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CEIOPS' Advice for Level 2 Implementing Measures on Solvency II:

Articles 120 to 126

Tests and Standards for Internal Model Approval

(former Consultation Paper 56)

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1. Introduction

1.1. One of CEIOPS' primary responsibilities is to provide technical support to the European Commission in developing a new solvency system for insurance and reinsurance undertakings (hereafter "undertakings") in the EU - Solvency II.

1.2. In its letter of 19 July 2007, the European Commission requested CEIOPS to provide final, fully-consulted Advice on Level 2 Implementing measures by October 2009 and recommended CEIOPS to develop Level 3 guidance on certain areas to foster supervisory convergence. On 12 June 2009 The European Commission sent a letter with further guidance regarding the Solvency II project, including the list of implementing measures and timetable until implementation[1].

1.3. The main objective of this document is therefore to provide the European Commission with sufficient technical Advice so that it is in a position to finalise its proposal for the 'Level 2' implementing measures as described below:

"The Commission shall, in order to ensure a harmonised approach to the use of internal models throughout the Community and to enhance the better assessment of the risk profile and management of the business of insurance and reinsurance undertakings, adopt implementing measures with respect to Articles 120 to 126."
(Article 127 of the Solvency II Level 1 Text).[2]

1.4. Generally, the Advice in this Paper may be seen as an extension of the Level 1 Text. This provides further detail on specific issues or offers greater clarity with respect to the general provisions for the requirements for the approval of internal models. Specific requirements for the approval of a partial internal model will be covered in later Advice.

1.5. Specificities related to the requirements for approval of group internal models are included in this Paper.

1.6. As stakeholders read this Paper, they should think carefully about the interactions between the requirements for an internal model to be approved by the supervisory authority. CEIOPS has published all the requirements in one Paper to emphasise these interactions and readers will notice the number of cross-references between the different Sections. Throughout the Paper CEIOPS has taken account of the proportionality principle described in Article 29(4) of the Level 1 Text. CEIOPS has already published Advice on proportionality[3], including advice on its application to internal models and that underpins this advice.

[1] See http://www.ceiops.eu/content/view/5/5/
[2] Latest version from 19 October 2009 available at http://register.consilium.europa.eu/pdf/en/09/st03/st03643-re01.en09.pdf
[3] http://www.ceiops.eu/media/docman/public_files/publications/submissionstotheec/AdviceProportionality.pdf

1.7. Furthermore, CEIOPS will also work to develop 'Level 3' standards and guidance to enable further convergence of supervisory practice.

1.8. Finally, CEIOPS would like to acknowledge the significant contribution made by stakeholder groups during the preparation of this Advice, the Stock-taking Report on the use of internal models in insurance[4] and the support provided through the past QIS exercises. Good working level contacts have been established with a number of stakeholder groups, enabling CEIOPS to receive expert input and to test ideas quickly.

[4] CEIOPS (2009) - "Stock-taking Report on the use of internal models in insurance", available at: http://www.ceiops.eu/media/files/publications/reports/Stock-taking-report-on-the-use-of-Internal-Models-in-Insurance.pdf

2. Legal basis

2.1 Introduction

2.1. This Section reproduces the key extracts from the Level 1 Text which are directly relevant for the supervisory approval of internal models.

2.2 Key extracts from the Level 1 Text

2.2. Articles 120 to 126 set out the various tests for the approval of an internal model. These are discussed further in the following Sections. Other Articles deal with general conditions for approval or with implementing measures.

2.3. Article 101 sets out the basis for the calculation of the Solvency Capital Requirement (hereafter "SCR").

Article 101

Calculation of the Solvency Capital Requirement

"1. The Solvency Capital Requirement shall be calculated in accordance with paragraphs 2 to 5:

2. The Solvency Capital Requirement shall be calculated on the presumption that the undertaking will pursue its business as a going concern.

3. The Solvency Capital Requirement shall be calibrated so as to ensure that all quantifiable risks to which an insurance or reinsurance undertaking is exposed are taken into account. It shall cover existing business, as well as the new business expected to be written over the following 12 months. With respect to existing business, it shall cover only unexpected losses.

It shall correspond to the Value-at-Risk of the basic own funds of an insurance or reinsurance undertaking subject to a confidence level of 99,5 % over a one-year period.

4. The Solvency Capital Requirement shall cover at least the following risks:
(a) non-life underwriting risk;
(b) life underwriting risk;
(c) health underwriting risk;
(d) market risk;
(e) credit risk;
(f) operational risk.

Operational risk as referred to in point (f) of the first subparagraph shall include legal risks, and exclude risks arising from strategic decisions, as well as reputation risks.

5. When calculating the Solvency Capital Requirement, insurance and reinsurance undertakings shall take account of the effect of risk mitigation techniques, provided that credit risk and other risks arising from the use of such techniques are properly reflected in the Solvency Capital Requirement".

2.4. Article 112 deals with the general conditions for the approval of an internal model. Relevant Sections are quoted below.

Article 112

General provisions for the approval of full and partial internal models

"1. Member states shall ensure that insurance or reinsurance undertakings may calculate the Solvency Capital Requirement using a full or partial internal model as approved by the supervisory authorities.

2. Insurance and reinsurance undertakings may use partial internal models for the calculation of one or more of the following:
(a) one or more risk modules, or sub-modules, of the Basic Solvency Capital Requirement, as set out in Articles 104 and 105;
(b) the capital requirement for operational risk as laid down in Article 107;
(c) the adjustment referred to in Article 108.
In addition, partial modelling may be applied to the whole business of insurance and reinsurance undertakings, or only to one or more major business units.

3. In any application for approval, insurance or reinsurance undertakings shall submit, as a minimum, documentary evidence that the internal model fulfils the requirements set out in Articles 120 to 125.

Where the application for that approval relates to a partial internal model, the requirements set out in Articles 120 to 125 shall be adapted to take account of the limited scope of the application of the model.
(…)

5. Supervisory authorities shall give approval to the application only if they are satisfied that the systems of the insurance or reinsurance undertaking for identifying, measuring, monitoring, managing and reporting risk are adequate and in particular, that

the internal model fulfils the requirements referred to in paragraph 3".

(…)

2.5. Article 120 sets out the Level 1 Text governing the Use test.

Article 120

Use test

"Insurance and reinsurance undertakings shall demonstrate that the internal model is widely used in and plays an important role in their system of governance, referred to in Articles 41 to 50, in particular:
(a) their risk-management system as laid down in Article 44 and their decision-making processes;
(b) their economic and solvency capital assessment and allocation processes, including the assessment referred to in Article 45.

In addition, insurance and reinsurance undertakings shall demonstrate that the frequency of calculation of the Solvency Capital Requirement using the internal model is consistent with the frequency with which they use their internal model for the other purposes covered by the first paragraph.

The administrative, management or supervisory body shall be responsible for ensuring the on-going appropriateness of the design and operations of the internal model, and that the internal model continues to appropriately reflect the risk profile of the insurance and reinsurance undertakings concerned".

2.6. Article 121 sets out the Level 1 Text governing Statistical quality standards.

Article 121

"1. The internal model, and in particular the calculation of the probability distribution forecast underlying it, shall comply with the criteria set out in paragraphs 2 to 9.

2. The methods used to calculate the probability distribution forecast shall be based on adequate, applicable and relevant actuarial and statistical techniques and shall be consistent with the methods used to calculate technical provisions.

The methods used to calculate the probability distribution forecast shall be based upon current and credible information and realistic assumptions

Insurance and reinsurance undertakings shall be able to justify the assumptions underlying their internal model to the supervisory authorities.

3. Data used for the internal model shall be accurate, complete and appropriate.

Insurance and reinsurance undertakings shall update the data sets used in the calculation of the probability distribution forecast at least annually.

4. No particular method for the calculation of the probability distribution forecast shall be prescribed.

Regardless of the method of calculation chosen, the ability of the internal model to rank risk shall be sufficient to ensure that it is widely used in and plays an important role in the system of governance of insurance and reinsurance undertakings, in particular their risk-management system and decision-making processes, and capital allocation in accordance with Article 120.

The internal model shall cover all of the material risks to which insurance and reinsurance undertakings are exposed. Internal models shall cover at least the risks set out in Article 101(4).

5. As regards diversification effects, insurance and reinsurance undertakings may take account in their internal model of dependencies within and across risk categories, provided that supervisory authorities are satisfied that the system used for measuring those diversification effects is adequate.

6. Insurance and reinsurance undertakings may take full account of the effect of risk mitigation techniques in their internal model, as long as credit risk and other risks arising from the use of risk mitigation techniques are properly reflected in the internal model.

7. Insurance and reinsurance undertakings shall accurately assess the particular risks associated with financial guarantees and any contractual options in their internal model, where material. They shall also assess the risks associated with both policy holder options and contractual options for insurance and reinsurance undertakings. For this purpose, they shall take account of the impact that future changes in financial and non-financial conditions may have on the exercise of those options.

8. In their internal model, insurance and reinsurance undertakings may take account of future management actions that they would reasonably expect to carry out in specific circumstances.

In the case set out in the first subparagraph, the undertaking concerned shall make allowance for the time necessary to implement such actions.

9. In their internal model, insurance and reinsurance undertakings shall take account of all payments to policy holders and beneficiaries which they expect to make, whether or not these payments are contractually guaranteed".

2.7. Article 122 sets out the Level 1 Text governing Calibration standards.

Article 122
Calibration standards

"1. Insurance and reinsurance undertakings may use a different time period or risk measure than that set out in Article 101(3) for internal modelling purposes as long as the outputs of the internal model can be used by those undertakings to calculate the Solvency Capital Requirement in a manner that provides policy holders and beneficiaries with a level of protection equivalent to that set out in Article 101.

2. Where practicable, insurance and reinsurance undertakings shall derive the Solvency Capital Requirement directly from the probability distribution forecast generated by the internal model of those undertakings, using the Value-at-Risk measure set out in Article 101(3).

3. Where insurance and reinsurance undertakings cannot derive the Solvency Capital Requirement directly from the probability distribution forecast generated by the internal model, the supervisory authorities may allow approximations to be used in the process to calculate the Solvency Capital Requirement, as long as those undertakings can demonstrate to the supervisory authorities that policy holders are provided with a level of protection equivalent to that set out in Article 101.

4. Supervisory authorities may require insurance and reinsurance undertakings to run their internal model on relevant benchmark portfolios and using assumptions based on external rather than internal data in order to verify the calibration of the internal model and to check that its specification is in line with generally accepted market practice".

2.8. Article 123 sets out the requirements for Profit and loss attribution.

Article 123

Profit and loss attribution

"Insurance and reinsurance undertakings shall review, at least annually, the causes and sources of profits and losses for each major business unit.

They shall demonstrate how the categorisation of risk chosen in the internal model explains the causes and sources of profits and losses. The categorisation of risk and attribution of profits and losses shall reflect the risk profile of the insurance and reinsurance undertakings".

2.9. .Article 124 sets out the standards for model validation.

Article 124

Validation standards

"Insurance and reinsurance undertakings shall have a regular cycle of model validation which includes monitoring the performance of the internal model, reviewing the on-going appropriateness of its specification, and testing its results against experience.

The model validation process shall include an effective statistical process for validating the internal model which enables the insurance and reinsurance undertakings to demonstrate to their supervisory authorities that the resulting capital requirements are appropriate.

The statistical methods applied shall test the appropriateness of the probability distribution forecast compared not only to loss experience but also to all material new data and information relating thereto.

The model validation process shall include an analysis of the stability of the internal model and in particular the testing of the sensitivity of the results of the internal model to changes in key underlying assumptions. It shall also include an assessment of the accuracy, completeness and appropriateness of the data used by the internal model".

2.10. Article 125 sets out the standards for Documentation standards.

Article 125

Documentation standards

"Insurance and reinsurance undertakings shall document the design and operational details of their internal model.

The documentation shall demonstrate compliance with Articles 120 to 124.

The documentation shall provide a detailed outline of the theory, assumptions, and mathematical and empirical basis underlying the internal model.

The documentation shall indicate any circumstances under which the internal model does not work effectively.

Insurance and reinsurance undertakings shall document all major changes to their internal model, as set out in Article 115".

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2.11. Article 126 sets out requirements for External models and data

Article 126

External models and data

"The use of a model or data obtained from a third party shall not be considered to be a justification for exemption from any of the requirements for the internal model set out in Articles 120 to 125".

2.12. Article 231 sets out the general provisions for the approval of group internal models. Relevant Sections are quoted below.

Article 231

Group internal model

"1. In case of an application for permission to calculate the consolidated group Solvency Capital Requirement, as well as the Solvency Capital Requirement of insurance and reinsurance undertakings in the group, on the basis of an internal model, submitted by an insurance or reinsurance undertaking and its related undertakings, or jointly by the related undertakings of an insurance holding company, the supervisory authorities concerned shall cooperate to decide whether or not to grant that permission and to determine the terms and conditions, if any, to which such permission is subject.

An application as referred to in the first subparagraph shall be submitted to the group supervisor.

The group supervisor shall inform the other supervisory authorities concerned without delay.

7. Where any of the supervisory authorities concerned considers that the risk profile of an insurance or reinsurance undertaking under its supervision deviates significantly from the assumptions underlying the internal model approved at group level, and as long as that undertaking has not properly addressed the concerns of the supervisory authority, that authority may, in accordance with Article 37, impose a capital add-on to the Solvency Capital Requirement of that insurance or reinsurance undertaking resulting from the application of such internal model.
Capital Requirement of that insurance or reinsurance undertaking resulting from the application of such internal model.

In circumstances, where such capital add-on would not be appropriate, the supervisory authority may require the undertaking concerned to calculate its Solvency Capital Requirement on the basis of the standard formula referred to in Title I, Chapter VI, Section 4, Subsections 1 and 2. In accordance with points (a) and (c) of Article 37(1), the supervisory authority may impose a capital add-on to the Solvency Capital Requirement of that insurance or reinsurance undertaking resulting from the application of the standard formula.

The authority shall explain any decision referred to in the first and second subparagraphs to both the insurance or reinsurance undertaking and the group supervisor".

2.3 Legal basis for the Level 2 implementing measures

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2.13. Article 127 requires that implementing measures be adopted for Articles 120 to 126.

Article 127

Implementing measures

"The Commission shall, in order to ensure a harmonised approach to the use of internal models throughout the Community and to enhance the better assessment of the risk profile and management of the business of insurance and reinsurance undertakings, adopt implementing measures with respect to Articles 120 to 126".

Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 301(3)".

2.14. Article 234 requires that implementing measures be adopted for Article 231.

Article 234

Implementing measures

"The Commission shall adopt implementing measures specifying the technical principles and methods set out in Articles 220 to 229 and the application of Articles 230 to 233 to ensure uniform application within the Community.

Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 301(3)".

3. Use test

3.1 Introduction

3.1 This Section covers the *"Use test"*, as set out in Article 120 of the Level 1 Text. Note that the final paragraph of Article 120, covering internal model governance, is covered in Section 4.

3.2 The scope of the issue is all undertakings applying for approval to use the internal model to calculate the SCR.

3.3 The Advice covers internal models generally, and the specificities relating to group internal models.

3.4 The discussion and Advice is based on the information gathered by CEIOPS during the production of the Stock-taking Report on the use of internal models in insurance, as well as the QIS exercises and the pre-visit programme undertaken by CEIOPS. We also reviewed information from the CRO Forum benchmarking study.

3.2 Legal Basis

3.5 Article 120 sets out the Use test.

Article 120

Use test

"Insurance and reinsurance undertakings shall demonstrate that the internal model is widely used in and plays an important role in their system of governance, referred to in Articles 41 to 50, in particular:
(a) their risk-management system as laid down in Article 44 and their decision-making processes;
(b) their economic and solvency capital assessment and allocation processes, including the assessment referred to in Article 45.

In addition, insurance and reinsurance undertakings shall demonstrate that the frequency of calculation of the Solvency Capital Requirement using the internal model is consistent with the frequency with which they use their internal model for the other purposes covered by the first paragraph.

The administrative, management or supervisory body shall be responsible for ensuring the on-going appropriateness of the design and operations of the internal model, and that the internal model continues to appropriately reflect the risk profile of the insurance and reinsurance undertakings concerned".

3.3 The Use test Requirements

3.3.1 Rationale for the *"Use test"*

3.6 The Basel Committee[5] indicated that there are three main areas where the use of model components for internal risk-management purposes should be observable: strategy and planning processes, exposure management and reporting. In their view, uses in any of these areas provide evidence of internal use model components; if model components are not used in some of these areas, the supervisory authority may require an explanation for such non-use, or may raise concerns about the quality of the model components. In comparison to the Level 1 Text, the Capital Requirements Directive[6] is module- based, so there is a Use test for every module which is used and which is certificated. The Use test for the AMA approach is regulated for example under Annex 10, Part 3, figure 1.1 number 2 (page 180) CRD.

3.7 A fundamental requirement for an undertaking to qualify for an internal model approach to determine regulatory capital requirements is that it demonstrates to its supervisory authority that there is sufficient discipline in its internal model development and application such that it is *"widely used and plays an important role in"* the course of conducting its regular business, particularly in risk management. From a regulatory perspective, the Use test philosophy boils down to the following: if an undertaking does not trust its model sufficiently to use it, why should the supervisory authority?

3.8 That means for example that the undertaking is likely to use the results of the model for assessing and ranking risk, setting risk tolerance limits, assessing risk appetite, monitoring the top risk exposures, producing risk-management information; producing risk reporting; the development of risk strategies; risk balancing, and the analysis of new products. Not only should these outputs from the internal model be used in the risk-management function but the information derived from the risk-management function, in terms of identifying risks, should be used as an input into the internal model to complement this process. This should assist in meeting the requirements of Article 44(5). The possible uses of an internal model are set out in Annex A.

3.9 The main aim of Solvency II is policy holder protection, and an undertaking that uses an internal model to quantify risks, rank risks, set the risk strategy, produce risk-management information and inform decision-making will have insight into extreme events. Using this risk management in decision-making would assist in protecting policy holders.

3.10. The more freedom the undertaking has in its modelling, the higher the test that the undertaking has to meet to comply with this requirement.

[5] "The IRB Use Test: Background and Implementation", Basel Committee Newsletter No. 9, September 2006, available at: http://www.bis.org/publ/bcbs_nl9.pdf?noframes=1

[6] http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_177/l_17720060630en00010200.pdf and http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_177/l_17720060630en02010255.pdf

This does not mean that CEIOPS advocates a proportional Use-test requirement, under which an undertaking with less freedom to develop its internal model would have to fulfil lower Use-test requirements. "Freedom" in this context means that the undertaking is free to choose the design of the internal model – which lines of business are modelled; the level of granularity in the internal model; the modelling approach. CEIOPS expects that undertakings will develop models that reflect their business needs and the structure of the business. Undertakings also are required to demonstrate their compliance with the Use test to the supervisory authorities. Thus, the Use test is the acid test of the model.

3.11. Thus, the rationale for the Use test is that supervisory authorities can take additional comfort in that an internal model is appropriate if it is widely used and plays an important role in how the undertaking measures and manages risk in its business.

3.12. A major implication of this fundamental requirement is that insurance and reinsurance undertakings must have one and only one modelling framework[7]. CEIOPS' Paper on Pillar 1 issues sets out our thinking that the internal model is more than the calculation kernel (referred to as the "actuarial model" in that Paper). The insurance and reinsurance undertaking will set out the scope of the modelling framework that it plans to use to calculate the SCR when it applies for approval to do so. This may include many different tools, used at different levels of the undertaking. For example, tools may be used daily by traders or less frequently in risk management. An undertaking will not be able to meet the Use test if it has one modelling framework for internal decision-making and a different modelling framework for regulatory capital assessment. The model which is used for the regulatory solvency capital requirements shall, for example, also be used for the internal capital allocation. In our Advice we propose a series of principles for assessing compliance with the Use test. One principle we propose is that the integration into the risk-management system shall be on a consistent basis for all uses, so undertakings need to be able to reconcile any outputs from different parts of the modelling framework with their decision-making processes. For example, the undertaking's interpretation of materiality in the outputs from the internal model shall be consistent with their interpretation of materiality within Article 121, and demonstrating this is one of the things undertakings will do to demonstrate compliance with the Use test. The risk-management function is responsible for a number of areas of the internal models regime as set out in Article 44(5) so there should already be a close relationship between those undertaking the modelling and the risk-management function.

3.13. If undertakings are not provided with the right incentives to employ models in a prudent manner, regulators must face the problem that undertakings have no reason to build models that measure the risks of interest to the regulator and there would be incentives to minimise capital requirements rather than produce accurate measurement of risks.

[7] http://www.ceiops.eu/media/files/publications/submissionstotheec/CEIOPS-DOC-08-07AdviceonPillarI-Issues-FurtherAdvice.pdf

Moreover, undertakings would have fewer internal incentives to keep the model and its parameters accurate and up-to-date. In these circumstances inappropriate models will be created; these cannot lead to good business decisions and will not be used in internal decision-making. In contrast, if undertakings employ internal models in their internal decision-making then they will want a disciplined process that develops models that are robust and of high quality, fed on data with the same properties. An example is the use of internal models in setting remuneration. This may lead to conflicts of interest where senior management are responsible for parameter setting and are remunerated based on model outputs. Dealing with conflicts of interest in model governance is covered in more detail in the Section on internal model governance, Section 4.

3.14. CEIOPS is recommending that a series of principles is adopted to assess compliance with the Use test. These principles stem from a foundation principle. If an undertaking or the supervisory authority is unclear about how to interpret one of the principles or should a new situation that has not been envisaged arise, then reference to the foundation principle should be made.

Foundation principle: the undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model.

3.15. CEIOPS expects that the undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model. This pressure may also come from outside the modelling team. Again noting CEIOPS' Report on lessons learned from the crisis, internal models should allow undertakings to get a complete view of the risks they are facing, with implications not only in terms of capital, but also regarding the running of the entity. To quote from CEIOPS' Report *"the ability and willingness of senior management to use the output of internal models, remains open, in the sense that there are questions regarding how these outputs can be used in cases where there is lack of understanding of the models"*[8]. Moreover responsibility means that management should not, for example, manipulate the internal model to get the results that they want. The internal controls around the internal model are covered in more detail in the Section on model governance, Section 4.

3.16. The foundation principle is not a requirement to extend the scope of a partial internal model, but to improve the internal model within the scope approved.

3.17. The following are examples of situations where a lack of quality in the internal model may give rise to supervisory concern:

[8] CEIOPS (2009) - "Lessons learnt from the crisis and beyond", available at http://www.ceiops.eu/media/files/publications/reports/CEIOPS-SEC-107-08-Lessons-learned-from-the-crisis-SII-and-beyond.pdf

- The internal model outputs are calculated for regulatory purposes with little or no internal incentive for ensuring the quality of those outputs;

- A deterioration in the accuracy, robustness and timeliness of the internal model outputs is unlikely to be picked up by the undertaking's internal processes;

- The undertaking lacks a process for monitoring the appropriateness of and improvement of the internal model; and

- The internal model is seemingly producing low results compared with the results of the undertaking's ORSA and the undertaking is unable to explain this satisfactorily.

3.18. The undertaking should ensure that there is a robust internal challenge of the assumptions underling the internal model. This is described in more detail in the Section on Validation standards.

3.3.2 General approach to the Use test

3.19. The following elements may be taken into account when assessing the use of the internal model:

a. Impact on policy holders;

b. Impact on risk management and use of policies, especially on risk mitigation, ALM, risk appetite, risk strategy, reinsurance program design, limit system, analysis of new products;

c. Impact on capital management, capital measurement and allocation;

d. Whether the scale of use of the internal model reflects the nature, scale and complexity of the risks inherent in the business of the undertaking;

e. Impact on the level playing field between undertakings;

f. Consistency between supervisory authorities' decisions.

3.20. There are several approaches that can be considered regarding the assessment of compliance with the Use test:

a. Detailed list of uses that the undertaking must use the internal model for;

b. Principle-based assessment;

c. Case-by-case analysis of each application.

3.3.3 Detailed list of possible uses

3.21. In this option a list of all possible uses would have to be issued. Firstly, a set of all possible uses would have to be identified, along with a definition / description of the use. For each use, a criterion for compliance would have to be established, as well as a metric to measure the materiality effect of the use. The metric may rely on materiality thresholds (expressed, for example, as a percentage of the SCR) or on qualitative judgment, depending of the nature of the use.

3.22. The main pros of this option are that is objective, relatively simple to apply and ensures harmonization across supervisory authorities' decisions.

3.23. On the other hand, even though simple to apply once the uses are identified and the criteria chosen, a detailed list of uses and their respective criteria would be very time consuming to construct, since it is virtually impossible to enumerate all possible situations. Producing a complete list that is relevant for all undertakings, and proportionate to the nature, scale and complexity of risks in undertakings, appears to CEIOPS to be a complex and possibly impossible task.

3.24. Furthermore, the list and criteria might become easily dated and might not always take properly into account each undertaking's specific situation. CEIOPS also expects undertakings to continually develop the use of their internal model, so the list may become out of date very quickly, and not reflective of current practice.

3.25. In addition, insisting that the undertaking uses the internal model for specific uses removes the initiative from the undertaking.

3.3.4 Principle-based assessment

3.26. Within a principle-based assessment approach, general criteria are proposed to assess the use made of the internal model.

3.27. This approach has important pros such as flexibility (as opposed to the previous option), harmonization across supervisory authorities' decision processes (once supervisory authorities gather enough experience and compare cases).

3.28. The main drawback of this approach is that it requires a high degree of communication between supervisory authorities in the first period of application, in order to obtain consistency and ensure a level playing field. Additionally, this option encompasses a higher degree of discretion than the previous option.

3.3.5 Case-by-case analysis

3.29. The main pro of this approach is that it ensures the highest degree of flexibility and decisions almost tailor-made to each undertaking's specific situation.

3.30. Among the numerous disadvantages of this approach we highlight that harmonization of decisions between supervisory authorities is unlikely to occur and that a level playing field may not be achieved.

3.3.6 Discussion in this Paper

3.31. The analysis below looks at each part of the Use test as set out in Article 120 and considers the options for each part. A case-by-case approach is not discussed below, as the general points above apply in all cases and CEIOPS does not consider that this option is viable.

3.32. In order to develop CEIOPS' thinking, we have taken the approach of considering a list of possible uses of an internal model (based on the Stock-taking Report) and considering which part of the Use test they would demonstrate. We then classified these uses as being essential / good practice / nice to have / irrelevant in respect of demonstrating that part of the Use test. This initial analysis is shown in Section 3.3.7, where the approach of requiring undertakings to use the internal model for specific things is discussed.

3.33. To develop principles for assessing compliance with the Use test, CEIOPS reviewed those uses that had been classed as essential to demonstrating compliance and considered what characteristics made those uses essential. This resulted in the principles set out in Section 3.3.8.

3.34. Internal model governance, including governance requirements in the last paragraph of Article 120, is covered separately in Section 4.

3.3.7 List of possible uses

3.35. Looking at the first part of Article 120, the Use test requires the internal model to be used in the undertaking's system of governance referred to in Articles 41 to 50. The following areas are highlighted as particularly important:

The undertaking's

a. System of governance

b. Risk-management system

c. Decision-making process

d. Economic capital assessment

e. Economic capital allocation

f. Solvency capital assessment

g. Solvency capital allocation

3.36. Note that "used" means "*is widely used in and plays an important role in"*. CEIOPS does not expect that an undertaking will make decisions

based solely on the output of the internal model (in other words CEIOPS does not expect that the model will be used to "run" the business per se) but that decision-making will take account of the output of the internal model, understanding the shortcomings of the internal model. That means that we expect that the results of the internal model will be used at least for business decisions that have a major impact on the risks of the undertaking. A "major impact" shall be consistent with the understanding of the meaning of materiality within Article 121. For example, if a decision was taken where the outputs from the internal model suggested an alternative conclusion should have been reached to the one taken then CEIOPS would expect that the rationale behind the decision be fully documented. This would not necessarily mean that the undertaking would fail the Use test, which requires that the output from the model should be *"widely used in and plays an important role in"* decision-making. In addition, CEIOPS also expects that if a decision is made where the outputs from the internal model suggest that conclusion, then the rationale for that should also be documented.

3.37. This Advice does not include a discussion of the allocation of regulatory solvency capital. CEIOPS' view is that undertakings will wish to allocate economic capital to lines of business and risk types as part of managing the business and that undertakings will asses the solvency capital in aggregate. Therefore CEIOPS expects that decision making will take account of the difference between the solvency capital and the allocated economic capital.

3.38. CEIOPS has considered the uses of internal models identified during the production of the Stock-taking Report. An approach to assessing compliance with the Use test based on a list of required uses is described below. An undertaking that uses its internal model for the uses described below in paragraphs 3.39 to 3.46 would demonstrate the internal model's compliance with the Use test in the areas described. The table in paragraph 3.50 shows which part of the Use test would be met by each use. The list below sets out the uses considered:

a. Reconciliation between the internal model and technical provisions

b. Reconciliation between the internal model and financial reporting

c. Asset / liability management

d. Investment decisions

e. Risk-management system uses

f. Risk mitigation

g. Development of the undertaking's risk appetite

h. Product development

i. Assessing the riskiness of the business strategy

j. Assessing customer benefits

k. Capital management

l. Allocating the economic capital

m. Calculating the SCR

3.39. Reconciliation between the internal model and technical provisions or between the internal model and internal or external financial reporting information (reporting to supervisory authorities) will demonstrate that the internal model is consistent with other information used to run the undertaking. Whilst the undertaking may use different financial bases for different decisions, it should be clear on the differences and the undertaking should be able to reconcile them in order to demonstrate that there is consistency of information across the undertaking.

3.40. CEIOPS expects that undertakings will use the internal model to make decisions about asset / liability management and investment decisions. However, CEIOPS recognises that the importance of this will vary depending on the type of undertaking. Typically, life undertakings are more likely to need this type of analysis, reflecting the nature of their liabilities. Non-life undertakings tend to have simpler investment strategies so have less need of this analysis, but use the internal model more to make decisions about the reinsurance strategy and program.

3.41. Article 120 requires the internal model to be used in the undertaking's risk-management system. CEIOPS expects that the internal model will be used:

a. to quantify and rank the risks the undertaking is exposed to and hence all material risks identified by the risk-management system should be an input into and therefore assessed by the internal model;

b. to assist the risk-management function in the production of risk-management information (MI) and hence assist in monitoring risk exposures through risk reporting – both internal and external reporting;

c. to develop risk strategies based on the measurement of the risk exposure, the undertaking's risk-tolerance limits and risk indicators;

d. for risk balancing to limit exposure to one risk and increase another, for example leading to efficient use of capital which may benefit from diversification effects;

e. for risk-exposure management and risk-limit setting; and

f. for the development and monitoring of the undertaking's overall risk appetite and hence risk-bearing capacity.

3.42. These are all aspects of the undertaking's risk-management system where the internal model should be used, and lead to the use of the internal model in calculating economic capital.

3.43. Alongside the risk-management system the undertaking will develop risk-mitigation approaches, and CEIOPS expects that undertakings use the internal model for these, including reinsurance programme design and other risk mitigation.

3.44. Other business decisions will use the internal model, such as product development, where the internal model will be used to assess the capital requirements and risks of new products. An explicit example of this is the use of the internal model for assessing customer benefits, for example, bonus setting. Another example is the use of the internal model in mergers and acquisitions, where it can be used to assess the effect of a decision on the overall risk and capital profile of the undertaking, and assess the risk / reward spectrum. The internal model may be used for setting return on capital targets for different products, business lines and business units. This is all part of the undertaking's business planning / strategy, and CEIOPS expects that undertakings will use the internal model to assess the riskiness of its future business strategy and the variation in possible outcomes. A natural extension of this is the expectation that the internal model will be used in the undertaking's ORSA process.

3.45. Many undertakings aim for efficient use of capital, and CEIOPS expects that undertakings will use the internal model for capital management, in terms of the capital structure of the undertaking.

3.46. Of course the internal model must be able to calculate the regulatory capital requirement, the SCR.

3.47. To assist both internal and external reporting, the internal model should at least be able to produce results by entities and material lines of business and have overall economic capital results split by material risks. This will assist in risk-management activities and identifying, in the undertaking's view, excessive risk positions by type of risk. The results of the model have to be at least able to produce the results on a level where decision-making processes take place, so that it can be *"widely used in and plays an important role"* in the business.

3.48. The profits and losses used for the purpose of the profit and loss attribution shall also be used as part of satisfying the Use Test. Hence the profits and losses have to be appropriate for the system of governance (including the ORSA, risk management, limit setting, allocation processes). Therefore CEIOPS Advice is to use the definition set out in 7.17 a below, i.e. to use internal definitions for profits and losses, which should be consistent with the variable underlying the probability distribution forecast (Article 121). The variable may differ from basic own funds, because a different internal definition may be used for economic capital resources. Undertakings shall be aware how the profits and losses used in the Profit and loss attribution may differ from

the profits and losses reported in their accounting systems and what the causes of these differences are.

3.49. It should be noted that CEIOPS considers that undertakings using a group internal model should review the sources of profit and loss for solo entities and undertake this assessment on a consolidated basis in addition to the assessment on a solo basis. A particular aspect of this is the assessment of the contribution of each entity to the consolidated profit and loss, as well as the contribution to changes in the SCR and required and actual economic capital. This will also form part of supervisory and public reporting.

3.50. The table below looks at the uses of the internal model described and discussed above, and attempts to allocate them in a non-conclusive way to the different elements of the Use test.

Area of use	**Use of the internal model**
System of governance	Reconciliation between internal model and technical provisions
System of governance	Reconciliation between internal model outputs and internal and external financial reporting
System of governance	Reconciliation between internal model and the technical implementation of management actions, e.g. for with-profit business.
System of governance	Reconciliation between internal model and the responsibility for parameterisation.
Risk-management system	Measurement of material risks
Risk-management system	Asset / liability management
Risk-management system	External risk reporting
Risk-management system	Internal risk monitoring (through MI)
Risk-management system	Reinsurance programme design
Risk-management system	Other risk mitigation
Risk-management system	Development of risk strategies
Risk-management system	Risk balancing (efficient use of capital)
Risk-management system	Exposure management and limit setting

Area of use	**Use of the internal model**
Risk-management system	Product development / Pricing
Risk-management system	Development and monitoring of risk appetite
Decision-making	Investment decisions e.g. strategic, tactical and operational decisions
Decision-making	Reinsurance decisions e.g. strategic, tactical and operational decisions
Decision-making	Setting return on capital targets and remuneration
Decision-making	Product development / Pricing
Decision-making	Business planning / strategy
Decision-making	Asset / liability management
Decision-making	Reinsurance strategy and development of reinsurance programme
Decision-making	Underwriting policies
Decision-making	Assessing customer benefits, for example, bonus setting
Decision-making	Risk Mitigation
Decision-making	Capital Management
Economic capital assessment	ORSA
Economic capital assessment	Capital Management
Solvency capital assessment	Regulatory capital (SCR for solo and for groups)
Economic capital allocation	By entities, lines of business, risks, major business units
Solvency capital allocation	By entities, lines of business, risks, possibly in the form of a reasonableness check

3.51. The table below gives an indicative overview of possible uses of an internal model. In addition, that an undertaking uses the internal model for the uses set out below would be an indication that the internal model is used well in an undertaking, but would not necessarily be an indicator of compliance with the Use test.

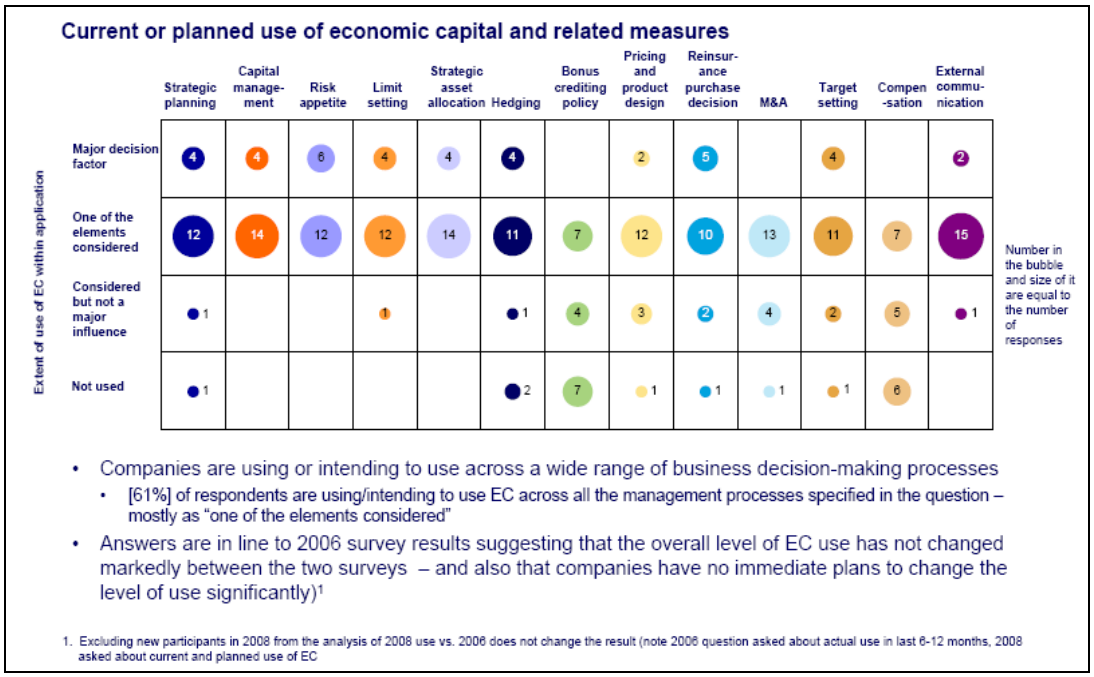
Area of use	**Use of the internal model**
System of governance	Reporting on technical provisions
System of governance	Reporting on business performance

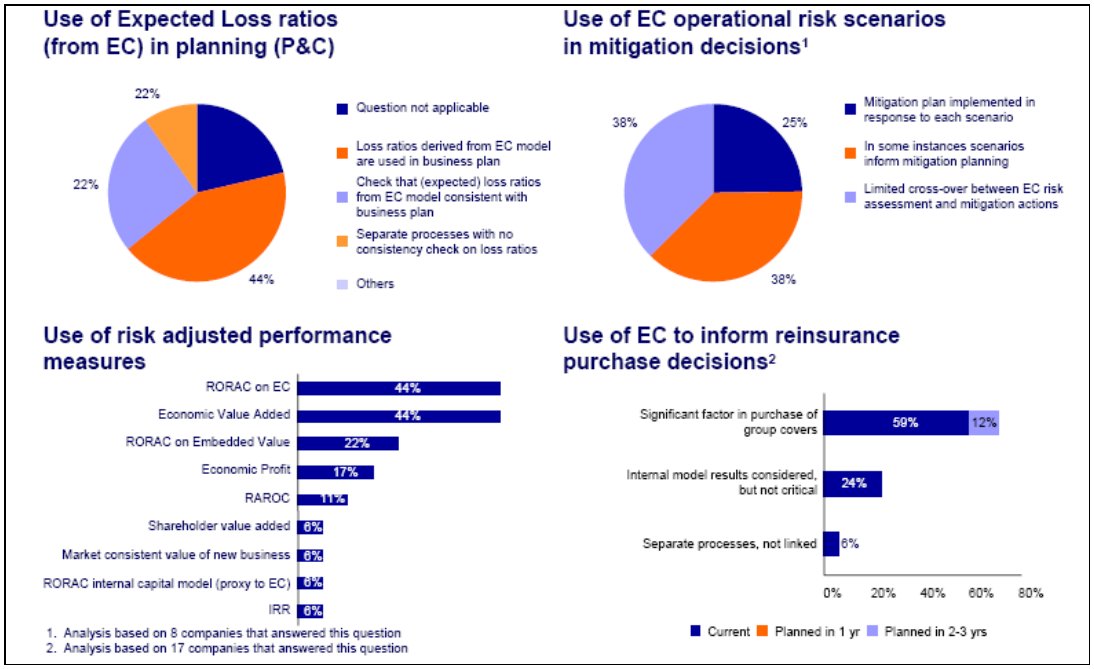
Area of use	Use of the internal model
System of governance	Reporting on performance including return on capital
System of governance	Reporting on MCEV / EV
System of governance	Producing MI
System of governance	Financial Reporting - internal model provides market valuations for IFRS
Risk-management system	Adequate pricing
Decision-making	Incentive / target setting
Decision-making	Setting profit targets
Decision-making	Portfolio transfer pricing
Decision-making	M&A
Economic capital assessment	Efficient use of capital

3.52. However, the length of the list demonstrates the unlikelihood of a list-based approach leading to a proportionate regime for assessing compliance with the Use test. If all undertakings had to demonstrate that they are using their internal model for all the uses in the first table, then many undertakings would either have to use the internal model for something that is not relevant for the internal model and could lead to inappropriate decisions being taken, or decide they will not apply for internal-model approval.

3.53. The recent CRO Forum benchmarking study[9] shows the range of uses of models by CRO Forum members. Note that the survey refers to the use of economic capital measures as part of Pillar 2. For the purposes of this discussion, CEIOPS is reviewing the findings in the context of Pillar 1, as the Use test explicitly refers to economic capital which under Solvency II falls under Pillar I. CEIOPS notes that this survey is of current practices and is useful here solely to provide examples of some of the uses that some undertakings are making of their internal models.

[9] http://www.croforum.org/publications.ecp





3.54. It can be seen that there is a wide variation in uses and level of use across undertakings. CEIOPS does not wish to tailor its Advice on the Use test to fit with market practice where this does not meet the requirements of the Level 1 Text. However, in this case, the analysis is based on 18 undertakings that CEIOPS expects to be at the more sophisticated end of the market in respect of internal models. Thus, the results of this benchmarking study lead to the conclusion that an

assessment of compliance based on a list of required uses will not fit the "live" experience of undertakings already using internal models.

3.55. AMICE[10] have also reviewed uses of internal models across their members. The results of their analysis is below, with the areas of use shown in descending order of importance to AMICE members:

Current or planned use of economic capital across a wide range of business decision-making processes such as:	Use in AMICE members
Strategic Planning	★
Limit Setting	★
Strategic Asset Allocation	★
Bonus Crediting	★
Pricing and product Design	★
Reinsurance and purchase decision	★
Capital Management	✶
Risk Appetite	✶
Target Setting	✶
Hedging	✶
M&A	✶
Compensation and External Communication	-

3.56. AMICE members also highlighted that use of the internal model can vary within an undertaking, between life and non-life insurance.

3.57. In addition, the rationale for the Use test is clear that the aim is for the undertaking to have some "skin in the game" by relying on the internal model for their own uses. If the uses are prescribed by the regulator, the undertaking is less likely to develop an internal model that suits their purposes.

