

## Prudential Standard FSI 5

### Calculation of the SCR Using a Full or Partial Internal Model

#### **Objectives and Key Requirements of this Prudential Standard**

*This Standard sets out the basis on which the Solvency Capital Requirement (SCR) is calculated for insurers using an internal model approach (either full or partial). The alternative Standardised Formula approach is set out in FSI 4 (Calculation of the SCR Using the Standardised Formula).*

*The SCR is one of two key solvency requirements (the Minimum Capital Requirement (MCR) being the other) designed to ensure the security of policyholder obligations and to provide triggers for regulatory intervention. The SCR is the primary requirement within the Financial Soundness Standards for Insurers.*

*An insurer may apply to the Prudential Authority for approval to calculate the SCR using a full or partial internal model. The key requirements to obtain and maintain approval for the use of an internal model are:*

- *Insurers must have an effective system of governance for the internal model;*
- *Insurers must demonstrate via the use test that the model is widely-used and plays an important role in their system of governance;*
- *Insurers must meet requirements relating to statistical quality, data quality, model calibration and validation;*
- *Insurers must adequately document the design and operational details of their internal model; and*
- *Partial models may be approved provided they are sufficiently justified and integrated.*

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## 1. Application

- 1.1. This Standard applies to all insurers licensed under the Insurance Act, 2017 (the Act), other than microinsurers, Lloyd's and branches of foreign reinsurers.
- 1.2. Unless otherwise indicated, all references to "insurer" in this Standard can be read as a reference to life insurers, non-life insurers and reinsurers. Similarly, a reference to "insurance" obligations/policies in this Standard can be read as a reference to "reinsurance" obligations/policies, unless otherwise specified.

## 2. Roles and Responsibilities

- 2.1. Ultimate responsibility for the prudent management of the financial soundness of an insurer rests with the insurer's board of directors. The board of directors must ensure the insurer meets the Solvency Capital Requirement (SCR) on a continuous basis, regardless of the approach taken to its computation. The board of directors must also ensure that the insurer has in place appropriate systems, procedures and controls to meet the principles and requirements of this Standard on an ongoing basis.
- 2.2. Where an insurer chooses to adopt an internal model-based approach to calculating the SCR, the board of directors is responsible for ensuring that the appropriate approval is obtained from the Prudential Authority. The board of directors must approve the key methodologies used in the internal model, and is responsible for the results of the SCR calculations.
- 2.3. An insurer's head of actuarial function is responsible for expressing an opinion to the board of directors regarding the accuracy of the calculations and the appropriateness of the assumptions underlying the approved internal model that is used to calculate the SCR.
- 2.4. An insurer's auditor, appointed under section 32 of the Act, must audit the financial soundness of an insurer in accordance with its legal and regulatory obligations. The auditor must report to the board of directors and Prudential Authority any matters identified during the performance of its responsibilities that may cause the insurer to be not financially sound.
- 2.5. Additional roles and responsibilities of the board of directors and senior management in relation to the approval and use of an internal model are set out in sections 6, 7, 10 and 12 of this Standard.
- 2.6. The roles and responsibilities of the board of directors and the head of actuarial function are described in more detail in the Governance and Operational Standards for Insurers (GOI 3).

## 3. Commencement and Transition Provisions

- 3.1. This Standard commences on 1 July 2018.

Version Number	Commencement Date
1	1 July 2018

## **4. General Principles**

- 4.1. The SCR establishes a critical level of financial soundness, below which regulatory intervention by the Prudential Authority is likely to occur. The SCR is forward-looking, risk-based, and involves stress testing an insurer's total balance sheet across a series of adverse scenarios.
- 4.2. Insurers may calculate the SCR using the standardised formula (as set out in FSI 4 (Calculation of SCR Using the Standardised Formula)) or may apply to the Prudential Authority for approval to calculate the SCR using an internal model. This approval may be for a full internal model or, for a partial internal model, where the application of the internal model applies only to certain risks or major business units of an insurer.
- 4.3. Insurers must meet the requirements set out in this Standard to obtain and maintain approval for using an internal model.
- 4.4. Where an insurer has approval to use an internal model to calculate the SCR, it must perform a complete SCR calculation using the internal model on a quarterly basis, or as otherwise required by the Prudential Authority. Insurers should also perform a complete calculation in the event of significant changes to their risk profile.

