurer should document the design and construction of the internal model, including an outline of the rationale and assumptions underlying its methodology. The documentation should be sufficient to demonstrate compliance with the regulatory validation requirements for internal models, including the three main tests outlined above.

55. The insurer should document the design and construction of the internal model sufficient for a knowledgeable professional in the field to be able to understand its design and construction. This documentation should include details of the underlying methodology, assumptions, and quantitative and financial bases, as well as information on the modelling criteria used to assess the level of capital needed.

56. The insurer should also document, on an ongoing basis, the development of the model and any major changes, as well as instances where the model is shown to not perform effectively. Where there is reliance on an external vendor/supplier, the reliance should be documented along with an explanation of the appropriateness of the use of the external vendor/supplier.

57. The insurer should document the results of the 'statistical quality test', 'calibration test', and 'use test' conducted to enable the supervisor to assess the appropriateness of its internal model for regulatory capital purposes.

4. Ongoing validation and supervisory approval of the internal model

Requirement 14

The supervisor should require the insurer to monitor the performance of its internal model and regularly review and validate the ongoing appropriateness of the model's specifications. The insurer should ensure and be able to demonstrate that the model remains fit for purpose for regulatory capital purposes in changing circumstances against the criteria of the statistical quality test, calibration test and use test.

Requirement 15

The supervisor should be notified of material changes to the internal model made by the insurer for review and continued approval of the use of the model for regulatory capital purposes.

Requirement 16

Internal model changes should be properly documented by the insurer.

58. Over time an insurer's business may alter considerably, as a result of internal factors or events (such as a change in insurer strategy) and external factors or events (such as a change in interest rates), so that the internal model may no longer fully capture the risks to which the insurer is exposed unless adapted. The supervisor should reassess an insurer's internal model and the results that it produces on a regular basis against the criteria of the statistical quality test, calibration test and use test, to ensure that it remains valid for use, both as a strategic decision-making tool in the context of the insurer's own risk and capital management, and as a means of calculating regulatory capital requirements where appropriate. In general only material changes to the model (such as changing the underlying model assumptions or the risk measure used) or to the risks faced by the insurer should require the model to be reassessed by the supervisor. A "model change policy" could be agreed between the supervisor and the insurer regarding the degree and timing of changes made to the internal model. This would enable the insurer to enact minor changes to its internal model without seeking prior supervisory approval (provided the changes are in accordance with the agreed policy), thereby allowing the model to be updated in a quicker and more flexible way.

59. The insurer should be required to notify the supervisor of material changes to the internal model and to properly document changes to enable the supervisor to assess, for continued approval, the ongoing validity of the model for use in determining regulatory capital requirements. Following any material changes to an internal model, the supervisor may give the insurer a reasonable amount of time to ensure that the updated model is embedded in its risk strategies and operational processes.

60. The supervisor should take care that its ongoing validation requirements do not unduly restrict the use of the internal model by the insurer for its own risk and capital management purposes and thereby reduce its ability to comply with the use test.

4.1 Supervisory responsibilities

61. The IAIS considers that it is essential that supervisors are able to understand fully the insurers' internal models and be able to appraise their quality. To this end, the supervisor should have access to experienced personnel with appropriate technical ability, as well as sufficient resources. It is likely to take time for supervisors to acquire the necessary experience to appraise an insurers' internal model. Without the experience and resources, the supervisor may be unable to reliably approve the use of an insurer's internal model for regulatory purposes. The supervisor may wish to use external specialists that are considered to have the appropriate experience, such as actuarial consultants, accountancy firms and ratings agencies, to assist it in reviewing an insurer's internal models. In such instances, the supervisor would still have the final responsibility for review and approval of the use of the internal model for regulatory purposes. This responsibility should not be delegated to a third party.

62. It may be appropriate for a solvency regime to consider transitional measures in moving from a regime that does not allow the use of internal models for regulatory purposes to one which permits an insurer to use its model to determine its regulatory capital requirement. Such measures will permit the necessary time for both insurers and the supervisor to become familiar with the internal models and their uses. For example, during a transition period, the solvency regime could include the use of partial internal modelling to allow the insurer to move gradually to full use of internal models or the solvency regime could require parallel reporting of regulatory capital determined by both the internal model and standard approach. The supervisor may also consider applying a minimum capital level during the transition period.

63. The supervisor should have the flexibility to impose additional capital requirements (capital add-ons) or take other supervisory action to address any perceived weaknesses in an internal model, either prior to approving the use of the model, as a condition on the use of the model or in the context of a review of the ongoing validity of an internal model for regulatory capital purposes. It may be necessary to introduce additional supervisory powers, to allow such supervisory actions and measures, when internal models are allowed for regulatory capital purposes in a supervisory regime.

64. Where an insurer which is a subsidiary of an insurance group seeks approval for the use of an internal model which itself is part of a broader "group model", the supervisor of this subsidiary should conduct the approval process in close co-operation with the group supervisor. In particular, the host supervisor should check the status of the "group model" and seek information from the group supervisor about its own approval process.

5. Supervisory reporting and public disclosure

Requirement 17

An insurer should provide information on its internal model for both supervisory reporting and public disclosure.

- a. The supervisor should have the power to require an insurer to report information necessary for supervisory review and ongoing approval of an internal model, where appropriate. The information should include details of how the model is embedded within the insurer's governance and operational processes and risk management strategy, as well as information on the risks assessed by the model and the capital assessment derived from its operation.**
- b. The supervisor should consider the appropriate level of public disclosure having due regard to any proprietary or confidential information.**

65. The IAIS expects that there would be separate levels of supervisory reporting and public disclosure in respect of the use of internal models within a solvency regime.

66. For supervisory reporting purposes, supervisors should require the insurer to submit sufficient information for them to be able to approve the use of the internal model for regulatory capital purposes, and to give confidence to the supervisor that the insurer is appropriately carrying out its responsibility to manage its risks and protect the interests of policyholders. This should include the results of analysis conducted under the 'statistical quality test', 'calibration test', and 'use test'. While supervisors should have the power to determine the exact nature and scope of the information they require, supervisory reporting should be subject to proportionality, taking into account the nature, scale and complexity of an insurer's business.

67. The level of information on internal models necessary to allow meaningful assessment by supervisors would be expected to include appropriate information regarding the insurer's risk and capital management strategy – for example, how the model is embedded into the insurer's governance procedures, overall business strategy, operational procedures and risk processes. An insurer should report details of the risks assessed by the model, including how these are identified and measured, as well as information on the results of the internal model analysis, the economic capital derived from these results and how the results of the internal model compare to those derived from the supervisory standardised approach¹⁷.

68. Publicly disclosing information on internal models should work towards the IAIS's objective of improving the transparency and comparability of existing solvency regimes and enhance market discipline and market confidence in insurers. The IAIS supports the need for balance regarding the level of information to disclose about the workings of an insurer's internal model, whilst producing sufficient information for external and internal stakeholders which is useful and meaningful. The requirements for public disclosure of information on an insurer's internal model should be carefully considered by supervisors. It is appropriate that commercially sensitive information (such as trade secrets, proprietary information or information that, if disclosed, may have adverse effects on insurers) not be publicly disclosed.

¹⁷ Supervisors may consider that the comparison between the capital requirements from an internal model and a supervisory standardised approach should only be required during a transition period.