[10] http://www.amice-eu.org/

3.58. This approach offers no scope for assessing the requirements in the second sub-paragraph of Article 120 (frequency of calculation of the SCR and other internal purposes). CEIOPS could provide some rules about the frequency of calculation of the SCR and economic capital, but it is unlikely that any rules will adequately reflect the internal requirements of all undertakings planning to apply to use an internal model. The rules will either impose a too-frequent calculation or a too-infrequent calculation. Such a rule would be disproportionate for many undertakings.

3.59. CEIOPS is of the view that a list-based approach is not suitable for assessing compliance with the Use test. Whilst CEIOPS has found the development of the example list of uses described and discussed above very helpful in increasing our understanding of how undertakings use their internal models, the reasons set out in Section 3.3.4 explain why CEIOPS considers that a principles-based assessment of the Use test is preferable and our Advice is based on this.

3.3.8 Principles-based assessment

3.60. As an alternative, CEIOPS has looked at the uses that it considers important in the assessment of compliance with the Use test, and has also considered the rationale for the Use test, in order to develop some principles that might be used by supervisory authorities in their assessment of internal models. More detail on the principles will be given at Level 3. CEIOPS considers that this principles-based approach to assessing compliance with the Use test is more suited to the proposed Solvency II regime and our Advice is that the principles described below be adopted.

3.61. The principles set out below apply equally to group and solo internal models. Some specificities relating to group internal model are highlighted in the discussion and the Advice. CEIOPS recognises that further work is needed regarding the Use test for groups.

3.62. As described above, the principles stem from a foundation principle. If an undertaking or the supervisory authority is unclear about how to interpret one of the principles or should a new situation that has not been envisaged arise, then reference to the foundation principle should be made.

Foundation principle: the undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model.

3.63. CEIOPS expects that the undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model. This pressure may also come from outside the modelling team.. Again noting CEIOPS' Report on lessons learned from the crisis, internal models should allow undertakings to get a complete view of the risks they are facing, with implications not only in terms of capital, but also regarding the running of the entity. To quote from the Report *"the ability and willingness of senior management to use the output of*

internal models, remains open, in the sense that there are questions regarding how these outputs can be used in cases where there is lack of understanding of the models". Moreover responsibility means that management should not, for example, manipulate the internal model to get the results that they want. The internal controls around the internal model are covered in more detail in Section 4, on model governance.

3.64. The foundation principle is not a requirement to extend the scope of a partial internal model, but to improve the internal model within the scope approved.

3.65. The principles are discussed below.

GENERAL PRINCIPLES

Principle 1. Senior management and the administrative, management or supervisory body shall be able to demonstrate understanding of the internal model

3.66. The Level 1 Text requires that the internal model is *"…widely used in and plays an important role in…"* the undertaking. In CEIOPS' view, it is unlikely that any internal model will be used in an undertaking if it is not understood by the senior management. CEIOPS expects that the decisions where the undertaking uses the internal model to inform the decision-making process will include strategic decisions, and thus have an impact on the future direction of the undertaking. Thus, CEIOPS expects that there is a willingness and ability within the undertaking that the outputs of the internal model will be used by the administrative, management or supervisory body of the undertaking to assess, for example, the relative risk and return of different options, and that they will therefore understand the internal model. Furthermore CEIOPS expects that the outputs of the internal model which have a major impact on the risk profile of an undertaking will be discussed with the risk-management function and that the results of this discussion are reported to the administrative, management or supervisory body and can therefore be seen in the minutes of the board meetings.

3.67. In order to demonstrate compliance with the Use test, the undertaking's administrative, management or supervisory body will need to show that that they understand the internal model, including:

a. Showing that they understand the structure of the internal model and how this fits with their business model and risk-management framework.

b. Showing that they understand the limitations of the internal model and that they take account of these limitations in their decision-making.

3.68. The CEIOPS Paper on lessons learned from the crisis also highlights senior management understanding of the internal model as an important factor. The administrative, management or supervisory body shall give evidence of understanding of the internal model. CEIOPS considers that

each member of the administrative, management or supervisory body shall have an overall understanding of the internal model. CEIOPS considers that this understanding may be gained from training provided by the undertaking. Each member of the senior management shall have an overall understanding of the internal model as well as a detailed understanding in the areas where they use the internal model.

3.69. The Report recommends that senior management be required to understand the drivers behind market movements, together with its own portfolio positions, in particular in times when historical relationships in markets break down. They have to:

a. understand the methodology behind the internal model;

b. understand the dynamics of the model, or how the different elements fit together;

c. understand the limitations of the model, for each aspect of it. This should include the limitations of statistical assumptions and limitations in business planning assumptions.

d. understand, in which areas and on which entity / hierarchy level within the undertaking/group diversification effects arise

3.70. Whilst the focus of the Use test is the undertaking's economic capital, it is also important that the administrative, management or supervisory body, as well as senior management, has a view on the consumption of regulatory capital, in particular on how and why the eligible own funds compared to the SCR changes over time.

3.71. Again noting CEIOPS' Report on lessons learned from the crisis, full internal models should allow undertakings to get a full view of the risks they are facing, with implications not only in terms of capital, but also regarding the running of the entity. To quote from CEIOPS' Report *"the ability and willingness of senior management to use the output of internal models, remains open, in the sense that there are questions regarding how these outputs can be used in cases where there is lack of understanding of the models."* Principle 1 covers this point.

3.72. Moreover responsibility means that management should not, for example, manipulate the internal model to get the results that they want. The internal controls around the internal model are covered in more detail in Section 4, on model governance.

Principle 2. The internal model shall fit the business model

3.73. CEIOPS' view is that if the internal model is not designed in alignment with the undertaking's business model (especially: the core aspects of a business, including purpose, offerings, strategies, infrastructure, organisational structures, trading practices, and operational processes and policies), then it is unlikely that the undertaking's management will find the output from the internal model useful in decision-making. Thus Principle 2 requires the outputs from the internal model to be tailored to

the business need and to fit the business model. One way of thinking of this is that to put the internal model into the business one has first to put the business into the internal model so that all material risks are modelled.

3.74. CEIOPS has identified some key areas where the undertaking should focus on aligning the internal model and the business model. These include:

a. It should link to technical provisions - the Statistical Quality Standard requires the methods used in the internal model to calculate the probability distribution forecast to *"be consistent with the methods used to calculate technical provisions".* Technical provisions are a major part of the balance sheet of most undertakings and give rise to much of the risk in undertakings. Thus the internal model should give the management useful information about the reserving risk.

b. It should assist in both internal and external reporting and enable reconciliation between internal and external reporting (particularly for supervisory reporting). The internal model should allow for different accounting regimes and allow senior management to look at results consistently. It is likely that management will wish to review internal model output on differing accounting bases, for example, local GAAP, Solvency II valuation bases and internal accounting principles. This is particularly important for undertakings that have subsidiaries in different countries with differing accounting treatments. This is also covered in Principle 5.

c. It should be internally proportionate to nature, scale and complexity of risks: each undertaking using an internal model will have a different mix of risks, with some larger and more complex and others smaller and simpler. In addition, the nature, scale and complexity of each undertaking will drive the assessment of relative riskiness. For an undertaking to use an internal model, the design will need to reflect the undertaking's own assessment of the risks it faces.

d. If the business model changes in a way that affects the internal model, the internal model must be changed. The undertaking will need to allow for changes of this nature in the proposed change policy (See CEIOPS' Advice on the Approval Process for internal models and Article 115 of the Level 1 Text). However, it is a consequence of requiring the internal model to reflect the business model to require that should the business model change, the internal model will need to change to reflect this. This is the responsibility of the administrative, management or supervisory body and is covered in more detail in the Advice on internal-

model governance in Section 4. Examples of such changes include reorganisations, expansion into new locations or lines of business.

e. The capital-allocation approach and granularity of allocation shall reflect the risk-management system and the business model. CEIOPS expects that all undertakings have an effective risk-management system in place and hence the internal model shall be aligned with the risk-management system. Article 44(5) requires the risk-management function to design, implement, test, validate, document, analyse the performance of the internal model and inform the administrative, management or supervisory body on its performance. It is therefore important that the internal model is aligned with the risk-management system to facilitate these tasks. The internal model is required to be used in capital allocation in the undertaking, and for this to be useful undertakings will need allocation of capital at a sufficiently granular level. For a group internal model, CEIOPS also expects that required and actual economic capital will be allocated as a minimum between subsidiaries and related undertakings. In line with Principle 1, CEIOPS also expects that the senior management has a view on the consumption of regulatory capital at a sufficiently granular level. This will require some allocation of regulatory capital at least for internal reporting purposes. For a group internal model, this will include allocation between subsidiaries and related undertakings.

f. The profits and losses used for the purpose of the profit and loss attribution shall also be used as part of satisfying the Use Test. Hence the profits and losses have to be appropriate for the system of governance (including the ORSA, risk management, limit setting, allocation processes). Therefore CEIOPS' Advice is to use the definition set out in 7.17 a below, i.e. to use internal definitions for profits and losses, which should be consistent with the variable underlying the probability distribution forecast (Article 121). The variable may differ from basic own funds, because a different internal definition may be used for economic capital resources. Undertakings shall be aware how the profits and losses used in the Profit and loss attribution may differ from the profits and losses reported in their accounting systems and what the causes of these differences are. It should be noted that CEIOPS considers that undertakings using a group internal model should review the sources of profit and loss for solo entities and on a consolidated basis in addition to the assessment on a solo basis. A particular aspect of this is the assessment of the contribution of each entity to the consolidated profit and loss, as well as the contribution to changes in the SCR and required and actual economic capital. This will also form part of supervisory and public reporting.

INTERNAL MODEL AND DECISION-MAKING

Principle 3. The internal model shall be used to support and verify decision-making in the undertaking.

3.75. Article 120 requires the internal model be used in decision-making processes. This includes the setting of a business or risk strategy. CEIOPS expects that internal models will be able to give undertakings information that will allow them to assess the expected profit and losses from potential decisions and assess the variability in the expected profit and losses from potential decisions. For example, undertakings may use the internal model to make decisions on the pricing of products. In addition, the internal model should be able to provide information to allow management to assess the capital implications of potential decisions. Decision-makers should be aware of the scope of the internal model.

3.76. CEIOPS does not expect undertakings to develop detailed assessments for small decisions - the analysis should be proportionate to the outcome of the decision - but should at least cover all decisions with material outcomes. Decisions with material outcomes are expected to be documented and be escalated as part of normal processes or on an ad hoc basis.

3.77. CEIOPS expects that the internal model and its results will be regularly discussed in relevant (risk) bodies, and also at board level. Supervisory authorities will expect the administrative, management or supervisory body to be able to demonstrate understanding of the internal model, in particular in respect of why and how decisions were made. Likewise, significant changes to the model should be discussed in these bodies (as described in Article 115). In this regard the risk-management function has the role of producing a clear picture of the model as required by Article 44(5). All of the above should be clearly evident in reports or meeting minutes.

3.78. However, as stated above, CEIOPS does not expect undertakings to make decisions that blindly follow the output of the internal model. Decision makers should be aware of the shortcomings of the internal model (as documented by the undertaking), and tailor their decisions accordingly. CEIOPS also regards it as good practice for undertakings to document why decisions differ from those indicated by the internal model output, and the additional information that has been used to arrive at the decision, as well as documenting the rationale for decisions where the outputs from the internal model support the decision.

Principle 4. The internal model shall cover sufficient risks to make it useful for risk management and decision-making

3.79. CEIOPS encourages undertakings to develop an internal model that is useful for them, whether this is a full or partial internal model. Article 121 is clear that the internal model shall cover all material risks, and the standards for assessing this are covered in our discussion and Advice on

the statistical quality standards in Section 5. However, gaining approval to use an internal model to calculate the SCR is not a trivial process, so CEIOPS expects undertakings to develop internal models that can inform significant risk-management and business decisions.

Principle 5. Undertakings should design the internal model in such a way that it facilitates analysis of business decisions.

3.80. From the pre-visit programme undertaken by CEIOPS, we have noted that undertakings use their internal model to develop their thinking about tricky issues in an analytical way. Whilst undertakings will not take the results of the internal model as the final answer, the results will be used to inform internal debate. CEIOPS expects that the results are, for example, at least discussed with the persons responsible for risk in the administrative, management or supervisory body and that timely (as discussed in 4.18) results are communicated to the board members in a way that allows them to take responsibility for the results. Nonetheless, the administrative, management or supervisory body has overall responsibility for the internal model, as described in the governance Section, Section 4.1. It is further expected that undertakings use the results of the internal model, for example, for their development plan for the internal model, internal project plans, their governance strategy and their model change and data policy. CEIOPS regards these types of uses as good practice and as a good demonstration of the Use test.

INTERNAL MODEL AND THE RISK MANAGEMENT SYSTEM

Principle 6. The internal model shall be widely integrated with the risk-management system

3.81. Article 120 makes the importance of the internal model in the undertaking's risk-management system clear. In CEIOPS' view, undertakings will be able to demonstrate that the internal model is used in the risk-management system by showing, for example, that the risk quantification and risk rankings produced by the internal model trigger action in the undertaking; that all material risks identified by the risk-management system should be an input into and therefore assessed by the internal model; that outputs are used to formulate risk strategies, including the development of the undertaking's risk appetite and any risk mitigation, and improve the risk-management system overall; and that outputs are used to formulate risk limits and appear on reports to internal forums in the undertaking. One example of a demonstration of this type of use is the discussion of risk at board level. The results of this discussion would be summarised in the minutes of the board meeting, and could be reviewed alongside management information provided to the board from the internal model, or used in the example self-assessment test of the undertaking described below.

3.82. In line with this, if the risk-management system changes, the internal model should also be changed to reflect this. The comments above on Principle 2 apply here. The organisational framework around the internal model and the internal risk treatment and control system must be

adapted to the changes in the environment within an appropriate period of time. Guidelines on organisational development must be set up to this end.

3.83. At each point in the internal model where diversification effects occur, there should be clear responsibility in the undertaking for quantifying and allocating any diversification benefits as part of the capital-allocation and risk-ranking processes.

Principle 7. The internal model shall be used to improve the undertaking's risk-management system.

3.84. Article 112(5) requires an undertaking applying to use an internal model to calculate the SCR to have an adequate risk-management system. In addition, Article 120 requires the internal model to be widely used and play an important role in the risk-management system. CEIOPS expects that the internal model, which is used to quantify risks, will allow undertakings to gain more insight in their risks, and hence improve risk management. This could include improving risk-mitigation techniques; clarifying the risk appetite of the undertaking; allowing more informed monitoring of risks; more risk-based decision making.

3.85. CEIOPS is of the view that undertakings using an internal model are more likely to develop a feedback loop between the internal model and the risk-management system, where results from one will lead to improvements in the other. The feedback loop is described in more detail in CEIOPS Advice on System of Governance[11], paragraph 3.8.

Principle 8. The integration into the risk-management system shall be on a consistent basis for all uses

3.86. CEIOPS recognises that undertakings will be likely to use output from the internal model that is on an economic basis, reflecting an internal view of valuation of assets and liabilities, for decision-making. However, CEIOPS is aware that undertakings, particularly groups, will also use a variety of accounting methods and concepts for the valuation of assets and liabilities, reflecting, for example, local GAAP, IFRS, internal management accounting and Solvency II regulatory basis[12]. If the internal model is to be used effectively in an undertaking, the internal model needs to produce output that is based on the relevant internal or external accounting basis (which may vary depending on the decision being made). This reflects the probable need to review the effect of the decision on an economic basis as well as on reported figures. In addition the management need to understand the basis of the output.

3.87. The undertaking's risk-management system may reflect the undertaking's view of risk and valuation of assets and liabilities. However, the Solvency II basis for assessing risk and for valuation of assets and liabilities must form part of the undertaking's risk-

[11] CEIOPS' advice for Level 2 implementing measures on System of Governance

[12] See CEIOPS advice for Level 2 implementing measures on valuation of assets and other liabilities

management system and hence the internal model. In particular, the internal model must be able to calculate the SCR on the Solvency II basis.

3.88. The Use test should always attach at least at the level at which risk strategy and risk management are defined. If these are defined at a group level, the Use test should also begin at this level. The Use test will apply across the entire scope of the internal model. The uses listed in the scope of the internal model should then be assessed by the supervisory authorities at a group level. In addition, the Use test will also be assessed at the level of related undertakings. CEIOPS recognises that an undertaking may have different uses for the internal model at the group level compared to the solo undertaking level.

3.89. The extent of the review by the supervisory authorities of the Use test in related undertakings will be proportionate to the nature, scale and complexity of risks in those undertakings. The approach to the review will reflect the group's governance structure and risk profile.

RECALCULATION

Principle 9. The SCR shall be calculated at least annually from a full run of the internal model, and also when there is a significant change to the undertaking's risk profile, assumptions underlying the model and / or the methodology arising from decisions or business model changes, and whenever a recalculation is necessary to provide up-to-date information for decision making or any other use of the model , or to fulfil supervisory reporting requirements.

3.90. CEIOPS considers that undertakings should calculate the SCR using a full run of the internal model at least annually, although we recognise that undertakings will wish to calculate the SCR more frequently, in line with internal reporting.

3.91. CEIOPS also recognises that undertakings will update the methodology, parameters and data input to the internal model on a regular basis, and consider that to fit with the proportionality principle, undertakings may calculate the change in the SCR for only the risk modules affected by the changes.

3.92. In line with Article 125 and Article 115, undertakings must document the changes to the internal model.

3.93. When developing the Advice, CEIOPS considered different requirements for the frequency of calculating the SCR from a full run of the internal model. The work done to develop the Stock-taking Report led us to the conclusion that an annual requirement reflects best practice from undertakings, and also recognises that many undertakings have developed an internal-model framework that best fits their own use of the internal model. These frameworks typically include a full run of the calculation kernel annually or semi-annually. The outputs are then updated regularly, in line with internal reporting or decision-making

requirements, from other elements of the internal model framework, including:

a. Using tools such as replicating portfolios

b. Running only those parts of the calculation kernel that are needed for the particular use

c. Developing "rules of thumb", or proxies, where the effect on the output of a certain change in one risk driver is known

d. Updating the outputs for known events since the last full run, and effectively "rolling forward" the previous results.

3.94. However, CEIOPS considers that requiring a full run of the internal model may, in some situations, be necessary to provide a more reliable calculation of the SCR. These situations may include, for example,

a. Where two risk drivers change at the same time and the combined effect cannot be assessed by proxies

b. Where the change in one risk driver is so large that the proxies are unreliable

c. Where risk drivers are changing rapidly and the effect on output is hence uncertain.

3.95. Supervisory authorities will decide on a case-by-case basis, giving reasons, whether undertakings should calculate the SCR using a full model run on a more frequent basis than annually in line with Article 102.

3.96. CEIOPS is aware that the MCR must be calculated quarterly and that the proposed methodology requires a link to the SCR. Under the principle of proportionality (see CEIOPS advice on Proportionality), undertakings using an internal model shall apply a quarterly calculation that is sufficiently sophisticated to produce the quarterly SCR (see CEIOPS Advice on the Calculation of the MCR).

3.97. The frequency of internal discussions on the internal model results and of the corresponding necessary calculations will largely depend on the individual risk classes.

3.98. The profits and losses used for the purpose of the profit and loss attribution shall also be used as part of satisfying the Use Test. Hence the profits and losses have to be appropriate for the system of governance (including the ORSA, risk management, limit setting, allocation processes). Therefore CEIOPS' Advice is to use the definition set out in 7.17 a below, i.e. to use internal definitions for profits and losses, which should be consistent with the variable underlying the probability distribution forecast (Article 121). The variable may differ from basic own funds, because a different internal definition may be used for economic capital resources. Undertakings shall be aware how the

profits and losses used in the Profit and loss attribution may differ from the profits and losses reported in their accounting systems and what the causes of these differences are.

3.3.9 Example Uses

3.99. As discussed in Section 3.3.4, CEIOPS is not advising a list of possible uses in order to assess compliance with the Use test. Annex A sets out a list of possible uses that undertakings might consider when designing their internal model and when setting out the scope of the internal model as part of their application for approval. CEIOPS does not intend that the list in Annex A should be used as a type of check-list for assessing compliance with the Use test.

3.100. One way to provide confidence that the internal model is actually used throughout the undertaking is by the implementation of a "use-test self assessment". For example, the undertaking may prepare a sheet with questions about possible uses, how the internal model could be used and how it actually is used. The questionnaire then is sent to the responsible persons in an undertaking who use the results of the model. One possibility ensuring that the internal model is actually used throughout the undertaking could be a kind of plausibility check. Therefore the recipient of the questionnaire could be asked to explain different possibilities of using the results of the model at this stage. In this context he could explain why he uses the results in this way. This may lead on the one hand to a better understanding of the model especially for the responsible persons, and on the other hand it makes it easier for other persons (such as the supervisory authority) to recognise whether or not the results are really understood and used in the undertaking. This may be a good indicator of the actual usage of the model for the undertaking.

3.101. CEIOPS considers that using these principles as a basis for assessing compliance with the Use test is more likely to result in a proportionate regime, as well as reflecting the need for undertakings to develop internal models that are fit for their purposes as well as regulatory ones.

CEIOPS' Advice

3.102. Note that the principles below are evidential provisions, compliance with which tends to show the Use test has been met. The principles are derived from the Level 1 Text in order to meet the requirement that the *"internal model is widely used in and plays an important role in the following..."*.Therefore it is possible that one of the principles or another plays a more or less important role in a single undertaking and the way an undertaking can show compliance with it can differ. But nevertheless the principles shall be fulfilled as they are derived from the Level 1 Text but the undertakings may use different ways to show compliance with these principles and in this context with the Level 1 Text.

The Use test

Foundation principle: the undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model.

3.103. When applying the principles below, reference to the foundation principle shall be made where there is lack of clarity. Supervisory authorities may regard situations including the following as examples of non-compliance with the Use test:

a. The internal model outputs are calculated for regulatory purposes with little or no internal incentive for ensuring the quality of those outputs;

b A deterioration in the accuracy, robustness or timeliness of the internal model outputs is unlikely to be picked up by the undertaking's internal processes;

c. The undertaking lacks a process for monitoring the appropriateness of and improving the internal model; and

d. The internal model is seemingly producing low results compared with the results of the undertaking's ORSA and the undertaking is unable to explain this satisfactorily.

3.104. The foundation principle is not a requirement to extend the scope of a partial internal model, but to improve the internal model within the scope approved. The pressure to improve the internal model may also come from outside the modelling team.

GENERAL PRINCIPLES

Principle 1. Senior management and the administrative, management or supervisory body, shall be able to demonstrate understanding of the internal model

3.105. The administrative, management or supervisory body shall give evidence of understanding of the internal model. Each member of the administrative, management or supervisory body shall have an overall understanding of the internal model. CEIOPS considers that this understanding may be gained from training provided by the undertaking. Each member of the senior management shall have an overall understanding as well as a detailed understanding in the areas where they use the internal model. The decisions where the undertaking uses the internal model to inform the decision-making process shall include strategic decisions that have an impact on the future direction of the undertaking. The administrative, management or supervisory body of the undertaking shall demonstrate where the outputs of the internal model are used in decision-making.

3.106. The administrative, management or supervisory body shall give evidence of an overall understanding of the internal model, including:

a. the structure of the internal model and how this fits with their business model and risk-management framework;

b. the methodology behind the internal model;

c. the dynamics of the model, or how the different elements fit together;

d. the limitations of the internal model, including the limitations of statistical assumptions and limitations in business planning assumptions and that these limitations are taken into account in decision-making;

e. in which areas and on which entity / hierarchy level within the undertaking/group diversification effects arise as well as the dependencies throughout the risk profile; and

f. the scope and purpose of the internal model and the risks covered by the internal model, as well as those not covered.

3.107. The administrative, management or supervisory body and the senior management shall not manipulate the internal model in order to obtain outputs that do not appropriately reflect its risk profile.

Principle 2. The internal model shall fit the business model

3.108. The design of the internal model shall be in alignment with the undertaking's business model. The design of the internal model shall align with the business model in at least the following aspects:

a. the methods used to calculate the probability distribution forecast underlying the internal model shall be consistent with the methods used to calculate technical provisions

b. the outputs of the internal model shall reconcile with internal and external [financial] reporting

c. modelling approaches adopted in the internal model may vary within the internal model and shall reflect the nature, scale and complexity of the risks modelled.

d. the internal model shall be changed to reflect changes in the business model. The undertaking shall allow for changes of this nature in the internal model change policy.

e. the capital-allocation approach and the granularity of allocation shall reflect the undertaking's risk-management system and its business model, and include information on the consumption of regulatory capital. The granularity shall especially correspond to the level of decision-making processes within the undertaking.

f. the profits and losses used for the purpose of the profit and loss attribution shall also be used as part of satisfying the Use Test. Hence the profits and losses have to be appropriate for the system of governance (including the ORSA, risk management, limit setting,

allocation processes). Therefore CEIOPS Advice is to use the definition set out in 7.17 a. below, i.e. to use internal definitions for profits and losses, which shall be consistent with the variable underlying the probability distribution forecast (Article 121). The variable may differ from basic own funds, because a different internal definition may be used for economic capital resources. Undertakings shall be aware how the profits and losses used in the Profit and loss attribution may differ from the profits and losses reported in their accounting systems and what the causes of these differences are. For a group internal model this shall include the major sources of profit and loss for solo entities and on a consolidated basis.

g. The internal model shall at least be able to produce results between entities and material lines of business and have overall capital results split by material risks to assist in risk-management activities. The granularity of internal-model output shall reflect the insurance and reinsurance undertaking's decision making processes.

INTERNAL MODEL AND DECISION-MAKING

Principle 3. The internal model shall be used to support and verify decision-making in the undertaking

3.109. The internal model shall be used in decision-making processes, including the setting of a business or risk strategy. Internal models shall be able to give undertakings information that will allow then to assess the expected profit from potential decisions and assess the potential variability in the expected profit from potential decisions.

3.110. The analysis that supports decision-making shall be proportionate to the expected outcome of the decision. This analysis shall be documented.

3.111. The internal model and its results shall be regularly discussed in relevant (risk) bodies, and also at board level.

3.112. Undertakings shall not make decisions that follow the output of the internal model without question. Decision makers shall be aware of the shortcomings of the internal model and tailor their decisions accordingly. Undertakings may document why decisions differ from those indicated by the internal model output, and the additional information that has been used to arrive at the decision, as well as documenting the rationale for decisions where the internal model output supports the decision.

Principle 4. The internal model shall cover sufficient risks to make it useful for risk management and decision-making

3.113. Undertakings shall demonstrate that the scope of the internal model covers sufficient uses and sufficient risks to be widely used in and play an important role in the system of governance, risk-management system and decision-making processes, as well as capital assessment and allocation. The list of uses in Annex A gives examples of the uses that undertakings may include in the scope of the internal model.

3.114. Gaining approval to use an internal model to calculate the SCR is not a trivial process, so undertakings shall develop internal models that can inform significant risk-management and business decisions.

Principle 5. Undertakings shall design the internal model in such a way that it facilitates analysis of business decisions.

3.115. The internal model shall be designed to ensure that the results shall be used to inform internal debate in the undertaking. The results from the internal model may be discussed with the people responsible for risk in the administrative, management or supervisory body. The results of the internal model shall be communicated to the board members so that they are able to take responsibility for the results.

3.116. Undertaking may use the results of the internal model for

a. their development plan for the internal model;

b. internal project plans;

c. their governance strategy; and

d. their model change and data policy.

INTERNAL MODEL AND THE RISK MANAGEMENT SYSTEM

Principle 6. The internal model shall be widely integrated with the risk-management system

3.117. Undertakings shall demonstrate that the internal model is used in the risk-management system. Uses of the internal model that will assist in demonstrating that this is the case may include:

a. that the quantifications of risks and risk ranking, including the quantification of diversification effects produced by the internal model, trigger action in the undertaking;

b. that the quantifications of risks and risk ranking, including the diversification effects produced by the internal model and assessment of accumulations of risk and tail dependencies, are used to formulate risk strategies, including the development of the undertaking's risk appetite and any risk mitigation, and improve the risk-management system overall;

c. that outputs are used to formulate risk limits and appear on reports to internal forums in the undertaking.

3.118. At each point in the internal model where diversification effects occur, there shall be clear responsibility in the undertaking for quantifying and allocating any diversification benefits.

3.119. If the risk-management system changes or if there are proposed changes, the internal model shall also be changed to reflect this.

Principle 7. The internal model shall be used to improve the undertaking's risk-management system.

3.120. Article 112(5) requires an undertaking applying to use an internal model to have an adequate risk-management system. The internal model, which is used to quantify risks, shall be designed to allow undertakings to gain more insight into their risks, and hence improve risk management by using a feedback loop between the risk-management system and the internal model.

3.121. Areas where the internal model could lead to improvements may include:

a. risk mitigation techniques;

b. clarifying the risk appetite of the undertaking;

c. allowing more informed monitoring of risks; and

d. more risk-based decision making.

Principle 8. The integration into the risk-management system shall be on a consistent basis for all uses

3.122. The internal model shall produce output that is based on the relevant internal or external accounting basis for each use. The administrative, management or supervisory body shall demonstrate that they understand the basis of the output.

3.123. The Use test shall always apply at least at the level at which risk strategy and risk management are defined. If these are defined at a group level, the Use test shall also apply at this level. The uses included in the scope of the internal model shall then be assessed by the supervisory authorities at a group level. In addition, the Use test shall be assessed at the level of related undertakings.

RECALCULATION

Principle 9. The Solvency Capital Requirement shall be calculated at least annually from a full run of the internal model, and also when there is a significant change to the undertaking's risk profile, assumptions underlying the model and / or the methodology arising from decisions or business model changes, and whenever a recalculation is necessary to provide up to date information for decision making or any other use of the model , or to fulfil supervisory reporting requirements.

3.124. Undertakings shall calculate the Solvency Capital Requirement using the internal model at least annually, and may calculate the Solvency Capital Requirement more frequently.

3.125. Supervisory authorities may require undertakings to calculate the Solvency Capital Requirement using a full run of the internal model more frequently than annually if necessary.

3.126. As undertakings will update the methodology, parameters and data input to the internal model on a regular basis, undertakings may calculate the change in the Solvency Capital Requirement for only the risk modules affected by such changes.

3.127. The MCR shall be calculated quarterly and the proposed methodology requires a link to the SCR. Under the principle of proportionality, undertakings using an internal model shall apply a quarterly calculation that is sufficiently sophisticated to produce the quarterly SCR. However this does not assume necessarily a full model run and approximations may be allowed.

4. Internal Models Governance

4.1 Definition and Rationale

4.1. CEIOPS regards internal model governance as an important mitigant for model risk – the risk that the internal model does not reflect the risk profile of the business of the undertaking, or produces results that are misleading because of unreliable model assumptions or techniques. This has been supported by feedback from companies taking part in the pre-visit programme. In addition, as internal model outputs may be used in external reporting, as well as internal reporting and supervisory reporting, the administrative, management or supervisory body must be able to have confidence in them. A good internal model governance system will go some way to achieving this. This internal model governance system should be adequately integrated in the undertaking's system of governance, as defined in Article 41 of the Level 1 Text, and should, despite its specificities, apply the requirements already set out by CEIOPS in this regard[13].

4.2. Article 120(1) requires that:

> *"The administrative, management or supervisory body shall be responsible for ensuring the ongoing appropriateness of the design and operations of the internal model, and that the internal model continues to appropriately reflect the risk profile of the insurance and reinsurance undertakings concerned."*

4.3. As specified in Article 41, Member States require all undertakings to have in place an effective system of governance, subject to regular internal review. CEIOPS has advised separately on the system of governance and proposes that the system of governance should:

a. Establish, implement and maintain effective cooperation, internal reporting and communication of information at all relevant levels within the undertaking;

b. Be robust with a clear and well-defined organisational structure that has well-defined, clear, consistent and documented lines of responsibility across the organisation;

c. Ensure that the members of the administrative, management or supervisory body possess sufficient professional qualifications, knowledge and experience in the relevant areas of the business to give adequate assurance that they are collectively able to provide a sound and prudent management of the undertaking;

d. Ensure it employs personnel with the skills, knowledge and expertise necessary for the proper discharge of the responsibilities allocated to them;

[13] Please refer to CEIOPS Advice for Level 2 implementing measures on System of Governance

e. Ensure all personnel are aware of the procedures for the proper discharge of their responsibilities;

f. Establish, implements and maintains decision-making procedures;

g. Ensure that any performance of multiple tasks by individuals does not and is not likely to prevent the persons concerned from discharging any particular function soundly, honestly and professionally;

h. Establish information systems that produce sufficient, reliable, consistent, timely and relevant information concerning all business activities, the commitments assumed and the risks to which the undertaking is exposed;

i. Maintain adequate and orderly records of its business and internal organisation;

j. Safeguard the security and confidentiality of information, taking into account the nature of the information in question;

k. Introduce clear reporting lines that ensure the prompt transfer of information to all persons who need it in a way that enables them to recognise its importance; and

l. Establish and maintain adequate risk management, compliance, internal audit and actuarial functions.

4.4. Article 116 requires the administrative, management or supervisory body of the undertaking to put in place systems to *"ensure that the internal model operates properly on a continuous basis"*. In CEIOPS' view, this requires a robust system of governance for the internal model, which forms part of the overall system of governance of the undertaking. CEIOPS considers that the system of governance for an internal model, which is part of the overall governance of the undertaking, should include these features as relevant to the internal model. Therefore the requirements above apply also to the governance of an internal model.

4.5. Specific requirements in respect of internal models are set out in Article 120, which states that the *"administrative, management or supervisory body shall be responsible for ensuring the ongoing appropriateness of the design and operations of the internal model, and that the internal model continues to appropriately reflect the risk profile of the insurance and reinsurance undertakings concerned"*. This means that the governance of the internal model, which forms part of the overall governance of the insurance and reinsurance undertaking, needs to include a framework for assessing how the internal model matches the undertaking's risk profile, particularly how the outputs reflect the risk profile.

4.6. CEIOPS has identified requirements for the high-level governance, i.e, the governance by the administrative, management or supervisory body (see the diagram below), of an internal model that would fulfil the

requirements of the Level 1 Text and provide a sound basis for the internal model. These requirements for the administrative, management or supervisory body and the risk management function are described below.

4.7. Whilst the undertaking's administrative, management or supervisory body is responsible for the overall governance of the internal model, CEIOPS understands that the Level 1 Text assigns "ownership" of an internal model to the risk-management function; this is set out in CEIOPS Advice on System of Governance[14]. The risk-management function described in Article 44 is responsible for the following tasks.

a. designing and implementing the internal model;

b. testing and validating the internal model;

c. documenting the internal model and any subsequent changes made to it;

d. informing the administrative, management or supervisory about the performance of the internal model, suggesting areas needing improvement, and up-dating that body on the status of efforts to improve previously-identified weaknesses; and

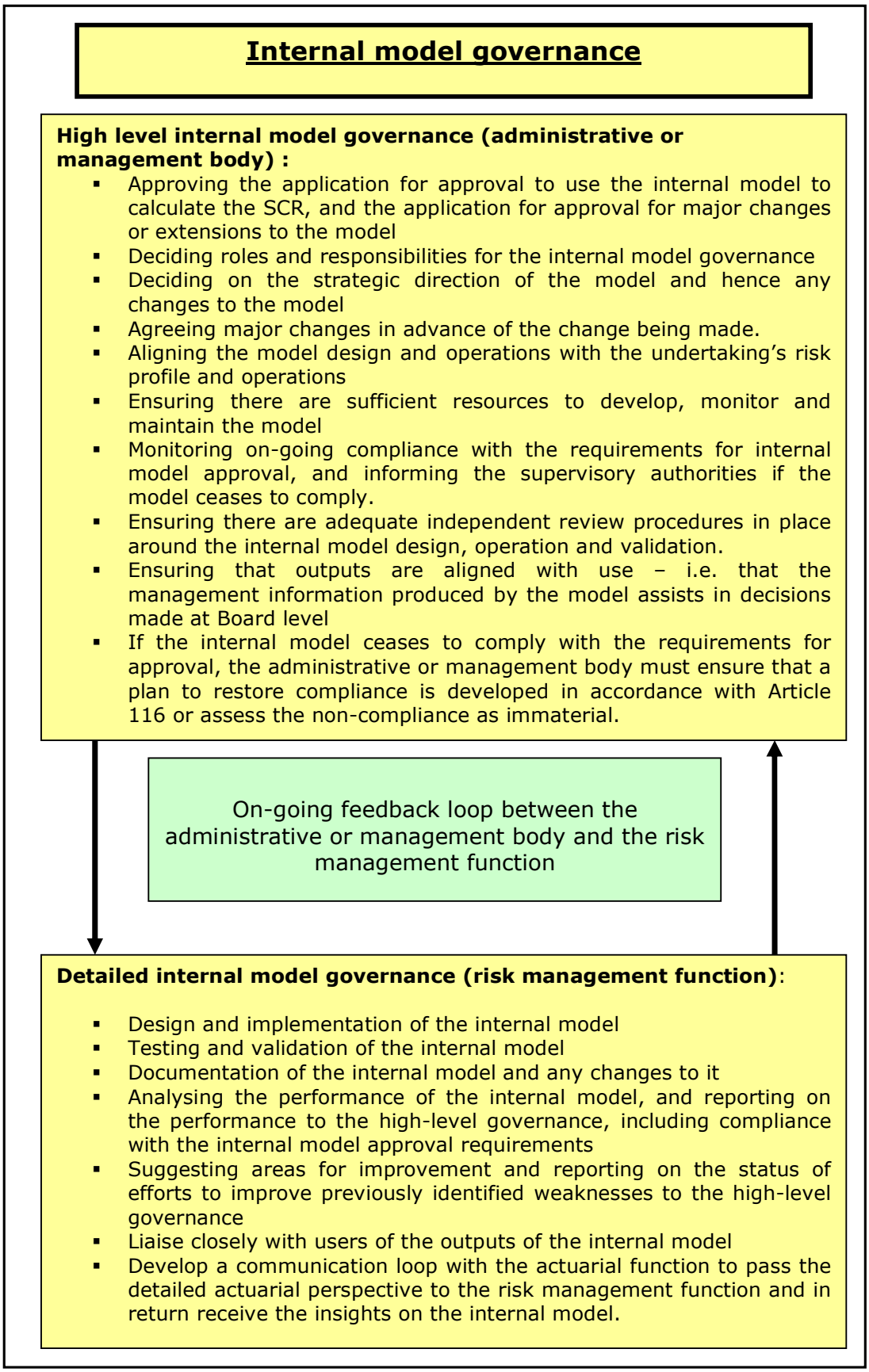
e. analysing the performance of the internal model and producing summary reports thereon.

4.8. CEIOPS has developed requirements for the detailed governance of the internal model by the risk management function, set out below.

4.9. CEIOPS considers that a feedback loop is necessary to link the high-level governance requirements with the more detailed governance requirement around the internal model. This provides the mechanism to pass the detailed information on the running of the internal model to the administrative, management or supervisory body, who are responsible for the high-level governance. In turn, they will make decisions about current and future developments of the internal model and pass these to the risk management function for implementation. CEIOPS considers that insurance and reinsurance undertakings should develop a process to ensure the feedback loop is in place and well understood.

4.10. The required governance of an internal model can be described diagrammatically thus:

[14] Please refer to CEIOPS Advice for Level 2 implementing measures on System of Governance


Internal model governance
High level internal model governance (administrative or management body) :
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
Deciding roles and responsibilities for the internal model governance
Deciding on the strategic direction of the model and hence any changes to the model
Agreeing major changes in advance of the change being made.
Aligning the model design and operations with the undertaking's risk profile and operations
Ensuring there are sufficient resources to develop, monitor and maintain the model
Monitoring on-going compliance with the requirements for internal model approval, and informing the supervisory authorities if the model ceases to comply.
Ensuring there are adequate independent review procedures in place around the internal model design, operation and validation.
Ensuring that outputs are aligned with use – i.e. that the management information produced by the model assists in decisions made at Board level
If the internal model ceases to comply with the requirements for approval, the administrative or management body must ensure that a plan to restore compliance is developed in accordance with Article 116 or assess the non-compliance as immaterial.
On-going feedback loop between the administrative or management body and the risk management function
Detailed internal model governance (risk management function):
Design and implementation of the internal model
Testing and validation of the internal model
Documentation of the internal model and any changes to it
Analysing the performance of the internal model, and reporting on the performance to the high-level governance, including compliance with the internal model approval requirements
Suggesting areas for improvement and reporting on the status of efforts to improve previously identified weaknesses to the high-level governance
Liaise closely with users of the outputs of the internal model
Develop a communication loop with the actuarial function to pass the detailed actuarial perspective to the risk management function and in return receive the insights on the internal model.

4.2 Overall requirements for internal-model governance

4.11. The model governance should encourage the organization of a dialogue between every user of the model, likely to be the business units, and the risk management function about the characteristics of the internal model in order to increase understanding of the model and its outputs. This should lead to proposals for improvements to the model, enabling it to better reflect the risk profile of the undertaking. This links to the foundation principle of the Use test, that the undertaking's use of the internal model shall be sufficiently material to result in pressure to improve the quality of the internal model.

4.12. The operation of the internal model shall be subject to on-going internal review. In this regard the administrative, management or supervisory body may, as part of their overall governance, set up an internal control committee for the internal model, to whom the undertakings assign the task of providing Advice and making proposals. This is linked to the level of understanding required by Principle 1 of the Use test.

4.3 Features of internal-model governance

4.3.1 High-level internal model governance

4.13. CEIOPS is of the view that the high level internal model governance includes a set of key responsibilities, shown in the diagram above. Taking each responsibility in turn, we discuss aspects of each. The Level 1 Text is clear that responsibility for high-level governance rests with the administrative, management or supervisory body of the undertaking.

4.14. The Level 1 Text is clear that the **application for approval** to use the internal model to calculate the SCR must be approved internally before submission to the supervisory authorities by the administrative, management or supervisory body of the undertaking. In CEIOPS' view, this is a key responsibility, and includes the whole process from the undertaking starting to consider whether to apply for internal model approval, deciding on the scope of the internal model, developing the application and going through an appropriate pre-application process, as well as the actual submission of the application to the supervisory authority. The high-level governance for the internal model shall therefore include appropriate controls and documentation of this process. A key part of the internal model governance processes shall also be the controls and documentation around development of the **internal model change policy**.

4.15. Alongside this, the high-level governance shall include a process, which may be similar to that for the development of the internal model, to cover applications for approval for major changes or extensions to the model. This should include a process for assessing potential changes against the agreed change policy to decide whether they are major or minor changes.

4.16. CEIOPS regards it as good practice for undertakings to update their internal models, and CEIOPS expects them to, for example, update methodologies as appropriate to reflect improved techniques where appropriate. The internal model should evolve as the risk profile of the undertaking changes. Alongside this, the administrative, management or supervisory body is required to ensure that the internal model design and operation is appropriate. Thus the administrative, management or supervisory body needs to set up an internal framework to enable them to monitor the appropriateness of the model, and then decide on the strategic direction of the model and hence any necessary changes to the model in consequence. Part of this process will be the regular reports from the risk management function about the performance of the internal model and areas for improvement. This should reflect changes in the undertaking's risk profile and additional uses that the undertaking is planning to use the internal model for, as well as improvements in methodologies. The administrative, management or supervisory body will also need to have an adequate process to assess proposed changes to the internal model against the approved model change policy.