## **5. Process for Approval of an Internal Model**

- 5.1. Insurers must obtain prior approval from the Prudential Authority to use an internal model (full or partial) to calculate their SCR. Insurers considering applying for the use of an internal model should first notify the Prudential Authority of their intention to do so, and complete any pre-application processes determined by the Prudential Authority. Subject to the Prudential Authority being satisfied that the insurer has complied with the necessary pre-application processes, an insurer must submit an application to the Prudential Authority requesting approval to use an internal model to calculate the SCR.
- 5.2. In addition, for insurers applying to use a partial internal model, the insurer must satisfy the Prudential Authority that:
  - a) The limited scope of application of the model is properly justified;
  - b) The resulting SCR appropriately reflects the risk profile of the insurer;
  - c) The model's design allows it to be fully integrated into the structure of the SCR standardised formula; and
  - d) There is no ambiguity as to which risks, assets and/or liabilities are included in the scope of the internal model.

Further details regarding the requirements for use of a partial internal model are set out in section 12 of this Standard.

- 5.3. Insurers must develop and maintain a model change policy that sets out the processes and controls that they will adhere to when implementing changes (both major and minor) to the internal model. Insurers should submit their model change policy to the Prudential Authority as part of their application for internal model use. Subject to the prior approval of the model change policy by the Prudential Authority, insurers may make minor changes to their model (without approval from the Prudential Authority), provided that the changes are implemented in line with requirements in the insurer's model change policy. Major changes to the model, or the model change policy itself, will require prior approval from the Prudential Authority.

- 5.4. Any material changes to other policies that are integral to the use of the internal model, or compliance with this Standard, must also be subject to prior approval from the Prudential Authority.<sup>1</sup>
- 5.5. An insurer that has received approval to use an internal model to calculate their SCR must continue to do so, unless otherwise specified by the Prudential Authority. Insurers that wish to cease calculating their SCR using an approved internal model must obtain prior approval from the Prudential Authority to do so.

## **6. Model Governance**

- 6.1. Insurers must have an effective system of governance for the internal model that is adequately integrated with the insurer's overall governance arrangements. In addition to the governance requirements set out in GOI 3 (Risk Management and Internal Controls for Insurers), the system of governance for the internal model must:
- a) Establish, implement and maintain effective cooperation, internal reporting and communication of information relating to the internal model at all relevant levels within the insurer;
  - b) Be robust with well-defined, clear, consistent and documented lines of responsibility across the organisation;
  - c) Ensure that senior management and personnel responsible for developing, monitoring and maintaining the internal model possess sufficient qualifications, knowledge and experience;
  - d) Include comprehensive documentation of the internal model; and
  - e) Include adequate processes and controls for the development, review and use of the internal model.
- 6.2. The board of directors retains ultimate responsibility for the internal model, including:
- a) Approving the application for approval to use the internal model to calculate the SCR, and the application for approval for major changes or extensions to the model;
  - b) Deciding roles and responsibilities in relation to the internal model's governance;
  - c) Deciding on the strategic direction of the model and any changes to the model;
  - d) Agreeing major changes in advance of the change being made;
  - e) Aligning the model design and operation with the insurer's risk profile and operations;
  - f) Ensuring there are sufficient resources to develop, monitor and maintain the model;
  - g) Monitoring ongoing compliance with the requirements for internal model approval, and agreeing actions in the event of non-compliance;
  - h) Ensuring there are adequate independent review procedures in place around the internal model design, operation and validation; and
  - i) Ensuring that outputs are aligned with use.
- 6.3. The board of directors may, as part of their overall governance, delegate responsibilities relating to the governance of the internal model.
- 6.4. An insurer should establish clear roles and responsibilities for the day-to-day operation of the internal model. This should include responsibilities for:
- a) Designing and implementing the internal model;

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<sup>1</sup> These include policies associated with data integrity and validation processes associated with the internal model.

- b) Testing and validating the internal model;
  - c) Documenting the internal model and any changes to it;
  - d) Analysing the performance of the internal model, and reporting on the performance to the board of directors and senior management;
  - e) Suggesting areas for improvement and reporting on the status of efforts to improve previously identified weaknesses to the board of directors and senior management;
  - f) Liaising closely with users of the outputs of the internal model; and
  - g) Developing an ongoing two-way communication loop with the actuarial function to ensure adequate actuarial input into the design and operation of the model.
- 6.5. An insurer must establish effective communication and regular reporting between the function(s) responsible for day-to-day operation of the internal model, and the board of directors and senior management. The board of directors should receive reports on the operation and performance of the internal model, and communicate to senior management any strategic or other decisions affecting the design or operation of the internal model for implementation. Any discussions and decisions forming part of the feedback loop must be documented.
- 6.6. The system of governance must also provide for ongoing and effective communication to users of the model about the characteristics of the internal model, in order to increase their understanding of the model and its outputs.
- 6.7. The operation of the internal model must be subject to ongoing internal review and validation as set out in section 10 below.
- 6.8. In the event that an insurer with an approved internal model identifies that the model ceases to comply with the requirements of this Standard, the insurer must notify the Prudential Authority immediately and assess the materiality of the non-compliance. Insurers must develop a plan to restore compliance and submit this to the Prudential Authority.

## 7. Use Test

- 7.1. Insurers using an internal model should be able to demonstrate that the model is widely used and plays an important role in their system of governance. This should include the use of the model in decision-making processes, business planning, risk management, capital assessment and allocation processes, and the Own Risk and Solvency Assessment (ORSA).
- 7.2. Where an insurer has a partial internal model, the use test requirements only apply to the part of the model that differs from the standardised formula.
- 7.3. The board of directors, as a collective whole, should have a general understanding of the internal model.<sup>2</sup> In context of the use test, a “general understanding” should be regarded as having knowledge of:
- a) The structure of the internal model and the way the model aligns to the business and is integrated in the insurer’s risk management system;
  - b) The scope and purpose of the internal model and the risks covered by the internal model, as well as those not covered;
  - c) The general methodology applied in the internal model calculations;
  - d) The limitations of the internal model;

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<sup>2</sup> The board of directors, as a collective whole, refers to the majority of the board members, including at least the senior office holders (e.g. chairman, managing director) and members of the board risk, and similar committees.

- e) The model components that have a high dependency on expert judgement, and the significance of expert judgement on the model outcome;
  - f) The diversification effects taken into account in the internal model;
  - g) How the internal model is to be used in decision making; and
  - h) The model development plan.
- 7.4. Any member of senior management who is responsible for the internal model, a component of the internal model, or whose responsibilities are impacted by the internal model, should have a detailed understanding and operating knowledge of the internal model in the areas where they use the internal model.
- 7.5. Insurers should be able to explain the different uses of their internal model and how they ensure consistency between the different outputs where the internal model is used for different purposes. Where insurers decide not to use the internal model for a relevant part of the system of governance, they should be able to explain this decision.
- 7.6. Insurers should ensure that the design of the internal model is aligned with their business in the following manner:
- a) The modelling approaches reflect the nature, scale and complexity of the risks inherent in the business of the insurer which are within the scope of the internal model;
  - b) The outputs of the internal model are consistent with the content of the internal and external reporting of the insurer;
  - c) The internal model is capable of producing outputs that are sufficiently granular to play an important role in relevant risk management and business decisions;
  - d) The outputs of the internal model differentiate between material lines of business, between risk categories and between major business units; and
  - e) The model change policy provides that the internal model is adjusted for changes in the scope or nature of the business of the insurer.
- 7.7. Insurers should be able to demonstrate that the internal model is widely integrated in their risk management system in the following manner:
- a) All material quantifiable risks identified by the risk management system which are within the scope of the internal model are covered by the internal model;
  - b) The outputs of the internal model, including the measurement of diversification effects, are taken into account in formulating risk strategies, including the development of risk tolerance limits and risk mitigation strategies;
  - c) The relevant outputs of the internal model are covered by the internal reporting procedures of the risk management system;
  - d) The quantifications of risks and the risk ranking produced by the internal model trigger risk management actions, where relevant; and
  - e) The model change policy provides that the internal model may change to reflect changes in the risk management system.

## **8. Methodology and Statistical Quality**

### **Probability Distribution Forecast**

- 8.1. The use of an internal model will typically involve the generation of a probability distribution forecast, which assigns probabilities to changes in the insurer's basic own funds (or other monetary amounts that reflect changes in basic own funds) from a wide range of future events. Although the generation of a probability distribution

forecast is a key feature of internal models, no particular method for the calculation of the probability distribution forecast is prescribed in this Standard.

- 8.2. Any methodology that evaluates the financial impact of future events must meet the statistical quality requirements in this Standard. The statistical quality requirements apply to the calculation framework of the probability distribution forecast, as well as to all quantitative methods and techniques associated with it.
- 8.3. In generating a probability distribution forecast, insurers should:
  - a) Ensure that the exhaustive set of mutually exclusive future events generated by the probability distribution forecast contain a sufficient number of events to reflect the insurer's risk profile; and
  - b) Base the forecast on all relevant information available.
- 8.4. Methods used in the calculation of the probability distribution forecast should be:
  - a) Based on adequate, applicable and relevant actuarial and statistical techniques;
  - b) Consistent with the methods used to calculate technical provisions as set out in FSI 2.2 (Valuation of Technical Provisions);
  - c) Based upon current and credible information; and
  - d) Based on realistic assumptions.

Further guidance on ways in which insurers can demonstrate adherence to these statistical quality requirements are set out in Guidance Note FSI GN 5.