4.17. The administrative, management or supervisory body is required to ensure that the model design and operations (and hence the parameterisation) reflect the undertaking's risk profile. As the internal model will be approved only if the risk management system is adequate, the undertaking must have sufficient information about its risk profile to be able to monitor the alignment of the internal model to its risk profile. Therefore, the internal model governance requires a process to review the information about alignment with the risk profile and act to change the internal model if necessary to ensure on-going alignment between the internal model and the material risks as identified by the risk management system. This is also very relevant for the Use test, as the internal model must be widely used in the risk management system (See Principles 2 and 4 of the Use test in Section 3.3.8).

4.18. The CEIOPS Report on lessons learned from the crisis points out that timely calculation of results is also essential. The administrative, management or supervisory body will need to ensure that the undertaking avoids significant time lags between the calculation of model output and the actual use of the model output for decision making purposes. (Note that we are not referring here to frequency of calculation of the SCR.) For example, high market volatility gives rapid changes in risk exposures and capital. CEIOPS plans to define acceptable time lags for data used for calculations of capital requirements when developing Level 3 implementing measures. CEIOPS also considers that the administrative, management or supervisory body should ensure that timely calculated outputs are used without significant delay. Undertakings will also have to consider the supervisory reporting timetable set under Pillar 3 and ensure that they are able to meet these requirements where their internal model is approved[15].

[15] See CEIOPS Advice on Supervisory Reporting and disclosure

4.19. The internal model will be an important tool in the decision-making processes of the undertaking – this is covered in more detail in Section 3.3.1 on the Use test. A key aspect of using the internal model in decision-making is keeping the internal model up to date in respect of the undertaking's risk profile and developments in modelling, which should lead to improvements in the internal model. To support this, the risk management function is required to take on certain significant tasks, detailed below. Thus the high-level governance process set up by the administrative, management or supervisory body shall ensure that there are sufficient resources to develop, monitor and maintain the model. The resources need to be appropriately skilled and experienced. The CEIOPS Paper on lessons learned from the crisis comments that there should be internal procedures in place to deal with contingencies derived from excessive reliance on a few experts with regards to the model, so appropriate planning is in place to foresee and deal with staff departures or similar situations. Part of this is ensuring that the undertaking should have sufficient numbers of staff skilled in the use of sophisticated models in the risk control area. Furthermore, for undertakings using an approved internal model there must be at least one expert in risk management in the senior management[16] (CEIOPS Advice on System of Governance expects that in large undertakings or undertakings with more complex risk profiles a CRO is appointed to undertake this task). Linked to this, the resources that develop, monitor and maintain the model must be organised appropriately, supporting the undertaking's strategic goals and fitting appropriately into the overall organisational structure. Responsibilities of the resources supporting the internal model must be clearly set out and avoid conflicts of interest.

4.20. Whilst internal model approval is given at a certain point in time, the high-level governance needs to include the monitoring and reporting of on-going compliance with the requirements for internal model approval, so that the administrative, management or supervisory body is able to inform the supervisory authorities if the model ceases to comply and assess the materiality of non-compliance. This requires understanding the requirements and setting up a process to monitor and report on compliance. If the internal model ceases to comply with the requirements for approval, and the non-compliance cannot be shown to be immaterial, the administrative, management or supervisory body must ensure that the risk management function develop a plan to restore compliance. The administrative, management or supervisory body is responsible for approving the plan before it is presented to the supervisory authority.

4.21. Looking at each of the requirements in turn:

a. Use test

[16] In general terms, senior management could include persons employed by the undertaking who are responsible for high level decision making and implementing the strategies devised by and the policies approved by the administrative, management or supervisory body. See CEIOPS Advice on Governance for more details

The Level 1 Text requires that the internal model is *"…widely used in and plays an important role in…"* the undertaking. In CEIOPS' view, the internal model governance processes should ensure that outputs from the internal model are discussed in the relevant internal decision-making fora, and decisions made are minuted and noted by the appropriate administrative, management or supervisory body level committees to ensure that there is evidence that can be shown to demonstrate the Use test.

b. Calibration standards

No specific items for the Calibration standards.

c. Statistical quality standards

The undertaking's data policy will need to be signed off by the administrative, management or supervisory body as part of the high level governance. They are also responsible for making sure it is adhered to, regularly reviewed and updated as necessary.

d. Profit and loss attribution

The administrative, management or supervisory body needs to ensure that the results of the Profit and loss attribution are used by the undertaking to revise their strategies and policies in respect of the development of the internal model.

e. Validation standards

CEIOPS is proposing that undertakings develop a validation policy. The administrative, management or supervisory body body is responsible for signing off the policy, and making sure it is adhered to, regularly reviewed and updated as necessary; see Section 8. They have a further responsibility to make sure that they then use this information to assist in determining any changes that may be required to the internal model.

f. Documentation standards

The administrative, management or supervisory body needs to set up a governance process that makes sure the internal model documentation complete and adequate, and is kept up to date and regularly reviewed, and also facilitates the understanding of the internal model across the undertaking.

g. External reporting – solvency and financial condition report and report to supervisory authorities

Undertakings are required to have a written policy on the appropriateness of any information disclosed for the solvency and financial condition report and report to supervisory authorities. This should include disclosure of information relating to the internal model, which is covered in more detail in the Section on external reporting.

The administrative, management or supervisory body is responsible for signing off the policy as part of the internal model governance.

4.22. Article 46 requires an effective internal control system, and this is clearly important for the good functioning of an internal model. CEIOPS considers that the high-level governance of the internal model should ensure that there are **adequate independent review procedures** in place around the internal model design and operation. Independent does not necessarily mean external to the undertaking and could be undertaken by the internal audit function for example, but the administrative, management or supervisory body needs to have reassurance that the detailed working of the internal model is adequate for its business and that the independent reviewers possess the right level of competence.

4.23. One part of this review should include an **assessment of possible conflicts of interest** in the administrative, management or supervisory body. For example, if the internal model is used in setting remuneration, there should be clear evidence that fundamental design choices or parameterisation of the internal model are not influenced by self-interest.

4.3.2 Detailed internal model governance (risk-management function)

4.24. The Level 1 Text gives certain responsibility for the internal model to the risk management function in Article 44. The Level 1 Text sets out what the responsibilities of the risk management function are in respect of the internal model. CEIOPS considers that the responsibility is for making sure that the functions are carried out in the undertaking, not necessarily performing all the functions in the risk management function.

4.25. The risk management function is required, among other tasks, to **design and implement the internal model**. CEIOPS' view is that this links to the high-level governance requirement in Article 120 where the administrative, management or supervisory body is responsible for ensuring that the design and operation of the internal model is appropriate. CEIOPS' view is that the risk management function is responsible for the detailed design and implementation of the internal model, with a reporting line to and from the administrative, management or supervisory body that ensures the internal model's design and operation fits with the strategic direction set by it.

4.26. The risk management function is required to **test and validate the internal model** as well as documenting the internal model and any changes to it. These aspects of the responsibilities of the risk management function are covered in the CEIOPS Advice on Articles 124 and 125, in Sections 8 and 9.

4.27. The Level 1 Text requires the risk management function to, among other tasks, **analyse and report on the performance of the model**. CEIOPS considers that these reports should be produced regularly for the

administrative, management or supervisory body so that they can make decisions about potential changes and improvements to the internal model. CEIOPS also considers that the analysis and reporting should include an assessment of compliance with the internal model approval requirements. This will allow the administrative, management or supervisory body to report to the supervisory authority without delay, as required by Article 118, should the internal model cease to comply.

4.28. The risk management function should therefore monitor compliance with the on-going requirements for internal model approval, and report any actual or expected areas of non-compliance to the administrative, management or supervisory body. This would include compliance with any plan for restoration of compliance with the requirements for internal model approval.

4.29. The Level 1 Text requires the risk management function to **suggest areas for improvement** to the internal model to the administrative, management or supervisory body. CEIOPS suggests that this should form part of the regular reporting on the performance of the internal model. By suggesting areas for improvement, the administrative, management or supervisory body will be able to make decisions about possible changes and improvements to the internal model. The additional requirement to report on the status of efforts to improve previously identified weaknesses to the administrative, management or supervisory body will enable that body to provide additional resource if necessary, and also to understand the weaknesses in the internal model, which is key for the Use test.

4.30. Particular areas where the risk management function will need to manage the internal model include:

a. Making sure internal model output is provided to the relevant decision-makers in the undertaking, and that the output is at an appropriate level of detail.

b. Implementing and documenting major and minor changes to the internal model.

c. Providing information on the internal model to the internal audit function for them to assess the effectiveness of controls around the internal model and other aspects of the internal model.

d. Providing information for the purposes of independent review (as detailed in the validation policy – see Section 8 - of the internal model.

e. Ensuring that the internal model is on a stable platform, that permits, for example, back-up and recovery of the system, storage of previous runs, version control, audit trail of internal model changes.

f. Ensuring that the internal control system and the storage of records for the internal model is appropriate and robust.

g. Developing and implementing clear and documented allocation of responsibilities for the different aspects of running and developing the model, including model changes, model development, reporting of model outputs, analysis of model outputs and documentation.

h. Implementing the undertaking's data policy and validation policy, as well as any other policies developed in the undertaking relating to the internal model, and making sure it is adhered to. Suggesting changes to the administrative, management or supervisory body.

i. Managing relationships with suppliers of external data and models in line with the outsourcing requirements of the Level 1 Text.

4.31. CEIOPS recognises that the risk management function cannot operate effectively in this area if isolated from the parts of the undertaking that use the internal model. The risk management function needs to **liaise closely with internal model users**, since they should have the greatest insight into the usefulness of the model as it relates to them and the risks they face. The risk management function will need to be aware that if the internal model users are too intimately involved with the internal model, they may have "blind spots" about the effectiveness of the internal model, and the risk management function should provide appropriate challenge.

4.3.3 Communication between high and detailed internal model governance

4.32. The Level 1 Text does not explicitly set out a **feedback loop** between the high-level and detailed governance of the internal model. CEIOPS considers, though, that this is an important piece of the governance framework of an internal model and that there should be a two-way link between the administrative, management or supervisory body, who are responsible for the high-level governance, and the risk management function that is responsible for the detailed governance.

4.33. Thus, the administrative, management or supervisory body needs to set up a feedback loop that allows information to flow from the risk management function to the high-level governance, and for decisions on the strategy for developing the internal model to flow to the risk management function for implementation. Such discussions should be documented.

4.34. The Level 1 Text sets out the responsibilities of the actuarial function in Article 48. Among other things, the actuarial function shall contribute to the effective implementation of the risk management system including the internal model. In particular, the actuarial function should contribute to the risk modelling underlying the calculations of capital requirements set out in Chapter VI, Section 4 and 5 of the Level 1 Text.

4.35. CEIOPS considers that an on-going communication loop is necessary between the actuarial function and the risk management function. This provides the mechanism to pass the detailed actuarial perspective to the risk management function and in return receive the insights on the internal model. We note that the actuarial function may also be a user of the internal model.

4.36. One part of this feedback loop may be an escalation of disagreements between the people responsible for parameterisation of the internal model. CEIOPS expects that the internal model governance processes will include a process for escalation and resolution of such disputes.

4.37. More detail on the responsibilities of the administrative, management or supervisory body and the risk management function will be provided by CEIOPS as part of Level 3 guidance.

4.4 Group internal models

4.38. In accordance with Article 246, the requirements that apply at solo level on the system of governance apply mutatis mutandis at group level. In addition, *"the group internal control mechanisms shall include at least the following:*

(a) adequate mechanisms as regards group solvency to identify and measure all material risks incurred and to appropriately relate eligible own funds to risks;
(b) sound reporting and accounting procedures to monitor and manage the intra-group transactions and the risk concentration".

4.39. The parent undertaking can be an undertaking or an insurance holding company.

4.40. This Section sets out the specificities for the governance of a group internal model. CEIOPS is developing a Consultation Paper on Article 246 of the Level 1 Text that will address issues on the system of governance at group level.

4.41. The allocation of tasks related to internal modelling between the various undertakings and entities of the group may vary and depends on the structure of the group and the structure of the internal model.

4.42. Within the scope of its activities of governance of the group, the parent undertaking shall exercise where relevant:

a. strategic control over the development of the areas of business covered in the scope of the internal model and the risks related to them;

b. technical and operational control aimed at assessing the various risk profiles that each undertaking or entity brings to the group internal model.

4.43. Undertakings using an internal model to calculate their solo requirements set up a system of governance for their internal model fulfilling the conditions mentioned above in this Advice. The parent undertaking sets up a system of internal controls of the internal model for the group, which is adequate for carrying out effective control over the group's overall strategic choices and the management balance of each individual undertaking or entity, and should be implemented consistently across the group.

4.44. The system of governance of the group internal model shall be put in place by the parent undertaking. It shall include at least:

a. procedures of coordination between the undertakings and entities in the scope of the internal model;

b. periodical information flows that allow the achievement of strategic objectives and the compliance with regulations specific to internal models to be verified;

c. procedures that ensure consistency between the data and information produced for the subsidiaries' internal model and those produced for the undertaking internal model;

d. the definition of tasks and responsibilities of the various units assigned with the control of risks covered by the group internal model and the mechanisms for coordination;

e. procedures that are appropriate for ensuring the identification, measurement, management and control of risks covered by the group internal model.

f. setting the reporting timetable across the group to ensure overall reporting deadlines are met, reviewing and challenging the subsidiaries' internal model practices and risk management procedures.

4.45. The parent undertaking will formalise and inform all the related undertakings and entities within the group that are covered by the group internal model about the internal model criteria used to identify, measure, manage and control their risks. The parent undertaking shall make sure the process is communicated effectively and the related undertakings have the appropriate level of understanding of the way the risks are modelled.

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4.46. The system of governance for an internal model, which forms part of the overall governance of the undertaking, shall in respect of the internal model:

a. Establish, implement and maintain effective cooperation, internal reporting and communication of information at all relevant levels within the undertaking;

b. Be robust with a clear and well-defined organisational structure that has well-defined, clear, consistent and documented lines of responsibility across the organisation;

c. Ensure that the members of the administrative, management or supervisory body possess sufficient professional qualifications, knowledge and experience in the relevant areas of the business to give adequate assurance that they are collectively able to provide a sound and prudent management of the undertaking;

d. Ensure it employs personnel with collectively the skills, knowledge and expertise necessary for the proper discharge of the responsibilities allocated to them;

e. Ensure all relevant personnel are aware of the procedures for the proper discharge of their responsibilities;

f. Establish, implement and maintain decision-making procedures;

g. Ensure that any performance of multiple tasks by individuals does not and is not likely to prevent the persons concerned from discharging any particular function soundly, honestly and professionally;

h. Establish information systems that produce sufficient, reliable, consistent, timely and relevant information concerning all business activities, the commitments assumed and the risks to which the undertaking is exposed;

i. Maintain adequate and orderly records of its business and internal organisation;

j. Safeguard the security and confidentiality of information, taking into account the nature of the information in question;

k. Introduce clear reporting lines that ensure the prompt transfer of information to all persons who need it in a way that enables them to recognise its importance; and

l. Establish and maintain adequate risk management, compliance, internal audit and actuarial functions

4.47. The required governance of an internal model shall operate as follows.

Internal model governance

High level internal model governance shall be the responsibility of the administrative or management body. This shall cover:

- 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
- Deciding roles and responsibilities for the internal model governance
- Deciding on the strategic direction of the model and hence any changes to the model
- Agreeing major changes in advance of the change being made.
- Aligning the model design and operations with the undertaking's risk profile and operations
- Ensuring there are sufficient resources to develop, monitor and maintain the model
- Monitoring on-going compliance with the requirements for internal model approval, and informing the supervisory authorities if the model ceases to comply.
- Ensuring there are adequate independent review procedures in place around the internal model design, operation and validation.
- Ensuring that outputs are aligned with use – i.e. that the management information produced by the model assists in decisions made at Board level
- If the internal model ceases to comply with the requirements for approval, the administrative or management body must ensure that a plan to restore compliance is developed in accordance with Article 116 or assess the non-compliance as immaterial.

There shall be an on-going feedback loop between the administrative or management body and the risk management function

Detailed internal model governance shall be the responsibility of the risk management function. This shall cover:

- Design and implementation of the internal model
- Testing and validation of the internal model
- Documentation of the internal model and any changes to it
- Analysing the performance of the internal model, and reporting on the performance to the high-level governance, including compliance with the internal model approval requirements
- Suggesting areas for improvement and reporting on the status of efforts to improve previously identified weaknesses to the high-level governance
- Liaise closely with users of the outputs of the internal model
- Develop a communication loop with the actuarial function to pass the detailed actuarial perspective to the risk management function and in return receive the insights on the internal model.

4.48. The governance of the internal model shall encourage the organization of a dialogue between every user of the model, likely to be the business units, and the risk management function about the characteristics of the internal model in order to increase understanding of the model and its outputs

4.49. The operation of the internal model shall be subject to on-going internal review. In this regard the administrative, management or supervisory body may, as part of their overall governance, set up an internal control committee, to whom the undertakings assign the task of providing advice and making proposals.

4.50. The administrative, management or supervisory body shall set up a feedback loop that allows information to flow from the risk management function to the high-level governance, and for decisions on the strategy for developing the internal model to flow to the risk management function for implementation. Discussions forming part of the feedback loop shall be documented.

4.51. More detail on the responsibilities of the administrative, management or supervisory body and the risk management function will be provided by CEIOPS as part of Level 3 guidance.

Specificities relating to group internal model governance

4.52. There system of governance of the group internal model shall be put in place by the parent undertaking. It shall include at least:

- procedures of coordination between the undertakings and entities in the scope of the internal model;
- periodical information flows that allow the achievement of strategic objectives and the compliance with regulations specific to internal models to be verified;
- procedures that ensure consistency between the data and information produced for the subsidiaries' internal model and those produced for the undertaking internal model;
- the definition of tasks and responsibilities of the various units assigned with the control of risks covered by the group internal model and the mechanisms for coordination;
- procedures that are appropriate for ensuring the identification, measurement, management and control of risks covered by the group internal model;
- setting the reporting timetable across the group to ensure overall reporting deadlines are met, reviewing and challenging the subsidiaries' internal model practices and risk management procedures.

4.53.	The parent undertaking will formalise and inform all the related undertakings and entities within the group that are covered by the group internal model about the internal model criteria used to identify, measure, manage and control their risks. The parent undertaking shall make sure the process is communicated effectively and the related undertakings have the appropriate level of understanding of the way the risks are modelled.

5. Statistical quality standards

5.1 Introduction

5.1. The Statistical quality standards for internal models laid down in Article 121 describe requirements that components and inputs of the internal model have to fulfil in order for it to gain regulatory approval. While many of the other Articles such as Article 120 (Use test) and Article 122 (Calibration standards) contain requirements from the point of view of the purpose of the internal model, Article 121 concentrates on the individual building blocks of an internal model. Thus, an internal model is not just a black box or an expert with good predictive power for the probability distribution forecast. Instead, the various elements making up the internal model and the inputs used have to pass quality standards. Naively, one could think that by not imposing any standards on the construction of a model the ultimate freedom in modelling may be granted and a sufficient control on model quality is imposed by checking whether the internal model fulfil s its purpose (e.g., that it is used for risk management, that it provides good forecasts of the probability distribution, etc.). This view would neglect the fact that, due to its complexity, an internal model can never be judged solely on the basis of its outputs. A good historical performance of an internal model may be due solely to luck, and whether the performance will hold up in a changed environment is impossible to determine based on the outputs alone.

5.2. However, Article 121(4) is clear that *"No particular method for the calculation of the probability distribution forecast shall be prescribed".* CEIOPS would like to emphasise that, within the boundaries set by the quality standards, it is the responsibility of undertakings rather than supervisory authorities to determine the approach to be used to assess and aggregate the risks covered in the internal model. This should be borne in mind when reading the whole of the discussion and Advice in this Section. Undertakings thus need to consider carefully the approaches they plan to use for the elements making up their internal model and the inputs used, and how they will meet the standards in this Section.

5.3. Rather than treating the model as a collection of statistical relationships, it should be seen as an aid to reveal fundamental and hopefully persistent connections between its inputs and outputs, and its results should be seen as conditional on its inputs and assumptions.

5.4. Therefore, to arrive at its internal model CEIOPS expects each undertaking to have in place a well-structured, documented and controlled modelling process that is consistently applied in different modelling areas. This is a key tool to manage model risk or other adverse effects of ad hoc practices.

5.5. While not claiming to contain a complete discussion of all issues surrounding the continuous appropriateness of the building blocks, this

Advice covers a large number of topics. To make the text more accessible, we highlight a number of issues which require, in our view, somewhat more attention than others:

a. Probability distribution forecast: Section 5.3.1.3 discusses whether a probability distribution forecast always has to consist of a full distribution, i.e. whether every quantile must be known.

b. Expert judgement: Section 5.3.3.5 discusses the use of expert judgement when related to data.

c. Materiality: Section 5.3.4.2 discusses circumstances under which risks which are in the scope of the internal model must actually be modelled in the internal model.

d. Aggregation: Section 5.3.5 contains a general discussion on aggregation in internal models

5.2 Legal Basis

5.6. Article 121 sets out the Level 1 Text governing Statistical quality standards.

Article 121

"*1. The internal model, and in particular the calculation of the probability distribution forecast underlying it, shall comply with the criteria set out in paragraphs 2 to 9.*

2. The methods used to calculate the probability distribution forecast shall be based on adequate, applicable and relevant actuarial and statistical techniques and shall be consistent with the methods used to calculate technical provisions.

The methods used to calculate the probability distribution forecast shall be based upon current and credible information and realistic assumptions

Insurance and reinsurance undertakings shall be able to justify the assumptions underlying their internal model to the supervisory authorities.

3. Data used for the internal model shall be accurate, complete and appropriate.

Insurance and reinsurance undertakings shall update the data sets used in the calculation of the probability distribution forecast at least annually.

4. No particular method for the calculation of the probability distribution forecast shall be prescribed.

Regardless of the method of calculation chosen, the ability of the internal model to rank risk shall be sufficient to ensure that it is widely used in and plays an important role in the system of governance of insurance and reinsurance undertakings, in particular their risk-management system and decision-making processes, and capital allocation in accordance with Article 120.

The internal model shall cover all of the material risks to which insurance and reinsurance undertakings are exposed. Internal models shall cover at least the risks set out in Article 101(4).

5. As regards diversification effects, insurance and reinsurance undertakings may take account in their internal model of dependencies within and across risk categories, provided that supervisory authorities are satisfied that the system used for measuring those diversification effects is adequate.

6. Insurance and reinsurance undertakings may take full account of the effect of risk mitigation techniques in their internal model, as long as credit risk and other risks arising from the use of risk mitigation techniques are properly reflected in the internal model.

7. Insurance and reinsurance undertakings shall accurately assess the particular risks associated with financial guarantees and any contractual options in their internal model, where material. They shall also assess the risks associated with both policy holder options and contractual options for insurance and reinsurance undertakings. For this purpose, they shall take account of the impact that future changes in financial and non-financial conditions may have on the exercise of those options.

8. In their internal model, insurance and reinsurance undertakings may take account of future management actions that they would reasonably expect to carry out in specific circumstances.

In the case set out in the first subparagraph, the undertaking concerned shall make allowance for the time necessary to implement such actions.

9. In their internal model, insurance and reinsurance undertakings shall take account of all payments to policy holders and beneficiaries which they expect to make, whether or not these payments are contractually guaranteed."

5.3 Advice

5.7. This Advice refers to the Statistical quality standards for internal models. In general, the requirements of Article 121 also apply to group internal models that are used to calculate the group SCR or the individual SCR of undertakings in the group. Statistical quality requirements which are specific for groups are indicated as such in the Advice (cf. Sections 5.3.1.3, 5.3.2, 5.3.3, 5.3.4.2, 5.3.5). Restrictions in the transferability

and fungibility of capital may or may not be taken into account in the internal model. Further Advice can be found in Section 6 (Calibration standards) and the CEIOPS Advice on Group solvency assessment.

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Application of Article 121 to group internal models

5.8. The standards of Article 121 also apply to group internal models that are used to calculate the group Solvency Capital Requirement or the individual Solvency Capital Requirement of insurance and reinsurance undertakings in the group.

5.3.1 Internal model and probability distribution forecast

5.9. The first paragraph of Article 121 states that the requirements which internal models have to fulfil are set out in the following paragraphs (2)–(9). Furthermore, it states that these requirements apply in particular to the calculation of the probability distribution forecast.

5.10. The term *"probability distribution forecast"* is defined in Article 13(38) as *"a mathematical function that assigns to an exhaustive set of mutually exclusive future events a probability of realisation"*. Although this definition appears at first sight to be quite precise, it is possible to interpret this in a number of different ways in the field of the internal models used by undertakings. Of the abstract terms used in the definition, *"exhaustive set"* and *"future events"*, especially, need consideration. In particular, there is no indication of the number of events the event set should include to be considered as exhaustive. It might also appear that the Level 1 Text has left completely open the question of the quantity underlying the probability distribution.

5.11. Moreover, it could be of benefit to clarify the aspects and areas of the internal model to which the requirements set out in paragraphs (2)–(9) refer both explicitly and implicitly. In particular, it is worth considering areas that go beyond the core calculation of the probability distribution forecast.

5.12. The first paragraph suggests that the calculation of a probability distribution forecast is key to internal models. In this respect it is not clear how to deal with models that do not achieve the ultimate goal of internal risk modelling: generating a probability distribution in the strict sense of Article 13(38).

5.13. Specifically, CEIOPS has raised the following three key issues:

1. Should the quantity described by the *"probability distribution forecast"* be further specified? Does the *"probability distribution forecast"* have to refer to a monetary value, or is it permissible for it to refer to risk factors?

2. How is the relationship between the probability distribution forecast and the internal model as a whole to be seen? How is the scope of an internal model to be understood from the Statistical quality standards perspective?

3. To what extent is a full probability distribution forecast to be understood as the discriminative characteristic of internal models?

5.3.1.1 Risk factor distribution forecast vs. economic loss distribution forecast

5.14. Ideally, the calculation of economic capital can be understood as a two-step process: possible future events are mapped to risk factors that are projected into the future; their value at the end of the time horizon under consideration is then transformed into monetary values to reflect the effect of the event on the financial situation of the undertaking. Though not always possible, this theoretical division of an economic capital model into a projection step (risk model) and a valuation step (valuation model) can often be observed in practice.

5.15. The Level 1 Text does not make such a division for the internal model, nor does it make any explicit statement on the nature of the quantity underlying the probability distribution forecast. Although the Level 1 Text contains some indications, it could remain somewhat unclear whether the Statistical quality standards refer primarily to the risk model or also to the valuation model.

5.16. For the sake of clarity CEIOPS wishes to address this issue and state the reasons why it is not appropriate from its point of view to restrict the statistical quality requirements to the projection step:

5.17. First of all, risk management relies on internal model output that is mostly provided in terms of monetary values, e.g. profits and losses, and typically not in terms of variation of risk factors. At least, if risks are to be compared across risk categories, valuation according to their economic effect is implied. Thus, Article 121(4), with its requirement that *"ability of the internal model to rank risk shall be sufficient to ensure that it is widely used in and plays an important role in the system of governance (…)",* can be understood as strong support for this view.

5.18. Furthermore, Article 122(2) refers to the ideal case of calculating the SCR: *"Where practicable, (…) undertakings shall derive the SCR directly from the probability distribution forecast (…), using the Value-at-Risk measure set out in Article 101(3)."* Again, this implies performing the valuation step, generating a distribution forecast that is related to the variation of basic own funds.

5.19. Finally, it is well known that the methods used and assumptions made in the valuation step strongly influence the model results.

5.20. For these reasons, CEIOPS is convinced that, due to its high significance, statistical quality requirements should also apply to the valuation step.

5.3.1.2 Calculation kernel vs. supplementary methods and techniques

5.21. Regarding the scope of Article 121, CEIOPS states in its Paper on Pillar issues[17] that the Statistical quality standards apply to the *"actuarial model"*. *"Actuarial model"* is used in this Paper as a short-hand for the internal model in a quantitative, statistical sense. More specifically, CEIOPS described the actuarial model as "*the system that transforms risk exposure data (how many contracts of which type are written) and risk driver data (historic information on the likelihood of certain events) into forecasts of Profit and loss (P&L) distributions*". Accordingly, in Article 121(1) the calculation of the probability distribution forecast is particularly highlighted: *"The internal model, and in particular the calculation of the probability distribution forecast underlying it, shall comply with the criteria set out in paragraphs 2 to 9".*

5.22. As the emphasis is thus put on the internal model output and its generation, from the Statistical quality standards perspective the internal model could to some degree be interpreted as the "core calculation engine" which provides the probability distribution forecast as output, restricting the scope of the statistical quality requirements accordingly. Alternatively, one could adopt a broader view of the internal model which also covers methods and techniques used to prepare input data or to post-process the outputs, for instance.

5.23. If one were to equate the internal model from the Statistical quality standards perspective and the core calculation framework of the probability distribution forecast, that would have the advantage that the scope of Article 121 is well-defined. This would facilitate the interaction between the undertaking and the supervisory authority during the initial model approval process and the ongoing supervisory review process (SRP).

5.24. However, in important areas methods and techniques which support the probability distribution forecast calculation, or precede or follow it, are left aside in this interpretation. Examples of such processes beyond the mechanistic forecast calculation are:

- data analysis, data processing
- mapping procedure
- determination of model points
- parameter estimation
- fitting procedure, approximations

5.25. Given the high significance of the processes mentioned, especially for the overall assessment of the statistical quality of the internal model and its appropriateness, the concept of internal models from the statistical

[17] http://www.ceiops.eu/media/files/publications/submissionstotheec/CEIOPS-DOC-08-07AdviceonPillarI-Issues-FurtherAdvice.pdf

quality standards perspective should be broad: all relevant quantitative methods and techniques used in addition to the probability distribution forecast calculation should also be subject to the statistical quality criteria.

5.26. No sharp boundary can be drawn between processes within this scope and those outside it. However, the extraction of the business in-force from front-line systems, and the resulting inventory of business in-force used as a basis for the internal model calculation, is clearly within the scope of Article 121, while the actual inventory record-keeping in front-line systems is not.

5.27. CEIOPS assigns a higher priority to a comprehensive assessment of statistical quality. The possible implications of a less clear definition of the scope of Article 121 are likely to be compensated, for instance, by enhanced communication between the undertaking and the supervisory authority and between supervisory authorities.

5.3.1.3 Probability distribution forecast

5.28. With regard to its output, internal modelling within a supervisory solvency regime is, as generally accepted (cf paragraph 37, IAIS Guidance Paper on use of internal models for regulatory capital purposes)[18], primarily about distributions and not risk numbers. For risk assessment purposes distributions represent a much more detailed source of information than single numbers. Accordingly, Article 121(1) highlights the probability distribution forecast as model output.

5.29. Within the Solvency II framework internal modelling ultimately aims at an overall distribution forecast for the topmost level of the undertaking, taking into account the scope of the internal model. For group internal models, the aim is to arrive at a probability distribution forecast at the topmost (i.e. group) level. Additionally, groups should aim to arrive at a probability distribution forecast wherever the internal model is used at the level of individual solo undertakings of the group, for SCR calculation or risk management purposes

5.30. In order to enable undertakings to develop internal models that accurately reflect their individual risk profile and are most valuable for internal use, the Level 1 Text does not make any explicit prescriptions concerning the underlying methodology. Article 121(4) states that *"no particular method for the calculation of the probability distribution forecast shall be prescribed"*, but the very distributional character required for the model output has implications for modelling. The various methods available meet the demands of a distributional forecast to a greater or lesser extent.

5.31. The question that arises is the extent to which the probability distribution forecast is to be understood as the defining or discriminative characteristic of internal models within Solvency II. What is the

[18] E.g. cp. IAIS Guidance paper on use of internal models for regulatory capital purposes, No. 2.2.6, October 2008

appropriate level of distributional character that the outcomes should have in order to qualify the internal model for approval?

5.32. The Level 1 Text touches on this issue. In the definition in Article 13 it is stated that the event set underlying the probability distribution forecast should be exhaustive. Depending on the interpretation, however, the meaning of "*exhaustive*" can vary: the richness of the distribution ranges from very few selected events to a very large number of events, resulting in an almost continuous distribution.

5.33. In CEIOPS' opinion, it is not reasonable to seek a definitive answer to this question for the following reasons:

The current state of internal modelling, and in particular the limits of viability, are quite inhomogeneous across risk categories. For example, models for market risk tend to be more advanced in this respect than for life underwriting risk. If Article 13(38) were to be interpreted strictly, there would be no methods available for some risk categories to build a compliant internal model. Often theoretical concepts do exist but are not feasible in practice. However, CEIOPS is convinced that internal models which do not provide a full distributional forecast as model output can nevertheless be of real use and can enhance the undertaking's risk management and decision-making processes.

CEIOPS therefore advocates some flexibility in this matter. Supervisory authorities should always have the opportunity to also approve internal models that generate a less-rich probability distribution forecast.

5.34. In the following, CEIOPS wishes to make some general remarks and provide undertakings with the criteria that supervisory authorities will apply when assessing the adequacy of the richness of the probability distribution forecast.

5.35. Support for a flexible approach should not be misinterpreted as deviating from the demand for high-quality standards or watering down the Level 1 Text. On the contrary, CEIOPS continues to regard the generation of a distributional forecast in accordance with Article 13(38) as a key feature of internal models.

5.36. CEIOPS wishes to stress that within the Solvency II framework internal modelling ultimately aims at an overall distribution forecast for the topmost level of the undertaking, taking into account the scope of the internal model. Such a distribution forecast is essential for integrated risk management, enabling the undertaking to take a comprehensive view of the risks. Aggregation reveals the importance of the whole, the sum of the risks under consideration, and helps to understand their interdependence.

5.37. The internal model integrates all the information that the undertaking uses relating to the risks within the scope of the model and this information is reflected in the probability distribution forecast as model output. Accordingly, the richness of the distribution forecast depends heavily in the first place on the underlying information basis. Therefore,

the probability distribution forecast should be based on all relevant information available.

5.38. The richness of the probability distribution forecast is also determined by the methodology chosen. There may be modelling approaches and methods which are suited to generating a distribution with a large number of data points, while others provide a distribution with few data points (e.g. selected quantiles).

5.39. Obviously, a probability distribution forecast with a larger number of data points may better reflect the underlying information basis. It may give a better picture of the distribution of profits and losses. In this spirit, CEIOPS regards a probability distribution forecast with more data points as a stronger basis for the undertaking's risk management and as providing better support for its decision-making processes. Therefore, a methodology providing a richer distribution forecast is generally to be preferred to others.

5.40. An internal model which does not provide a full distribution forecast, on the other hand, generates its key points as required for internal and external use. Typically, these points correspond to selected quantiles of a potential full distribution forecast, i.e. the undertaking is aware of the mean outcome, is likely to be able to estimate the standard deviation and has some information about the shape or the tail of the distribution. In this context, CEIOPS would like to point out that the statement made above, namely supervisory authorities' preference for modelling approaches providing a richer distribution forecast, should not mislead undertakings into introducing spurious or unfounded richness into their probability distribution forecast.

Undertakings should take special care when interpolating between key points of the distribution or extrapolating to the tails because the evidence basis is usually scarce, involving great reliance on expert judgement.

In particular, there is little benefit in fitting a distribution to a forecast with a small number of data points, possibly just for the sake of generating a continuous distribution forecast, if there is little or no evidence for the distribution assumption. The users of the model results, such as senior management or underwriters, could be confused and ascribe a higher information content or reliability to the model results than they actually provide. For example, fitting a normal distribution could hide from model users the fact that in effect only the first two moments of the distribution are specified.

In the event that the undertaking adequately enriches the probability distribution forecast, be it by e.g. interpolation, extrapolation or fitting, the resulting forecast should always be presented as conditional on the related assumptions, in order to enable model users to objectively assess its information value.

5.41. In CEIOPS' opinion, supervisory authorities shall decide on the adequacy of the richness of the probability distribution forecast on the basis of three criteria as described in the following. An internal model which generates only the key points of the probability distribution forecast would nevertheless qualify for approval if all three criteria are satisfied.

5.42. First of all, the undertaking shall demonstrate that the methodology chosen takes into account current knowledge and developments in internal modelling or justify its choice of not taking into account some of them, in particular in light of the proportionality principle and its risk profile. This is to prevent some undertakings from lagging behind what is technically and economically feasible for them in the long term.

Then, reference is made to alternative methods suited to realising the modelling goals.

The undertaking's model may be approved if no appropriate alternative methods exist that would generate a richer distribution forecast, i.e. with more data points.

If a method which is appropriate and more sophisticated in this respect is available, however, the undertaking must carefully justify its choice of methodology as opposed to this method. The model is considered to be approvable only if the supervisory authority comes to the decision that the use of more sophisticated methods would not create enough benefits, taking into account the nature, scale and complexity of the risks inherent in the undertaking's business, or would not be appropriate. Otherwise the model does not qualify for approval due to an inadequate model output.

In particular, outdated approaches should not be accepted by supervisory authorities where superior methods exist and are both practicable and appropriate.

5.43. Probability distribution forecasts which generate only key points mainly occur in areas where scientific developments have so far not resulted in methodologies which could generate full distributions. However, many of those areas are evolving, so that in future improved methods can be expected that yield full distributions. These methods will probably first be used in the scientific and research community and may not immediately be applicable in a business or industry context, for example because of stability or performance issues. However, over time those newly-developed methods will mature and find their way into undertakings' production environment and may become standard industry practice. Where this is the case, CEIOPS expects undertakings making use of internal models, in the absence of good reasons to the contrary, to pick up on these developments and improve their internal models so that they achieve at least the same model quality.

5.44. Therefore, the second criterion is as follows. When and where a generally accepted market practice has been established, the resulting model quality shall be used as the minimum standard and the internal

model may be approved only if the modelling approach chosen leads to a model quality with at least the same standard.

This does not imply that all undertakings have to follow exactly the generally accepted market practice. Undertakings need not to be completely in line with this practice as it is essential that the chosen modelling technique is adapted to the undertaking's risk profile and the proportionality principle applies. This supervisory approach avoids creating systemic risk and encourages reflection of existing alternative techniques and innovation.

Another reason for supervisory authorities to refer to the generally accepted market practice and to link the required minimum standard to that practice is the following: Both the supervisory authority and the undertaking can draw to some extent on the experience that has been acquired in the use of the methodology concerned. It can be reasonably assumed that so far most of the methodological limitations or shortcomings have become evident and are known. Accordingly, the minimum standard will likely to be stable and supervisory authorities can be more comfortable with approving internal models that meet this standard.

5.45. If the first two criteria are met, the supervisory authority finally judges the shortcomings that result from the fact that the model generates only key points in its probability distribution forecast.

In general, shortcomings may arise in connection with all of Articles 120 to 126; CEIOPS expects shortcomings to arise in respect of Article 120 and Article 124 in particular. Internal models that generate probability distribution forecasts with fewer data points may need a more intensive model validation process and tighter integration into the system of governance. Undertakings using such a model are expected to make extensive use of validation techniques (stress-testing, scenario analysis etc) and to put more effort into improving the model with the aim of arriving at a richer distribution forecast.

The onus must be on the undertaking to identify all shortcomings and to assess their materiality. If the undertaking is able to provide evidence that each shortcoming is either irrelevant or compensated for by additional measures, the supervisory authority considers the model as qualifying for approval.

5.46. It should be noted that shortcomings originating from individual components of the model are transferred, via aggregation, to the internal model as a whole. If there is just one model component that generates key points only, then the probability distribution forecast at the topmost level of the undertaking (in line with the model scope) can also consist only of key points. For this reason, the undertaking shall also identify all shortcomings that arise at this level, assess their materiality and ensure that every relevant shortcoming is compensated for.

CEIOPS´ Advice

Internal model and probability distribution forecast

Risk factor distribution forecast vs. economic profit and loss distribution forecast

5.47. The probability distribution forecast shall refer, among other things, to a quantity of monetary value such as profits and losses. Accordingly, any methodology that valuates the financial impact of future events is also subject to statistical quality requirements.

Calculation kernel vs. supplementary methods and techniques

5.48. The criteria set out in Article 121 paragraphs (2)–(9) apply to the calculation framework of the probability distribution forecast as well as to all quantitative methods and techniques associated with it.

Probability distribution forecast

5.49. The generation of a probability distribution forecast as defined in Article 13(38) is a key feature of internal models.

5.50. Within the Solvency II framework internal modelling ultimately aims at an overall distribution forecast for the topmost level of the undertaking, taking into account the scope of the internal model. For group internal models, the aim is to arrive at a probability distribution forecast at the topmost (i.e. group) level. Additionally, groups shall aim to arrive at a probability distribution forecast wherever the internal model is used at the level of individual solo undertakings of the group, for Solvency Capital Requirement calculation or risk management purposes.

5.51. With respect to the richness of the probability distribution forecast, the undertaking shall base the forecast on all relevant information available.

5.52. The exact nature of the probability distribution forecast may include a wide range of distributions from continuous ones to ones with few data points, subject to the conditions elaborated below.

5.53. CEIOPS considers that probability distribution forecasts with more data points generally provide a stronger basis for the undertaking's risk management and provide better support for its decision-making processes. However, in order to avoid confusing model users, the undertaking shall take care not to introduce unfounded richness into the forecast. In the event that the probability distribution forecast is adequately enriched, be it by e.g. interpolation, extrapolation or fitting, the resulting forecast shall always be presented as conditional on the related assumptions, in order to enable model users to objectively assess its information value.

5.54. An internal model that generates only the key points of the probability distribution forecast may nevertheless comply with the statistical quality standards if:

- it takes into account current knowledge and developments in internal modelling or the undertaking justifies its choice of disregarding some of them, in particular in light of the proportionality principle and its risk profile;
- alternative methods that generate more data points are either lacking or their application would be disproportionate with respect to the nature, scale and complexity of the risks inherent in the undertaking's business or would not create enough benefits, taking into account proportionality, or would not be appropriate;
- in those cases where a generally accepted market practice has been established, the quality of the internal model meets or exceeds the model quality of the generally accepted market practice;
- resulting shortcomings with respect to the requirements of Articles 120-126 are compensated for by additional measures.

5.55. CEIOPS stresses that undertakings shall not be forced to follow exactly the generally accepted market practice. It is essential that the chosen modelling technique is adapted to the undertaking's risk profile, and therefore undertakings may have to deviate from the generally accepted market practice. Also, the proportionality principle applies. Still, a certain minimum standard in model quality has to be ensured.

5.56. Internal models that generate probability distribution forecasts with fewer data points may need more intensive validation and stricter governance.