- 8.5. Where an insurer has insufficient data to perform credible prediction of extreme events, an insurer may develop its internal model using only key points of the probability distribution forecast.
- 8.6. An internal model that generates only key points of the probability distribution forecast must be subject to more intensive validation and stricter governance. Where the use of key point's results in shortcomings with the model, the insurer should adopt additional measures to ensure that appropriate conservatism is incorporated in the model's outputs.

### **Risk ranking and model coverage**

- 8.7. Insurers should be able to rank all material risks covered by the internal model, and satisfy the following key principles in relation to risk ranking:
  - a) Coverage: Risk ranking should be applied to all material risks covered by the internal model;
  - b) Resolution: There should be sufficiently precise differentiation of various risk categories and components to allow senior management to take appropriate decisions;
  - c) Congruence: Risk ranking should be consistent with the classification of risks used in the risk management system; and
  - d) Consistency: Risks of a similar nature should be ranked consistently throughout the insurer and over time.
- 8.8. The internal model should cover all of the material risks to which the insurer is exposed, and at a minimum, the risk categories and components covered by the standardised formula to calculating the SCR. When assessing the coverage of all material risks, insurers must give due consideration to the joint impact of risk factors that have been omitted, including their dependencies.

## **Recognition of diversification effects**

- 8.9. Insurers may take into account dependencies and diversification effects within and across risk categories in their internal model, provided that the system used for measuring those diversification effects is adequate.
- 8.10. At a minimum, the system used for measuring the diversification effects must:
- a) Identify the key variables driving dependencies;
  - b) Provide support for the existence of diversification effects;
  - c) Justify the assumptions underlying the modelling of dependencies;
  - d) Take into particular consideration extreme scenarios and tail dependence;
  - e) Take into account the characteristics of the risk measure used in the internal model;
  - f) Test the robustness of this system on a regular basis (e.g. as part of the model validation process); and
  - g) Take diversification effects actively into account in business decisions.

## **Recognition of risk mitigation**

- 8.11. Insurers may take account of the effect of risk mitigation instruments in their internal model, provided that they satisfy the requirements and conditions for eligible risk mitigation instruments set out in Attachment 1 of FSI 4 (Calculation of the SCR Using the Standardised Formula).

## **Guarantees and contractual options**

- 8.12. Insurers must accurately assess the risks associated with guarantees and any contractual options in the internal model, where material. Insurers should identify, collect and model the risk of all relevant guarantees and contractual options, taking into account the key features of these guarantees and options, as well as the impact on option exercise from future changes in financial and non-financial conditions.
- 8.13. The accurate assessment of the risks associated with guarantees and options within the internal model must be carried out in a manner consistent with the methods used to value technical provisions as set out in FSI 2.2 (Valuation of Technical Provisions).

## **Future management actions**

- 8.14. An insurer may take account of future management actions that they would reasonably expect to carry out in specific circumstances in the internal model, making allowance for the time necessary to implement such actions and the materiality of such action. The materiality of future management actions should be determined by having regard to the potential impact on the SCR. The incorporation of future management actions in the internal model should also be carried out in a manner that is consistent with the criteria and methods used to value technical provisions (as set out in FSI 2.2 (Valuation of Technical Provisions)).
- 8.15. Any assumptions regarding future management actions that are incorporated in the internal model must be supported by a documented future management actions plan approved by the board of directors, which includes:
- a) The identification of future management actions incorporated in the internal model;
  - b) The identification of the specific circumstances in which the insurer would reasonably expect to carry out these future management actions;



- c) The identification of the specific circumstances in which the insurer may not be able to carry out these future management actions, and a description of how those circumstances are reflected in the internal model;
  - d) The order in which future management actions would be carried out and the governance requirements applicable to those future management actions;
  - e) A description of any ongoing work required to ensure that the insurer is in a position to carry out the future management actions;
  - f) A description of how future management actions have been reflected in the calculation of the probability distribution forecast; and
  - g) A description of the applicable internal reporting procedures to implement the future management action.
- 8.16. Significant deviations from planned management actions that may have a material impact on the SCR must be reported to the Prudential Authority, together with an analysis containing the reasons for the deviation and its consequences.

### **Payments to policyholders and beneficiaries**

- 8.17. The internal model must take account of all expected payments to policyholders and beneficiaries, whether or not these payments are contractually guaranteed. These expected payments should be incorporated in the internal model in a manner consistent with the methods used to value technical provisions as set out in FSI 2.2 (Valuation of Technical Provisions).

### **Allowance for expected future profits on new business**

- 8.18. Expected future profits from new business should not be fully recognised in the internal model due to the inherent uncertainty of the assumptions of parameters like volume and profitability of business still to be written.
- 8.19. The Prudential Authority may allow for partial recognition of expected future profits upon application by an insurer, where the Prudential Authority may set requirements and conditions on a case-by-case basis.