5.57. Undertakings shall ensure that shortcomings are compensated for at the topmost level as well, given the scope of the internal model. This is because one model component generating only key points is on its own enough to restrict the forecast at more aggregated levels to key points as well (cf. Subsection 5.3.5.3 Aggregation of distributions with only key points known).

5.3.2 Calculation methodology and assumptions

5.58. The methods used in the calculation of the probability distribution forecast and the assumptions underlying the internal model constitute most of the methodological basis of the internal model.

5.59. The Statistical quality standards set out several requirements for this methodological basis.

Article 121(2) states that the methods used in the calculation of the probability distribution forecast shall be

- based on adequate, applicable and relevant actuarial and statistical techniques;
- consistent with the methods used to calculate technical provisions;
- based upon current and credible information; and
- based on realistic assumptions.

In addition, undertakings must be able to justify the assumptions underlying their internal model to supervisory authorities.

5.60. Given the wide modelling freedom that undertakings have been granted (cf. Article 121(4)), principles-based criteria are best suited to assessing compliance with these requirements. The criteria, which undertakings have to take into account as a minimum when demonstrating compliance, are expanded upon in the following Subsections.

5.61. For group internal models, the assumptions and methods used shall be consistent throughout the whole group. The different risk profiles and portfolios of the undertakings within the group may necessitate adaptations of assumptions and methods to the specific requirements of the individual portfolio. Only if assumptions and methods are adapted to the specificities of the undertaking, the calculation of the solo SCR or the group SCR can be appropriate. However, such differences between portfolios of the same group must not exist to such an extent that results are conflicting, leading to negative implications for risk management at group level.

5.3.2.1 Adequate actuarial and statistical techniques

5.62. Various dimensions exist in the understanding of the adequacy of actuarial and statistical techniques used within the framework of the probability distribution forecast calculation. The Level 1 Text provides undertakings with two: Adequacy in the sense of

- Applicability; and
- Relevance.

With regard to methods *"adequate"* can also refer to the following terms:

- Appropriate;
- Up to date;
- Detailed and parsimonious;
- Transparent; and
- Robust and sensitive.

5.63. Conscious that in the context of modelling these terms can hardly be defined and distinguished clearly, CEIOPS provides a basic interpretation:

Applicable:

The undertaking has the resources necessary to implement, test and maintain the methods chosen. Resources can mean the knowledge and experience of model developers and users, the IT system infrastructure etc.

Relevant:

The methods chosen are such that the internal model and its results can act as aids to risk management. In particular, inputs and outputs of the model need to be relevant from a decision-making perspective.

Appropriate:

The methods chosen are suited to the modelling goals (i.e. intended internal use and regulatory purpose) and adapted to the available input and data basis. They apply to the undertaking's business and risk portfolios, enabling the internal model to accurately reflect the risk profile. Any shortcomings in the methods used are recognised and accounted for.

Up to date:

The methodology is based on the best evidence available at the time the model is built. The methodology is scrutinised repeatedly, and when necessary modified or replaced (e.g. as new evidence becomes available).

The undertaking is aware of the current state of knowledge in internal modelling, taking into account the latest developments and trends.

Detailed and parsimonious:

The key in the modelling is to find the right balance between the complexity of the real world and parsimony of the model. A sophisticated methodology is typically quite complex, involves many modelling steps and makes great demands on the knowledge of the user. However, the most complex model is not necessarily the best. In some cases a simple, more parsimonious model may be perfectly adequate.

The methodology used results in a model structure that is as simple as possible, while still capturing all essential characteristics. The methods allow for the essential and necessary level of detail. There is a balance between the inclusion of additional characteristics and the need to keep the model manageable, interpretable and evidence-based. For example, the inclusion of a large number of risk factors or parameters might not improve the explanation of relationships or enhance accuracy, but might rather correspond to overfitting to the underlying information or data.

A structural sensitivity analysis can provide reassurance that simplifications or approximations are reasonable.

Transparent:

The methodology used must be transparent. It is not just that the model results must be valuable for the user. The methodology should also reveal the logical connection between inputs (data and assumptions) and outputs (probability distribution forecast, e.g. profits and losses). The complexity of the methodology must not turn the model into a black box in the eyes of the users. The model developers should be able to grasp the logic behind its results at an intuitive level.

Robust and sensitive:

The methods used shall be suited to the internal model, enabling it to provide results that are stable and at the same time indicate changing conditions in the surrounding world.

5.64. The onus shall be on the undertaking to provide evidence that the actuarial and statistical methods used are adequate. Compliance should be demonstrated on the basis of the criteria given above, while the undertaking may also apply additional criteria.

5.65. In assessing the methodological adequacy of the internal model, both undertakings and supervisory authorities shall have regard to the proportionality principle.

5.3.2.2 Consistency of calculation methods used for the probability distribution forecast and technical provisions

5.66. Since the internal model must have the ability to value the financial impact of future events, as pointed out in Section 5.3.1.1, the calculation of the probability distribution forecast includes methods that are used in the calculation of technical provisions and vice versa. Whereas these methods serve basically the same purpose and are applied to the same items, in practice methods used in the valuation of technical provisions and their underlying assumptions are not identical to their counterparts in the calculation of the probability distribution forecast. The different objectives, i.e. valuation of technical provisions and determination of economic capital, allow for deviations to some extent. For example, the level of granularity might be higher for the valuation of technical provisions.

5.67. However, methodological deviations must not exist to such an extent that results are conflicting, leading to negative implications for risk management. For this reason, Article 121 (2) demands, as a basic principle, consistency between the methods used to calculate the probability distribution forecast and those used to calculate technical provisions. The same demands hold for all other areas in the undertaking where valuations or models are used for the internal model and for other purposes inside the undertaking (e.g. models for the valuation of options on the asset side).

5.68. The questions that arise are:

To what extent should methodological deviations be permissible?

How can compliance with the consistency requirement be ensured?

5.69. In CEIOPS' opinion, prescribing a defined set of consistency criteria limiting the extent of permissible methodological deviations would probably not lead to the desired goal, given the great variety in internal modelling. Instead, CEIOPS recommends a flexible approach. Undertakings shall develop their own conception of consistency between the methods used to calculate the probability distribution forecast and the methods used to calculate technical provisions. By doing so, undertakings develop individual consistency criteria. These criteria form the basis for the undertaking to prove compliance.

5.70. Establishing such criteria and checking consistency on an ongoing basis requires the undertaking to regularly identify any differences in the actuarial and statistical techniques used in the calculation of the probability distribution forecast and technical provisions, respectively.

5.71. When looking for deviations, the undertaking must in general investigate all relevant methodological characteristics of the internal model. However, particular attention should be paid to the key model assumptions as referred to in Article 124 and to the parameterisation of the model.

5.72. In order to arrive at conclusions about the level of methodological consistency achieved between the calculation of the probability distribution forecast and the calculation of technical provisions, the undertaking must be able to assess the materiality of the deviation. This assessment can be conducted qualitatively or quantitatively. CEIOPS recognises that a quantitative assessment is not always possible. However, if a quantitative assessment is possible and also reasonable according to the principle of proportionality, CEIOPS expects undertakings to conduct a quantitative assessment as well. For example, the undertaking can contrast the value of the technical provisions with the average internal model outcome, i.e. the expected value of the probability distribution forecast. It can compare the valuations of options and guarantees as part of the calculation of technical provisions with the corresponding valuations in the internal model.

5.73. Irrespective of whether they are material or not, any deviations identified must be documented, explained and well-founded by the undertaking.

5.74. By applying the consistency criteria to the results from the materiality assessment, the undertaking judges whether consistency exists to a sufficiently high degree or not. When supervisory authorities assess the undertaking's judgement and the corresponding procedure followed, they shall have regard to the proportionality principle.

5.75. Undertakings are expected to conduct regular consistency checks as part of their model validation process. As a minimum, their frequency should be consistent with the frequency of the model validation.

5.76. As both the methodological basis of the internal model and the calculation of technical provisions evolve over time, the consistency criteria and the procedure for assessing the materiality of deviations must be regularly reviewed. Model changes represent natural triggers for such reviews.

5.3.2.3 Current and credible information

5.77. In the initial design of the internal model the undertaking's specialist professionals decide on the methods to be used in the calculation of the probability distribution forecast. Even after the model has been brought into operation, the specialist professionals continuously review the actuarial and statistical techniques in use, as the internal model must keep up with the changing world.

5.78. The specialist professionals form an opinion about the adequacy of the methodology chosen on the basis of a variety of information. As any new information has the potential to change the conclusions about the methodological adequacy of the internal model, information must be kept up-to-date. Ensuring the credibility of the information is a prerequisite for drawing reliable conclusions.

5.79. CEIOPS wishes to provide some indication of the kind of the information concerned here and of how to ensure the up-to-dateness and credibility of this information. In those cases where a combination of expert judgement and data leads to model assumptions, the remarks in Section 5.3.3.5 may also be relevant.

5.80. Apart from information about the modelling goals (cf. Article 120), there are basically three different types of information that affect the choice of methods:

- data
- information on model assumptions
- knowledge of viable techniques

5.81. One can distinguish between data currently used in the internal model and other data which is not in use but may affect its methodological basis (e.g. data needed to test the incorporation of a new risk factor).

5.82. Data used in the internal model may cease being accurate, complete and appropriate. In that case, methods which have been in use can no longer be applied with confidence and may be replaced by other, possibly simplified methods. On the other hand, the data basis may significantly improve, as a result of which the set of possible methods that can be applied grows. The undertaking should always seek the most appropriate methods.

5.83. Undertakings regularly update the data used in their internal model with a frequency in line with the frequency of model usage (cf. Article 121(3)). In CEIOPS' opinion, there is no reason for a more frequent update, as in practice the model is used more frequently than its methods are challenged.

5.84. Any other data which may affect the methodological basis of the model as well as any information on model assumptions should also be gathered on a regular basis. One example is data needed to test the incorporation of a new risk factor. CEIOPS recommends an update frequency in line with that of the model validation process.

5.85. In order to be able to assess the actuarial and statistical techniques in use, it is essential to be aware of alternative techniques available at the time. For that reason undertakings must keep track of the latest developments and trends in internal modelling. This can be achieved for instance by a regular survey of the relevant scientific literature or by communication with peers and the relevant scientific community. Undertakings will then take note of new and possibly more advanced methods emerging.

5.86. A natural trigger for an information review is any findings from the model validation process that cast doubts on the adequacy of the methods used.

5.87. Gathering new information and incorporating it into the internal model is an ongoing process where the time-period between the receipt of the information and the effecting of model changes triggered should be based on their expected materiality.

5.88. The undertaking must provide evidence that the information basis underlying the methodology of the internal model is credible. The assessment should rely on a set of criteria defined by the undertaking. As a general rule, these criteria relate to the quality of the information itself as well as to the quality of the process of generating, collecting and providing the information.

5.89. The undertaking may refer to the following criteria:

Consistency:

The information basis is consistent in itself, i.e. there are no internal contradictions.

Objectivity:

The information basis relies on a sufficiently large set of information sources. The information sources are characterised by a high degree of independence from the undertaking.

The exclusion of known information sources from consideration should be well-founded.

Competence:

The source and the provider of the information, respectively, are qualified.

The quality of the information is verified, e.g. peer-reviewed.

Transparency:

The process of generating, processing and providing the information is well documented.

The undertaking is aware of the ambiguity inherent in the information.

5.3.2.4 Justification of underlying assumptions

5.90. In developing an internal model, undertakings take a huge number of decisions. In particular, undertakings decide on a multitude of model assumptions which significantly determine the specification of the model and its area of application. Obviously, the assumptions made affect the choice of actuarial and statistical techniques, their implementation and their application.

5.91. Usually, for certain model aspects a number of different assumptions are feasible and it is hardly ever possible to identify with certainty the "right" one.

5.92. In CEIOPS' opinion, it is essential that undertakings have taken their decisions on model assumptions conscientiously. Accordingly, undertakings shall be able to justify the assumptions underlying their internal model to the supervisory authority in detail and at any time.

5.93. Undertakings which have made assumptions conscientiously are aware of

- their significance;
- associated limitations, e.g. with respect to model application, model performance etc;
- the model risk involved; and
- possible alternative assumptions and their implications.

5.94. When justifying the model assumptions to supervisory authorities, CEIOPS expects undertakings to cover the points listed above as a minimum.

5.95. As a first step, however, undertakings identify all assumptions that are inherent to the internal model. In practice, the identification of assumptions is not a simple task, as assumptions often do not remain that obvious after they have been made or they are made implicitly.

5.96. Testing the significance or materiality of model assumptions and estimating the model risk can be done qualitatively as well as quantitatively. In a quantitative assessment the change in model results due to a variation of assumptions is investigated.

5.97. In general, CEIOPS favours a quantitative assessment over a qualitative assessment, because a quantitative assessment usually tends to be more objective and comprehensible. Therefore, undertakings must conduct at least a qualitative materiality assessment, but if possible and reasonable according to the proportionality principle, undertakings are expected to assess the materiality quantitatively as well.

5.98. Furthermore, CEIOPS wishes to point out that supervisory authorities will probably expect a more in-depth justification in the event of uncommon assumptions that deviate widely from the current market standard.

5.99. Undertakings shall document all internal model assumptions, their justification and the procedure followed in that respect.

5.100. The justification of model assumptions and in particular their quantitative assessment is closely related to model validation. Article 124 stipulates that the model validation process shall include the testing of the sensitivity of the results of the internal model to changes in key underlying assumptions. However, it should be noted that the justification of underlying assumptions to supervisory authorities may go far beyond the regular validation process, which focuses only on the key assumptions.

CEIOPS´ Advice

Calculation methodology and assumptions

Adequate actuarial and statistical techniques

5.101. The undertaking shall provide evidence that the actuarial and statistical methods used are adequate. The demonstration of methodological adequacy shall be based on a set of defined criteria that may include the following:

- Applicable;
- Relevant;
- Appropriate;
- Transparent;
- Up to date;
- Detailed and parsimonious; and
- Robust and sensitive.

5.102. In the assessment both undertakings and supervisory authorities shall have regard to the proportionality principle.

5.103. For group internal models, the assumptions and methods used shall be consistent throughout the whole group. The different risk profiles and portfolios of the undertakings within the group may necessitate adaptations of assumptions and methods to the specific requirements of the individual portfolio. Such differences between portfolios of the same group shall not exist to such an extent that results are conflicting, leading to negative implications for risk management at group level.

Consistency of calculation methods used for the probability distribution forecast and technical provisions

5.104. The undertaking shall demonstrate that the methods used to calculate the probability distribution forecast are consistent with the methods used to calculate technical provisions as defined within Solvency II. The same demand holds for all other areas where valuations or models are used for the internal model and for other purposes inside the undertaking.

5.105. To this end, the undertaking shall identify and document any differences in the actuarial and statistical techniques used and the underlying assumptions made to calculate the probability distribution forecast and technical provisions, respectively. While consistency checks in general apply to all methodological model characteristics, special attention shall be given to the key assumptions underlying the internal model, as referred to in Article 124 and to its parameterisation.

5.106. The undertaking shall explain, justify and document all deviations concerning methodology and assumptions.

5.107. The undertaking shall assess the consistency between the calculation methods used for the probability distribution forecast and technical provisions on the basis of appropriate criteria to be established by itself. To this end, the undertaking shall assess the materiality of the deviations identified. The undertaking shall assess their materiality from a qualitative perspective and, if possible and proportionate, also from a quantitative perspective.

5.108. Supervisory authorities shall judge the level of consistency, taking due account of the proportionality principle.

Current and credible information

5.109. The onus is on the undertaking to demonstrate that the methods used to calculate the probability distribution forecast are based upon current and credible information.

5.110. To this end, the undertaking shall perform regular methodological reviews, taking into account, as a minimum, the relevant data, information on assumptions and the alternative methods available.

5.111. While the undertaking updates data used in the internal model in line with the frequency of model usage, any other data which may affect the methodological basis of the model and information on model assumptions shall be collected with a frequency in line with that of the model validation process.

5.112. The undertaking shall demonstrate that it keeps track of recent progress in the development of methods and that it takes these insights into account in the assessment.

5.113. A natural trigger for methodological reviews are any findings from the model validation process that may cast doubts on the adequacy of the methods used.

5.114. The undertaking shall provide evidence for the credibility of the information used to form the basis for those methods. In performing this task, the undertaking shall apply appropriate criteria and may refer to the following list:

- Consistency;
- Objectivity;
- Competence; and
- Transparency.

Justification of underlying assumptions

5.115. The undertaking shall identify all assumptions inherent to the internal model.

5.116. At any time the undertaking shall be able to explain and justify in detail those assumptions to the supervisory authority. In doing so, the undertaking shall take into account as a minimum

- their significance;
- associated limitations, e.g. with respect to model application and model performance;
- the model risk involved; and
- possible alternative assumptions and their implications.

5.117. The undertaking shall assess the materiality of the assumptions chosen and also possible alternative assumptions. In line with the proportionality principle and where practicable and reasonable, undertakings shall conduct a quantitative assessment in addition to a qualitative assessment.

5.118. Undertakings shall document all internal model assumptions, their justification and the corresponding procedure.

5.3.3 Data

5.119. The determination of economic capital, and especially internal modelling, within Solvency II is mainly about forecasting the future based on past experience and available information. In this respect data, as forming the basis of the internal model, is of crucial importance. Data quality essentially affects the quality of the internal model's results and consequently the value of their use in risk management. Furthermore, data quality is key to the undertaking's choice of methods.

5.120. For group internal models, the same general remarks apply to data and the setting of parameters as have been made above regarding model assumptions and methods: While CEIOPS is well aware of the fact that adaptations may be necessary to capture the specific risk profile of individual portfolios, data and parameter settings used in the internal model should be consistent throughout the group.

5.121. Given the high importance of data in internal modelling, undertakings and supervisory authorities should strive for the highest data quality standards to be applied.

5.122. The Level 1 Text relates data quality to three different criteria:

> Article 121(3) states that *"data used for the internal model shall be accurate, complete and appropriate."*
>
> Data quality is also an integral part of model validation, as Article 124 states that the model validation process *"shall (…) include an assessment of the accuracy, completeness and appropriateness of the data used by the internal model."*

5.123. In general, the more accurate, complete and appropriate the data used in the internal model, the more reliable the resulting model output, and the probability distribution forecast in particular, and the greater the confidence that can be placed in the decisions made on the basis of the model results. Moreover, it is often the case that higher data quality involves a larger set of actuarial and statistical techniques that can potentially be considered for application.

5.124. Whereas the current Section of this Paper is focused on setting out Advice in the context of internal models, it is noted that the issue of data quality is also relevant in other areas of solvency assessment, for example for the calculation of technical provisions and of the SCR using undertaking-specific parameters within the standard formula. CEIOPS envisages that, to the extent appropriate, a consistent approach to data quality issues is taken across Pillar 1, without however disregarding the different objectives and specificities of each area.

In this sense, requirements from the Data Quality Standards for Technical Provisions (see CEIOPS Advice) shall also apply, where applicable, to internal model data in addition to the requirements set out below.

5.125. In the context of this Paper, and consistent to the other areas related to data quality as mentioned above[19], data comprises numerical, census or classification information but not qualitative information. Assumptions are not regarded as data, but it is noted that the use of data is an important basis in the development of model assumptions.

Key questions

5.126. With regard to data quality requirements in the context of internal models CEIOPS has identified the following key questions:

1. What should the scope of the data quality requirements be?

2. How should the abstract criteria for assessing data quality – *"accuracy",* *"completeness"* and *"appropriateness"* – be interpreted? To what level of detail should Level 2 implementing measures provide for a further specification of these criteria? What is the role of undertakings in this respect?

3. How should the quality of data be monitored and ensured on an ongoing basis? What are the contributions of the undertaking, the supervisory authorities and third parties?

4. Should requirements additional to the updating of data used in the calculation of the probability distribution forecast be laid down? What are the implications of a data update?

5. How should one deal with instances where data quality is compromised? What requirements should be set out to the use of expert judgement in relation to data?

6. What should be the content of the undertaking's policy on data quality and updating?

In the following, these key questions are individually addressed. The rationale behind CEIOPS' Advice is presented for each of them.

5.127. It should be noted that CEIOPS has defined a policy issue on data quality and expert judgement according to its request to contribute to the Impact Assessment of Level 2 implementing measures conducted by the European Commission. This policy issue addresses some of the key questions listed above, in particular the questions 2, 3 and 5.

5.128. In the following, Advice to each of the key questions is provided in a separate Subsection. Wherever the Impact Assessment is concerned it is indicated as such and the relevant aspects of the policy issue and the options are presented as well as the main rationale. For details please confer the Impact Assessment in Annex C.

[19] In accordance with CEIOPS Advice on Technical Provisions - Standards for Data Quality

5.3.3.1 Scope of data-quality standards

5.129. The nature of data used in an internal model can be very diverse and the scope of data to which the quality criteria are to be applied is rather unclear. In principle, two possible interpretations exist: a restricted scope or a comprehensive scope for data quality standards.

5.130. The scope of data quality requirements could be restricted to e.g. data used in the calculation framework of the probability distribution forecast. The advantage is that a clear distinction can be made between data that is subject to data quality assessment and data that is not. In addition, if a restricted scope is applied, undertakings and supervisory authorities incur lower costs for monitoring data quality. However, with this interpretation it is more likely that poor quality data will have a negative effect on model results, even though it is not used directly in the calculation kernel.

5.131. If a comprehensive scope is applied, data quality must, in principle, be ensured for any data involved in the internal model. This should be particularly true for all data that is used to develop, validate and operate the model. That being so, it is best to stipulate that any relevant data be subject to quality assessment and that any data used satisfy the quality criteria. That way, the quality of the model itself and its output is enhanced, forming a thorough grounding for high-quality risk management. A comprehensive scope would, however, involve higher costs for undertakings and supervisory authorities.

5.132. Given the vital importance of high data quality standards, CEIOPS advocates gearing interpretation towards a comprehensive scope of data quality requirements, i.e. data quality requirements shall apply to any data used to operate, validate and develop the internal model.

5.133. Furthermore, CEIOPS is not aware of any reasons that justify treating external data differently from internal data as regards data quality. From a practical point of view, there will be differences in the type of assessment that can be made (e.g. the assessment of accuracy for external data will necessarily need to follow a different route, as the data has not been collected and compiled by the undertaking), but this does not justify setting different requirements for external data. Therefore, data quality requirements should apply to data irrespective of the source.

5.134. Undertaking shall compile a directory of any data used to operate, validate and develop their internal model. In doing so, they shall specify in detail the data source, its characteristics and usage.

5.3.3.2 Interpretation and specification of the criteria of *"accurate, complete and appropriate"* for assessing data quality

5.135. As prescribed in Article 121(3), the quality of data shall be assessed by means of three criteria: data accuracy, data completeness and data appropriateness. *"Accurate"*, "*complete"* and *"appropriate"* are rather abstract terms that require interpretation. The ultimate goal should be to make these criteria applicable in practice in data quality assessment. The issue that arises here is the extent to which this interpretation should be reasonably conducted and what scope of interpretation should be left to undertakings.

5.136. To address this issue, the following points need to be considered:

In themselves, the criteria of *"accuracy", "completeness",* and *"appropriateness"* are absolute. However, in reality data is seldom absolutely accurate, complete and appropriate.

The ways in which data is used are many and varied and can change with time.

5.137. Hence, the data quality criteria need to be put into perspective, particularly in relation to the intended purpose of use (e.g. internal modelling aims): In assessing data quality, a meaningful statement is that data is sufficiently *"accurate"/"complete"/"appropriate"* with respect to the current purpose under consideration.

5.138. The prescription of concise data quality requirements might possibly facilitate the interaction between undertakings and supervisory authorities in matters relating to data quality. However, the huge variety of data typically used in internal models makes it difficult, where it is feasible at all, for supervisory authorities to prescribe highly detailed quality standards that

- are comprehensive (e.g. covering data of every risk category),
- are relevant for all undertakings with their diverse business and risk profiles, and
- remain valid over time.

5.139. For this reason, CEIOPS prefers to follow a principles-based approach and to provide undertakings with an initial interpretation of the data quality criteria. In CEIOPS' view it makes sense to leave the further specification to the undertakings themselves. More precisely, undertakings shall develop their own concept of data quality starting from a basic interpretation given for the terms *"accurate", "complete"* and *"appropriate"*.

5.140. Following this procedure, supervisory authorities then check whether the undertaking has reached the ultimate goal, i.e. putting the initially abstract concept of data quality into practice.

5.141. The assessment of data quality implies in practice the prior definition of objective characteristics that data should have. Consequently, the undertaking is required to assign to any data set specific qualitative and/or quantitative criteria which, if satisfied, qualify them for being used in the internal model.

5.142. At an intermediate stage of the process of refining data quality, the undertaking may develop quality standards specific to the various risk categories or address risk driver data and risk exposure data separately.

5.143. Being in favour of convergence, CEIOPS draws on the banking sector with regard to the basic interpretation of the data quality criteria: the terms *"accuracy", "completeness"* and *"appropriateness"* should be interpreted as having the following meaning:

"Accurate" refers to the degree of confidence that can be placed in the data. Data must be sufficiently accurate to avoid material distortion of the model output.

"Complete" means that databases provide comprehensive information for the undertaking (i.e. data for all material business lines and all relevant model variables).

"Appropriate" means that data do not contain biases which make them unfit for purpose.

Section 5.3.3.3 refers to the way undertakings can demonstrate the fulfilment of the quality criteria by undertakings.

5.144. This interpretation of the three data quality criteria from the perspective of internal models, as being very high-level, is also applicable to those other areas where the Level 1 Text explicitly mentions these criteria (in the context of the calculation of technical provisions and of the use of undertaking-specific parameters within the SCR standard formula), thereby ensuring a consistent approach to the assessment of data quality. However, considering that the scope, the level of demand and the objectives are different in each area, it is obvious that the concrete application of the criteria is differing.

5.145. Provided that undertakings are willing to make use of the considerable freedom afforded them in the design and implementation of detailed quality standards for data used in their internal model, this flexible, principles-based approach is most likely to result in data quality standards that are tailored to each individual undertaking. Another advantage is that the approach inherently allows for the proportionality principle.

5.3.3.3 Data quality control/monitoring

5.146. The quality of internal model data has to be monitored and ensured on an ongoing basis. Accordingly, undertakings shall perform regular data quality checks. To this end, undertakings shall have in place processes which they have designed specifically to provide assurance of the

accuracy, completeness and appropriateness of the data used to operate, validate and develop their internal model. These processes serve to implement the data quality standards established by the undertakings.

5.147. The key question arising here is: Which parties should exercise control functions and to what degree of closeness?

As part of the Impact Assessment of Level implementing measures CEIOPS has identified four policy options with varying degrees of involvement of supervisory authorities and independent third parties, respectively (cf. Impact Assessment, Annex C).

In Option 1 undertakings agree the use of data (and expert judgement in relation to data) with the supervisory authorities on a case-by-case basis.

In Option 2 undertakings and supervisory authorities agree on a common basis for data quality assessment: a comprehensive policy on data quality established by the undertaking and approved by the supervisory authorities.

In Option 3 and Option 4 data (and the use of expert judgement) is subject to review by an independent third party.

5.148. Option 1 implies frequent and close interaction between undertakings and supervisory authorities, whereas in Option 2 supervisory authorities exercise their control function on the basis of the undertaking's data policy. With options 3 and 4, third parties are heavily involved in data quality review. The four options are described in detail in Annex C.

5.149. Within the framework of the Impact Assessment CEIOPS has investigated the potential impact on the relevant stakeholders (policy holders and beneficiaries, insurance industry and undertakings in particular, supervisory authorities) and has conducted a cost-benefit analysis. As a result, CEIOPS concluded that Option 2 is to be favoured because this option is most effective and efficient in realising the related objectives which are *"Introduce risk-sensitive harmonized solvency standards"* and *"Harmonize supervisory powers, methods and tools"*.

5.150. Accordingly, CEIOPS recommends that undertakings shall establish their own policy on data quality and data update approved by senior management. The data policy shall be agreed with the supervisory authorities as part of the initial model approval process and will then form the basis for supervisory analysis of data quality standards. Major changes to the data policy shall always be subject to prior supervisory approval. A review of the data policy shall be part of the model validation process.

5.151. Within its regular data quality review CEIOPS expects the undertaking to demonstrate the fulfilment of the criteria of *"accuracy", "completeness"* and *"appropriateness"*. In particular, undertakings shall demonstrate that

- data used is free from material mistakes, errors and omissions (accuracy);

- data is to a large degree consistent in time such that the model output refers to a well-defined point in time (accuracy);

- it has at its disposal comprehensive data for all business lines under consideration and, where possible, all relevant model variables (completeness);

- no relevant data available is excluded from consideration without justification (completeness);

- the granularity of data is sufficient to allow for adequate actuarial and statistical techniques to be used (appropriateness);

- data used is relevant to its business and the portfolio of risks being analysed (appropriateness);

- data used for prediction exercises is a good guide to the future (appropriateness).

5.3.3.4 Data update

5.152. Article 121(3) requires undertakings to "*update the data sets used in the calculation of the probability distribution forecast at least annually*".

5.153. Data updates are necessary in order to take account of changes in the (risk) situation the undertaking is faced with as time evolves. The model output, i.e. economic capital and the SCR in particular (cf. Article 124), should reflect such changes in good time. Only then will the undertaking be able to take decisions which are informed by internal model results in good time.

5.154. In CEIOPS' opinion consideration should be given to whether the frequency of once a year for data updates, as a minimum requirement, is sufficient or whether the minimum requirement should be supplemented.

5.155. CEIOPS would argue that the frequency of updates of data used in the calculation of the probability distribution forecast should, as a general rule, be linked to the frequency of model use as covered by the Use test. This is supported by the Level 1 Text, since Article 120 requires the frequency of calculation of the SCR to be consistent with the frequency of model use. This implies an equally frequent data update to ensure that the regulatory capital requirement is meaningful.

5.156. Moreover, in abnormal circumstances, especially in a crisis, it might be essential for both the undertaking and supervisory authorities that updates of data used in the calculation of the probability distribution forecast be performed at shorter notice and more frequently by the undertaking.

5.157. Undertakings may benefit from identifying events which they consider to be severe enough to warrant their performing non-regular, unscheduled data updates. Furthermore, undertakings should define circumstances under which they regard a prompt recalculation of economic capital and (parts) of the SCR as necessary.

5.158. CEIOPS regards the minimum frequency of one year for data updates as sufficient under normal conditions. However, CEIOPS recommends that this minimum data update frequency requirement be supplemented to take account of the special demands of abnormal market conditions.

5.3.3.5 Data and expert judgement

5.159. CEIOPS recognises that expert judgement comes always into play in internal model design, operation and validation. Expert judgement may be based on an opinion formed by a group or an individual. It may involve subjective probability assessments or concern the assumptions underlying a quantitative probabilistic model. Since Article 121(2) already contains requirements regarding adequate actuarial and statistical techniques, here we consider expert judgement solely from the perspective of Article 121(3) as a complement to existing data or a substitute for missing data. CEIOPS is aware that in the practice of internal modelling data is usually complemented to a certain degree by expert judgement (cf. CEIOPS Stock-taking Report on the use of internal models in insurance). In general, the more data quality and data availability is compromised, the greater the extent to which undertakings rely on expert judgement. If appropriate data is not available at all, expert judgement may act as a substitute and allow risk assessment which would otherwise have been impossible.

5.160. CEIOPS recognises that even in situations where there exists a lot of data about a risk, there is still a need for expert judgement, for example, in selecting the data to use; selecting the time period of the data; adjusting the data to reflect current and future conditions; adjusting for outliers and adjusting industry data to reflect the undertaking's circumstances. Therefore, CEIOPS recognises that even the most comprehensive data requires the application of expert judgement.

5.161. The use of expert judgement is actively encouraged by CEIOPS where there is a lack of data to quantify a known risk – it is better to assess the risk than not to assess the risk at all. Encouraging the use of expert judgement increases undertakings' acknowledgement that the risks exist, thereby increasing the incentive for undertakings to allow for the risk in their modelling.

5.162. The Level 1 Text does not address the interrelationship between data and expert judgement. Nevertheless, CEIOPS wishes to address this issue in Level 2 implementing measures and set out requirements to the proper use of expert judgement in relation to data.

5.163. CEIOPS has addressed the use of expert judgement in relation to data as part of the policy issue within the Impact Assessment concerning Article 121.

CEIOPS has defined four options that differ especially in the scope of expert judgement used in relation to data. In the first three options the scope of expert judgement is not generally restricted. Expert judgement on data may be used in all areas of an internal model, either as complement to data or as a substitute for data in case where data is not available or of dubious quality. If data is available, supervisory authorities (in Option 1 and 2) and independent third parties providing data reviews (in Option 3) should check that expert judgement is reconciled with the data.

In contrast, in Option 4 undertakings should keep the use of expert judgement to a minimum. In particular, the use of expert judgement is allowed only when data is unavailable.

5.164. As stated already in Section 5.3.3.3, CEIOPS has decided in favour of Option 2 (cf. Annex C for details). Thus, the scope of expert judgement in relation to data should not be generally restricted: Undertakings should be allowed to make use of expert judgment as an addition to or substitute for data.

5.165. Irrespective of the considerations above, CEIOPS recommends that undertakings should always

- document all instances in which data quality may be compromised;
- justify, explain and validate the use of expert judgement when related to data; and
- document the inputs and assumptions on which expert judgement is based, as well as the methodology applied in the generation, use and validation of expert judgement.

5.166. In terms of the second point above (cf. also Section 8), undertakings may consider using some or all of the following approaches:

a. Where possible, any decision made using expert judgement is compared to external information.

b. Industry groups may also be used to validate expert judgements. These can be particularly useful for smaller undertakings, although care must be taken to avoid systematic risks or herd behaviour whereby each undertaking follows the expert judgement of another.

c. Where expert judgement is used within an undertaking, this expert judgement is challenged and validated by an 'expert panel'. This might consist of a mixture of skills of people such as underwriters, modellers, risk experts, economists etc.

d. Expert judgement may also be compared to the emerging experience for the risk that it was used to model. The expert judgements may then be revised using the additional experience gained.

e. Sensitivity analysis may be carried out on each of the parameters derived by expert judgement to highlight significant sensitivity to a single parameter.

5.167. Expert judgement may be subject to biases or other shortcomings. These limitations must be acknowledged and solutions be implemented to reduce their detrimental effects, taking into account the materiality and significance of the expert judgement used. The requirements of Article 121(2) also apply to expert judgement (cf. Section 5.3.3.5) where suitable. Where expert judgement as addition to or substitute for data has a material impact, its use is admissible only if a scientific method is followed, i.e.:

a. The expert judgement must be falsifiable, i.e. circumstances under which the expert judgement would be considered false can be clearly defined even though they may only be realised at a point in time far in the future.

b. The expert must be able to make transparent the uncertainty surrounding the judgement. To this end, the expert may outline the context of the judgement; define its scope and validity; provide the underlying information basis; and state the limitations.

c. Standards concerning the operation of the methodology used must exist and be maintained.

d. The expert judgement must be documented. In particular, a track record of the expert judgements used must be available. This will facilitate to asses the reliability of the expert judgement.

e. The expert judgement must be validated. Validation may include assessing the track record of expert judgements; challenging the expert judgement using scrutiny from other experts; comparing the expert judgement with existing and emerging data.

5.168. The approach outlined above ties in with the views expressed by the Groupe Consultatif[20] about characteristics of personal judgement where they state that: *"In general, a professional applies rigorous analysis to arrive at judgements. In whatever area of activity, she will consider all available knowledge, facts, data and other available information. This includes that she also considers solutions her profession has chosen in the past in comparable situations. To arrive at conclusions she applies reasoning specific to her area of competence and presents corroborating evidence of the points in question. In reality often seemingly contradicting views, opinions and theories exist. The professional weighs*

[20] www.gcactuaries.org

the various diverging parts and balances the pros and cons, before coming up with her own judgement. Most importantly by documenting and sharing all methodology, assumptions and data she makes her findings available for scrutiny by other professionals. There are also approaches to commonly occurring insurance issues and problems which are worth to describe."

5.169. Thus, we would add further possible aspects that undertakings may consider when using expert judgment:

a. Take account of all available knowledge, facts, data and other information, including solutions to similar problems previously used.

b. Experts should apply reasoning specific to their area of competence and present corroborating evidence.

5.3.3.6 Data policy contents

5.170. As set out in Section 5.3.3.3., undertakings shall establish their own policy on data quality and update. The policy should provide undertakings and supervisory authorities a common basis in their interaction with regard to data quality assessment. Particularly, on the basis of the undertaking's data policy, supervisory authorities shall control that data used in the internal model is accurate, complete and appropriate as well as up-to-date.

5.171. In light of this, undertakings shall enlarge in their data policy on all the issues addressed in the previous Subsections 5.3.3.1 – 5.3.3.5. From the perspective of supervisory authorities, it shall be presented in what way undertakings achieve compliance with the data quality requirements.

5.172. CEIOPS believes that it is useful to prescribe a minimum content of the data policy.

5.173. The policy on data quality and data update shall, as a minimum, cover the following subject areas:

a. The undertaking specifies its own concept of data quality and the actual implementation. It must be clear to the supervisory authority from this what standards the undertaking applies in judging the quality of data.

b. The processes which the undertaking has in place for checking and validating data quality are described in detail. The undertaking specifies the actions to be taken in the event that data is not or does not continue to be accurate, complete and appropriate.

c. The undertaking documents the methodology which is followed in order to validate the use of expert judgment in relation to data, especially in the event that the quality of existing data is poor.

d. The processes which the undertaking has in place for the update of data must be described in detail. In this respect, the focus should be on data that is used in the calculation of the probability distribution forecast.

e. The undertaking sets standards regarding

- the frequency of regular data updates;
- circumstances that trigger unscheduled data updates or require a prompt recalculation of the SCR, respectively, and the timeliness of their realisation.

In the case of data used in the calculation of the probability distribution forecast the undertaking specifies when the update does not necessarily require a re-run of the internal model in order to determine economic capital or to recalculate the SCR, respectively.

The process specifications should include a precise description of the various methods or methodologies in use, the determination of responsibilities and the frequency of application.

CEIOPS´ Advice

Data

5.174. Requirements form the Data Quality Standards for Technical Provisions (CEIOPS Advice on Data Quality Standards for Technical Provisions) shall apply, where applicable, to internal model data in addition to the requirements set out below.

Scope of data quality standards

5.175. The data quality requirements apply to all data used in the internal model, i.e. any data used to operate, validate and develop the internal model, irrespective of whether it is internal or external.

5.176. The undertaking shall compile a directory of any data used, specifying its source, characteristics and usage.

Interpretation and specification of the data quality criteria

5.177. Undertakings shall interpret the terms *"accuracy", "completeness"* and *"appropriateness"* as having the following meaning:

- *"Accurate"* refers to the degree of confidence that can be placed in the data. Data must be sufficiently accurate to avoid material distortion of the model output.
- *"Complete"* means that databases provide comprehensive information for the undertaking.

- *"Appropriate"* means that data does not contain biases which make it unfit for purpose.

5.178. Based on the criteria of *"accuracy", "completeness"* and *"appropriateness"*, and consistent with the basic interpretations given, the undertaking shall further specify its own concept of data quality. Provided that undertaking-wide there is a common understanding of data quality, the undertaking shall also define the abstract concept of data quality in relation to the various types of data in use. For example, the undertaking may develop specific quality standards for the data of each risk category. Risk driver data and risk exposure data may be addressed separately. The undertaking shall eventually assign to the different data sets specific qualitative and/or quantitative criteria which, if satisfied, qualify them for use in the internal model.

Data quality control / monitoring

5.179. The onus is on the undertaking to demonstrate that data is accurate, complete and appropriate. To this end, undertakings shall perform regular data quality checks. Data quality checks are processes which undertakings have specifically designed to provide assurance of the accuracy, completeness and appropriateness of the data used to operate, validate and develop their internal model.

5.180. Undertakings shall establish their policy on data quality and data update (cf. 5.186). The data policy shall be agreed with the supervisory authorities as part of the initial model approval process and will then form the basis for supervisory analysis of data quality standards. A review of the data policy shall be part of the model validation process (cf. Article 124). Major Changes to the policy shall always be subject to prior supervisory approval.

5.181. Within its regular data quality review the undertaking shall demonstrate the fulfilment of the criteria of *"accuracy", "completeness"* and *"appropriateness"*,and in particular that:

- data used is free from material mistakes, errors and omissions (accuracy);
- data is to a large degree consistent in time such that the model output refers to a well-defined point in time (accuracy);
- it has at its disposal comprehensive data for all business lines under consideration and, where possible, all relevant model variables (completeness);
- no relevant data available is excluded from consideration without justification (completeness);
- the granularity of data is sufficient to allow for adequate actuarial and statistical techniques to be used (appropriateness);

- data used is relevant to its business and the portfolio of risks being analysed(appropriateness);
- data used for prediction exercises is a good guide to the future (appropriateness).

Data update

5.182. Undertakings shall update the data sets used in the calculation of the probability distribution forecast at least once a year. As a general rule, the update frequency shall be linked to the frequency of model use as covered by the Use test. In stressed circumstances, however, undertakings would be expected to carry out short-term updates more frequently.

5.183. Data updates normally involve the recalculation of the probability distribution forecast and, consequently, the recalculation of economic capital and (parts of) the Solvency Capital Requirement, respectively. The recalculation of the Solvency Capital Requirement shall be carried out in a timely manner in order to assure its continuous appropriateness.

Data and expert judgement

5.184. Undertakings shall document all instances in which data quality may be compromised as well as the implications. In such cases the undertaking shall address the interrelationship between data and expert judgement. Expert judgment may be used to complement or substitute data. When data is available, expert judgement shall be reconciled with the data.

5.185. Where expert judgement as complement to or substitute for data has a material impact, its use must be well-founded and is admissible only if its derivation and usage follows a scientific method, i.e.:

a. The expert judgement must be falsifiable, i.e. circumstances under which the expert judgement would be considered false can be clearly defined even though they may only be realised at a point in time far in the future.

b. The expert must be able to make transparent the uncertainty surrounding the judgement, e.g. by providing the context of the judgement, its scope, basis and limitations.

c. Standards concerning the operation of the methodology used must exist and be maintained.

d. The expert judgement must be documented. In particular, a track record of the expert judgements used must be available.

e. The expert judgement must be validated. Validation may include assessing the track record of expert judgements to assess reliability; challenging the expert judgement using scrutiny from other experts; comparing the expert judgement with existing and emerging data.

Data policy

5.186. The policy on data quality and data update shall, as a minimum, cover the following subject areas:

a. The undertaking specifies its own concept of data quality and the actual implementation. It must be clear to the supervisory authority from this what standards the undertaking applies in judging the quality of data.

b. The processes which the undertaking has in place for checking and validating data quality are described in detail. The undertaking specifies the actions to be taken in the event that data is not or does not continue to be accurate, complete and appropriate.

c. The undertaking documents the methodology which is followed in order to validate the use of expert judgment in relation to data, especially in the event that the quality of existing data is poor.

d. The processes which the undertaking has in place for the update of data must be described in detail. In this respect, the focus shall be on data that is used in the calculation of the probability distribution forecast.

e. The undertaking sets standards regarding

- the frequency of regular data updates;
- circumstances that trigger unscheduled data updates or require a prompt recalculation of the SCR, respectively, and the timeliness of their realisation.