### **Calibration**

- 8.20. Insurers may use their internal model for multiple purposes, consistent with the use test requirements set out in section 7 above. While insurers may adopt a different time period or risk measure to the 99.5% confidence level, one-year value-at-risk measure underlying the calculation of the SCR for their own internal modelling purposes, the SCR derived from the internal model must meet the 99.5% confidence level, one-year value-at-risk calibration requirement.
- 8.21. Where an insurer applies a different time period to one year for internal modelling purposes, the insurer should:
- a) Demonstrate that the internal model takes into account the time effects of the risks to which it is exposed;
  - b) Demonstrate that all significant risks over a one-year period are properly managed;
  - c) Give special attention to the choice of the data used;
  - d) Justify the choice of time horizon in view of:
    - i. The average duration of the liabilities of the insurer;
    - ii. The business model of the insurer; and
    - iii. The uncertainties associated with long time horizons;
  - e) Give due consideration to the solvency position during the time period; and

- f) Justify the particular assumptions made in order to properly take into account the dependencies between consecutive time periods.
- 8.22. Where an insurer applies a different confidence level for internal modelling purposes, the insurer should derive the SCR directly from the probability distribution forecast generated by the internal model, where possible. Where this is not possible, adjustments or approximations may be applied by the insurer to calculate the SCR to the level that is equivalent to a 99.5% confidence level over one-year calibration.
- 8.23. The Prudential Authority may require an insurer to run their internal model based on benchmark portfolios or using external assumptions where the Prudential Authority has concerns about the calibration of the internal model and/or the adequacy of its specification.<sup>3</sup> If the Prudential Authority has concerns about the appropriateness of the calibration of the internal model and its specifications, it may reject the model or impose other requirements.<sup>4</sup>

## 9. Data

### Data quality

- 9.1. Any data used to operate, validate and develop the internal model, including internal and external data, should satisfy the data quality requirements set out in this section of the Standard. An insurer should compile a directory of all data used in the model, specifying its source, characteristics and usage.
- 9.2. Data used for the internal model must be:
- a) Accurate: The data are sufficiently accurate to avoid material distortions to the model output;
  - b) Complete: The data provide comprehensive information for the insurer;
  - c) Appropriate: The data do not contain biases which make it unfit for purpose; and
  - d) Current: The data are up-to-date.
- 9.3. Insurers may develop specific data quality standards for each risk category. Insurers should assign to the different data sets specific qualitative and/or quantitative criteria which, if satisfied, qualify them for use in the internal model.
- 9.4. Insurers must perform regular data quality reviews to ensure the data used in the model remain accurate, complete, appropriate and current. As part of the regular data quality reviews, insurers should be able to demonstrate that:
- a) The data are free from material mistakes, errors and omissions;
  - b) The data are consistent over time, such that the model output refers to a well-defined point in time;
  - c) Comprehensive data for all relevant business lines and, where possible, all relevant model variables, are available for use in the model;
  - d) The data include sufficient historical information to assess the characteristics of the underlying risk and to identify trends in the risk;
  - e) No relevant data available are excluded from consideration without justification;
  - f) The granularity of data is sufficient to allow for adequate actuarial and statistical techniques to be used;

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<sup>3</sup> For clarity, this may occur during the approval process or as part of ongoing supervisory review processes.

<sup>4</sup> The Prudential Authority's power to reject or impose other requirements on an insurer's internal model is set out in section 36 of the Act.

- g) The data used are relevant to their business and the portfolio of risks being analysed;
  - h) Data used for prediction exercises provide a reasonable guide to the future;
  - i) Data are collected, processed and applied in a transparent and structured manner; and
  - j) Data are up-to-date.
- 9.5. Insurers must document all instances in which data quality may be compromised, the implications of these compromises on the outputs of the internal model, and the actions that have been undertaken to address the data quality issues.
- 9.6. Insurers should regularly update the data sets used in the internal model. At a minimum, the data sets used in the calculation of the probability distribution forecast should be updated at least once a year.
- 9.7. Insurers may use expert judgment to complement or substitute data in the internal model. The use of expert judgement must be well-founded, documented, transparent and subject to validation. Validation of expert judgement may include:
- a) Comparing decisions made using expert judgement against external information;
  - b) Using industry groups or data to validate expert judgements;
  - c) Challenging expert judgements by others within the insurer with different skills or perspectives on the relevant data (e.g. underwriters, risk experts, economists);
  - d) Comparing expert judgements against emerging experience for the risk modelled; or
  - e) Carrying out sensitivity analysis on each of the parameters derived by expert judgement.

## **Data Policy**

- 9.8. Insurers must establish a policy on data quality and data updates (“data policy”) in respect of data used in the internal model. This data policy must be agreed with the Prudential Authority as part of the internal model approval process, and will form the basis of supervisory analysis regarding the insurer’s data quality practices. A review of the data policy should also be part of the model validation process (as set out in section 10 below).
- 9.9. The data policy must, as a minimum, include the following:
- a) Details of the insurer’s data quality requirements and how these requirements are implemented by the insurer;
  - b) Processes to check and validate data quality, including actions to be taken in the event that data are not accurate, complete, appropriate and current;
  - c) The methodology to validate the use of expert judgment in relation to data, especially in the event that the quality of existing data is poor; and
  - d) Processes to update data (particularly with respect to data used in the calculation of the probability distribution forecast), including:
    - i. The frequency of data updates;
    - ii. Circumstances that trigger unscheduled data updates;
    - iii. Circumstances that trigger a recalculation of the SCR or a re-run of the internal model; and
    - iv. Required timeframes for these actions.

## **External models and data**

- 9.10. The use of external models or data within an insurer's internal model must be appropriate to the nature, scale and complexity of the risks associated with the insurer's strategy, business objectives, and data and modelling capabilities.
- 9.11. If the use of external models or data plays a material role, an insurer must demonstrate that internal model requirements are met to the fullest extent possible. In particular, the insurer retains the responsibility for any deficiencies of the internal model or data introduced by the use of external models or data.
- 9.12. Where insurers rely on external models or data, they must:
- a) Document and explain the role of external models and data, including the extent to which they are used within their internal model processes;
  - b) Be able to explain the reasons for preferring external models or data to internal ones;
  - c) Be able to list the alternatives considered and explain the decision for a particular external model or data;
  - d) Demonstrate a detailed understanding of external models and data used in their internal model processes;
  - e) Be aware of any model and data limitations; and
  - f) Have clearly articulated strategies for validating and regularly reviewing the performance of external models and the integrity of external data used.
- 9.13. Insurers should recognise and document the risks arising from the use of external data and models. If those risks are material and quantifiable, they should be taken into account in the SCR calculation.

## **10. Validation**

- 10.1. Insurers must 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.
- 10.2. The scope of validation should encompass all qualitative and quantitative processes of the model including:
- a) Data;
  - b) Methods;
  - c) Assumptions;
  - d) Expert judgement;
  - e) Documentation;
  - f) Systems and IT;
  - g) Model governance; and
  - h) Use Test.
- 10.3. The model validation process must include an effective statistical process for validating the internal model, which enables insurers to demonstrate that the resulting capital requirements are appropriate. The statistical process for validating the internal model must be based on:
- a) Current information, taking into account, where it is relevant and appropriate, developments in actuarial techniques and generally accepted market practices; and

- b) A detailed understanding of the economic and actuarial theory, and the assumptions underlying the methods to generate the probability distribution forecast of the internal model.
- 10.4. Insurers should analyse the results of their model validation processes, and report these results to the appropriate level of management. Model validation outcomes should be used to determine the extent to which any changes to the internal model are required.
- 10.5. In order to ensure independence of the model validation process, the persons or organisational unit carrying out the validation must be free from influence from those responsible for the development and operation of the internal model. Insurers may use external review and systems to assist them with their validation.
- 10.6. The board of directors has ultimate responsibility for approving the insurer's validation processes, and must not delegate this responsibility to a third party.

### **Validation tools**

- 10.7. The model validation process should make use of a range of validation tools including:
- a) Back-testing (i.e. testing model results and assumptions against experience);
  - b) Sensitivity analysis and other tests on the stability of the model;
  - c) Stress testing and scenario analysis; and
  - d) Profit and loss attribution.

Further guidance in relation to each of these validation tools and how they may be used by insurers are set out in Guidance Note FSI GN 5.

- 10.8. Insurers must implement validation tools that are proportionate to the nature, scale and complexity of the risks incorporated in their internal model.

### **Validation Policy**

- 10.9. Insurers must have a documented validation policy that sets out the approach for validation of the internal model, as well as the reasons for selecting the approach. The validation policy must address the following:
- a) Purpose and scope of validation;
  - b) Validation tools and methods;
  - c) Frequency of the validation process for the various components of the model;
  - d) Governance of validation results, including assigned responsibilities for validation tasks required in the validation process;
  - e) Limitations and future developments; and
  - f) Independent review requirements.

Attachment 1 of this Standard provides further details of the specific items that should be included as part of each aspect of the validation policy.