In the case of data used in the calculation of the probability distribution forecast the undertaking specifies when the update – as opposed to the general rule (cf. 5.583) - does not necessarily require a re-run of the internal model in order to determine economic capital or to recalculate (parts of) the Solvency Capital Requirement, respectively.

The process specifications shall include a precise description of the various methods or methodologies in use, the determination of responsibilities and the frequency of application.

5.187. For group internal models, CEIOPS is well aware of the fact that adaptations may be necessary to capture the specific risk profile of individual portfolios. However, data and parameter settings used in the internal model shall be consistent throughout the group.

5.3.4 Risk ranking and model coverage

5.188. Article 121(4) states that *"no particular method for the calculation of the probability distribution forecast shall be prescribed."* The rationale is that the undertaking should have methodological freedom to the largest extent possible so as to be able to develop an internal model that closely reflects its risk profile.

5.189. Furthermore, in Article 121(4) the risk-ranking ability of the internal model is addressed with respect to the Use test. The internal model, and hence the conclusions of the risk-ranking, shall be widely used in the governance system of the undertaking, particularly in its risk management system, decision-making processes and capital allocation.

5.190. Paragraph 4 also states that "*the internal model shall cover all of the material risks to which undertakings are exposed*." Internal models shall cover at least the risks set out in Article 101(4)).

5.191. CEIOPS has identified the following key issues:

1. What is to be understood by *"the ability of the internal model to rank risk"*?

2. What are the criteria for assessing whether the ability of the internal model to rank risk is sufficient to ensure that it is widely used in and plays an important role in the system of governance?

3. What are the criteria for assessing whether all material risks are covered by the internal model?

5.3.4.1 The ability of the internal model to rank risk

5.192. The *"ability of the internal model to rank risk"* considers the qualitative, and preferably, quantitative assessment of the relative importance of some risk drivers in relation to other risk drivers within risk categories or across risk categories. Thus, the internal model enables the undertaking to distinguish the "good risks" from the "bad risks".

5.193. *"Risk ranking"* assigns risks to different severity categories so that these risks can then be compared. Unlike the calibration test, it is not the absolute amount (monetary value or probability) assigned to the risk that is important. Rather, it is the comparability of different risks that is the starting point for risk management.

To shed some further light on the issue, an example from CEIOPS Advice on Pillar 1 issues, is picked up again here. A credit rating system which assigns a probability of default to each debtor but has only one rating class does not possess the ability to rank risks: it assigns the same probability of default to each debtor, making it useless for risk management purposes. This is the case even if the one probability of default is estimated perfectly correctly and the rating system could therefore be called "well-calibrated". Risk ranking is closely related to the internal uses of the model, as it forms the basis of decision-making in this area.

5.194. As risk management takes place both within risk categories and across risk categories, the determination of a proper risk-ranking can be seen as a two-step process:

1. Within a particular risk category and based on the particular risk management approach, the risk manager or relevant person has

to choose the most suitable risk measure - or a set of risk measures - for the risk category under his responsibility (risk-ranking within risk categories).

2. In order to obtain a risk-ranking across risk categories these possibly different risk measures must be made comparable, for example by scaling or translating. Alternatively, one risk measure that is adequate for all risk categories can be chosen (risk-ranking across risk categories).

Particular attention should be drawn to the potential biases resulting from the aggregation of risks.

5.195. The diversity of risk measures across risk categories and even across the undertaking reduces systemic risk and procyclicality. Risk managers or relevant persons should be free to select suitable risk measures for the various risk categories so that risk-ranking can, in principle, closely reflect the risk profile of their area of responsibility in particular and, as a consequence, the undertaking's individual risk profile in general.

The ability to rank risk shall be sufficient

5.196. The purpose of risk-ranking is that it enables the model to be widely used in and to play an important role in the governance system, in particular in the risk management system, decision-making processes and capital allocation. This is covered in more detail in the Section 3 on the Use test. It seems reasonable that undertakings differentiate their risk-rankings according to the requirements of the risk management approach and practices chosen in each risk category.

5.197. CEIOPS envisages a principles-based approach to assess the risk-ranking ability of the internal model.

The overall requirement is the suitability of the risk-ranking with regard to Article 120 (Use test). In particular, this means:

- *Coverage:* The risk-ranking ability should exist for all material risks covered by the internal model.

- *Resolution:* The differentiation between the various risks and risk drivers has to be sufficiently precise to allow senior management to take appropriate decisions.

- *Congruence:* The structure of different kinds of risk-ranking reflects the structure of risks or risk categories and the risk management system.

- *Consistency:* Risks of a similar nature are ranked consistently throughout the undertaking and over time. The overall risk-ranking is reconciled with the capital allocation.

5.198. The undertaking defines its own individual methodology for risk-ranking according to the risk categories and requirements of risk management

and governance. The risk-ranking has to comply with the principles (coverage, resolution, congruence, consistency) defined above.

5.3.4.2 Coverage of all material risks

5.199. The internal model can support risk management and inform decision-making in a reasonable manner only if it provides the full picture within its scope, i.e. the risk profile must be reflected in its entirety. Therefore, it is essential to ensure that there is no material risk that is in the model scope but is not included in the model.

5.200. As part of the initial model approval process the supervisory authority assesses the adequacy of the model coverage (cf. CEIOPS Advice on the procedure to be followed for the approval of an internal model), i.e. the supervisory authority examines whether all material risks within the model scope are covered by the internal model.

5.201. Following approval, the internal model must continue to cover all material risks within its scope. In order to provide evidence on an ongoing basis the undertaking should define trigger events that initiate a new assessment of the adequacy of the model coverage, and potentially initiate a necessary model change. The new product process is a typical example of where these trigger events could be installed.

5.202. Pursuant to Article 45 (Own Risk and Solvency Assessment), the undertaking has processes in place which enable it to properly identify and measure the risks it faces. The findings of the ORSA, especially those of the risk identification process, should serve both the undertaking and the supervisory authority as a starting point in assessing the adequacy of the internal model coverage.

5.203. While risk management includes in general both quantitative and qualitative elements, in assessing the model coverage it also seems natural to rely on both qualitative and quantitative indicators that reveal the materiality of the risks concerned.

5.204. The methodology underlying the quantitative risk indicators does not necessarily need to comply with the high standards expected from the internal model and its results, but may have to be more basic, especially when risks involved are not covered by the internal model. The determination of quantitative risk indicators can be approximate to some extent, provided that the resulting figures allow the undertaking to decide with confidence whether the risk under consideration is material or not. Accordingly, a calculation may be based on largely simplified models and involve External models and data. Proxies such as accounting figures may also qualify as quantitative risk indicators.

5.205. CEIOPS is aware that the determination of risk indicators, irrespective of whether they are qualitative or quantitative, may to a great extent involve expert judgement (cf. Section 5.3.3.5).

5.206. In CEIOPS' opinion, quantitative risk indicators are to be preferred by supervisory authorities to qualitative ones. Quantitative risk indicators

tend to be more objective and reliable. They usually provide a more detailed analysis of the materiality of risks. However, the development and use of quantitative risk indicators may need more time and resources compared to qualitative ones. Therefore, the extent to which quantitative or qualitative indicators are used should be linked to the proportionality principle.

The undertaking shall use quantitative risk indicators to assess their materiality proportionate to the nature, scale and complexity of the risk, supplementing them with qualitative indicators.

5.207. The onus should be on the undertaking to establish appropriate indicators of the materiality of risks which are suited to demonstrating that their internal model covers all material risks within the model scope. However, CEIOPS recommends a minimum standard for the risk indicators to be specified. This can be realised as described in the following:

Quantitative risk indicators

5.208. Undertakings shall use quantitative risk indicators that correspond to the level of policy holder protection as set out in Article 101. This will ensure the appropriateness of the SCR in respect to risk coverage as calculated by the internal model.

5.209. It is essential to also make the assessment based on the level of confidence at which the undertaking operates its business. Undertakings shall therefore include in the assessment any other quantitative risk indicator that is used in risk management or decision-making processes in the risk category under consideration. This will encourage the undertaking's confidence in the appropriateness of the economic capital calculation and allocation based on internal model results.

5.210. The undertaking or supervisory authority may include in the set of quantitative risk indicators additional ones beyond those mentioned above. CEIOPS wishes to highlight three examples:

a. The capital allocated to the risks under consideration. In general, one assumes risks to which a substantial amount of capital is allocated to be material ones.

b. The amount of profits and losses which cannot be explained by the categorisation of risk chosen in the internal model (cf. Article 123). An unexpectedly high amount of unexplained profits and losses indicates the existence of material risks not yet covered in the internal model.

c. Any tool used in model validation. Results from sensitivity analyses, stress testing, scenario analysis or testing model results against experience can provide valuable information about the adequacy of model coverage.

Qualitative risk indicators

5.211. While several qualitative indicators of the materiality of risks may exist, CEIOPS wishes to highlight some selected indicators. Undertakings shall make use of at least one of them or other appropriate indicators.

5.212. The fact that a risk is attracting special management action suggests that this risk is considered as material.

5.213. Accordingly, the existence of dedicated risk management processes for an individual risk alone provides some evidence for its materiality.

5.214. The same reasoning applies to the existence of dedicated risk mitigation.

5.215. Furthermore, the fact that a risk has been identified within the ORSA as material and falls within the scope of the internal model suggests that it should be included in the internal model.

Any risk that is listed in the report by the risk management function to the administrative, management or supervisory body on the material risks faced by the undertaking (cf. CEIOPS Advice on System of Governance) should be covered by the internal model, provided it falls into its scope.

Materiality and dependencies

5.216. The assessment of the materiality of risks and the adequacy of model coverage, as referred to so far, adopts what is primarily a bottom-up approach: the materiality of individual risks or risk factors is evaluated. Such an assessment without any further investigations is inadequate. This is because individual risks or risk factors on their own may appear immaterial, while in aggregate they may become material.

Undertakings shall therefore give due consideration in their assessment to the joint impact of risk factors that have been omitted, including their dependencies.

5.3.4.3 Group specific risks

5.217. In order to reflect the total risks that that the group may face, the group SCR should reflect the risks that arise at the level of the group and that are specific to the group.

5.218. The lessons learnt from the financial crisis illustrate the importance of group-specific risks, such as reputational risk, contagion risk, impact of intra-group transactions[21] and operational risk. QIS4 also reported that entities within groups may face significant reputational risks and other group-specific risks.

[21] For further details please refer to CEIOPS Advice on Group Solvency Assessment

Assessment methodology

5.219. For further details on the assessment of group specific risk please refer to CEIOPS Advice on Group solvency assessment.

CEIOPS´ Advice

Risk-ranking and model coverage

Ability to rank risk

5.220. On the basis of the criteria given (coverage, resolution, congruence, consistency) the undertaking shall provide evidence that the ability of the internal model to rank risk is sufficient to ensure that it is widely used in and plays an important role in the system of governance, in particular the risk management system, decision-making processes and capital allocation as described in the Use test.

5.221. The following interpretation is given for the four criteria:

- *Coverage:* The risk-ranking ability shall exist for all material risks covered by the internal model.
- *Resolution:* The differentiation between the various risks and risk drivers has to be sufficiently precise to allow senior management to take appropriate decisions.
- *Congruence:* The structure of different kinds of risk-ranking reflects the structure of risks or risk categories and the risk management system.
- *Consistency:* Risks of a similar nature are ranked consistently throughout the undertaking and over time. The overall risk-ranking shall be reconciled with the capital allocation.

Coverage of all material risks

5.222. The undertaking shall demonstrate that the internal model covers all material, quantifiable risks within its scope by using a set of qualitative and quantitative risk indicators.

5.223. As a minimum, the undertaking shall use quantitative risk indicators which correspond to the level of policy holder protection as set out in Article 101 and any other quantitative risk indicator used in its risk management or decision-making processes for the risk category under consideration.

5.224. In addition, the set of quantitative risk indicators may include:

- the capital allocated to the risks under consideration; and
- the amount of profits and losses which cannot be explained by the categorisation of risk chosen in the internal model; and
- any validation tool such as sensitivity analysis, stress testing, scenario analysis or testing against experience.

5.225. The set of qualitative risk indicators may include one or more of the following:

- the existence of dedicated risk management processes for individual risks;
- the existence of dedicated risk mitigation;
- the identification of this risk in the ORSA;
- the inclusion in the report by the risk management function to the administrative, management or supervisory body on the material risks faced by the undertaking.

5.226. When assessing the coverage of all material risks, the undertaking shall give due consideration to the joint impact of risk factors that have been omitted, including their dependencies.

Group specific risks

5.227. In order to reflect the total risks that that the group may face, the group Solvency Capital Requirement shall reflect the risks that arise at the level of the group and that are specific to the group.

5.228. For further details on the assessment of groups specific risk please refer to CEIOPS Advice on Group Solvency Assessment.

5.3.5 Recognition of diversification effects

5.229. Modelling diversification effects is a central element of internal models and an important determinant in the calculation of the SCR as set out in Recital 37 to the Level 1 Text. However, no common market practice concerning the modelling of diversification effects has been established so far. This is especially true for diversification across different risk categories.

5.230. In order to support overall decision making, the internal model has to integrate all the different risks of the undertaking by

a. using its risk ranking ability to make them comparable and

b. aggregating them into a single quantity.

During the aggregation process, the internal model will typically realise diversification effects. In this way, the aggregation mechanism of the

internal model improves the reflection of the risk profile of the undertaking by the internal model and is vital for its usability for risk management. Basically, there are two different approaches to aggregation. As many internal models are composed of a multitude of risk modules and sub-modules, internal models often implement an aggregation mechanism which is executed in several steps. Especially for such modular models with their multi-step aggregation mechanism, a natural link exists between the diversification benefits realised in the internal model and the structure and practice of risk management reflected in the Use test (see Article 120). In integrated models, however, aggregation usually takes place in a single step. Then, the link mentioned above is a priori not that evident. At this point, it should be noted that CEIOPS does not prefer one mechanism to the other. According Article 121(4), undertakings are in principle not restricted in their choice of an appropriate aggregation mechanism as *"no particular method for the calculation of the probability distribution forecast shall be prescribed"* (cf. also the introduction in Section 5.1). Therefore, the requirements to aggregation and the recognition of diversification effects set out in this Section hold irrespective of the aggregation mechanism being a single-step or a multi-step approach.

5.231. Diversification effects may also arise at the group level for group internal models. Wherever diversification effects may arise, they shall be as a general rule subject to the requirements detailed below. In particular, it should be demonstrated that the system for measuring diversification effects that are realised at group level is adequate. As there may be some risks which specifically arise as a consequence of the group activity and which are to be quantified, it has to be taken into account that diversification benefits may be reduced due to these risks.

5.232. Restrictions in the availability of capital are dealt with in Section 6 (Calibration standards) and the CEIOPS Advice on Group Solvency Assessment.

5.233. CEIOPS is aware that in implementing an aggregation mechanism for an internal model undertakings face a number of challenges:

a. Dependencies are very hard to estimate and validate

   Dependencies are harder to estimate or calibrate than marginal distributions (or the quantification of individual risks). In many cases, there may be no conclusive evidence regarding the theoretically correct dependency or aggregation mechanism. The required parameters may be based on expert judgement which will require extra efforts in the validation approach.

b. In addition, aggregation mechanisms can be inherently sensitive to parameter changes. Seemingly small changes in parameterisation may result in large changes in overall capital.

c. Methods to account for dependency are not necessarily stationary across confidence levels, i.e. dependency measured at a central

point may become inoperative at the confidence level required for capital calculations.

Combining the points above, CEIOPS concludes that modelling of dependencies and the aggregation mechanism requires special attention by the supervisory authority.

5.234. As an example, for certain risks the simple sum of results may not be a sufficiently conservative and appropriate aggregation method. Firstly, the distribution of the underlying risk factor may be such that VaR does not possess the subadditivity property, and this is often the case for insurance technical risks. Another reason may be in the nonlinearity of certain risks. For example, the interaction of mortality risk and interest rate risk in a life portfolio may give rise to a total VaR that is bigger than the sum of the individual VaRs for mortality risk and interest rate risk calculated separately, because of mutually amplifying effects of the two risks on the value of the portfolio. A well-hedged life portfolio may have zero interest-rate sensitivity (for small changes in interest rates) and its only risk driver may be mortality. So superficially the VaR of this portfolio is its VaR from mortality risk. However, as soon as mortality assumptions change, the portfolio will not have a zero interest rate sensitivity anymore and therefore will be exposed to changes in interest rates. Taking a combined view of mortality and interest rate risk will therefore result in a total VaR that is bigger than just the mortality VaR.

5.235. Below, CEIOPS will elaborate requirements for aggregation mechanisms. As part of the assessment of the internal model, supervisory authorities shall challenge the aggregation assumptions relating to parameters (and data, expert judgment and estimation process used to estimate them) and methodologies. They may also require the recalculation of the internal model results based on a different set of assumptions for the purpose of sensitivity analysis and stress testing.

5.236. In the case of deficiencies in the aggregation mechanism regulatory model approval may still be granted, but may be subject to terms and conditions such as:

a. changes in the parameters used for aggregation

e.g. require change in correlation parameters, changes in the data set used to estimate the parameters or changes in the expert judgment process

b. The imposition of different methodology

e.g. require simple sum aggregation

5.237. Concerning the recognition of diversification effects in the internal model CEIOPS has identified three key issues:

1. Segmentation of risk categories.

2. Adequate system for measuring diversification effects.

3. Aggregation of distributions with only key points known.

5.3.5.1 Categorisation of risks

5.238. There are various possibilities for classifying the level at which diversification effects may arise. The classification also influences the modelling techniques employed and vice versa.

5.239. Given that diversification effects are to a large extent undertaking-specific and that managing diversification is one central aspect of risk management in undertakings, it should be up to the undertaking to determine its own risk categories. As a minimum requirement, the principle of homogeneity should be fulfilled: similar risks should be treated in a similar fashion and therefore be part of the same risk category. Risk categories could also be broken down further into sub-categories.

5.240. In addition to the exact definition, every classification should ideally contain the main risk drivers of the respective category in order to facilitate the identification and analysis of dependencies between risk drivers.

5.241. Furthermore, the determination of risk categories should be consistent with the Profit and loss attribution requirements set out in Article 123.

5.242. Ensuring comparability between undertakings and consistency of supervisory actions regarding the proper recognition of diversification effects may be complicated under this flexible approach. However, this can probably be relieved by requiring high documentation and transparency standards from the undertakings regarding diversification effects and by close communication between supervisory authorities.

5.3.5.2 Adequate system for measuring diversification effects

5.243. Given that there exists a wide variety of measurement and modelling techniques for diversification effects and because no industry standard has been established so far, any prescriptive rules regarding the adequacy of the system to measure diversification effects should be avoided. Therefore, the approach to be used to aggregate risks within the internal model, thereby calculating the effects of diversification, as well as the associated parameters shall be determined by the undertaking. However, there are some basic elements which should be taken in account if diversification effects are to be recognised:

5.244. The key variables driving dependencies and undertakings' exposure to them should be identifiable. Depending on the chosen aggregation method, different variables come into consideration, e.g. risk factors, risk drivers for market, credit or underwriting risk, economic indicators or overall profits and losses etc.

5.245. There should be meaningful support for claiming diversification effects. This includes for example empirical/statistical analyses and expert judgement of causal relationships or a combination of both. Regarding expert judgements, it is important to note that these should be explained and documented in detail and in a well-reasoned manner, including how expert judgement is challenged and reviewed/monitored against actual experience wherever possible. Model assumptions regarding diversification effects can be considered as key assumptions and are therefore part of the respective requirements of Article 121(2), e.g. regarding the justification of assumptions.

5.246. It is well known that dependencies between risks can behave differently in extreme scenarios, e.g. as compared to scenarios that correspond to the centre of the probability distribution. As the SCR focuses primarily on the tail of the probability distribution forecast, the dependency structure in the tail is of particular importance. This is sometimes characterised as the concept of tail dependence and also described as one of the lessons learned in CEIOPS Paper on lessons learnt form the crisis. Whatever technique is used for modelling diversification effects, undertakings shall ensure that diversification effects hold not only on average but also in extreme scenarios and scenarios for those quantiles which are used for risk management purposes. Extreme scenarios should not only be considered in isolation of each other but interactions between them should also be taken into account, e.g. when several extreme events happen at the same time.

5.247. Given the particular model uncertainties relating to diversification effects, it is important that the model robustness be tested on a regular basis. This includes, but is not limited to, sensitivity analyses and stress tests.

5.248. Diversification effects shall be actively considered in business decisions and risk management in order to demonstrate that the calculated diversification benefits can be captured.

5.3.5.3 Aggregation of distributions with only key points known

5.249. The aggregation and modelling of diversification effects is particularly challenging for those risks for which instead of the entire distribution or a very good approximation only some key points are known. Then also the overall (aggregated) distribution will not be fully known, but again only some key points.

5.250. In those cases the aggregation mechanism may require information or data which may not be available, because the underlying probability distributions are unknown, and could be based to a large extent on expert judgement (requirements from Section 5.3.3.5 apply) and circumstantial evidence. Any assumptions and parameters for this aggregation mechanism will be subject to the particular scrutiny of supervisory authorities, and the resulting model uncertainty shall be compensated with additional measures such as higher Validation standards (including more sophisticated validation tools such as specific

sensitivity analysis and stress-testing and a particular emphasis on the validation on expert judgement) or reference to findings from scientific or other sources such as the Standard Formula or CEIOPS publications. The undertakings shall provide the supervisory authorities with a detailed description of the methodology used in these additional measures.

5.251. The scarcity of information available may make it more challenging for the undertaking to demonstrate compliance of the aggregation mechanism and the resulting model outputs with the requirements of Articles 120 to 126, in analogy to the underlying probability distribution forecasts (cf. Section 5.3.1.3). If, for example, the aggregation mechanism results in increased uncertainty regarding the calculated SCR, the undertaking may have to take additional measures to ensure that it is still equivalent to the level of protection set out in Article 101.

CEIOPS´ Advice

Recognition of diversification effects

Determination of risk categories

5.252. The undertaking shall determine its own risk categories while allowing for the homogeneity principle, and ensuring consistency with the attribution of profits and losses (cf. Article 123).

Adequate system for measuring diversification effects

5.253. Supervisory authorities shall be satisfied that the system for measuring and recognising diversification effects is adequate if, as a minimum, the undertaking:

- identifies the key variables driving dependencies;
- provides support for the existence of diversification effects;
- justifies the assumptions underlying the modelling of dependencies;
- takes into particular consideration extreme scenarios and tail dependence;
- tests the robustness of this system on a regular basis, e.g. as part of the model validation process;
- takes diversification effects actively into account in business decisions.

5.254. For group internal models, groups shall demonstrate that the system for measuring diversification effects realized at group level is adequate and fulfils the requirements above. As there may be some risks which specifically arise as a consequence of the group activity and which are to

be quantified, groups shall take any reduction in diversification benefits due to these risks into account.

Aggregation of distributions with only key points known

5.255. The aggregation and modelling of diversification effects of risks for which only some key points of the distribution are known is particularly challenging.

5.256. The aggregation mechanism may require information or data which may not be available, because the underlying probability distributions are unknown, and could be based to a large extent on expert judgement (N.B. requirements to the use of expert judgement apply) and circumstantial evidence. Any assumptions and parameters for this aggregation mechanism shall be subject to the particular scrutiny of supervisory authorities, and the resulting model uncertainty shall be compensated with additional measures such as higher Validation standards (including more sophisticated validation tools such as specific sensitivity analysis and stress-testing and a particular emphasis on the validation on expert judgement) or reference to findings from scientific or other sources such as the Standard Formula or CEIOPS guidance. The undertakings shall provide the supervisory authorities with a detailed description of the methodology used in these additional measures.

5.257. The scarcity of information available may make it more challenging for the undertaking to demonstrate compliance of the aggregation mechanism and the resulting model outputs with the requirements of Articles 120 to 126. If, for example, the aggregation mechanism results in increased uncertainty regarding the calculated Solvency Capital Requirement, the undertaking may have to take additional measures to ensure that it is still equivalent to the level of protection set out in Article 101.

5.3.6 Recognition of risk mitigation

5.258. Risk mitigation techniques are an important risk management tool and as such they should be given adequate recognition in reducing the relevant capital charges. Acceptable risk mitigation techniques can consist of both traditional and non-traditional risk transfer instruments and they can be employed on the asset side as well as on the liability side of the balance sheet. Risk mitigation techniques which do not involve risk transfer (e.g. introduction of controls which reduce operational risk) are also covered by this Section. Article 121(6) states that credit risk and other risks arising from the use of risk mitigation techniques are to be properly reflected in the internal model. In this respect it is essential to make sure that the use of risk mitigation techniques actually causes a reduction in net risk. For reasons of simplicity the set of credit risk and other risks that potentially arise from the use of risk mitigation techniques is referred to as "secondary risks" in the following. An appropriate treatment of secondary risks arising from risk mitigation techniques is essential for a reduction of the SCR. Where intra-group risk transfer is taken into account from the solo

perspective, any restrictions or other limitations that exist for this risk transfer should be given due consideration.

5.259. The question that arises is how to ensure that undertakings properly reflect risk mitigation techniques as well as associated secondary risks in their internal model.

5.260. One option would be to prescribe a set of acceptable risk mitigation techniques along with their secondary risks and to specify the way their effect is to be reflected in the model. While this approach would be highly objective, facilitating harmonisation, it has serious shortcomings. Its inflexibility would be likely to endanger new market developments in risk mitigation techniques and to create negative incentives for their use in daily risk management.

5.261. For this reason, CEIOPS came down in favour of adopting a principles-based approach. Within this approach several criteria are linked to risk mitigation techniques and their reflection in the internal model. Supervisory authorities may consider the inclusion of risk mitigation in the internal model as acceptable if as a minimum requirement the following criteria are met:

a. Economic effect over legal form

Regardless of their legal form or accounting treatment, risk mitigation techniques that have a material impact on an undertaking's risk profile shall be recognised and treated equally, provided that they do not run counter to the principles as noted below. The undertaking shall demonstrate that a risk transfer takes place from an economic perspective.

b. Legal certainty, effectiveness and enforceability

- The risk-mitigating instruments, together with the undertaking's processes and policies accompanying these instruments, shall result in risk mitigation arrangements which are legally effective and enforceable in all relevant jurisdictions.

- The undertaking shall take all appropriate steps, for example an adequate legal review, to ensure and confirm the effectiveness and continuing enforceability of the risk mitigation techniques and to address related risks. In the event that the full effectiveness or continuing enforceability cannot be verified, the risk mitigation instrument shall not be recognised in the internal model. The same holds for undocumented or inadequately documented risk mitigation techniques.

- For collateralised transactions the legal mechanism by which collateral is pledged or transferred must ensure that the undertaking has the right to liquidate or take legal possession of it, in a timely manner, on the occurrence of any

counterparty event set out in the transaction documentation (and, where applicable, of the custodian holding the collateral). Undertakings shall have clear and robust procedures for the timely liquidation of collateral in order to ensure that any legal conditions required for declaring the default of the counterparty and liquidating the collateral are observed and that collateral can be liquidated promptly.

c. Liquidity and ascertainability of value

- Risk mitigation techniques shall have a value over time sufficiently reliable to provide appropriate certainty as to the risk mitigation achieved.

- The undertaking shall consider the possible liquidity risks of risk mitigation instruments under normal and stressed conditions. The undertaking shall have written guidance on the liquidity requirements that risk mitigation instruments should meet. These requirements should be in line with the objectives of the undertaking's risk management policy.

- The double-counting of risk mitigation effects shall be avoided.

- In the event of the default, insolvency or bankruptcy of the provider of the risk mitigation instrument – or other credit event set out in the transaction document – the risk mitigation instrument should be capable of liquidation in a timely manner or of retention.

d. Identification and assessment of secondary risks

- Undertakings are obliged to make their own risk assessment of their risk mitigation techniques. As part of this assessment they shall identify and document all secondary risks arising from risk mitigation, including the methods to be used to deal with these risks. The assessment shall also include analyses of extreme scenarios, e.g. liquidity constraints for hedging instruments or collateral.

- The materiality concept of Article 121(4) also applies to secondary risks, i.e. the internal model shall cover all material secondary risks. Undertakings shall take account of all material secondary risks arising from risk mitigation techniques and shall properly reflect them in their internal model. This includes, but is not limited to, credit risk, concentration risk, basis risk, legal risk, operational risk and model risk due to complex risk mitigation structures. If they are material, interactions between risks – e.g. the value of a risk mitigation instrument being positively correlated with the probability of default of its provider ("specific wrong way risk") – shall also be taken into account.

- Proper reflection of secondary risks is not necessarily restricted to a quantitative treatment within the internal model. For certain secondary risks it may also be sufficient to control and manage them in a more qualitative way, e.g. via processes and controls.

e. Direct, explicit, irrevocable and unconditional features

Risk-mitigating instruments shall contain the following elements:

- They provide the undertaking with a direct claim on the protection provider (direct feature);

- They contain explicit reference to specific exposures or a pool of exposures, so that the extent of the cover is clearly defined and incontrovertible (explicit feature);

If there is a clause the fulfilment of which is outside the direct control of the undertaking, and which would allow the protection provider to unilaterally cancel the cover or which would increase the effective cost of protection as a result of certain developments in the hedged exposure, then the effect of this should be taken into account in the internal model. If this is not possible, the risk mitigation technique is to be excluded from reflection in the internal model (irrevocable feature).

If there is a clause outside the direct control of the undertaking which could prevent the protection provider from being obliged to pay out in a timely manner in the event that a loss occurs on the underlying exposure then the effect of this should be taken fully into account in the internal model. If this is not possible, the risk mitigation technique is to be excluded from reflection in the internal model (unconditional feature).

f. Provision for risk mitigation techniques in the internal model

- In addition to the documentation requirements to ensure legal certainty, the undertaking shall also document the way in which the effects of risk mitigation techniques and possible secondary risks are reflected in its internal model.

- As far as possible, the undertaking shall assess exposures gross and net of risk mitigation techniques.

5.262. CEIOPS believes that this principles-based approach will provide a reasonable framework which rewards undertakings for using risk mitigation techniques in their risk management and at the same time ensures that a risk transfer does actually take place. High documentation and transparency standards on the part of the undertakings as well as enhanced communication between supervisory authorities is likely to lead to highly harmonised supervisory actions regarding the recognition of risk mitigation techniques.

5.263. It should be noted that supervisory authorities regard all risk mitigation techniques which the undertaking only plans to have in force at a future point in time (e.g. future reinsurance after renewal of existing policies) as future management actions (cf. Section 5.3.8).

CEIOPS' Advice

Recognition of risk mitigation

Definition of risk mitigation techniques

5.264. Supervisory authorities may allow the undertaking to take full account of the effect of risk mitigation techniques if their reflection in the internal model meets the following criteria:

- Economic effect over legal form (a risk transfer takes place from an economic perspective);
- Legal certainty, effectiveness and enforceability (in all relevant jurisdictions) and documentation;
- Liquidity and ascertainability of value including the liquidity risks under normal and stressed conditions as well as written guidance on liquidity requirements, avoidance of double counting effects and – in the event of default of the counterparty - capability of liquidation in a timely manner or of retention;
- Identification and assessment of secondary risks including analysis of extreme scenarios and interactions between secondary risks;
- Direct claim on the protection provider, explicit reference to specific exposures or a pool of exposures, reflection of clauses outside the direct control of the undertaking (irrevocable and unconditional features);
- Provision for risk mitigation techniques in the internal model (documentation and assessment of exposure gross and net of risk mitigation techniques).

5.265. Undertakings shall make sure that the use of risk mitigation techniques actually causes a reduction in net risk.

5.266. Where intra-group risk transfer is taken into account from the solo perspective, any restrictions or other limitations that exist for this risk transfer shall be given due consideration.

5.3.7 Financial guarantees and contractual options

5.267. The correct assessment of financial guarantees and options is a vital issue for the internal model. That is the reason why the Level 1 Text places great emphasis on the inclusion of all options in the internal

model, whether they are contractual, statutory, policy holder or otherwise, whatever form they take and irrespective of whether the undertaking has a long or short position in the option. It also applies regardless of the counterparty to the option.

5.268. Guarantees and options are typically nonlinear, where nonlinearity refers to the fact that sensitivities of their value to changes in input parameters vary strongly within the parameter range. Such nonlinearity poses particular challenges for the model. The main issue to be discussed here is the conditions under which the particular risks of nonlinear exposures are accurately assessed. Assets that are not typically associated with options but which also possess nonlinear features include, for example, Collateral Debt Obligations (CDOs). Other examples exist for the liability side. The assessment of the risks of these nonlinear exposures should comply with the same requirements as detailed below for options.

5.269. The prerequisites needed to accurately assess the particular risks of options or other nonlinear exposures can take many different forms. They might include, but are not restricted to, the following:

a. Additional categories of risk factors that are peculiar to this special kind of option. One example would be the category of implied volatilities, which are typically needed for options and other nonlinear instruments, but not for simpler products. Another example is economic factors like the level of unemployment or the GDP the development of which may influence the holder of life policies in the exercise of contractual options.

b. Within these categories of risk factors, care must be taken to select the right ones. For implied volatilities, for example, there are many dimensions to cover: an appropriate selection based on option maturity, the precise underlying and strike is needed.

c. Nonlinearities also pose special demands on the accuracy and stability of valuation models. This is the case in particular where the payoff profile is discontinuous. Such payoff profiles can be a challenge for valuation models, but also for the determination of replication portfolios if such an approach is used by the undertaking.

d. Other risks include the fact that a large number of options might have to be settled due to a certain trigger event, as in the case of credit default swaps.

e. In case of extreme unfavourable financial conditions and where the undertaking has written a guarantee it may have to liquidate assets at a time when the market is very illiquid, either to satisfy client demands or to dynamically hedge the risk exposure from the guarantee.

5.270. For an accurate assessment the undertaking should be aware of any options and nonlinear products in its portfolio and the special features

they possess. It should be able to demonstrate that the internal model takes into account these special features and treats them in accordance with the considerations stated above.

5.271. The accurate assessment of the particular risks of financial guarantees and options within the internal model must be carried out in a manner consistent with the methods used to calculate technical provisions as required by Article 121(2).

5.272. The financial and non-financial conditions to be considered in this assessment include not only the risk factors mentioned above in a) or b) or the market liquidity mentioned in d) or e), but generally all changes in the environment that could affect the valuation or exercise of those options.

CEIOPS´ Advice

Financial guarantees and contractual options

5.273. In order for the assessment to be accurate, the undertaking needs to identify, collect and model the risk of all relevant financial guarantees and contractual options, taking into account the key features these guarantees and options possess. Mere expert judgement alone does not qualify as an accurate assessment within the meaning of Article 121(7).

5.274. In its risk assessment the undertaking shall take account of the impact that future changes in financial and non-financial conditions may have on the option exercise.

5.275. The accurate assessment of the particular risks of financial guarantees and options within the internal model must be carried out in a manner consistent with the methods used to calculate technical provisions as defined in the context of the Solvency II calculations (cf. Article 121(2)).

5.3.8 Future management actions

5.276. Over the internal model projection period, predictable decisions by the administrative, management or supervisory body and senior management of the undertaking in response to future events can have a significant impact. That internal model results referring to the end of the forecast period, and the probability distribution forecast in particular, are meaningful and useful in risk management may be attributed to a large part to the implementation of future management actions. Typically, future management actions will aim to reduce risk in adverse scenarios and thus lower the SCR. However, in certain cases future management actions may also increase risk and the SCR.

5.277. The aim of this Section is to offer some criteria to ensure compliance with the regulations.

5.278. We identify two key issues to be discussed in this Advice:

- Definition of *"future management action"*
- *"Reflection in the model"*

5.3.8.1 Definition of management action

5.279. There is no concise definition of a management action, and especially no clear differentiation between management actions and (contractual) options that the undertaking has or between management actions and some of the risk mitigation techniques mentioned earlier.

5.280. In the context here, future management actions can be linked to any decision which the undertaking has the right to make. This can involve just the undertaking itself or relate to any third party. Any and all decisions are covered, irrespective of whether the right to make the decision stems from a contractual, statutory or commercial option or from any other source. A future management action is the currently anticipated exercise or implementation behaviour of any such right of decision. For example, future management actions may comprise changes in asset allocation or changes in the application of a market value adjustment.

5.281. Some risk mitigation techniques may also be classified as the exercise of an option vis-à-vis a third party. The decision to purchase protection against a particular, unfavourable outcome could be seen as a management action. Then again, this could also be classified as a risk mitigation technique. However, Article 121(8) mentions future management actions, which indicates that these actions have not been installed yet. Hence CEIOPS wishes to differentiate between future management actions and risk mitigation techniques in the following way:

Risk mitigation techniques that are currently in place are clearly not future management actions and are to be treated solely in accordance with the standards set out in Article 121(6) on risk mitigation techniques. On the other hand, planned risk mitigation actions that are not yet in place, e.g. protection intended to be bought under certain conditions but which has not been bought yet, are to be classified as future management actions, and as such they must therefore comply with the requirements in this Section over and above the requirements on risk mitigation techniques. This may also include strategies on a rolling forward basis, e.g. dynamic hedging strategies.

5.3.8.2 Reflection in the model

5.282. According to Article 121(8), undertakings may take account of future management actions in their internal model.

5.283. In order to adequately reflect management actions in the model, a number of issues have to be considered:

5.284. Future management actions that are implemented in the internal model become effective after certain events have occurred. The undertaking shall document these triggering events, indicating clearly when and how

the management actions are assumed to apply. In particular, the undertaking should allow for the time period between the time when the triggering event is taking place and the time when the action is effective as well as any other effects that the triggering event could induce, such as reduced market liquidity.

5.285. Future management actions fall into two categories, depending on whether conditions beyond the undertaking's control must be met for the option to be exercised or not. In those cases where such conditions exist they shall clearly be taken into account in the implementation. Examples of such conditions are:

a. The liquidity of financial or reinsurance markets;

b. The willingness of counterparties to carry out the transaction.

The undertaking shall also take into account all costs associated with the management action. The provisions regarding the secondary risks of risk mitigation techniques and their reflection in the model apply here as well.

5.286. In order to determine the materiality of future management actions, their impact on the SCR shall be estimated where this is practicable. This can be done by calculating the SCR with and without individual future management actions enabled. In some cases it may be possible to calculate the impact of individual future management actions on a stand-alone basis. One exception where the impact is difficult to determine could be future management actions determining asset reallocation, for example in a life insurance context: in this case, disregarding future management actions could potentially lead to nonsensical model results.

5.287. There must be a strong link between management actions and the administrative, management or supervisory body of the undertaking, when both planning management actions and deviations from those plans occur. In order to comply with these rules, a process and governance structure has to be established to monitor conditions leading to management actions and to identify the need to deviate from intended management actions, so that board approval can be sought beforehand. Only those management actions where the intention has been signed off by the board may be reflected in the model. Management actions that are reflected in the model have to be carried out as planned if the specific circumstances occur. Deviations from such planned management actions shall be approved by the board beforehand.

5.288. Significant deviations from planned management actions shall be reported to the supervisory authorities together with an analysis which contains the reasons for the deviation and its consequences, in particular with regard to the undertaking's SCR as calculated in advance (cf. above). After such a referral, the supervisory authority may determine that the model no longer complies with the requirements of Article 118, with the consequences indicated there.

5.289. Alternatively or in addition, the supervisory authorities may find that the risk profile of the undertaking deviates significantly from the assumptions underlying the SCR as calculated using an internal model, and that for this reason a capital add-on is required (cf. Article 37).

5.290. A significant deviation from planned management actions may also result in non-compliance with the SCR (cf. Article 138), with the consequences indicated there.

5.291. Historical deviations from planned management actions shall be taken into account by the supervisory authority when approving a new or changed set of future management actions.

5.292. Taking account of future management actions within the internal model has to be carried out in a manner consistent with the methods used to calculate technical provisions as required by Article 121(2). Consequently, the undertaking must ensure that the assumptions for future management actions in the internal model are objective, realistic and verifiable as defined in CEIOPS Advice on assumptions about future management actions for the assessment of provisions.

5.293. Regarding the "realistic" criterion, future management actions have to be exercisable in the cases for which they are intended. The undertaking has to demonstrate to the supervisory authority the circumstances in which it deems the future management action reasonable and why. This demonstration is needed especially in extreme cases or stress scenarios where it might be rather difficult or at least rather expensive to execute the actions planned. The more extreme the scenario or the action planned (e.g. extreme change of portfolio allocation), the more well-founded this demonstration has to be.

CEIOPS´ Advice:

Future management actions

Definition of future management actions

5.294. Future management actions may be linked to any decision which the undertaking has the right to make. This may involve only the undertaking itself, or relate to any third party. Irrespective of whether the right to make the decision stems from a contractual, statutory or commercial option or from any other source, any and all decisions shall be covered. A future management action is the currently anticipated exercise or implementation behaviour of any such right of decision. For example, future management actions may comprise changes in asset allocation or changes in the application of a market value adjustment.

5.295. Risk mitigation techniques that are currently in place are clearly not future management actions and are to be treated solely in accordance with the standards set out in Article 121(6) on risk mitigation techniques. On the other hand, planned risk mitigation actions that are not yet in

place are to be classified as future management actions, and as such they must therefore comply with the corresponding requirements over and above the requirements on risk mitigation techniques.

Reflection in the model

5.296. When implementing management actions in the internal model, conditions beyond the undertaking's control shall be taken into account. Examples include liquidity, the willingness of counterparties to trade as well as additional costs. The provisions regarding the secondary risks of risk mitigation techniques and their reflection in the model apply here as well.

5.297. The materiality of future management actions shall be determined by estimating their impact on the Solvency Capital Requirement, where practicable.

5.298. A strong link between management actions and the administrative, management or supervisory body of the undertaking shall be established. This applies both during the planning phase, when future management actions are determined, and during the operating phase, when planned management actions are carried out. The administrative, management or supervisory body shall approve management actions as well as significant deviations from them. A process and governance framework around management actions shall be established.

5.299. Significant deviations from planned management actions shall be reported to the supervisory authorities together with an analysis which contains the reasons for the deviation and its consequences, in particular with regard to the undertaking’s Solvency Capital Requirement as calculated in advance. After such a referral, the supervisory authority may determine that the model no longer complies with the requirements of Article 118, with the consequences indicated there. Alternatively or in addition, the supervisory authorities may find that the risk profile of the undertaking deviates significantly from the assumptions underlying the Solvency Capital Requirement as calculated using an internal model, and that for this reason a capital add-on is required.

5.300. Historical deviations from planned management actions shall be taken into account by the supervisory authority when approving a new or changed set of future management actions.