- 10.10. Insurers must conduct at least an annual review of their validation policy, to ensure that their approach to validation (including the underlying tools, processes and governance requirements related to model validation) remains up-to-date. Material changes to the validation policy must be approved by the Prudential Authority, as set out in section 5.4 above.

## 11. Documentation

- 11.1. Insurers must document the design and operational details of their internal model. The documentation must provide a detailed outline of the theory, assumptions, and mathematical and empirical bases underlying the internal model. The documentation must be timely and kept up-to-date.
- 11.2. The documentation of the internal model must be thorough, sufficiently detailed and sufficiently complete to allow an independent knowledgeable third-party to:
  - a) Form a sound judgment as to the reliability of the internal model;
  - b) Assess the model's compliance with the requirements of this Standard;
  - c) Understand the underlying design and operational details of the internal model; and
  - d) Understand the reasoning behind the underlying design chosen.
- 11.3. Outputs of the internal model must be capable of being reproduced using the internal model documentation and all of the inputs into the internal model.
- 11.4. The documentation must demonstrate how the requirements in this Standard have been taken into account and how they have been fulfilled. This includes satisfying requirements in addition to the need to document a model change policy, data policy and validation policy.
- 11.5. The documentation must include:
  - a) An overview of the structure of the document;
  - b) All relevant testing and validation done in relation to model changes;
  - c) Evidence that the appropriate levels of management understand the relevant aspects of the internal model;
  - d) Known drawbacks and weaknesses of the model, including the circumstances under which the model does not work effectively;
  - e) Overview of the historical development;
  - f) Major changes to the model, and how these changes have complied with the insurer's model change policy;
  - g) Operational details regarding the use of the model, including a description of the information technology and software tools to implement the internal model, and explicit information about data management as per the insurer's data policy;
  - h) Detailed outline of the theory, assumptions, and mathematical and empirical basis, particularly on the use of expert judgement in relation to data, assumptions and parameters; and
  - i) Details on compliance with prudential requirements.

Further guidance on what insurers should include as part of the documentation of their internal model can be found in Guidance Note FSI GN 5.

## 12. Use of Partial Internal Models

- 12.1. The Financial Soundness Standards for Insurers provides insurers with the scope to use a partial internal model, subject to approval by the Prudential Authority. Insurers may use a partial internal model to model:
  - a) One or more risk categories for the whole of their business;
  - b) One or more risk categories for one or more major business units;
  - c) One or more risk components for the whole of their business;

- d) One or more risk components, in the same or different risk category, for one or more major business units;
  - e) The adjustment for the loss-absorbing capacity of technical provisions and deferred taxes (for the whole of their business or for one or more major business units); or
  - f) The capital requirement for operational risk (for the whole of their business or for one or more major business units).
- 12.2. Insurers employing a partial internal model may use different risk categorisations than those in the standardised formula. Insurers may also decide to model risks not covered by the standardised formula. Neither full nor partial internal models need to follow the modular structure used in the standardised formula.

### **Integration of partial internal models**

- 12.3. Insurers employing a partial internal model must integrate the results of the partial internal model with the results of the standardised formula in a manner that ensures:
- a) All material quantifiable risks are taken into account in the calculation of the SCR;
  - b) Any diversification effects between risk categories and risk components incorporated as part of the integration are justifiable; and
  - c) That the overall SCR derived is calibrated to a level that consistent with the value-at-risk of an insurer's basic own funds at a confidence level of 99.5% over a one-year period.
- 12.4. Insurers may adopt a number of techniques to integrate their partial internal model, including the use of correlation matrices and other integration options. As a default approach, insurers should adopt the standardised formula correlation matrices to integrate the partial internal model whenever this approach is feasible and there is no strong evidence to suggest that it would lead to inappropriate outcomes.
- 12.5. If the direct application of the standardised formula correlation matrix is not feasible, or if the Prudential Authority is satisfied that there is strong evidence that it would lead to inappropriate outcomes, the insurer may discuss the use of alternative integration techniques with the Prudential Authority.

### **Adaptations to Standards**

- 12.6. In general, the requirements set out in this Standard apply equally to users of full and partial internal models. There are, however, certain requirements within this Standard requiring adjustment or clarification for partial internal model users. These adjustments and clarifications are set out below.

#### ***Model governance***

- 12.7. The board of directors should have an appropriate rationale for applying to use a partial internal model. The board of directors should ensure that the design of the partial internal model reflects more appropriately the risk profile of the insurer relative to the standardised formula.
- 12.8. The board of directors is responsible for defining the appropriate scope of the partial internal model, and ensuring that it is properly documented and well understood by users and developers of the model.
- 12.9. Section 6.4 above requires clear roles and responsibilities to be defined in relation to the operation, analysis and reporting of the internal model. For users of a partial internal model, the analysis and reporting should include an assessment of the

insurer's compliance with the specific partial internal model requirements set out in this section of the Standard.