5.301. Taking account of future management actions within the internal model has to be carried out in a manner consistent with the methods used to calculate technical provisions as required by Article 121(2).

5.302. The undertaking shall ensure that the assumptions for future management actions in the internal model are objective, realistic and verifiable as defined in CEIOPS Advice on assumptions about future management actions for the assessment of provisions.

5.3.9 Payments to policy holders and beneficiaries

5.303. As with financial options and guarantees, the reflection of all other expected payments in the internal model is very important, regardless of whether they are contractually guaranteed.

5.304. Taking account of all expected payments, even if not contractually guaranteed, within the internal model has to be carried out in a manner consistent with the methods used to calculate technical provisions as required by Article 121(2).

CEIOPS' Advice

Payments to policy holders and beneficiaries

5.305. The internal model shall take account of all expected payments, whether or not contractually guaranteed.

5.306. Taking account of all expected payments, whether or not contractually guaranteed, within the internal model has to be carried out in a manner consistent with the methods used to calculate technical provisions as required by Article 121(2).

6. Calibration standards

6.1 Introduction

6.1. The Calibration standards aim to assess whether the SCR derived from the internal model has the appropriate level of prudence, as clarified in CEIOPS' Advice on Pillar 1 issues para.6.43:

> *"The aim of the 'calibration test' is to assess whether the SCR derived from the model has the appropriate level of prudence. The burden of performing the computations that underlie the calibration test could be assigned to the undertaking, with the obligation of the supervisor to [review] the results. Due to the statistical uncertainties associated with 200-year-events, and difficulties in estimating and validating correlations, the desired absolute level of prudence can only be a target. It is more important to check whether the manner in which the SCR is derived from the internal model is comparable across undertakings"*.

6.2. Thus, the implementing measures of the Article 122 should take into account two objectives:

- On the one hand, the calibration used should provide the adequate level of protection to the policy holder.
- On the other hand, undertakings for which the standard risk measure and time horizon (Var 99,5% / 1 year) are not appropriate express their risk appetite with a different calibration. Those undertakings should be allowed to use another calibration for their internal model, in order to be able in particular to meet the Use test.

6.3. Evidence for the fact that undertakings use different risk measures or time horizons to express their risk appetite is provided in the Stock-taking Report on the use of internal models in insurance (page 84).

> *"Firms participating in the exercise expressed their risk appetites in different ways. Different risk measures, time periods and probabilities are used:*
>
> *- Where a Value-at-Risk (VaR) measure was used, this was typically measured over a one-year period, and probabilities of solvency varied from 99,5% to 99,95%, with 99,93% and 99,97% also being used.*
>
> *- Where a Tail VaR measure was used, this again was typically over one year and probabilities of insolvency tended to be at the 99,0% percentile.*

- In some cases, firms expressed their economic capital requirement as a multiple of the VaR or TailVaR measure.
- Where firms used a longer period than one year, this was up to 25 years".

6.2 Legal Basis

6.4. Article 122 sets out the Calibration standards.

Article 122
Calibration standards

"*1. Insurance and reinsurance undertakings may use a different time period or risk measure than that set out in Article 101(3) for internal modelling purposes as long as the outputs of the internal model can be used by those undertakings to calculate the Solvency Capital Requirement in a manner that provides policy holders and beneficiaries with a level of protection equivalent to that set out in Article 101.*

2. Where practicable, insurance and reinsurance undertakings shall derive the Solvency Capital Requirement directly from the probability distribution forecast generated by the internal model of those undertakings, using the Value-at-Risk measure set out in Article 101(3).

3. Where insurance and reinsurance undertakings cannot derive the Solvency Capital Requirement directly from the probability distribution forecast generated by the internal model, the supervisory authorities may allow approximations to be used in the process to calculate the Solvency Capital Requirement, as long as those undertakings can demonstrate to the supervisory authorities that policy holders are provided with a level of protection equivalent to that set out in Article 101.

4. Supervisory authorities may require insurance and reinsurance undertakings to run their internal model on relevant benchmark portfolios and using assumptions based on external rather than internal data in order to verify the calibration of the internal model and to check that its specification is in line with generally accepted market practice".

6.3 Advice

6.3.1 Different time period and different risk measures

6.5. The Use test set out in Article 120 explains how undertakings shall use the results of an internal model within their risk management system and decision making process. For the undertakings to use the results in this way, they shall be able to model the capital in a way that makes

sense for them so as to manage their risks. Due to the varied nature of risks faced by different undertakings operating in different environments, the appropriate way to model these risks – and especially the appropriate time period and risk measure - may vary significantly from undertaking to undertaking.

6.3.1.1 Use of different risk measures and/or time periods within the same model

6.6. Even the risks within the business of an undertaking may be managed in different ways, owing to the different characteristics of the risks faced. Article 122(1) states that for internal-modelling purposes undertakings can use a different time period or risk measure than that set out in Article 101(3). This shall apply both to the internal model as a whole and to the use of different risk measures and time periods for different risks or business units within the same model. Thus, the calibration of the internal model has a larger degree of freedom and may differ from the calibration underlying the calculation of the SCR, as long as the outputs of it can be used to calculate the SCR with the standard calibration.

6.7. There are practical implications that the undertaking would need to consider if the undertaking uses different time periods and/or risk measures within the same internal model, especially when aggregating the capital for the different risks. When taking this approach, the undertaking shall show that the level of protection provided by the SCR is equivalent to that set out in Article 101(3), and specifically that the approach taken to aggregate the risks is appropriate.

6.3.1.2 Restriction on time period or risk measure

6.8. There is a risk that undertakings use time periods and/or risk measures which are not appropriate.

6.9. One option would be to require the undertakings to set out why the time period and/or risk measure that the undertaking is using is appropriate whenever they use a time period and/or risk measure which is different from that set out in Article 101. This allows the supervisory authority to determine on a case by case basis whether the alternative time periods and/or risk measures used by the undertakings are appropriate.

6.10. A further option would be to set out a list of principles with which the risk measures need to comply with. For example: Are there any statistical properties that the risk measures should fulfil? Should they fulfil at least the statistical properties of the Value-at-Risk measure? CEIOPS considers that there is no need for such principles: if the statistical properties of the risk measure chosen by the undertaking are not adequate for the modelling of risks in insurance, then the internal model will not meet the statistical quality standards as defined in the Article 121.

6.11. There is another risk that the undertaking's choice of time period or risk measure leads to a level of economic capital, which corresponds to an amount of Basic Own Funds (as calculated within the Solvency II framework) that is lower than the SCR. It shall be recalled that even in

this case the undertakings are required to hold eligible own funds covering the SCR (Article 100 of the Level 1 Text) and that the non-compliance set out in Article 138 refers to the SCR and not to the Economic Capital. Whilst the focus of the Use test is the undertaking's economic capital, it is important that the administrative, management or supervisory body, as well as senior management, has a view on the consumption of regulatory capital, in particular on how and why the eligible own funds compared to the SCR changes over time.

6.12. The Stock-taking Report mentions some examples of undertakings that, in addition to the Value-at-Risk measure, also use the Tail Value-at-Risk (TVaR) risk measure (see part 10.2 / p.84). The Stock-taking Report also shows that some undertakings use time periods longer than a year, up to 25 years.

6.13. Shorter time periods than one year for the distribution at the topmost level of the undertaking shall not be prohibited but CEIOPS thinks this is unlikely to happen in practice. However, it may be more appropriate for some risks to use shorter time horizons, provided that the undertaking is able to aggregate all the risks calibrated with different time horizons (see §6.7).

6.14. For such time periods, undertakings shall demonstrate that their internal model takes into account the time effects of the risks to which they are exposed. In particular, a special attention has to be given to the choice of the data used.

6.15. In any case, undertakings shall justify their choice of time horizon, in particular in view of the average duration of the liabilities of the undertaking, of the business model and of the uncertainties associated with too far time horizons (see paragraph 6.78 of the CEIOPS' Advice on Pillar 1 issues).

6.16. The use of a different time period or risk measure shall not be considered to be a justification for exemption from any of the requirements for the internal model set out in Articles 120 to 126.

6.3.2 Direct derivation of the SCR from the probability distribution forecast

6.17. The Article 122 distinguishes two different situations depending on the outputs of the model. Article 122(2) applies when the SCR can be derived directly from the probability distribution forecast. Article 122(3) applies if this is not practicable and states that after agreement with the supervisory authority, the SCR can be calculated using approximations.

6.18. More precisely, the third paragraph of Article 122 applies "*Where insurance and reinsurance undertakings cannot derive the Solvency Capital Requirement directly from the probability distribution forecast generated by the internal model*". It should be assumed that this paragraph applies when this direct derivation is "*not practicable*", that is when the second paragraph is not applicable.

6.19. Some examples where the SCR cannot be derived directly are:

- If the probability distribution is based on risks assessed with another time period than a one-year horizon, it will be impossible to derive the SCR directly from the probability distribution (see CEIOPS' Advice on Pillar 1 issues: 6.77).

- If the probability distribution forecast calculated by the undertaking does not refer to the evolution of Basic Own Funds as valued in the Solvency II Framework. This may happen when the distribution is not calculated at the top level of aggregation (see CEIOPS' Advice on Pillar 1 issues: 6.77) or the methods chosen for the valuation of the assets and liabilities for internal modelling purposes are different from those prescribed for the Solvency II balance sheet (e.g.: different future premium taken into account, some assets marked to model instead of marked to market…).

- If the probability distribution forecast is restricted to some data points of the distribution of Basic Own Funds as valued in the Solvency II Framework, and if the value of the distribution associated with the 99,5% quantile is unknown.

6.20. Nevertheless, it seems that if two simple conditions are fulfilled, there should not be any problem to calculate the Value-at-Risk with a one-year period and a level of confidence of 99,5%:

- Risks underlying the probability distribution are assessed over a one-year period.

- The internal model generates directly the full probability distribution forecast of the Basic Own Funds defined in Article 88 of the 'Level 1 Text' and this forecast meets the statistical quality standards as defined in Article 121.

6.3.3 Showing the equivalence of the protection

6.21. If undertakings use a different time period and/or different risk measures for internal modelling purposes, they will need to show that the SCR calculated gives a level of protection equivalent to that set out in Article 101. Thus, the undertaking shall reconcile the outputs of the internal model (using the different risk measure and/or time horizon) to the 99,5% VaR of the Basic Own Funds (as defined in Article 88 of the Level 1 Text) over a one-year period. This ensures a level playing field between undertakings using internal models and those using the Standard Formula to assess their SCR.

6.22. CEIOPS emphasizes the fact that, even where some reconciliation is needed between the outcomes of the internal model and the SCR, the SCR calculation shall be consistent with the methods used for internal purposes. This reconciliation shall therefore be not only the explanation of differences between two independent models, one being used regularly and for the assessment of the economic capital and the other only for regulatory purposes. It shall rather be a process explaining the differences in the ways the same model is used and their rationale.

6.23. Article 122(3) states that undertakings may be allowed to use approximations to calculate their SCR. The onus is on the undertaking to justify that these approximations lead to a SCR which provides an equivalent level of protection to policy holders and beneficiaries.

6.24. Approximations may significantly decrease the effort required to obtain the 99,5% one year VaR, making it more practical for undertakings to use different time periods or risk measures. Consideration is required of how accurately do undertakings have to calculate the 99,5% one year VaR when approximations are used.

6.25. If the SCR cannot be derived directly from the probability distribution, the undertaking shall:

- Explain how it rescales risks and justify that the bias introduced when doing so is immaterial.
- Explain the shortcuts used to reconcile the outputs of its internal model with the distribution of the Basic Own Funds, if any.
- If considering a longer time horizon that that set out in Article 101(3), show due consideration of the solvency position at the earlier time horizons.
- If considering a different time horizon that that set out in Article 101(3), justify the particular assumptions made in order to properly take into account the dependencies between consecutive time steps.

6.26. CEIOPS may issue a Level 3 Guidance to discuss such possible approximations.

6.27. The standards set out in the Articles 121, 124 and 125 and the Article 126 shall apply "mutatis mutandis" to the approximations used for the purposes of Article 122(3). Nevertheless, the internal use of these approximations may be less intensive as compared to the internal use of the probability distribution forecast. Moreover, there may be a particular high degree of uncertainty attached to these approximations. As a consequence, undertakings should compensate the approximations made in this context by additional provisions. In particular, the assumptions underlying those approximations should be thoroughly tested against

alternative assumptions as part of the demonstration of compliance with the Validation standards.

6.28. The precision of the estimated SCR shall be in line with the requirements set out in Article 121. Nevertheless, there may be situations in which there is absolutely no doubt that the Economic Capital calculated for internal purposes is higher than the SCR set out in Article 101 and that the undertakings holds enough own funds to cover these requirements. In these cases the supervisory authority may settle with an estimate which balances two conflicting considerations: On the one hand it should achieve an accuracy as much in line with the requirements of Article 121 as possible without imposing costs that make it virtually impossible to use a different time horizon or different risk measures. Therefore the precision of this estimate may be lower depending on the a priori level of safety (with regards to the economic capital, the SCR and the amount of eligible own funds held) and the confidence in it.

6.3.3.1 How often must equivalence be justified?

6.29. If undertakings are required to show equivalence too often, this may give them a large resource requirement. On the other hand, if equivalence is not shown often enough, the undertaking may not be providing the appropriate amount of policy holder protection in the SCR.

6.30. The undertaking shall show equivalence at least annually, but also when there are significant events or changes to the risk profile of the undertaking.

6.3.4 Equivalence of the protection in the case of group internal models

6.31. A group internal model may be used to assess the group SCR as well as the SCR of undertakings in the group (Article 231 of the Level 1 Text).

6.32. When it is used to assess the solo SCR of related undertakings, the provisions defined at solo level apply. Besides, CEIOPS emphasizes the fact that, when the group internal model is used to assess the solo SCR of one related undertaking, the calculation should not take into account any group diversification, either directly or indirectly (eg, by using group consolidated parameters), in order among others to achieve a level playing field between undertakings and in order the level of protection of the policy holders to be equivalent to that set out in Article 101.

6.33. In order to achieve a level playing field between groups using the standard formula and those using an internal model and to be consistent with other Directives currently in force, CEIOPS recommends that the principles set out in CEIOPS Advice on Group solvency assessment and related to the possible consolidation methods and the assessment of diversification benefits shall apply to the assessment of the group SCR with an internal model.

6.34. In particular, because of the current wording of the Financial Conglomerates Directive[22], no diversification benefits with financial regulated entities from other sectors shall be recognized.

6.35. As stated in Article 222 of the Level 1 Text, the amount of own funds eligible to cover the SCR must be determined after taking into account all the possible restrictions to the limited availability of own funds located in one specific undertaking (see CEIOPS Advice on Group solvency assessment).

6.36. The SCR shall thus be calibrated in a way that it does not reflect any restriction about the ability of own funds located in a related undertaking to cover any kind of losses within the group.

6.3.5 Benchmark portfolios

6.37. The Level 1 Text gives the ability to supervisory authorities to require undertakings to run their internal model for benchmark portfolios in order to verify its calibration.

6.38. The main problem of benchmark portfolios is the following: At the same time, they have to be general to apply to all undertakings, but also have some specific characteristics in order to be adapted to the individual risk profile of each undertaking. They must be simple enough to be applicable to all undertakings, yet complex enough to show weaknesses also in the sophisticated models.

6.3.5.1 When supervisory authorities require undertakings to run their internal model on relevant benchmark portfolios and using external assumptions?

6.39. Several options may be considered regarding the events that may lead the supervisory authorities to require undertakings to run their internal model on relevant benchmark portfolios and using external assumptions. This requirement may take place:

- During each approval process;
- During the approval process whenever supervisory authorities have concerns about the calibration of the internal model and the adequacy of its specification;
- After the model approval as part of the Supervisory Review Process (SRP):
  - On a regular basis (annually for example);
  - In industry's crisis situations (market, underwriting, CAT...) and the requirement may apply to all or some undertakings;

[22] Directive 2002/87/EC

- As part of the SRP whenever supervisory authorities have concerns about the calibration of the internal model and the adequacy of its specification; or

- Whenever supervisory authorities have concerns about the calibration of the internal model and the adequacy of its specification, either during the approval process or as part of the SRP, either for individual undertakings or for the market (or segments of it).

6.40. For the assessment of the options above, it should be noted that:

- For some approval processes (e. g.: for the approval process of some major changes in the model), supervisory authorities may be comfortable enough with the calibration of the internal model and not need to require undertakings to run their internal model on relevant benchmark portfolios or using external assumptions.
- In some cases, supervisory authorities may want to ask an undertaking to run its internal model on relevant benchmark portfolios or using external assumptions, outside any approval process. This may happen for example if the risk profile of an undertaking seems to have changed (e.g. because he started operating on a new market) and if the undertaking has not applied for the approval of a change in its model.
- A too frequent use of the option given to the supervisory authorities by Article 122(4), especially if it is compulsory during some kinds of events, may be uselessly burdensome as well for the undertakings as for the supervisory authorities.

6.41. As a consequence, CEIOPS recommends that supervisory authorities may require undertakings to run their internal model on relevant benchmark portfolios or using external assumptions whenever they have concerns about the calibration of the internal model and the adequacy of its specification. This may occur during the approval process or as part of the SRP, and may be asked individually or for the whole market (or segments of it). Level 3 Guidance may be issued to ensure supervisory convergence regarding the use of benchmark portfolios.

6.3.5.2 At which level may the relevant benchmark portfolios and the assumptions based on external data be defined?

6.42. The level at which the relevant benchmark portfolio and the assumptions based on external data are defined may be the European or the national level. Moreover, there may be different types of relevant benchmark portfolios for different types of risks or risk profiles.

6.43. It seems impossible to construct a benchmark portfolio suitable for all undertakings, both for assets and for liabilities, as they differ considerably among the types of undertakings (life/non life/composite/niche players, etc), among the Member States and among other criteria. This task may prove to be difficult even at national or sectoral level (within one Member State).

6.44. Thus, CEIOPS recommends that flexibility should be given to supervisory authorities regarding the level at which the benchmark portfolio is constructed. As a rule, these portfolios may be constructed at sectoral level (within one Member State) or at national level. Nevertheless, in some circumstances cross national benchmark portfolios may prove to be a useful tool for transnational insurance group supervision.

6.3.5.3 How should these portfolios and assumptions be built?

6.45. CEIOPS recommends that the technical details of the construction of benchmark portfolios be part of further measures.

6.3.5.4 What are the consequences of the test?

6.46. If the results of the test raise questions about the appropriateness of the calibration of the internal model and of its specifications, supervisory authorities should discuss them with undertakings in order to assess if undertakings comply or not with Calibration standards.

6.47. Benchmark portfolios are only one supervisory tool among others. Therefore they are to be considered by supervisory authorities in conjunction with other factors to assess whether the issues raised by their should lead to consequences.

6.48. The types of consequences will depend on the situation, and among other factors whether it leads to non compliance with the Calibration standards or not and the time it will take to amend it if necessary. In any case, undertakings shall justify the results obtained and deviations regarding the benchmark.

6.49. The consequences may encompass:

- As part of the approval process:
  - Further tests/discussion;
  - Amendments to the internal model;
  - Model approval subject to conditions;
  - Model rejection.
- Outside of the approval process, as part of the SRP:
  - Further tests/discussion;
  - Demonstration by the undertaking that the non compliance with Calibration standards is immaterial (refer to Article 118(1));
  - Undertakings presenting a compliance restoration plan as referred in Article 118(1).

CEIOPS' Advice:

Different time period and risk measure

6.50. The option given to the undertakings in Article 122(1) shall apply both to the internal model as a whole, as well as to the use of different risk measures and time periods for different risks or business units within the same model.

6.51. The use of a different time period or risk measure shall not be considered to be a justification for exemption from any of the requirements for the internal model set out in Articles 120 to 126. The choice of the time period or risk measure used for internal modelling purposes shall be appropriate and justified.

6.52. In particular, if the time period used is different from the one set out in Article 101, the undertaking shall:

- demonstrate that the internal model takes into account the time effects of the risks to which it is exposed;
- demonstrate that all significant risks over a one-year-period are properly managed.
- give special attention to the choice of the data used;
- justify the choice of time horizon (if different from one year) in view of the average duration of the liabilities of the undertaking, of the business model and of the uncertainties associated with too far time horizons.

Equivalent protection of policy holders

6.53. Where some reconciliation between the outcomes of the internal model and the Solvency Capital Requirement is needed, the Solvency Capital Requirement calculation shall be consistent with the methods used for internal purposes.

6.54. The undertaking shall demonstrate the equivalence set out in Article 122 at least annually, but also when there are significant events or changes to the risk profile of the undertaking.

6.55. If the Solvency Capital Requirement cannot be derived directly from the probability distribution, the undertaking shall:

- Explain how it rescales risks and justify that the bias introduced when doing so is immaterial.
- Explain the shortcuts used to reconcile the outputs of its internal model with the distribution of the Basic Own Funds, if any.

- If considering a longer time horizon that that set out in Article 101.3, show due consideration of the solvency position at the earlier time horizons.

- If considering a different time horizon that that set out in Article 101.3, justify the particular assumptions made in order to properly take into account the dependencies between consecutive time steps.

6.56. The standards set out in the Articles 121, 124 and 125 and the Article 126 shall apply mutatis mutandis to the approximations used for the purposes of Article 122(3). Undertakings shall compensate the approximations made by additional provisions. In particular, the assumptions underlying those approximations shall be thoroughly tested against alternative assumptions as part of the demonstration of compliance with the Validation standards.

6.57. When a group internal model is used to assess the solo Solvency Capital Requirement of related undertakings, the provisions defined at solo level shall apply. Therefore intra-group arrangements can be taken into account. However, this calculation shall not take into account any group diversification, either directly or indirectly (e.g., by using group consolidated parameters). The principles set out in the CEIOPS Advice on Group Solvency Assessment and related to the possible consolidation methods and the assessment of diversification benefits shall apply to the assessment of the group Solvency Capital Requirement with an internal model. The Solvency Capital Requirement shall thus be calibrated in a way that it does not reflect any restriction about the ability of own funds located in a related undertaking to cover any kind of losses within the group.

Benchmark portfolios

6.58. Supervisory authorities may require undertakings to run their internal model on relevant benchmark portfolios or using external assumptions whenever they have concerns about the calibration of the internal model and the adequacy of its specification. This may occur during the approval process or as part of the SRP, and may be asked individually or for the whole market (or segments of it).

6.59. Flexibility shall be given to supervisory authorities regarding the level at which the benchmark portfolio is constructed. This construction of the portfolios will be considered as part of CEIOPS Level 3 work.

6.60. If the results of the test raise questions about the appropriateness of the calibration of the internal model and its specifications, the consequences may encompass the rejection of the model, or one of the actions set out in Article 118(1).

7. Profit and loss attribution

7.1 Introduction

7.1. One of the requirements for an internal model to be approved for calculation of the regulatory capital under Solvency II is that the undertaking must perform a Profit and loss attribution as set out in Article 123 of the Level 1 Text. This Section sets out the draft technical Advice to the Commission relating to the Profit and loss attribution to be carried out.

7.2. This Section considers the general Advice relating to Profit and loss attribution for internal models as well as the specificities related to group models. However, the Advice does not consider the specificities related to the Profit and loss attribution for partial internal models, which has been released in a CEIOPS Consultation Paper in October 2009.

7.3. This draft Advice takes into account, amongst other, the information gathered by CEIOPS in their Stock-taking Report on the use of internal models in insurance, and from pre-visits to undertakings.

7.2 Legal Basis

7.4. Article 123 sets out the requirements for Profit and loss attribution.

Article 123

Profit and loss attribution

"Insurance and reinsurance undertakings shall review, at least annually, the causes and sources of profits and losses for each major business unit.

They shall demonstrate how the categorisation of risk chosen in the internal model explains the causes and sources of profits and losses. The categorisation of risk and attribution of profits and losses shall reflect the risk profile of the insurance and reinsurance undertakings".

7.3 Advice

7.3.1 Major business Units

7.5. According to Article 123, an undertaking shall regularly review the sources and causes of profit and loss for each major business unit. It is important to recognise that the business units for which risk treatment is performed do not necessarily have to be legal entities. Further consideration of the definition of a major business unit is addressed in the CEIOPS Consultation Paper relating to Partial Internal Models, released in 2009.

7.6. The review of the causes and sources of profits and losses should be geared to the categorisation of risks. This will allow the undertaking to demonstrate that the sources are classified according to the risks the insurance or reinsurance undertaking takes into account and which reflect the risk profile of the undertaking.

7.7. The Profit and loss attribution should make transparent the causes and sources of profit and loss. The comparison to considered risks, either with the internal model or in the qualitative risk management system gives important information about possible gaps or misjudgement. Useful information will also be received about, for example, the top risk exposures (for example the top 5 natural-hazard exposures).

7.8. The Profit and loss attribution for each major business unit shall be as transparent as possible. The attribution shall enable the undertaking to explain sources of its annual profit and loss. Furthermore the Profit and loss attribution has to be a tool for validating the internal model (Article 124) and for managing the business (Article 120).

7.9. In any case, sources and causes for the attribution process should be granular enough to allow the identification of weaknesses of the internal model. For example, missing risk factors in the internal model may be detected through a large amount of unexplained profits and losses.

7.3.2 Profit and loss attribution and the Use test

7.10. The results of the Profit and loss attribution exercise provide information that has to be used for the system of governance (including the ORSA, risk management, limit setting, allocation processes). Therefore the Profit and loss attribution is very important to show compliance with the Use test.

7.11. As an example, the Profit and loss attribution will give the undertaking information relating to the risk profile of the undertaking, and therefore CEIOPS expects that this information is also used in the ORSA. The Profit and loss attribution may also provide an unbiased view on the risks of the portfolio to better understand the portfolio exposures and assess whether the risk management framework is appropriate.

7.12. There are also further ways in which the results of the Profit and loss attribution can assist in showing that the model is used. As an example, the results of the Profit and loss attribution can also be used for other internal purposes such as budgeting, forecasting, reinsurance-program testing.

7.3.3 Profit and loss attribution and validation of the internal model

7.13. How the Profit and loss attribution is linked to the validation process is considered in Section 8.3.6.

7.3.4 Categorisation of risks

7.14. Undertakings shall demonstrate how the categorisation of risks explains the causes and sources of profits and losses. The categorisation of risks is a result of a qualitative and a quantitative assessment and is also described earlier in this Paper in Section 5.3.5 relating to the diversification benefit in the Statistical quality standards.

7.15. Regarding the quantitative assessment, the categorisation of risks shall be based on the results of the internal model. The economic capital requirements relevant for the system of governance (including the ORSA, risk management, limit setting, allocation processes) and resulting from the internal model shall be used for the categorisation of risks. These results shall lead directly to a categorisation of all material risks.

7.16. The qualitative assessment of non-material risks or non-quantifiable risks completes the categorisation of risks based upon the internal model results.

7.3.5 Form of profit to be taken

7.17. The Level 1 Text does not set out on which definition of profit and loss the Profit and loss attribution should take place. Different options that could be considered include:

a. Internal definitions for profits and losses, consistent with the variable underlying the probability distribution forecast (Article 121),

b. Profits/losses reported on an IFRS basis in the accounts

c. MCEV profits and losses as reported in addition to the accounts by some undertakings

7.18. The profits and losses used for the purposes of the Profit and loss attribution shall also be used as part of satisfying the Use test. Hence the profits and losses have to be appropriate for the system of governance (including the ORSA, risk management, limit setting, allocation processes). Therefore CEIOPS Advice is to use the definition set out in 7.17 a above, i.e. to use internal definitions for profits and losses, which should be consistent with the variable underlying the probability distribution forecast (Article 121). The variable may differ from basic own funds, because a different internal definition may be used for economic capital resources. Undertakings shall be aware how the profits and losses used in the Profit and loss attribution may differ from the profits and losses reported in their accounting systems and what the causes of these differences are.

CEIOPS' Advice

7.19. The Profit and loss attribution for each major business unit shall be as transparent as possible. The attribution shall enable the insurance or reinsurance undertaking to explain a large part of its annual profit and loss. Furthermore the Profit and loss attribution has to be a tool for validating the internal model (Article 124) and for managing the business (Article 120).

7.20. The economic capital requirements resulting from the internal model shall lead directly to a categorisation of all material risks. The qualitative assessment of non-material risks or non-quantifiable risks completes the categorisation of risks based upon the internal model results.

7.21. The profits and losses used for the purpose of the Profit and loss attribution shall also be used as part of satisfying the Use test. Hence the profits and losses have to be appropriate for the system of governance. Therefore CEIOPS Advice is to use internal definitions for profits and losses, which shall be consistent with the variable underlying the probability distribution forecast (Article 121). The variable may differ from basic own funds, because a different internal definition may be used for economic capital resources. Undertakings shall be aware how the profits and losses used in the Profit and loss attribution may differ from the profits and losses reported in their accounting systems and what the causes of these differences are.

8. Validation

8.1 Introduction

8.1. One of the requirements for an internal model to be approved for calculation of the regulatory capital under Solvency II is that the internal model must be validated by the undertaking as covered in Article 124 of the Level 1 Text. This Section sets out the draft technical Advice to the Commission relating to the validation of internal models under this context.

8.2. Whereas no model can predict uncertain future events with absolute certainty, the validation of an internal model can give the undertaking a degree of confidence that the internal model is appropriate for the purpose for which the model is to be used.

8.3. This Section considers the general Advice relating to validation for internal models as well as the specificities related to group models. However, the Advice does not consider the specificities related to the validation of partial internal models, which has been released in a CEIOPS Consultation Paper in 2009.

8.4. This draft Advice takes into account, amongst other, the information gathered by CEIOPS in their Stock-taking Report on the use of internal models in insurance, and from pre-visits to undertakings.

8.2 Legal Basis

8.5. Article 124 sets out the standards for model validation.

Article 124

Validation standards

"Insurance and reinsurance undertakings shall have a regular cycle of model validation which includes monitoring the performance of the internal model, reviewing the on-going appropriateness of its specification, and testing its results against experience.

The model validation process shall include an effective statistical process for validating the internal model which enables the insurance and reinsurance undertakings to demonstrate to their supervisory authorities that the resulting capital requirements are appropriate.

The statistical methods applied shall test the appropriateness of the probability distribution forecast compared not only to loss experience but also to all material new data and information relating thereto.

The model validation process shall include an analysis of the stability of the internal model and in particular the testing of the sensitivity of the results of the internal model to changes in key underlying assumptions. It shall also include an assessment of the accuracy, completeness and appropriateness of the data used by the internal model".

8.3 Advice

8.3.1 Rationale for Validation

8.3.1.1 Why do supervisory authorities require validation of internal models and why it is important?

8.6. Under Solvency II, undertakings will have the ability to use internal models to calculate their regulatory capital if the model has been approved by the supervisory authority, as set out in Article 112(1). The objectives of allowing undertakings to use their own internal model to calculate the SCR have been set out in CEIOPS' Advice on Pillar 1 issues:

"6.446 CEIOPS has identified a number of objectives and potential benefits of basing the SCR on the internal risk modelling of an undertaking as an alternative to the standard formula approach.

6.447 The major supervisory objectives can be summarized as (CfA 11.64):

- *better risk management, which also improves policy holder protection (CfA 11.4),*
- *continual upgrading and encouragement of innovation in risk management methodology (CfA 11.2 and 11.4) and*
- *improved risk sensitivity of the SCR, especially for undertakings with non-standard risk profiles (CfA 11.2-11.3).*

6.448 The development of internal models can potentially deliver a wide range of benefits to supervisors, undertakings and, ultimately, policy holders (CfA 11.7 and 11.65):

- *higher competitiveness through better risk management and hence lower costs of capital;*
- *more adequate modelling of non-standard, especially non-linear, contracts;*
- *more effective Pillar 2 discussion and familiarity of the supervisor with more detailed exposure data than is generally available in accounting records; and*
- *realization of cost efficiencies through re-use of risk modelling infrastructure for discussion with supervisors, rating agencies, analysts and shareholders."*

8.7. In designing the internal model, the Level 1 Text allows a large amount of freedom to the undertakings. Two examples of this are given below:

a. Article 121(4) sets out that "*No particular method for the calculation of the probability distribution forecast shall be prescribed.*"

b. Article 122(1) sets out that "*Insurance and reinsurance undertakings may use a different time period or risk measure than that set out in Article 101(3) for internal modelling purposes as long as the outputs of the internal model can be used by those undertakings to calculate the Solvency Capital Requirement in a manner that provides policy holders and beneficiaries with a level of protection equivalent to that set out in Article 101.*"

8.8. It is important for undertakings to appropriately use their internal model to measure and manage their risks according to the risk profile of the undertaking.

8.9. In addition to being used for the undertaking's own risk management purposes, the internal model is also used to calculate the regulatory capital. Materially misstating the regulatory capital, especially holding regulatory capital that is not high enough, will result in a decrease in the level of the policy holder protection provided by the undertaking.

8.10. Therefore, the primary reason that supervisory authorities will require undertakings to take appropriate steps to validate that the internal model is appropriate for the calculation of regulatory capital is to ensure that the level of regulatory capital is not materially misstated so as to decrease the level of the policy holder protection provided by the undertaking.

8.11. In addition, Article 120 requires the undertaking to

"demonstrate that the internal model is widely used in and plays an important role in their system of governance, referred to in Articles 41 to 50, in particular:

(a) their risk-management system as laid down in Article 44 and their decision making processes;

(b) their economic and solvency capital assessment and allocation processes, including the assessment referred to in Article 45."

8.12. Thus any material mis-estimation within the internal model will affect not only policy holder protection, but also the whole risk management and decision making processes of the undertaking.

8.13. Therefore supervisory authorities will also require undertakings to take appropriate steps to validate that the internal model is appropriate for use within the undertaking's risk management and decision making processes.

8.14. The importance of improving validation process has been highlighted by the work that has been done by CEIOPS to identify lessons learnt from the recent economic crisis.

8.3.1.2 What is validation?

8.15. Validation is a set of tools and processes used by the undertaking to gain confidence over the results, design, workings and other processes within the internal model. These tools and processes used for validation will be quantitative as well as qualitative. In fact, having in place only quantitative systems for validation with no scope for qualitative interpretation of the results from these systems will pose serious risk to the undertaking, as it is highly unlikely that the undertaking will be able to design quantitative processes that will be able to explain sufficiently all the results and processes of the model.

8.16. When considering the scope of what parts of the internal model framework need to be validated there are different interpretations. One interpretation would be for the scope to include only the validation of the calculation kernel of the internal model that calculates the SCR. This would provide comfort on some aspects of the SCR calculation, but would not provide any comfort on the qualitative aspects of the internal model (cf. 5.3.1.2).

8.17. Another interpretation would be for the validation scope to include all the quantitative processes defined in the calculation kernel of the internal model, as well as the qualitative processes defined in the internal model. This would provide comfort on both the quantitative and qualitative aspects of the internal model.

8.18. CEIOPS considers that because of the broad scope of the internal model the validation does not only apply to the calculation kernel to calculate the SCR, but shall encompass the qualitative and quantitative processes of the model. Examples of the areas of the internal model that need to be validated shall include at least:

a. Data

b. Methods

c. Assumptions

d. Expert judgement

e. Documentation

f. Systems/IT

g. Model governance

h. Use test

Note that this is not an exhaustive list. In addition, the scope of the validation structure of the internal model shall include the review of the validation policy itself, as set out below in Section 8.3.2.

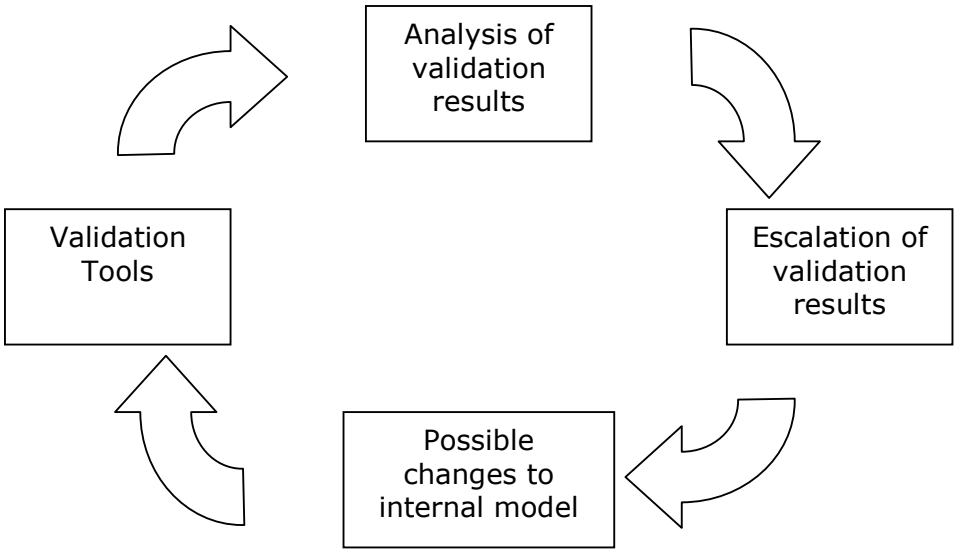
8.19. CEIOPS envisages that the validation of qualitative aspects of the model, such as the model governance and the Use test, will not be performed by the quantitative tools usually associated with validation, such as those set out in Sections 8.3.3 to 38.3.3.1.4. Instead this part of the validation process will relate to the steps taken by the undertaking to gain confidence that the qualitative aspects of the model are appropriate. For example, how has the undertaking gained confidence that they are meeting the Use test, and how has the undertaking gained confidence that they have the appropriate governance systems in place?

8.20. The validation cycle is an iterative process. It forms part of the requirement set out in Article 124 of the Level 1 Text that the administrative, management or supervisory body shall be responsible for ensuring the on-going appropriateness of the design and operations of the internal model, and that the internal model continues to appropriately reflect the risk profile of the undertakings concerned. **Therefore it is the undertaking which has the primary role in this process, not the supervisory authority.**

8.21. The validation cycle will include the use of various tools, some of which are described in Sections 8.3.3 to 38.3.3.1.4. Once these validation tools are run, the results of the validation tools shall be analysed by the undertaking. This shall include a qualitative analysis of the outputs of the quantitative validation tools.

8.22. The validation cycle is also linked to the wider internal model governance requirements, as the results of the analysis shall be escalated to the appropriate level of management.

8.23. The undertaking shall then use this information to assist in determining any changes that may be required to the internal model. A simplified diagram of this validation process is included below:



8.24. There is a link between the internal audit function and validation, as parts of the validation activity may be carried out by the internal audit function. More detail of the internal audit function can be found in the CEIOPS Advice to the Commission on the system of governance.

8.25. The validation process, for which the undertaking is responsible, must not be mistaken for the approval process, in respect of which the supervisory authority needs to take a decision. As part of the approval process, the supervisor will need to evaluate the validation processes which the undertaking has in place. Further details of the approval process undertaken by the supervisors can be found in the CEIOPS Advice on the procedure to be followed for the approval of an internal model.

8.26. Owing to the large scope of the validation process, there may be a resource constraint on the undertaking to put the appropriate validation tools and processes in place. Undertakings may make use of external review and systems to assist the undertaking with their validation, but the ultimate responsibility for signing off the appropriate validation processes shall fall on the board of the undertaking, and this responsibility may not be delegated to any third party.

8.3.2 Validation Policy

8.27. As illustrated in Section 8.3.1 of this document, the validation of internal models by undertakings is very important, and failure to have appropriate validation procedures in place will affect the security of policy holders' benefits.

8.28. Setting out a detailed list of which validation procedures are deemed to be appropriate may cause difficulties, as different procedures may be

more appropriate for different undertakings, depending on the type of model, the risk profile and the corporate structure of the undertaking. In addition, setting out validation procedures that are appropriate and sufficient now, may not be appropriate and sufficient in the future.

8.29. Therefore, CEIOPS recommends that undertakings shall have a validation policy, which sets out the way in which they will validate their own internal model and why that way is appropriate. Specifically, this validation policy shall set out at least the following items.

8.3.2.1 Purpose and Scope of Validation

8.30. The undertaking shall with respect to both design and operational aspects of the internal model set out the parts of the internal model that will be covered by the validation policy. The minimum scope of the validation policy was set out in paragraph 8.18. However, if exceptionally there are further parts of the internal model framework which are not covered by the validation policy, the undertaking shall also explicitly state this. For the parts of the internal model not covered, the undertaking shall set out why it is appropriate not to cover those parts.

8.31. In addition, the undertaking shall set out the extent to which they will aim to gain comfort that their internal model is appropriate, and also set out how they will achieve this level of comfort. When setting the scope of validation, undertakings may consider the materiality of the different internal model components. However undertakings may also need to consider sensitivity testing when determining the materiality of various internal model components.

8.32. Where expert judgement is used, the validation policy shall explicitly consider the validation of expert judgement as set out in 5.165.

8.3.2.2 Tools used

8.33. The undertaking shall set out which validation tools it will use to achieve the purpose and scope which it has defined in the validation policy. ”Validation tool” means any approach designed to gain comfort that the internal model is appropriate and reliable. It may be a mathematically well defined test, a qualitative judgement or any other process with such an aim.

8.34. It would not be appropriate to prescribe the tools to be used by all undertakings. Different tools will have different characteristics, and will be appropriate for different uses. Some tools may be more appropriate to validate certain risks than other validation tools. Thus, each undertaking will need to consider which validation tools will be most appropriate for the undertaking to meet the purpose and scope that has been set within the undertaking’s validation policy. In addition, further validation tools may be developed in the future which may be more effective or more appropriate than tools currently available.

8.35. Different validation tools are discussed later in this Section. Some of the validation tools will need to be used by all undertakings, as the tests are

prescribed in the Level 1 Text. It will be up to the undertakings themselves to set out how they will use further validation tools within their validation policy.

8.36. With each further test that is used by the undertaking, the undertaking will be able to gain an extra level of comfort that the internal model is appropriate for use.

8.37. Many of the tools will be iterative in nature, requiring the tools to be used or run a number of times in order that the undertaking can obtain comfort that the internal model is appropriate.

8.38. CEIOPS may provide further guidance on various validation tools in Level 3 guidance.

8.3.2.3 Frequency of validation process

8.39. The frequency with which validation will be carried out for the various components of the model shall be established within the validation policy, with for instance due account being taken of the frequency of up-dating the respective part of the model. Significant changes in the external environment may necessitate additional ad hoc checks on the validity of the internal model. The proportionality principle shall be observed in considering how frequently the various aspects of the model shall be validated.

8.40. The undertaking shall set out limits on when events become significant enough to lead to further ad hoc checks on the validity of the internal model.

8.41. Different validation tools may be run with different frequencies.

8.3.2.4 Governance of validation results

8.42. The validation policy shall set out clear responsibilities for all the validation tasks required in the validation process. Article 44(5) sets out that the risk management function shall be tasked with the validation of the internal model. Nevertheless, certain parts of the validation process may be carried out by other parts of the undertaking, as long as there are clear lines of reporting and the risk management function retains overall responsibility for the validation process.

8.43. The validation policy shall set out how the results of the different validation tools are reported, for both regular validation as well as ad hoc checks described in 8.38 above, and how they will be used if the tests show that the internal model did not meet its objectives.

8.44. There shall be a clear escalation path setting out how the results are escalated within the governance structure of the internal model. Specifically, the undertaking shall define pre-set criteria which will determine whether the results are required to be escalated.

8.45. The validation policy shall also set out how the senior management is involved in the validation processes.

8.46. For groups the governance of the validation results shall also consider the allocation of responsibilities for validation at different levels within the group. Specifically, consideration needs to be given to what is validated at group level and what is validated at the related undertaking level.

8.3.2.5 Limitations and future developments

8.47. The undertaking shall set out all the known limitations of the current validation policy, with specific reference made to any parts of the internal model that exceptionally are not covered by the validation policy. In addition the undertaking shall set out its planned developments in the validation process to meet these limitations.

8.48. In addition, we would expect that the model and its associated validation processes will constantly develop as the risk profile of the undertaking develops and as new validation tools become available to the undertaking. The undertaking shall set out its planned developments in its validation policy.

8.3.2.6 Documentation of the validation policy

8.49. The validation policy shall be documented. Specifically, the carrying out of the validation process and the responsibilities shall be defined clearly and in an understandable way for knowledgeable third parties, and shall be geared to the organisation of the respective undertaking.

8.3.2.7 Independent review

8.50. Independence within the validation process is essential to effective validation as it creates objective challenge to the internal model.

8.51. The validation policy shall set out how independent review, external or internal, is being used within the validation process. The undertaking shall set out how the review is independent, taking into account at least the responsibilities and the reporting structures for internal review and remuneration structures for external review. The validation policy shall refer to the independence of all parts of the validation process, including the quantitative tools as well as the qualitative analysis performed as part of the validation process.

8.52. Undertakings shall also consider how independence is maintained over time. As an example, if model changes are implemented in response to an independent review, the review of the change by the same reviewer in future validation cycles may result in a decrease in independence over time. A proportionate approach to maintaining independence over time needs to be taken by the undertaking to ensure that it is manageable.

8.53. The principle of proportionality should also be taken into account, especially for undertakings with limited resources. In its Advice on Proportionality[23], CEIOPS advised that we are seeking

"an effective validation, for which an objective challenge is essential. In this spirit, ensuring the structural independence of the validation function can be a means to that end. When deciding who will perform this task, due consideration must be devoted to the nature, scale and complexity of the risks that the insurer faces and also to the internal organisation of the undertaking and its governance system. CEIOPS is of the view that the right balance must be struck between any potential conflict of interest that might arise in the course of the validation of the internal model on the one hand, and a disproportionate level of segregation of duties on the other hand."

8.3.3 Validation tools

8.54. As set out in paragraphs above, some validation tools will need to be used by all undertakings using an internal model to calculate the SCR. In Section 8.3.3.1, we have set out these validation tools. The tools set out in this Section are

a. Testing results against experience

b. Testing the robustness of the internal model

c. Stress and scenario testing

d. Profit and loss attribution

8.55. Further validation tools are considered in Section 8.3.3.2. The validation tools introduced in this Section are not part of the advice on Level 2 implementing measures, but have been included to provide a view on what further validation tools undertakings may want to use in their validation process. Further details of these validation tools may be provided in Level 3 guidance. The tools set out in this Section are

a. Benchmarking

b. Analysis of change

c. Hypothetical portfolio

d. Qualitative reviews

[23] http://www.ceiops.eu/media/docman/public_files/publications/submissionstotheec/AdviceProportionality.pdf

8.3.3.1 Validation tools to be used by all undertakings using an internal model

8.3.3.1.1 Testing results against experience

What is it?

8.56. The testing of results of the internal model against experience is used to assess the discrepancies between forecasts made by the model and actual realisations. Where actual realisations may not be directly available, the model forecasts may be compared to realisations made on the base of comparable data set. Where comparable data sets are used, CEIOPS notes that there is a danger of subjectivity when choosing a comparable data set and advises that undertakings should justify why the comparable data set chosen is appropriate. This testing of results against experience tells us to which extent the prediction proved right and how the assumptions were adequate to the reality and for this reason it is an inherent part of the validation process.

8.57. For the remainder of this Section, this process of testing model results against experience will be referred to as "backtesting". This is not directly comparable to the term as it is used in the banking sector, as the availability of data to test against is not comparable for many risks faced by undertakings. In banking, backtesting is generally understood as a comparison of predictions to actual realizations, as well as out of sample methods. In addition to this, backtesting for undertakings may include different forms of testing than that used in banking. As an example, undertakings may perform additional tests such as:

- compare actual experience against prediction of inputs into the calculation kernel to determine the quality of parameter estimation, or
- overall goodness of fit tests to investigate the shape and stability of the distribution.

8.58. Where there is less data, some techniques can be used that are similar to those used for backtesting counterparty credit risk in the banking sector. These include using various time horizons and various confidence levels to avoid concentrating on one percentile level.

8.59. In general, backtesting consists of the following steps. Firstly one or more trigger events are defined, such as the actual realisation of a loss that exceeds a predetermined limit. The occurrence of this trigger event leads then to an investigation which typically covers the following topics:

a. Identification of the portfolio where the event was triggered.

b. Analysis of the root causes that led to this event, such as movements of market prices or changes in other parameters.

c. Examination of how the root causes are reflected in the internal model with the aim of identifying potential model weaknesses.

d. Sometimes, the comparison of large movements in profits and losses to the existing stress tests can provide useful indications of the continued validity of the stress test assumptions.

8.60. In addition, undertakings shall also, on a regular basis, analyse the results of the backtesting that are not above the trigger event, as this may provide additional information on the shape of the distribution, as well as information on the performance of the model for new business where there is limited data.

Why do we need it?

8.61. This kind of analysis is necessary to indicate some shortcomings which can not be detected in any other way. In addition, backtesting is a process which may be easily automated or industrialized and thereby efficiently applied to a large number of portfolios with a high frequency. However the implicit assumption is that past performance is a good indicator of future performance, and therefore every backtesting exercise must be supplemented with a qualitative analysis of the results.

8.62. The backtesting enables undertakings to find the various kinds of errors, such as modelling and estimation errors, depending on what is subject to backtesting (from risk factors to the whole portfolio). The detection of divergences is necessary to eliminate systematic modelling errors.

8.63. To this end the assumptions on distributions of and dependencies between risk factors and their impact on relevant quantities shall be questioned. It shall also be asked whether relevant risk factors are excluded.

Hook to Level 1 Text and link to validation policy

8.64. According to Article 124 of the Level 1 Text, the regular cycle of validation of the internal model should be *"testing its results against experience"*. *It* should be highlighted that this validation is complementary to other review methods.

8.65. Using backtesting results (the significant deviations between actual and predicted values) to change parameters without any qualitative analysis of those results may lead to the parameters systematically being strengthened or weakened without proper analyses of whether the underlying risk has actually changed. In addition, this practice will make the model appropriate for the past experience, but possibly not appropriate for the future experience which the model is trying to represent.

8.66. The backtesting results shall be the basis for an analysis which identifies the reason for the divergence between the modelled results and reality. Undertakings shall decide on the base of other validation techniques, some of which are discussed in this Section, and qualitative analysis

whether the deviation is for example the consequence of a lucky or unlucky random change in environment, a permanent change or rather a model assumption error or parameter estimation error. The qualitative analysis is the most important part of the backtesting process.

8.67. There shall be discussion at the appropriate level of management, whether deviations will for example lead to a change to the model, and whether the change will be to the model structure or only to some of the parameter values. The precise escalation path and management decision taking process in response of the significant deviations (the word "significant" must be defined by the undertaking in its internally defined error tolerance) shall be the part of the validation policy. The policy shall contain the goals and measures of the backtesting.

Scope of backtesting

8.68. Backtesting shall be applied at various levels of the business activity (for example to loss ratio or equity volatility but also to portfolio profit and loss distribution). Where the undertaking has more data available, more detailed backtesting can be done and more comfort can be drawn from this process.

8.69. Where expert judgment was used in the modelling, then backtesting will also include a commonsense comparison between prediction and realization. Backtesting shall be carried out at least annually and ideally more often if practical. The frequency of backtesting shall be commensurate with the frequency of valuation and the generation of the probability distribution forecast and shall be defined by the undertaking in the validation policy.

8.70. Backtesting shall occur at a sufficiently granular level, to provide sufficient information to assist the undertaking in the validation process as defined by the validation policy of the undertaking.

Data

8.71. Backtesting requires data of good quality and of an appropriate time period to be collected. These aspects of data are considered in the CEIOPS' draft Advice given in Section 5 of this Paper.

8.72. In certain cases, data may need to be adjusted to be comparable and a "cleaning" exercise (correction or removal of erroneous (dirty) data) may be required.

Comparing model to model, or model to reality?

8.73. In some cases, the actual data required for the actual against expected comparison may not be directly available, and the actual data may need to be estimated or approximated by a model. In this case, the model predictions shall be compared to data which is as "real" or "market–based" as is practically possible. Where this is the case and model predictions are compared to estimates of the actual data based on models, there may be an increased danger of overlooking model

weaknesses. Similarly, comparing the model against the same data that is used for calibrating the model may hide model weaknesses.

8.3.3.1.2 Testing the robustness of the internal model

8.74. In Article 124, the Level 1 Text states that *"the model validation process shall include an effective statistical process for validating the internal model which enables the insurance and reinsurance undertakings to demonstrate to their supervisory authorities that the resulting capital requirements are appropriate"*.

8.75. Undertakings shall perform an analysis of the robustness of their internal model. This analysis shall include at least sensitivity testing and further tests on the stability of the model. This part of the validation process is closely linked to, and to a certain extent difficult to isolate from, the statistical quality testing, backtesting and stress and scenario testing analyses.

8.76. Sensitivity and stability analysis of an internal model consists of assessing the extent to which its outputs (such as regulatory capital requirements, economic capital, asset valuations, and so forth) are sensitive to the key underlying assumptions; this assessment covers not only parameters, but also the structure and formulation of the internal model.

8.77. This analysis may be performed by introducing small changes to assumptions and may also be complemented by a qualitative review of the model results derived from changes to:

a. the model architecture, structure (for example structural changes under the same family of models), formulaic definition and/or numerical procedures; and/or

b. the parameters used by the model.

Sensitivity testing

8.78. By testing of the sensitivity of results to changes in key underlying assumptions, the internal modelling is challenged. In this sense, these analyses are to be considered as assessments of model risk or parameter risk, depending on which assumptions are changed. These analyses help the undertaking to identify the key assumptions underlying its model and to quantitatively asses their significance. Sensitivity analyses introduce forward-looking elements into the capital planning process.

8.79. The internal models rest on assumptions of various kinds, some of which are obvious, while some are less so. As such, certain aspects of models are 'built-in' and cannot be altered without changing the model. To illustrate, these assumptions could be: assumptions about the shape of tail distributions, assumptions about the behaviour of senior management or of customers, or assumptions underlying expert judgement used to assist in deriving some parameters in the model. The

undertaking shall examine whether the model output is sensitive to changes in key assumptions made.

8.80. The requirement for the documentation of the assumptions made is considered in the documentation Section 9. In addition to these general documentation requirements, the undertaking shall identify and document the most significant assumptions and demonstrate the effect on the results to changes in the assumptions. This analysis shall also be completed as part of the statistical quality standards with regard to the justification of underlying assumptions, considered in Section 5.3.2.4 of this Paper. The undertaking shall also identify and document the assumptions that are key to the undertaking's business and its future plans. The undertakings shall describe all model modifications they have decided to make as well as further steps or development plan.

8.81. The results from sensitivity testing shall be reviewed regularly and shall be considered when establishing policies and limits.

8.82. Sensitivity testing is especially important in validating parts of the internal model which place particular reliance on expert judgement, or where the expert judgement has a material impact on the results. This is due to the level of uncertainty that may be associated with the expert judgement. An example where this may be the case is where expert judgement is used to assist in determining the dependency structures between risks.

8.83. The difference between the significant changes in the output as a consequence of small changes in parameter due to the model characteristics or for any other reason shall be recognised by the undertakings. In some cases a small difference in the input may justifiably result in a large difference in the output, for example:

- if there is a discontinuous distribution within the calculation kernel
- if the model output is very sensitive to the model input due the nature of the risk profile of the undertaking

In these cases, the undertaking must be able to explain the underlying reasons for the sensitivities and the sensitivity testing should illustrate how the cause-effect-relation is modelled adequately. This sensitivity testing will identify the stability and the robustness of the model.

8.84. When changes in model output are exceptional or contrary to expectations, this instability - if material - has to be resolved by changing the model. Article 115 of the Level 1 Text sets out more detail about the policy for model changes.

8.85. Sensitivity tests may be run relatively quickly and may be used by senior managers to form a first approximation of the impact on the undertaking of certain events, such as a movement in a financial variable. By sensitivity testing undertakings may estimate current losses (or profits) by scaling market moves to unit changes.

8.86. Sensitivity tests may also examine the effect of making changes in a number of factors at the same time. Depending on the relationship between the factors, testing factors at the same time may provide the maximum loss, but the unrealistic combination of risks may result in a loss that is overly pessimistic as not all factors may be expected to move at the same time in all cases. Scenario testing, where a number of related events occur at the same time, is considered below in the Section dealing with stress tests.

Further tests on the stability of the model

8.87. Apart from sensitivity testing, further tests may be required to assess whether or not the results produced by the internal model are stable and robust. A further run of the model shall be able to produce results that are not significantly different if there have been no changes to the input parameters. Any changes in model output in these circumstances shall be reasonable, explicable and comprehensible. This testing may be especially relevant for stochastic models.

8.88. One such test is re-running a model with a different set of random numbers and assessing the stability of the results (i.e. reproducibility). This approach may also help to validate changes made to the model.

8.89. The calculation kernel of the internal model shall be deemed unstable if two runs of the same model with exactly the same input, parameters and data, and with an equal number of simulations gives a significantly different answer. A stochastic model shall be run using a set of random numbers derived from the same seed. The model shall be stable enough such that enough simulations are run to ensure the result at the 99.5th percentile is statistically significant.

8.3.3.1.3 Stress and scenario testing

8.90. The Level 1 Text states that the undertakings shall have processes in place as part of the ORSA to identify possible events or future changes in economic conditions that could have unfavourable effects on its overall financial standing. This is stress and scenario testing.

8.91. According to the Committee on the Global Financial System's (CGFS)

"Stress test is a risk management technique used to evaluate the potential effects on an institution's financial condition of a specific event and/or movement in a set of financial variables. It shall focus on exceptional but plausible events"[24].

8.92. Stress and scenario testing typically aims to assess the impact of a single event in a stress test, or to assess the impact of a combination of events, as in a scenario test. The source of the shock, or stress event, is well defined, as are the financial risk parameters which are affected by the shock. This is in contrast to sensitivity tests, described above in

[24] "Stress testing at major financial institutions: survey results and practice", CGFS, January 2005

Section 8.3.3.1.2, in which a parameter is changed, although the source of the shock is not identified. Moreover, the time horizon for sensitivity tests is generally shorter - often instantaneous - in comparison with scenarios[25].

8.93. Stress and scenario testing is one of the quantitative tools used in a validation process by the undertakings and may assist by:

a. providing information relating to the dependencies between risks and capturing non linearity

b. getting further insight into the tail of the loss distribution

c. capturing the impact on a portfolio of exceptional but plausible large-loss events

d. understanding the risk profile of an undertaking

e. allocating and verifying of limits and capital

f. identifying possible shortcomings of the model – in this case modifications shall be made to the model in order to correct these shortcomings

8.94. As a validation tool stress and scenario testing shall permit a degree of confidence by providing more information about what results may look like under various conditions. It may also identify possible limitations of the model, thereby increasing the confidence of users in the outputs of the model. The stress and scenario testing and the resulting effects shall be monitored, assessed and updated on an ongoing basis by the undertakings.

8.95. The stress and scenario tests are intended to help quantify the financial effects on the undertaking of the risks that it is running. The undertaking shall ensure that its stress and scenario testing methodologies are consistently and comprehensively applied throughout the undertaking.

8.96. An internal model shall embody assumptions about relationships between variables and about their behaviour under periods of stress. Stress and scenario testing can also support the development of long-term business plans, by modelling the impact of changes on the level of risk to which the undertaking is exposed and their implications for risk management. Stress and scenario testing may help the undertaking to ascertain whether its tolerance limits remain suitable for its business, or whether the business it has written continues to meet its risk tolerance.

8.97. We recognise that undertakings' stress tests and scenarios may be developed by a special risk management team, risk experts, consultants or academics and derived by using statistical analysis, expert judgement or applying 'historical' scenarios. Stress tests shall cover at least deterministic scenarios, but may cover scenarios that have been

[25] "Stress testing at major financial institutions: survey results and practice", CGFS, January 2005

stochastically generated as well. Stress tests that have been stochastically generated may provide more information than deterministic stress tests. Stress tests may be of limited scope (for example only assets) and/or cover both assets and liabilities.

8.98. Undertakings shall analyse the results, review the interaction of risks and mitigating actions, make recommendations and revise scenarios and calibrations in the light of the results. The results shall, as applicable, be reviewed both at local as well as at group level. The results shall be compared to risk tolerance or limits as defined by the undertaking. The senior management shall be involved in overseeing a comprehensive and coordinated stress and scenario testing programme.

8.99. Stress and scenario testing shall be individually set out by the undertakings or groups based on their own experience. Supervisory authorities may prescribe the areas/risk which shall be stressed by the undertakings. Undertakings shall develop their own stress and scenario tests which they identify as most appropriate, based on the characteristics of their own portfolios. Undertakings shall provide their supervisory body with a description of the methodology used both to select stress and scenarios and that used to carry out these stress and scenario tests in the model and the risk management system. They shall also explain why these selected stress and scenario tests are adequate for their risk profile.

8.100. Undertakings shall also conduct reverse stress tests to understand what stresses would seriously threaten their viability. In a reverse stress test, undertakings would be expected to identify scenarios that could threaten their survival and describe the precautions they were taking against them. Reverse stress tests shall, as applicable, be carried out on a solo as well as group basis. We will expect an undertaking to document its reverse stress testing and to be able to demonstrate that it has been signed off by its board and supervisory authorities may seek to review it as well.

8.101. Reverse stress testing shall also determine what scenarios could challenge the viability of the undertakings and thereby uncover hidden risks and interactions among risks. A reverse stress test induces undertakings to consider scenarios beyond normal business settings and leads to the identification of events with contagion and systemic implications.

8.102. The implementation of the stress and scenario testing requirement shall be proportionate to the nature, scale and complexity of an undertaking's business. The undertakings shall describe further steps in respect of stress and scenario testing or describe their development plan if any.

8.103. For group internal models, consideration will need to be given to the interaction between the related risks in different subsidiaries. As an example a natural catastrophe for a subsidiary in one country may coincide with a natural catastrophe in a neighbouring country.

8.104. One of the conclusions from the CEIOPS lessons learned from the crisis document is that stress testing should be used in the process to internally challenge model results and some parameters, such as correlations.

8.3.3.1.4 Profit and loss attribution

8.105. The process of Profit and loss attribution is described in Section 7.

8.106. Profit and loss attribution provides information as to whether the risks in the internal model are complete, and whether there are any material risks in the risk profile of the undertaking which are not represented in the internal model. A large part of profits and losses that is unexplained may be an indication that not all material risks are covered by the internal model, and thus that the risks in the internal model are not complete. This may then imply that more risk factors may need to be introduced into the internal model.

8.107. Any indication from the results of the Profit and loss attribution which imply that the risk categorisation of the internal model does not reflect the risk profile of the undertaking shall be escalated to the management body. If further qualitative and quantitative analyses of the results show that the model does not reflect the risk profile appropriately, then the model shall be improved.

8.108. We have found that there are similarities between the Profit and loss attribution and backtesting. Both of these tools consider the results produced by the internal model and compare them to actual values available to the undertaking.

8.109. However, backtesting tests the results against experience to test the appropriateness of the probability distribution forecast, whereas Profit and loss attribution goes beyond this validation method. Nevertheless some work is done for the required Profit and loss attribution with backtesting methods.

8.3.3.2 Other tests to consider

8.3.3.2.1 Benchmarking

8.110. As noted in the specificities for internal models in the CEIOPS Advice on public disclosure, public transparency and disclosure requirements under Pillar III enhance market discipline and complement requirements under Pillars I and II. Different market participants could assess the internal model, make comparisons with peers and available (academic) literature and research, which would reinforce pillar I and II requirements.

8.111. This would however, require that information is disclosed to the highest level possible comparable, disclosed in a similar format and have a clear explanation of the differences from the standard formula.

8.112. This kind of comparison with or benchmarking against other internal models that suit the same purpose may be seen as one form of

validation tool. This validation tool may be especially helpful in considering alternative modelling approaches, but should not be used blindly, as it may encourage "herd mentality" and systemic risk[26]. Furthermore, great care needs to be taken when comparing figures from two different internal models since they might not be fully comparable with each other.

8.113. The benchmarking described above is performed by the undertaking, with benchmarks chosen by the undertaking. This is different to the benchmark portfolios described in Section 6 of this Paper where the supervisory authorities may require undertakings to run their internal model on relevant benchmark portfolios and using assumptions based on external rather than internal data in order to verify the calibration of the internal model and to check that its specification is in line with generally accepted market practice.

8.114. Undertakings may choose to separately benchmark various components of their internal model.

8.3.3.2.2 Analysis of change

8.115. An analysis of change considers how the results of the internal model have changed from one period to the next.

8.116. There is a large overlap between this tool and testing results against expected, as one of the reasons for the change in outputs of the model from one period to the next will be that assumptions made about future experience at the start of the period will be different to the actual experience which took place over the period.

8.3.3.2.3 Hypothetical portfolio

8.117. Another form of validation strongly related to benchmarking could be to run the internal model against a hypothetical portfolio of assets and/or liabilities. A hypothetical portfolio would be constructed and different internal models would be run to estimate the risk profile of hypothetical portfolio. The different outcomes would then be analysed and compared and outliers would be given special attention to.

8.118. This validation could overcome some of the comparison problems related to the benchmarking approach described above, but will nevertheless include similar systemic risk issues if used blindly.

8.119. This validation tool could be used by supervisory authorities as well as undertakings. An example of the application of this validation tool relates to liability valuation, where different ESG results for some traded financial instruments are compared with each other and analysed. In this example, care would be required in analysing the results, as the ESG may have been constructed for a specific type of asset class.

[26] CRO Forum,, Internal Model admissibility - Principles and criteria for internal models, April 2009

8.120. As with benchmarking, the hypothetical portfolios described above is performed by the undertaking with the hypothetical portfolios chosen by the undertaking, compared to the benchmark portfolios described in Section 6 which the supervisory authority may require specific benchmarking to be performed.

8.121. As with benchmarking, care should be taken with the use of hypothetical portfolios to avoid herding behaviour and systemic risk.

8.3.3.2.4 Qualitative reviews

8.122. This Section briefly describes further qualitative validation tools that may be used in the validation process. These tools are also introduced in the Paper considering the range of practices and issues in economic capital modelling written by BIS[27].

- **Use test**

8.123. Undertakings must pass the Use test, described in Section 3, if they are to be permitted to use their internal models to calculate the regulatory capital. However, the Use test may also provide a level of comfort to the supervisory authority that the undertaking is actually using the internal model and therefore the undertaking has a sufficient level of comfort that the outputs produced by the internal model are appropriate for use.

8.124. It should be stressed that compliance with the Use test alone does not mean that the internal model is validated, and that further validation tools will be required to validate the model.

- **Qualitative Review**

8.125. A qualitative review may be used to gain comfort over the theoretical basis of the internal model. This may include issues relating to the conceptual mathematical framework and whether the correct risk drivers are captured in the model.

8.126. The qualitative review may be of any part of the internal model. Typically, the qualitative review may be performed by an objective review of the documentation of the model, through dialogue with model developers.

CEIOPS' Advice

8.127. CEIOPS considers that the scope of the validation does not only apply to the calculation kernel to calculate the Solvency Capital Requirement, but shall encompass all the qualitative and quantitative processes of the

[27] http://www.bis.org/publ/bcbs143.pdf?noframes=1

model. Examples of the areas of the internal model that need to be validated shall include at least:

a. Data

b. Methods

c. Assumptions

d. Expert judgement

e. Documentation

f. Systems/IT

g. Model governance

h. Use test

In addition, the scope of the validation structure of the internal model shall include the review of the validation policy itself.

8.128. Once the validation tools are run, the results of the validation tools shall be analysed by the undertaking. This shall include a qualitative analysis of the outputs of the quantitative validation tools.

8.129. The validation cycle is also linked to the wider internal model governance requirements, as the results of the analysis shall be escalated to the appropriate level of management. The undertaking shall then use this information to assist in determining any changes that may be required to the internal model.

8.130. The undertaking shall be responsible for the validation process, not the supervisory authority.

8.131. Undertakings may use external review and systems to assist themselves with their validation. However, the ultimate responsibility for signing off the appropriate validation processes shall fall on the board of the undertaking, and this responsibility may not be delegated to any third party.

Validation Policy

8.132. Undertakings shall have a validation policy, which sets out the way in which they will validate their own internal model and why that way is appropriate. Specifically, this validation policy shall set out at least the following:

8.133. (a) Purpose and scope of validation

The undertaking shall with respect to both design and operational details of the internal model set out the parts that will be covered by the validation policy. The minimum scope of the validation policy was set out

in paragraph 8.122. However, if exceptionally there are further parts of the internal model framework which are not covered by the validation policy, the undertaking shall also explicitly state this. For the parts of the internal model not covered, the undertaking shall set out why it is appropriate not to cover those parts

8.134. In addition, the undertaking shall set out the extent to which they will aim to gain comfort that their internal model is appropriate, and also set out how they will achieve this level of comfort. When setting the scope of validation, undertakings may consider the materiality of the different internal model components. However undertakings may also need to consider sensitivity testing when determining the materiality of various internal model components.

8.135. Where expert judgement is used, the validation policy shall explicitly consider the validation of expert judgement as set out in 5.165.

8.136. (b) Validation tools used

The undertaking shall set out which validation tools it will use to achieve the purpose and scope which it has defined in the validation policy. ”Validation tool” means any approach designed to gain comfort that the internal model is appropriate and reliable. It may be a mathematically well defined test, a qualitative judgement or any other process with such an aim.

8.137. (c) Frequency of validation process

The frequency with which validation will be carried out for the various components of the model shall be established within the validation policy for the various components of the model. Significant changes in the external environment may necessitate additional ad hoc checks on the validity of the internal model. The proportionality principle shall be observed in considering how frequently the model shall be validated.

8.138. The undertaking shall set out limits on when events become significant enough to lead to further ad hoc checks on the validity of the internal model.

8.139. Different validation tools may be run with different frequencies.

8.140. (d) Governance of validation results

The validation policy shall set out clear responsibilities for all the validation tasks required in the validation process.

8.141. The validation policy shall set out how the results of the different validation tools are reported, for both regular validation as well as ad hoc checks, and how they will be used if the tests show that the internal model did not meet its objectives.

8.142. There shall be a clear escalation path setting out how the results are escalated within the governance structure of the internal model.

Specifically, the undertaking shall define pre-set criteria which will determine whether the results are required to be escalated.

8.143. The validation policy shall also set out how the senior management is involved in the validation processes.

8.144. For groups the governance of the validation results shall also consider the allocation of responsibilities for validation at different levels within the group. Specifically, consideration needs to be given to what is validated at group level and what is validated at the related undertaking level.

8.145. (e) Limitations and future developments

The undertaking shall set out all the known limitations of the current validation policy, with specific reference made to any parts of the internal model that exceptionally are not covered by the validation policy.

8.146. The undertaking shall set out its planned developments in its validation policy.

8.147. (f) Documentation of the validation policy

The validation policy shall be documented. Specifically, the carrying out of the validation process and the responsibilities shall be defined clearly and in an understandable way, and shall be geared to the organisation of the respective insurance or reinsurance undertaking.

8.148. (g) Independent review

The validation policy shall set out how independent review, external or internal, is being used within the validation process. The undertaking shall set out how the review is independent, taking into account at least the responsibilities and the reporting structures for internal review and remuneration structures for external review. Undertakings shall also consider how independence is maintained over time.

8.149. The principle of proportionality shall be taken into account, especially for undertakings with limited resources, however retaining an objective challenge of the validation process.

Testing results against experience

8.150. In general, backtesting consists of the following steps. Firstly one or more trigger events are defined, such as the actual realisation of a loss that exceeds a predetermined limit. The occurrence of this trigger event leads then to an investigation which typically covers the following topics:

a. Identification of the portfolio where the event was triggered.

b. Analysis of the root causes that led to this event, such as movements of market prices or changes in other parameters.

c. Examination of how the root causes are reflected in the internal model with the aim of identifying potential model weaknesses.

d. Sometimes, the comparison of large movements in profits and losses to the existing stress tests can provide useful indications of the continued validity of the stress test assumptions.

8.151. In addition, undertakings shall also, on a regular basis, analyse the results of the backtesting that are not above the trigger event.

8.152. The backtesting results shall be the basis for an analysis which identifies the reason for the divergence between the modelled results and reality. Undertakings shall decide on the base of other validation techniques and qualitative analysis whether the deviation is for example the consequence of a lucky or unlucky random change in environment, a permanent change or rather a model assumption error or parameter estimation error.

8.153. There shall be discussion at the appropriate level of management, whether deviations will for example lead to a change to the model, and whether the change will be to the model structure or only to some of the parameter values. The precise escalation path and management decision taking process in response of the significant deviations shall be the part of the validation policy. The policy shall contain the goals and measures of the backtesting.

8.154. Backtesting shall be applied at various levels of the business activity (for example to loss ratio or equity volatility but also to portfolio profit and loss distribution). Where the undertaking has more data available, more detailed backtesting can be done and more comfort can be drawn from this process.

8.155. Where expert judgment was used in the modelling, then backtesting will also include a commonsense comparison between prediction and realization. Backtesting shall be carried out at least annually and ideally more often if practical.

8.156. Where actual data is not available model predictions shall be compared to data which is as "real" or "market–based" as is practically possible. Where this is the case and model predictions are compared to estimates of the actual data based on models, there may be an increased danger of overlooking model weaknesses.

8.157. Where actual realisations may not be directly available, the model forecasts may be compared to realisations made on the base of comparable data set. Where comparable data sets are used, CEIOPS notes that there is a danger of subjectivity when choosing a comparable data set and advises that undertakings shall justify why the comparable data set chosen is appropriate

Testing the robustness of the internal model

8.158. Undertakings shall perform an analysis of the robustness of their internal model. This analysis shall include at least sensitivity testing and further tests on the stability of the model

8.159. This analysis may be performed by introducing small changes to assumptions and may also be complemented by a qualitative review of the model results derived from changes to:

a. the model architecture, structure, formulaic definition and/or numerical procedures; and/or

b. the parameters used by the model.

8.160. Undertakings shall perform a critical analysis of the results from the sensitivity and stability analysis to determine whether changes are required to the model. Appropriate governance arrangements shall be in place to ensure that results are escalated to senior management in an appropriate way.

8.161. The undertaking shall identify and document the most significant assumptions and demonstrate the effect on the results to changes in the assumptions.

8.162. The results from sensitivity testing shall be reviewed regularly and shall be considered when establishing policies and limits.

8.163. Sensitivity testing is especially important in validating parts of the internal model which place particular reliance on expert judgement, or where the expert judgement has a material impact on the results. This is due to the level of uncertainty that may be associated with the expert judgement.

8.164. In some cases a small difference in the input may justifiably result in a large difference in the output. In these cases, the undertaking must be able to explain the underlying reasons for the sensitivities and the sensitivity testing shall illustrate how the cause-effect-relation is modelled adequately.

8.165. Apart from sensitivity testing, further tests may be required to assess whether or not the results produced by the internal model are stable and robust. A further run of the model shall be able to produce results that are not significantly different if there have been no changes to the input parameters. Any changes in model output in these circumstances shall be reasonable, explicable and comprehensible.

Stress and scenario testing

8.166. As a validation tool stress and scenario testing shall permit a degree of confidence by providing more information about what results may look like under various conditions. It may also identify possible limitations of the model, thereby increasing the confidence of users in the outputs of

the model. The stress and scenario testing and the resulting effects shall be monitored, assessed and updated on an ongoing basis.

8.167. The undertaking shall ensure that its stress and scenario testing methodologies are consistently and comprehensively applied throughout the undertaking.

8.168. An internal model shall embody assumptions about relationships between variables and about their behaviour under periods of stress.

8.169. Undertakings shall analyse the results, review the interaction of risks and mitigating actions, make recommendations and revise scenarios and calibrations in the light of the results. The results shall, as applicable, be reviewed both at local as well as at group level. The results shall be compared to risk tolerance or limits as defined by the undertaking. The senior management shall be involved in overseeing a comprehensive and coordinated stress and scenario testing programme.

8.170. Undertakings shall develop their own stress and scenario tests which they identify as most appropriate, based on the characteristics of their own portfolios. Undertakings shall provide their supervisory body with a description of the methodology used both to select stress and scenarios and that used to carry out these stress and scenario tests in the model and the risk management system. They shall also explain why they believe that the stress and scenario tests are adequate for their risk profile.

8.171. Undertakings shall also conduct reverse stress tests to understand what stresses would seriously threaten their viability. We will expect an undertaking to document its reverse stress testing and to be able to demonstrate that it has been signed off by its board.

8.172. The implementation of the stress and scenario testing requirement shall be proportionate to the nature, scale and complexity of an undertaking's business.

8.173. For group internal models, consideration will need to be given to the interaction between the related risks in different subsidiaries.

Profit and loss attribution

8.174. Profit and loss attribution, as described in Section 7, provides information as to whether the risks in the internal model are complete, and whether there are any material risks in the risk profile of the undertaking which are not represented in the internal model.

8.175. Any indication from the results of the Profit and loss attribution which imply that the risk categorisation of the internal model does not reflect the risk profile of the undertaking shall be escalated to the management body. If further qualitative and quantitative analyses of the results show that the model does not reflect the risk profile appropriately, then the model shall be improved.

9. Documentation standards

9.1 Introduction

9.1. The Stock-taking report on the use of internal models in insurance conducted by CEIOPS reports as a general conclusion that there is some consistency of views expressed on the scope of documentation required for an internal model, both from the actuarial profession and undertakings. This confirms the need to instil a culture of good documentation praxis leading to all model developments being documented.

9.2. However, the meaning of a culture of good documentation praxis seems to vary, at least with respect to, for instance

- the need to use different levels of documentation,
- the level and depth of the documentation,
- the timing of the documentation process,
- documentation of internal model enhancement and
- the acceptance of programming code as documentation.

9.3. Documentation is the primary way to communicate with supervisory authorities about internal models to allow them to form a continuing judgment on the internal model's appropriateness and reliability.

9.4. As set out in CEIOPS Advice on Proportionality, the proportionality principle described in Article 29(4) of the Level 1 Text also applies to the documentation of internal models. Proportionality does not exempt any insurer from adequately documenting its internal model. For simpler internal models this might result in smaller amounts of documentation. However this should be a consequence of the level of complexity of the model, and not of the thoroughness of its documentation.

9.2 Legal Basis

9.5. Article 125 sets out the standards for Documentation standards.

Article 125

Documentation standards

"Insurance and reinsurance undertakings shall document the design and operational details of their internal model.

The documentation shall demonstrate compliance with Articles 120 to 124.

The documentation shall provide a detailed outline of the theory, assumptions, and mathematical and empirical basis underlying the internal model.

The documentation shall indicate any circumstances under which the internal model does not work effectively.

Insurance and reinsurance undertakings shall document all major changes to their internal model, as set out in Article 115".

9.3 Advice

9.3.1 General points

9.6. If documentation is not kept timely and up to date, the undertaking is not protected from key-person risk, which is one of the main reasons that documentation is held.

9.7. The documentation of an internal model shall be thorough, sufficiently detailed and sufficiently complete to satisfy the criterion that an independent knowledgeable third party could form a sound judgment as to the reliability of the internal model and the compliance with Articles 120 to 126 and could understand the reasoning and the underlying design and operational details of the internal model. A clarification on the application of this principle when it comes to a detailed outline of the theory, assumptions and mathematical and empirical basis is given in 9.39.

9.8. The documentation shall describe the drawbacks and weaknesses of the model, including the circumstances under which the model does not work effectively (see hereafter).

9.9. One would not expect the Board of Directors or the senior management to be able to understand all the details of the internal model. The documentation for the Board of Directors, the Senior Management, the personnel responsible for the internal model and others shall be commensurate with their oversight responsibilities for the internal model.

9.10. Tailoring documentation for key bodies and key personnel is very important, since this will facilitate more effective implementation and control of the internal model as well as more effective supervisory review.

9.11. Hence, the granularity of the documentation shall take into account the level of management or the key function at which it is intended to be used.

9.12. It should be noted that the "fit and proper" assessment would in most circumstances be determined before any internal model approval and would hence not necessary be covered from an internal model approval perspective. Therefore, the documentation shall include evidence such as training that all levels and functions of management, for example the

board, senior management, and the internal audit, of the undertaking understand the relevant aspects of the internal model.

9.13. The level of understanding and mastery required of different bodies and personnel would depend on their respective oversight responsibilities for the internal model. It is especially important that the Board of Directors and the senior management understand the key parts of the internal model, as well as the related limitations.

9.14. The documentation shall include a list of all documents that the undertaking considers relevant to the internal model, and where and how these documents can be accessed.

9.15. This list of documents bringing together all relevant pieces of documentation is a key part of the documentation itself, and will be vital for any users of the documentation. The documentation does not have to be one single document, provided there is a list or a mapping process that brings it all together. The documentation shall also identify those responsible for pulling together and/or updating documents.

9.3.2 Design and operational details

9.16. Article 125(1) requires that undertakings document the design and operational details of their internal models.

9.17. CEIOPS' view is that internal models require strict documentation of their design and operational details and their changes.

9.18. Since the result from the internal model will form fully or partly the SCR and will also form the basis for steering and making decisions (Use test) in the undertaking on an ongoing basis it is necessary that documentation shall enable an independent knowledgeable third party to determine the state, appropriateness and reliability of the internal model at all times.

9.19. It is hence important that the documentation of the design and operational details of the internal model is timely and up to date.

9.20. CEIOPS' view is that a main aim for the documentation of the design and operational details of the internal model needs to be defined.

9.21. The documentation itself may consist of different levels of granularity of information, for example: 1) Methodology, 2) Formulas and parameters, 3) Methods for estimating and testing parameters, 4) IT implementation, etc…

9.22. If the documentation of the design and operational details are not thorough, sufficiently detailed and sufficiently complete to be understandable by a independent knowledgeable third party the undertaking could be faced with increased key-person risk.

9.23. Furthermore, the documentation of the design and the operational details of the internal model shall be such that it can always be subject

to an independent review, whether it is internal, external or a supervisory review.

9.24. A record of the past development of the internal model will provide more information about how the model has evolved over time, why the model is in its current form and what other approaches have been considered along the way. This will give some extra comfort about the chosen modelling approach. Frequent model changes in the past could also be an indication of an internal model that is "almost there, but not yet ready" and could influence the judgment about the reliability and stability of the internal model. On the other hand, one could argue that a lack of changes could indicate inferior technical input into the model over time. Nevertheless, future developments will in any case need to be considered in order to reflect improved risk management techniques.

9.25. Furthermore, documentation of past developments is an important aspect in considering key-person risk and could prevent an undertaking from doing the same work twice.

9.26. Therefore the documentation shall include an overview of the historical development of the internal model, including methodologies, assumptions and data, so that an independent knowledgeable third party would be able to understand key development steps and the reasoning behind them. CEIOPS recognises that, if the internal model documentation before Solvency II implementation has been neglected to a large extent, a historical overview of key development steps could, in practice, be difficult or burdensome to create. The timescale or how long records should be in place at approval will depend on the internal model.

9.27. The operational details of the internal model do to some extent determine whether or not an undertaking has an appropriate governance structure as set out in Article 112(5). Therefore, undertakings shall have documented policies, controls and procedures in place for the management of the operational details of the internal model, including written responsibilities and accountabilities. These shall be clearly understood by all incumbents and be reviewed at least annually.

9.28. An internal model often relies on software implementation to which appropriate attention shall be given. In principle undertakings are free to select the IT environment they prefer to implement the internal model. However, undertakings have to ensure on a regular basis sufficient integrity, availability and confidentiality of their IT systems, IT governance and IT audit.

9.29. The description of technology and software tools used to implement the internal model, whether they are internal or external solutions, shall be thorough, sufficiently detailed and sufficiently complete to support a review by an independent knowledgeable third party. The description shall demonstrate how they are covered by the undertaking's contingency plans[28], security policies and business recovery plans[29].

[28] What to do when problems occur with IT

9.30. Strongly related to the IT-implementation of the internal model and equally important is storage of data. "Storage of data" covers input as well as output (result) data. Poor input data storage will most likely restrict the design of the internal model. In some cases there might be constraints on the set and/or subset of results that can be saved, with possible further implications for the undertaking's ability to check and correct errors, and where necessary reproduce results for audit purposes.

9.31. The documentation shall contain explicit information about data management. This may include a general description of the databases, clear dictionaries that provide definitions of data items, description and construction of the databases, description of external and internal data interfaces, processes used to obtain and load the data, data consistency aspects, filters used to create and debug the database and security and maintenance information. In addition, a data flow chart illustrating how data flows through the internal model is needed so that the origin of data used in the calculation of the probability distribution forecast can be transparently tracked.

9.32. The documentation of the internal model shall provide an audit trail. This is useful for following up model changes, back-testing, assessing where the internal model has gone wrong and demonstrating the Use test. The documentation of the internal model shall be a living document with dates showing when the documentation was valid from and with good version control.

9.33. CEIOPS' view is that a version-control record of the internal-model documentation needs to be kept. Material changes made, whether minor or major, to the design or the operational details of the internal model shall be documented, including the rationale for the changes.

9.34. Furthermore, any relevant testing and validation done in relation to model changes made shall also be documented.

9.35. Additional documentation requirements for major changes are set out in Section 9.3.6. Hence the documentation requirement for minor changes is narrower than for major changes.

9.3.3 Compliance with Articles 120 to 124

9.36. Article 125 requires that the documentation shall demonstrate compliance with Articles 120 to 124.

9.37. It shall be noted that there are various ways in which one can construct, operate and use an internal model and still comply with Articles 120 to 124. How to satisfy the requirements laid out in Articles 120 to 124 is hence ambiguous.

9.38. CEIOPS' view is that the documentation of compliance with Articles 120 to 124 shall not be a single statement that the requirements in Articles

[29] How to resume business after problems occur with IT

120 to 124 are met. The demonstration of compliance shall verify how the different requirements have been taken into account and how they have been fulfilled.