### ***Use Test***

- 12.10. In relation to the board of directors and senior management understanding of the internal model (sections 7.3 and 7.4 above), the general understanding requirements should extend to the way in which the partial internal model is integrated into the standardised formula.
- 12.11. In relation to the internal model's alignment with the insurer's business model (section 7.6 above), the degree to which this requirement is feasible will depend on the scope and structure of the model. While the scope of some partial internal models may allow this requirement to be fulfilled, other models with very limited scope may make this requirement difficult to meet. Insurers should seek to align the relevant aspects of their partial internal model with their business model to the extent it is possible to do so.

### ***Methodology and statistical quality***

- 12.12. No specific adaptations should be made on the statistical quality requirements with respect to partial internal models. For partial internal models, a probability distribution forecast should be generated at the highest level within the scope of the partial internal model.
- 12.13. When integrating the results of the partial internal model with the Standardised Formula, insurers must calibrate the internal model results to a value-at-risk measure at 99.5% confidence over a one-year period.

### ***Validation***

- 12.14. For partial internal models, the validation policy must include the following in addition to the minimum requirements set out in section 10.9 above:
- a) The validation of the limited scope of the model; and
  - b) The adequacy of the integration technique used to integrate the partial internal model's results into the standardised formula's results.
- 12.15. When testing the robustness of the partial internal model through sensitivity analysis, the analysis should also include the technique used to integrate the partial internal model's results into the standardised formula's results.
- 12.16. When performing stress testing, the analysis should also include the technique used to integrate the partial internal model's results into the standardised formula's results.

### ***Documentation***

- 12.17. In the specific case of partial internal models, the documentation should cover (in addition to the requirements specified in section 11 above) the justification for the limited scope of the model, and the technique used to integrate the partial internal model's results into the standardised formula's results.

### ***External models and data***

- 12.18. Any external models or data that may be used to support the technique used to integrate the partial internal model's results into the standardised formula's results should be representative of the insurer's own risk profile.



The dependency structure between the risk categories or components affected by the use of external models or data should form part of the validation policy as set out in section 10.9 above.

## **Attachment 1: Contents of Validation Policy**

This Attachment sets out additional details on information that insurers should include as part of their validation policy. As set out in section 10.9 of this Standard, the validation policy must at least contain information regarding:

- a) Purpose and scope of validation;
- b) Validation tools and methods;
- c) Frequency of the validation process for the various components of the model;
- d) Governance of validation results, including assigned responsibilities for validation tasks required in the validation process;
- e) Limitations and future developments; and
- f) Independent review requirements.

### ***A. Purpose and scope of validation***

1. An insurer's validation policy should detail the design and operational details of the internal model to be covered by the validation process. Any parts of the internal model framework that are not covered by the validation policy should be identified and documented, with the reasons for this exclusion noted in the validation policy. When setting the scope of validation, insurers should consider the materiality of the different internal model components.
2. Insurers should describe the criteria they will apply in determining whether their internal model is appropriate.

### ***B. Validation tools and methods***

1. The validation policy should set out the tools and methods used to validate the internal model and their purpose.
2. Where expert judgement is used, the validation policy should address the techniques it will apply to validate the accuracy and appropriateness of these judgements.
3. The validation policy should contain the goals and measures of the various tools.

### ***C. Frequency of validation process***

1. The frequency with which validation will be carried out for the various components of the internal model should be set out in the validation policy. The validation policy should also detail the circumstances which may trigger additional (i.e. out-of-cycle) validation.
2. Insurers may apply different validation tools with different frequencies.

### ***D. Governance of validation results***

1. The validation policy should set out clear responsibilities for all the tasks required in the validation process, including the involvement of senior management.
2. The validation policy should set out requirements for reporting the results from the application of different validation tools, and for both regular validation and ad-hoc checks.
3. The validation policy should set out the procedures to be followed in the event that the model validation process identifies problems with the reliability of the internal model, and the decision-making process to address those problems.

4. The validation policy should establish a clear process, including pre-defined criteria, for the reporting and escalation of model validation results as part of the governance structure of the internal model.

#### ***E. Limitations and future developments***

1. Insurers should identify all known limitations of their validation processes in the validation policy, with specific reference made to any parts of the internal model that are not covered by the policy.
2. The validation policy should detail any planned developments in the validation process.

#### ***F. Independent review***

1. The validation policy should set out the processes it will employ to ensure the quality and independence of the validation, including the use of external or internal parties to complete independent reviews. Insurers should also consider how independence is to be maintained over time.