9.3.4 Detailed outline of the theory, assumptions and mathematical and empirical basis

9.39. Article 125(3) requires that the documentation shall provide a detailed outline of the theory, assumptions, and mathematical and empirical basis underlying the internal model. CEIOPS' view is that the main aim of this documentation needs to be defined.

9.40. The documentation of the theory, assumptions, and mathematical and empirical basis underlying the internal model shall be thorough, sufficiently detailed and sufficiently complete to satisfy the criterion that an independent knowledgeable third party could understand the model framework, its methodology, the underlying assumptions, and the limits of applicability of the model and in principle reproduce the model outputs if all the parameters and exposure data were available.

9.41. In principle any knowledgeable independent party could then use a different platform to build a consistent internal model within a reasonable time period. This reduces key-person risk, and if a disaster occurred this requirement would enable the undertaking to move or rebuild the internal model or part of it on a different software platform. It also supports any review process. The mathematical and statistical details of the internal model shall be such that it can always be subject to an independent review, whether it is internal, external or a supervisory review.

9.42. The documentation shall contain a map of mathematical methods used and a description of the theories and empirical basis underlying the mathematical methods. The documentation shall include the rationale for selecting a specific method and an elaboration on the techniques used to meet the nature and complexity of the item under consideration. This shall include at least which risks are captured and which are not, any approximations used and key assumptions.

9.43. All algorithms such as for instance optimising algorithms related to the mathematical methods shall be documented in detail as required in 9.39, including the rationale supporting the selection of the algorithms and known drawbacks or weaknesses.

9.44. The undertaking shall thoroughly document;

- The modelling of the nature of risks, risk drivers and other variables used in the model
- The modelling of cash flows arising from assets and liabilities, and the interactions between them.
- The algorithms setting the sequence of operations necessary to produce the outputs

This shall include the rationale supporting choices made in that regard.

9.45. The documentation shall include a rationale for decisions on assumptions, data and parameters and its development over time. Known drawbacks or weaknesses that have a material impact on the appropriateness of the internal model shall also be documented. Where complex approaches have been used a more detailed description of the approach shall be given. Where adjustments are made to the underlying data the nature, amount, and rationale for the adjustments shall be clearly stated.

9.46. The use of expert judgment on assumptions, data and parameters is very likely to be an important part of the internal model. Judgment must be used to make sense of the assumptions, data and parameters; for example, using data blindly suggests that the undertaking thinks that the past experience perfectly predicts future behaviour, which is in many circumstances not appropriate. However, judgment, by its very nature, will be subjective, and there may be large differences of practice between undertakings.

9.47. The documentation shall include all use of expert judgment on assumptions, data and parameters. Undertakings shall have thorough documentation of expert judgment and shall include at least why it is an expert judgment, what processes the expert judgment is based on, the extent to which the expert judgment is likely to affect the internal model result and how the expert judgment has been evaluated (cf 5.167). Where an expert judgment has been made the name, experience and qualifications of the person or people making the judgment shall be documented.

9.3.5 Circumstances under which the internal model does not work effectively

9.48. Article 125(4) requires that the documentation shall indicate any circumstances under which the internal model does not work effectively.

9.49. CEIOPS' view is that the documentation of circumstances under which the undertaking believes that the internal model does not work effectively shall address both design and operational details of the internal model and the possible implications of any lack of compliance with Articles 120 to 126.

9.50. The definition of *"not working effectively"* is ambiguous. When assessing and documenting circumstances where the internal model does not work effectively undertakings shall take into account at least the following aspects:

- Any specific features of the internal model or circumstances or limitations that present potential concerns or would significantly increase the uncertainty of the results of the internal model beyond what would reasonably be expected. For instance:

- Limitations in risk modelling and the cover of risk captured.
- The nature, degree and sources of uncertainty surrounding the results of the internal model and sensitivity to key assumptions.
- Shortcoming and/or deficiencies in input data.

• Insufficiencies in IT-systems, governance and related controls surrounding the internal model.

9.3.6 Major changes

9.51. Article 125(5) requires that undertakings shall document all major changes to their internal model, as set out in Article 115.

9.52. CEIOPS' view is that the documentation of major changes to the internal model shall address the implications for both the design and operation of the internal model and an assessment of continued compliance with Articles 120 to 126 after the model change has been implemented.

9.53. For major model changes that have a significant impact on the internal model result the connection or link from the most recent valuation date shall be disclosed. For transparency reasons past figures need to be recalculated with the new approach to show the impact of the model change.

9.54. When a major change has had a significant impact on the outcome of the internal model the most recent valuation date shall be calculated with both the revised internal model and the previous version of the internal model and the outcomes of the internal models shall be compared. Any differences between the two due to the change in the model shall be, if possible, identified, quantified and documented.

CEIOPS' Advice

General points

9.55. The documentation of an internal model shall be thorough, sufficiently detailed and sufficiently complete to satisfy the criterion that an independent knowledgeable third party could form a sound judgment as to the reliability of the internal model and the compliance with Articles 120 to 126 and could understand the reasoning and the underlying design and operational details of the internal model. Application of this principle when it comes to a detailed outline of the theory, assumptions and mathematical and empirical basis is given in 9.67.

9.56. The documentation of the internal model shall be timely and up to date.

9.57. The documentation shall describe the drawbacks and weaknesses of the model, including the circumstances under which the model does not work effectively (see hereafter).

9.58. The granularity of the documentation shall take into account the level of management or the key function at which it is intended to be used.

9.59. The documentation shall include evidence that all levels of management of the undertaking understand the relevant aspects of the internal model. The level of understanding for different bodies and personnel would depend on the oversight responsibilities of the internal model. The administrative, management or supervisory body shall understand the key parts of the internal model, as well as the related limitations, so that they are able to confirm the use of the model and to take responsibility for that decision.

9.60. The documentation shall include a list of all documents that the insurance or reinsurance undertaking considers relevant to the internal model, and where and how these documents can be accessed. The list of documents bringing together all relevant pieces of documentation is a key part of the documentation itself, and will be vital for any users of the documentation. The documentation does not have to be one single document, provided there is a list or a mapping process that brings it all together. The documentation shall also identify those responsible for pulling together and/or updating documents.

Design and operational details

9.61. The documentation shall include an overview of the historical development of the internal model, including methodologies, assumptions and data, so that an independent knowledgeable third party would be able to understand key development steps and their reasoning.

9.62. Insurance and reinsurance undertakings shall have documented policies, controls and procedures in place for the management of the operational details of the internal model, including written responsibilities and accountabilities. These shall be clearly understood by all incumbents and be reviewed at least annually.

9.63. Description of technology and software tools used to implement the internal model, whether they are internal or external solutions shall be thorough, sufficiently detailed and sufficiently complete to support a review by an independent knowledgeable third party. The description shall demonstrate how they are included in the undertaking's contingency plans[30], security policies and business recovery plans[31].

9.64. The documentation shall contain explicit information about data management. This may include a general description of the databases, clear dictionaries that provide definitions of data items, description and construction of the databases, description of external and internal data

[30] What to do when problems occur with IT
[31] How to resume business after problems occur with IT

interfaces, processes used to obtain and load the data, data consistency aspects, filters used to create and debug the database and security and maintenance information. In addition, a data flow chart illustrating how data flows through the internal model is needed so that the origin of data used in the calculation of the probability distribution forecast can be transparently tracked.

9.65. A record of version control of the internal model needs to be kept. Material changes made, whether minor or major, to the design or the operational details of the internal model shall be documented, including the rationale for the changes.

9.66. All relevant testing and validation done in relation to model changes shall also be documented.

Compliance with Articles 120 to 124

9.67. When demonstrating compliance with Articles 120 to 124 insurance and reinsurance undertakings shall document how the requirements have been taken into account and how they have been fulfilled.

Detailed outline of the theory, assumptions, and mathematical and empirical basis

9.68. The documentation of the theory, assumptions, and mathematical and empirical basis underlying the internal model shall be thorough, sufficiently detailed and sufficiently complete to satisfy the criterion that an independent knowledgeable third party could understand the model framework, its methodology, the underlying assumptions, and the limits of applicability of the model and in principle reproduce the model outputs if all the parameters and exposure data were available.

9.69. The documentation shall contain a map of mathematical methods used and a description of the theories and empirical basis underlying the mathematical methods. The documentation shall include the rationale for selecting a specific method and an elaboration on the techniques used to meet the nature and complexity of the item under consideration. This shall include at least which risks are captured and which are not, key assumptions and analysis of known drawbacks or weaknesses.

9.70. All algorithms related to the mathematical methods shall be documented in detail as required in 9.67, including the rationale supporting the selection of the algorithms and known drawbacks or weaknesses.

9.71. The documentation shall include a rationale for decisions on assumptions, data and parameters and its development over time. Known drawbacks or weaknesses that have a material impact on the appropriateness of the internal model shall also be documented. Where complex approaches have been used then a more detailed description of the approach shall be given. Where adjustments are made to the underlying data the nature, amount, and rationale for the adjustments shall be clearly stated.

9.72. The documentation shall include all use of expert judgment on assumptions, data and parameters. Insurance and reinsurance undertakings shall have thorough documentation for expert judgement and shall include at least why it is an expert judgment, what processes the expert judgment is based on, the extent the expert judgment is likely to affect the internal model result and how the expert judgment has been evaluated. Where an expert judgment has been made the name, experience and qualifications of the person or people making the judgment shall be documented.

Circumstances under which the internal model does not work effectively

9.73. The documentation of circumstances under which the undertaking believes that the internal model does not work effectively shall address both design and operational details of the internal model as well as the possible implications due to any lack of compliance with Articles 120 to 126.

9.74. When assessing and documenting circumstances where the internal model does not work effectively insurance and reinsurance undertakings shall take into account at least the following aspects:

a. Limitations in risk modelling and the cover of risk captured

b. The nature, degree and sources of uncertainty surrounding the results of the internal model and sensitivity of key assumptions.

c. Shortcoming and/or deficiencies in input data.

d. Any specific features of the internal model or circumstances or limitation that present potential concerns or would significantly increase the uncertainty of the results of the internal model beyond what would reasonably be expected.

e. Insufficiencies in IT-systems, governance and related controls surrounding the internal model.

Major changes

9.75. The documentation of major changes to the internal model shall address the implications for both the design and operational details of the internal model and an assessment of continued compliance with Articles 120 to 126 after the model change has been implemented.

9.76. When a major change has had a significant impact on the outcome of the internal model the most recent valuation date shall be calculated with both the revised internal model and the previous version of the internal model and the outcomes of the internal models shall be compared.. Any differences between the two due to the model change shall be, if possible, identified, quantified and documented.

10. External models and data

10.1 Introduction

10.1. The Quantitative Impact Study 4 in the Framework of the Solvency II project[32] reports that the internal models are in general developed through a combination of externally and internally produced software and that the respondents to the QIS4 typically included several purchased models or modelling platforms for particular risks in their overall internal model. Furthermore, the study indicates that for some risk modules such as the ones corresponding to the market and default risks the reliance on external data can be of great importance.

10.2. The Stock-taking report on the use of internal models in insurance conducted by CEIOPS gives some further insight into the potential use of External models and data. The report concludes that internal models in the insurance sector are generally based on several different external and internal platforms and components and that for some risks the use of external data is quite significant.

10.3. Furthermore, vendor software solutions generally appear to be flexible and can handle most insurance products. They can often be integrated into several different IT environments and offer a wide variety of options to describe asset and/or liability features and behaviour. Many risk technological platforms have been designed to focus exclusively either on financial risks or on insurance risks. As a result, most undertakings have implemented different software applications, which are quite often vendor products that address a single kind of risk, and aggregate the results in a semi-automated or even completely manual way, often with some reliance on spreadsheets. Special software solutions are sometimes used to provide the data management (integration, storage, flows and so forth), with interfaces with different specialised risk-modelling software solutions and combine their outputs in a reporting portal.

10.4. The Stock-taking report concludes that both software providers and undertakings agree that individual undertakings shall drive the modelling of risks and not vice versa. Undertakings emphasised the need for a thorough understanding of the software features to enable them to make the most appropriate modelling choices. However, given the external providers' interest in maintaining the confidentiality of certain key aspects of their products, most undertakings expressed concerns about the level of disclosure provided. Undertakings stressed that this may hamper their ability to meet the Solvency II validation and statistical quality standards with respect to external data and model components.

10.5. The Basel Committee Accord Implementation Group's Validation Subgroup (AIGV) set out recommendations relating to the use of vendor

[32] CEIOPS' Report on its fourth Quantitative Impact Study (QIS4) for Solvency II, CEIOPS-SEC-82/08, November 2008, available at: http://www.ceiops.eu/content/view/118/124/

products or External models and data within internal ratings-based (IRB) approaches of the Basel II framework[33].

10.6. According to the AIGV:

"Vendor products comprise risk measurement models and data that have been developed by parties external to the bank to assist institutions in their risk measurement and management functions."

10.7. They also concluded that while vendor products can theoretically be classified into two types - vendor models and vendor data - in practice this distinction is often blurred. For instance, vendor models are often developed and calibrated using external, vendor-supplied data. Similarly, datasets purchased from vendor undertakings often incorporate some type or degree of modelling, for example in the forms of smoothing or adjustment of the data or compensation for missing data.

10.8. The AIGV did not believe it would be either feasible or necessary to issue a set of prescriptive disclosure requirements for vendor products or to develop a process whereby vendor models would be approved by supervisors for use in banks' IRB processes.

10.9. Since many financial conglomerates aim at achieving synergies between Basel II and Solvency II when calculating capital requirements with internal models and an increasing amount of Basel II solution vendors make the move into Solvency II, CEIOPS' view is that it is sensible to have principles for the use of External models and data that are consistent with Basel II to the extent possible.

10.2 Legal basis

10.10. Article 126 sets out the requirements for External models and data.

Article 126

External models and data

"The use of a model or data obtained from a third-party shall not be considered to be a justification for exemption from any of the requirements for the internal model set out in Articles 120 to 125".

10.3 Advice

10.11. Undertakings must ensure that External models and data are consistent with the standards and requirements set out for the use of an internal model to calculate the SCR.

[33] "Use of Vendor Products in the Basel II IRB Framework", Basel Committee Newsletter No. 8, March 2006, available at: http://www.bis.org/publ/bcbs_nl8.pdf?noframes=1

10.12. The use of External models and data gives rise to a number of difficulties in the areas of management, control, documentation and operational transparency. The integration of external models and/or outsourced modelling activity into the undertakings' own full or partial internal models for the purpose of calculating solvency capital requirements will be a key area of interest for supervisory authorities. Particular areas of interest are the appropriateness of the External models and data to their business, transparency, correlation with other risks and associated sensitivity, and stress and scenario testing.

10.13. There is also a clear link between the statistical quality standards, the Validation standards and the Documentation standards. For instance, undertakings using an internal model need to have good data underlying the model and a clear understanding of the extent to which they may rely on the model outputs for assessing capital requirements and decision-making. This means that undertakings may need to supplement data with expert judgement in some areas and will need to document the extent of this.

10.14. The use of External models and data evidently requires the creation of an additional outsourcing-like interface for undertakings to manage. That interface will retain responsibility for the maintenance of the modelling standards and the compliance with all requirements in that context.

10.15. However, external models cover different possibilities which need to be treated distinctively. There is an important difference between the use of external platforms on which an internal model is built and the use of an entire external model or library of models. The latter should be subject to more scrutiny and challenge than the former.

10.16. The use of external data includes aspects not directly seen in the use of external models and vice versa. Hence it would be improper to apply strictly all requirements covered by external models and data blindly in the same way to both of them. An appropriate change of focus is needed.

10.17. It is the responsibility of undertakings to demonstrate and document how their solvency capital requirements are derived and validated. When External models and data play a material role in either deriving or validating these capital requirements, it is important that undertakings clearly state what role the External models and data play in the estimation process and the extent to which these vendor products are used within their internal model processes.

10.18. To improve the understanding of undertakings' internal models, both by themselves and their supervisory authorities, the undertakings shall be prepared to explain the underlying rationale for choosing External models and data over internally developed models and data. Examples of such rationales are lack of data or internal resources, economic considerations, efficiency in development, external model stability and/or reliability issues and experience of the vendor. Supervisory authorities also may expect undertakings to be able to explain what alternative

solutions they have considered, and, if possible, how they compare to those of alternative products or solutions.

10.19. Hence, undertakings must be able to document and explain the role of External models and data and the extent to which they are used within their internal model processes.

10.20. Undertakings shall be also able to explain the reasons for preferring external models or data to internal ones. They shall also be able to list the alternatives considered and explain the decision for a particular external model or data.

10.21. In general, when undertakings use External models and data in their internal model processes, they must be able to demonstrate a detailed understanding of those products.

10.22. This in-house knowledge of the External models and data may be demonstrated by the following:

- Detailed knowledge of the methodological underpinnings and basic construction of External models and data, including an understanding of the models' capabilities, limitations, and appropriateness for use in deriving the SCR.
- Demonstration of a full understanding of the effect and significance of the proprietary elements in the external models;
- Performing detailed validation of external model output;
- Documentation of the rationale behind any judgment-based overrides or any other adjustments made to external data sets or external model outputs; and
- Retention of in-house expertise on the External models and data for as long as these are used to derive the SCR.

10.23. "Retention of in-house-expertise" shall not preclude the possibility of outsourcing the development of models and/or provision of data as long as compliance with respective regulations and control mechanisms is given.

10.24. CEIOPS concludes that undertakings must be able to demonstrate a detailed understanding of External models and data used in their internal model processes. In particular they shall be aware of model and data limitations.

10.25. CEIOPS considers that supervisory authorities' expectations of external models or data used by an internal model to calculate the SCR should be appropriate to their nature, scale and complexity. This recognises the principle of proportionality. For instance, if the results produced by an external model rely heavily on external data inputs, and that model in turn plays a material role in an undertaking's own risk strategy and business objectives, then the principles shall be applied to the fullest

extent possible to both the external model and the external data inputs used by the model as they relate to the risk quantification, validation and use-test processes. If, on the other hand, external data are used only to provide broad benchmarks for certain risk parameters, undertakings' validation efforts might be limited to processes that ensure the integrity of the data and their applicability to undertakings' own exposures.

10.26. External models and data have to be suitable for representing the undertakings' own risk profile. Undertakings are responsible for making sure that External models and data used by the internal model are suitable and representative for modelling the risks the undertaking is exposed to.

10.27. As noted in the beginning of the Advice, undertakings must ensure that External models and data are consistent with the standards and requirements set out for the use of an internal model to calculate the SCR. For example, the output of the external models might be consistent with the Calibration standards but the models themselves and data used might not comply with the statistical standards. In such a case the external model outcomes might require adjustment or supplementation in the form of additional information (for example, qualitative information not included in the external model) or a mathematical adjustment. Undertakings must recognize the need for such supplementation and incorporate the combined results in their internal model processes to achieve full compliance.

10.28. Hence, the use of External models and data must be appropriate to the nature and complexity of the risks inherent in undertakings' own risk strategies, business objectives and modelling methodologies and the availability of internal data and must be suitable for use within their internal model processes.

10.29. Furthermore, if external models or data play a material role then undertakings shall demonstrate that the internal model requirements are met to the fullest extent possible. In particular, the undertaking retains the responsibility for any deficiencies of the internal model or data introduced by the use of external models or data.

10.30. A fundamental difference between internally and externally developed models is the degree to which undertakings are able to provide transparent descriptions, documentation and validation of their internal model. Therefore undertakings shall in cases where the documentation of the external model does not fulfil the regulatory standards on documentation and validation fulfil compensating requirements in the fields of documentation (e.g. documentation regarding the handling of external data and models, the connection with the vendor) and validation (e.g. comparative calculations). Accordingly, undertakings shall implement clear strategies designed to periodically (at least once a year) validate the performance of any external model used in their internal model processes to ensure that the model continue to function as intended. Since external model parameters may have been calibrated using external data, it is critical for undertakings to test the performance

of external models against their own portfolio of exposures. Where there is a scarcity of internal performance data with which to perform back-testing or outcomes analysis, undertakings' performance reviews will have to rely more on alternative validation techniques, such as for instance expert judgments. In addition, undertakings shall develop and implement strategies designed to verify the accuracy, completeness and appropriateness (see Article 121 of the Level 1 Text) of any external data used for internal risk-quantification processes. It is important that undertakings challenge periodically the External models and data given their own models and data, even if they are not as sophisticated, accurate or exhaustive as the external ones.

10.31. Thus, undertakings must have clearly articulated strategies for regularly validating and reviewing the performance of external models' results and the integrity of external data used in their internal risk-quantification processes.

10.32. The use of External models and data increases an undertaking's dependence on third parties (service providers), which may increase or at least could change the risk profile of the undertaking. Some of the risks related to the outsourcing activity include

- *Strategic risk* (For example, failure to implement appropriate oversight of the service provider, inadequate expertise to oversee the service provider, intellectual black box),
- *Reputational risk* (For example, poor service from the service provider, service provider practices not in line with practice of the undertaking),
- *Compliance risk* (For example, service provider not adequately complied with standards and practices, inadequate compliance systems and controls by the service provider),
- *Operational risk* (For example, technology failure, fraud or error, risk that undertakings find it difficult or costly to undertake reviews of the service provider, the service provider might fail to perform),
- *Exit-strategy risk* (For example, the risk that appropriate exit strategies are not in place, over-reliance on the service provider, the loss of relevant skills in the undertaking itself preventing it from bringing the activity back in-house, contracts which make a speedy exit prohibitively expensive, limited ability to return to an in-house approach due to lack of staff or loss of intellectual history),
- *Contractual risk* (For example, the ability to enforce contract, settlement of disputes),
- *Access risk* (For example, the outsourcing arrangement hinders ability of regulated entity to provide timely data and other

information to regulators, additional layer of difficulty in regulator understanding activities of the service provider) and

- *Concentration and Systemic risk* (For example, the overall insurance industry has significant exposure to a small set of service providers and systemic risk to the insurance industry as a whole.)

10.33. Therefore it is important that undertakings shall also recognise and document the risks arising from the use of external data and models. If those risks are material and quantifiable they shall be taken into account in the SCR calculation.

CEIOPS' Advice:

10.34. Insurance and reinsurance undertakings shall document and explain the role of External models and data and the extent to which they are used within their internal model processes.

10.35. Insurance and reinsurance undertakings shall be able to explain the reasons for preferring external models or data to internal ones. They shall also be able to list the alternatives considered and explain the decision for a particular external model or data.

10.36. Insurance and reinsurance undertakings shall demonstrate a detailed understanding of External models and data used in their internal model processes. In particular they shall be aware of model and data limitations.

10.37. The use of External models and data shall be appropriate to the nature and complexity of the risks incorporated within insurance and reinsurance undertakings' own risk strategy, business objectives, modelling methodologies, availability of internal data and suitable for use within their internal model.

10.38. If the use of external models or data plays a material role insurance and reinsurance undertakings shall demonstrate that internal model requirements are met to the fullest extent possible. In particular, the undertaking retains the responsibility for any deficiencies of the internal model or data introduced by the use of external models or data.

10.39. Insurance and reinsurance undertakings shall have clearly articulated strategies for validating and regularly reviewing the performance of external models results and the integrity of external data used in their internal risk quantification processes.

10.40. Insurance and reinsurance undertakings shall recognise and document the risks arising from the use of external data and models. If those risks are material and quantifiable they shall be taken into account in the SCR calculation.

Annex A

List of example uses referred to in 3.3.9

Example use
Adequate pricing
Assessing customer benefits, for example, bonus setting
Asset / liability management
Business planning / strategy
Capital Management
Development and monitoring of risk appetite
Development of risk strategies
Efficient use of capital
Exposure management and limit setting
External risk reporting
Financial Reporting - internal model provides market valuations for IFRS
Incentive / target setting
Internal Risk monitoring (through MI)
Investment decisions e.g. strategic, tactical and operational decisions
M&A
Measurement of material risks
ORSA
Other risk mitigation
Portfolio transfer pricing
Producing MI

Example use
Product development / Pricing
Reconciliation between internal model outputs and internal and external financial reporting
Reconciliation between internal model and the technical implementation of management actions, e.g. for with-profit business.
Reconciliation between internal model and technical provisions
Regulatory capital (SCR for solo and for groups)
Reinsurance decisions e.g. strategic
Reinsurance programme design
Reinsurance strategy and development of reinsurance programme
Reporting on MCEV / EV
Reporting on business performance
Reporting on performance including return on capital
Reporting on technical provisions
Risk balancing (efficient use of capital)
Risk Mitigation
Setting profit targets
Setting return on capital targets and remuneration Underwriting policies

Annex B Impact Assessment – Use test: Minimum requirements for the Use test when insurance and reinsurance undertakings use an internal model to calculate the SCR.

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures[34]. To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment[35]. On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made[36]. This impact assessment covers issue 13 of the list of policy issues and options.

Two summary tables accompany the impact assessment, published in a separate excel document.

Narrative

1) Description of the policy issue

B.1. Article 120 of the Level 1 Text requires undertakings to demonstrate that the internal model is *"widely used in and plays an important role in their system of governance",* including the risk-management system, decision-making processes and economic and solvency capital assessment and allocation. This is one of the tests and standards for internal models in Solvency II, and a supervisory authority may give approval to an internal model only if they are satisfied that these tests and standards are met.

B.2. In addition, there has been a lot of focus on the Use test in respect of internal models, in particular in the CEIOPS Report on "lessons learned from the crisis". The extracts below highlight the key findings:

> *"The issue of the Use test, and the ability and willingness of senior management to use the outputs of internal models, remains open, in the sense that there are questions regarding how these outputs can be used in cases where there is a lack of understanding of the models."*
>
> *"If internal models are to be considered mainly as management toolkits, the Use test should, in practice, play the role foreseen to*

[34] http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf
[35] http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf
[36] http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf. This list does not include yet the Option 3. This Option will be included for the Issue 13 (SCR- Internal Model – Use test)

it in the Level 1 Text. Undertakings should prove that models are embedded in their decision making processes and that senior management understands the models and their outputs. If this is not the case, supervisory authorities should not approve the models."

B.3. The impact assessment covers the level of application of the Use test in order to assist supervisory authorities in assessing whether the Use test is met by undertakings, and to give guidance to undertakings about the minimum requirements for meeting the test.

2) Detailed description of policy options and assessment of the relative impacts on the different affected parties

Detailed description of policy options

B.4. Option 1

As a minimum requirement, the internal model is to be used at the topmost organisational level of the undertaking. The model is to be used, for instance:

- *in setting the risk strategy,*
- *allocating risk capital and*
- *taking strategic business decisions.*

This option would require the undertaking to demonstrate as a minimum that the internal model output is used in strategic decision-making. There is no requirement to use the internal model output for more granular or tactical decision-making.

B.5. Option 2

The internal model is to be used at all levels of the undertaking. The areas or processes in which the undertaking has to make use of its internal model are comprehensive and mandatory for all undertakings and include, as an example, the pricing of individual insurance contracts.

This option looks at the use of the internal model across the undertaking. Supervisory authorities will review how internal model outputs are used at all levels and look for demonstrations of use in decision-making for strategic and tactical decisions. This option includes a mandatory aspect to the uses made of the internal model.

B.6. Option 3

The internal model is to be used at all levels of organisation. The areas or processes in which the undertaking has to make use of its internal model are comprehensive, but not mandatory and may include, as an example some of the possible uses set out in Annex A.

This option is similar to Option 2, in that use of the internal model is to be made at all levels of the undertaking. However, in contrast, Option 3 does not set a mandatory list of uses but leaves discretion to the undertaking. Furthermore, the aim is that the more the undertaking improves the internal model, the more the outputs will be used in the different levels of the undertaking.

Impact on industry, policy holders and beneficiaries and supervisory authorities

Likely Industry Response

B.7. All Options assume that an undertaking will have an approved internal model and hence will use the model in decision-making. Option 1 will ensure that undertakings embed the internal model at the topmost level of the organisation. Option 2 will push them to embed it throughout the undertaking. The mandatory nature of the uses in Option 2 may push undertakings to artificially demonstrate use of the internal model in decision-making, and this may distract resources from more useful internal model development work. Option 3 reflects the current and planned approaches of industry to embedding their internal models, and so should lead to further improvements in modelling and use of internal models in decision-making.

B.8. It is likely that industry will prefer Option 3 to the other Options, as this reflects well-established in undertakings. The CEIOPS Stocktaking Report on internal models shows that undertakings use the outputs from their internal models for many types of decision-making, and that uses vary from undertaking to undertaking. Option 2, will maybe not reflect that variety. On the other hand it is likely that industry will comment on Option 1 that the use of the internal model only at the topmost organisational level of the undertaking will not ensure that the model is *"widely used in and plays an important role in their system of governance"*, including the risk-management system, decision-making processes and economic and solvency capital assessment and allocation. Therefore they may comment that it is important that the persons in an undertaking who are dealing with material risks also have to taken the outputs of the internal model for their decision making process into account. Furthermore they want to achieve a high degree of acceptance of the internal model within the undertaking and that may get lost if only a handpicked circle has access to the outputs of the model.

B.9. Industry is likely to comment on Option 2 that having areas or processes that are mandatory for use will not reflect the underlying aim of the Use

test – to make sure the undertaking relies on the internal model, and hence has designed it for its own purposes.

B.10. Option 3 is therefore more likely to reflect industry planned and current practice.

Cost and benefits

- Policy holders and Beneficiaries

B.11. The impact of the options is unlikely to vary by type of beneficiary or policy holder, whether life or non-life, or low or high income.

B.12. One would expect an undertaking that can demonstrate usage of an internal model at all levels of decision-making to be more aware of the risks faced, thus Options 2 or 3 might be considered to be better for policy holders and beneficiaries than Option 1.

B.13. On the other hand one could expect that Option 2 is likely to push undertakings into developing internal models that comply with a test rather than fulfill their own needs, and take effort away from properly understanding their risks. This might reduce the level of policy holder protection.

B.14. Option 3 is therefore more likely to benefit policy holders and other beneficiaries by encouraging use of the internal model at all levels of the undertaking.

- Industry / (Re)insurance undertakings:

B.15. The key issue for undertakings is the need to take the output of the internal model into account in their decision making process and to demonstrate in this context the use of the output of the internal model in decision-making. Option 1 will require the demonstration of buy-in to and understanding of the internal model by the administrative, management or supervisory body of the undertaking.

B.16. However, as Option 2 and Option 3 include Option 1, this difficulty will be a feature of all options. On the one hand Option 1 focuses on the topmost organisation level of an undertaking and therefore it is easier to demonstrate the use of the outputs. But to prove that an implementation of the internal model in the whole entity (e.g. more precisely at the points where they have to handle material risks) has taken place would be more difficult. On the other hand Option 2 requires the demonstration of understanding from all levels of the undertaking, which will be more stretching. The mandatory nature of Option 2 may make demonstrating fruitful use at all levels an artificial exercise. Option 3 will reflect the use

of the internal model in the undertaking and therefore will facilitate demonstrating.

B.17. As Option 1 is established only at the topmost organisational level of an undertaking, there may be a disconnect between this level and everyday use of the internal model. This may lead to misconceptions at the topmost level about the use made of the internal model in everyday decision making processes. This may lead to an artificial belief in that the outputs of the internal model are really used for the decision making process.

There will be extra costs for the undertaking as follows:

- there is cost in using different information bases
- there is the cost in making a decision on the wrong information basis.

B.18. As Option 2 is likely to make some uses mandatory, undertakings may be deterred from using internal models, as the effort of developing them may have limited value in many areas of their own decision-making. In addition, there will be extra costs to the undertaking in two ways:

- there is the cost of demonstrating wider use.
- there is the cost of making other areas of the undertaking use the model.

B.19. As Option 3 does not have a mandatory list of uses to be made of the internal model, undertakings may be encouraged to use internal models, as the effort of developing them should lead to improved decision-making. There will be extra costs to the undertaking in two ways:

- there is the cost of demonstrating wider use.
- there is the cost of making other areas of the undertaking use the model.

B.20. However, as the uses in Option 3 are decided by the undertaking, then these costs should be outweighed by improved decision-making.

- Supervisory authorities

B.21. All options will require qualitative assessments from the supervisory authorities. Options 1, 2 and 3 will require the supervisory authority to assess the level of understanding of the internal model in the administrative, management or supervisory body of the undertaking. This is likely to require an assessment by interviewing members of the administrative, management or supervisory body and reviewing

management information provided from the internal model as well as minutes of meetings where the output is used.

B.22. Options 2 and 3 will also require a qualitative assessment of use and understanding at other levels of the undertaking. This is likely to take a similar format as the assessment for the administrative, management or supervisory body.

B.23. All options will require supervisory authorities to have staff who are trained in interviewing and challenging.

3) Operational objectives

B.24. The assessment of the Use test has several operational objectives for Solvency II:

- Introduce risk-sensitive harmonized solvency standards
- Harmonise supervisory powers, methods and tools
- Promote compatibility of the prudential regime for EU undertakings with the work of the IAIS and IAA
- Ensure efficient supervision of insurance groups and financial conglomerates

4) Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives defined in Section 3 of this Annex

B.25. Neither Option 1 nor Option 2 alone achieves all the objectives reasonably effectively and efficiently. By putting the use test at the centre of the undertaking's strategic decision-making, on the one hand Option 1 encourages good risk management and a more risk-sensitive assessment of the SCR. On the other hand the use of the output only at the topmost organisational level may lead to a situation where the identification with the internal model gets lost and this may lead to a situation where the information basis in an undertaking may differ from each other. In this case the formal good risk management decreases. Option 3 achieves the objectives most effectively, as it encourages the use of the internal model in decision-making at all levels of the undertaking. This removes the disadvantages of Options 1 and 2 and combines the advantages of Option 1 and Option 2. This is summarised in the Summary table, where there is an explicit assessment of each option against the objectives.

B.26. Option 2 is effective in harmonising supervisory powers, methods and tools, but may rely more on a check-list approach to assessing compliance. Option 1 is similarly effective, but the harmonisation ends at

the topmost organisation level of an undertaking. Option 3 achieves consistency without reliance on a check-list.

B.27. Options 1 and 3 link more strongly to the work of the IAIS and the IAA than Option 2.

B.28. On the one hand, Option 1 ensures the undertaking meets the use test requirements by putting the use test at the centre of strategic decision making and allows undertakings to organise themselves, and hence the internal model, in a way that reflects their own decision-making. On the other hand Options 2 and 3 ensure the insurance group the perspective that the internal model is widely accepted in the whole group as it is used on every level of the undertaking and this avoids different information basis within one group.

B.29. In conclusion, taking into account the potential cost and benefits for policy holders and beneficiaries, undertakings and supervisory authorities, the effectiveness and efficiency level to meet the relevant objectives, and its sustainability and comparability level CEIOPS recommends Option 3, combining the level of detail in Option 2 and the non-mandatory nature of Option 1. Option 1 embeds the internal model into the undertaking at the top level. But CEIOPS would also expect the undertaking to use the outputs of the model at a more granular level (nearly Option 2). CEIOPS also expect that the more the undertaking improves the internal model, the more the outputs will be used in the different levels of the undertaking. Thus, Option 3 encourages the use of the internal model at all levels of the undertaking and reflects the undertaking's use of the internal model in decision-making. This links to the foundation principle in CEIOPS' advice on the Use test.

Annex C Impact Assessment - Data and expert Judgement

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures[37]. To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment[38]. On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made[39]. This impact assessment covers issue 14 of the list of policy issues and options.

Two summary tables accompany the impact assessment, published in a separate excel document.

Narrative

1) Brief description of the policy issue

C.1. The internal model relies on the calculation of a probability distribution forecast, which in turn should be based upon current and credible information and realistic assumptions. For that purpose, undertakings may wish to use different sources of information, among which there are in particular internal and external data, as well as expert judgement when data is scarce or it is not reasonable to assume that it provides a good basis for assessing likely future conditions. The question that arises in this context is how quality standards for data and the use of expert judgement should be determined. How should the quality of data be monitored and ensured on an ongoing basis? What are the contributions of the undertaking, the supervisory authorities and third parties in this role? How should one deal with instances where data quality is compromised? Under what conditions are undertakings allowed to supplement available data with expert judgement?

2) Detailed description of policy options and assessment of the relative impacts on the different affected parties

[37] http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf
[38] http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf
[39] http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf.

Detailed policy option description

C.2. Option 1

Undertakings shall check the quality of all data used in the internal model as well as expert judgement used in relation to data. Undertakings shall agree the use of internal and external data and expert judgement with the supervisory authority on a case-by-case basis.

Initially during model approval and each time the undertaking intends to make a change in the data used in the internal model or to apply expert judgement it will approach the supervisory authorities and seek approval for the specific use of data or expert judgement under consideration in that case. The supervisory authorities may approve or decline the undertaking's request, or they may impose restrictions or conditions that the undertaking has to observe in using the respective data or expert judgement

In this option supervisory authorities would exercise a very tight control function as they take decisions on the quality of data and expert judgement on an individual basis.

C.3. Option 2

Undertakings establish their own policy on data quality. The policy specifies the data quality criteria, the respective data sources (internal, external) and use of expert judgements, as well as the methods used and the responsibilities for validating the data and expert judgements. Furthermore, the interrelation between data and expert judgement must be addressed. The policy, as well as major changes to it, are subject to supervisory approval.

Undertakings are required to put the use of data and expert judgement on a undertaking footing by establishing their own policy on data quality. With the aim to ensure the quality of data and expert judgement used in the internal model the policy provides a common basis for both the undertaking and the supervisory authority, as it is subject to supervisory approval.

As a minimum, the undertakings specify in the policy their understanding and implementation of the three data quality criteria *"accurateness", "completeness"* and *"appropriateness"*, all data sources irrespective of being internal or external sources, their use of expert judgements as well as the methodology applied and the responsibilities for validating the data and expert judgement.

In the assessment of the adequateness of data and expert judgement both parties may refer to the policy. Thereby, the interaction between undertaking and supervisory authority is well-structured as happening

according to the policy and specific case-by-case decisions requiring intensive communication are reduced to the necessary amount.

The fact that any major changes to the data policy are subject to supervisory approval contributes to the continuous appropriateness of the undertaking's data quality standards.

C.4. Option 3

Internal as well as external data and the use of expert judgement must be reviewed by an independent third party. Expert judgement may be used in all areas. The use of expert judgement must be well-justified, explained and documented. In particular, when data is available, expert judgement must be reconciled with the data.

All data irrespective of being internal or external data as well as expert judgement must be subject to review by an independent third party. Thus, always a third party besides the undertaking itself and its supervisory authority is highly involved in the assessment of data quality. Nonetheless, the undertaking remains ultimately responsible for the quality of data and expert judgement in use.

In the exercise of its control function where data quality is concerned the supervisory authority strongly relies on the judgement made by these third parties.

While undertakings are allowed to make use of expert judgement related to data in all areas (e.g. for every risk category or modelling purpose), in the case that data is available, expert judgement must be reconciled with that data.

In this option the requirement to justify, explain and document the use of expert judgement is set out explicitly in order to increase transparency given that supervisory authorities are mostly acting on the findings of third parties.

C.5. Option 4

Internal as well as external data and the use of expert judgement must be reviewed by an independent third party. The use of expert judgement should be kept to a minimum and is only allowed when data is unavailable. It must be well-justified, explained and documented.

Option 4 is the same as Option 3 except for the scope of expert judgement that is restricted. According to the belief that expert judgement in relation to data is often unobjective, non-transparent and difficult to validate, undertakings are expected to keep the use of expert judgement to a minimum. Thus, the application of expert judgement is allowed only if relevant data is unavailable.

Impact on industry, policy holders and beneficiaries and supervisory authorities

Likely Industry response

C.6. Insurance industry will most likely reject Option 1 because it demands a lot of interaction with the supervisory authorities. This may be considered by undertakings as too resource intensive and time-consuming.

C.7. Option 2 will most likely be perceived as a workable solution that enables undertakings to set up valuable quality standards regarding data and expert judgement with the associated costs limited. Particularly, undertakings will likely appreciate the flexibility inherent in this option to use expert judgement in the way that is most suitable to their needs.

C.8. Part of the insurance industry will support the idea to commit undertakings to have their use of data and expert judgement regularly reviewed by independent third parties. While this may be especially true for providers of such services, some undertakings may also willingly choose to rely on external quality checks and to use these independent reviews to demonstrate compliance with the requirements set out to data and expert judgement to supervisory authorities. However, it is most likely that the majority of undertakings considers third party reviews as too costly and will therefore reject Option 3 and Option 4.

C.9. Option 4 will probably be rejected even stronger than Option 3 because the industry relies on using expert judgement also in those cases where data is available or even comprehensive, and restricting the use of expert judgement to those situations where no data is available would reduce the amount of discretion they can apply to the use of data.

C.10. In all, insurance industry will probably favour Option 2.

Cost and Benefits

- Policy holders and Beneficiaries

C.11. Options 1, 3 and 4 all impose significant additional costs on the undertaking, either due to supervisory authorities case-by-case decisions on data and expert judgement resulting in increased bureaucracy or by the requirement to have the use of data and expert judgement validated by an independent third party. It can be assumed that in the long term these additional costs are (in all or part) passed on to policy holders or beneficiaries. This is in contrast to Option 2 where incremental costs are expected to be considerably lower, as no third party is involved, and with

the data policy the undertaking and supervisory authority have a common basis for communication at their disposal.

- Industry / (Re)insurance undertakings:

C.12. As already mentioned above, in options 1, 3 and 4 undertakings will most likely incur additional costs that are significantly higher than those incurred in Option 2.

C.13. The costs in Option 2 are likely to be to a great deal one-off expenses that are incurred for the initial development and implementation of the quality standards as set out in the undertaking's own data policy. Beyond that, the undertaking will also incur ongoing costs. It must allocate continuously resources to the communication with the supervisory authorities, the validation of the standards etc.

C.14. In the other options costs arise almost exclusively on an ongoing basis.

C.15. In Option 1 the expenses will be predominantly determined by costs incurred due to the interaction with supervisory authorities. The interaction undertaking – supervisory authority will be relatively frequent and intensive as afforded by decisions on the use of data and expert judgement that are taken case-by-case. Therefore, in Option 1 these costs will surely be considerably higher than in Option 2.

C.16. In Option 3 and 4 undertakings incur expenses for the third party reviews that have to be conducted on a regular basis. It can be assumed that external reviews of the use of data and expert judgement are so costly that the undertaking's overall expenses with respect to data in Option 3 and 4 are well above the costs in Option 1 and even higher than those in Option 2.

C.17. For each option the relative amount of costs will likely vary with the undertaking's business and with its size. (Re)insurance groups and large undertakings may benefit from synergy effects (e.g. due to central data maintenance within a large undertaking or a group). Therefore, it can be expected that the costs tend to be higher for SMEs. Especially, the costs for independent third party reviews in Option 3 and 4 may be prohibitively high for some SMEs.

C.18. While every option is, in principle, suited to guarantee the quality of all data and expert judgement in use, in practice some shortcomings may arise.

C.19. The burdensome communication with supervisory authorities in Option 1 might prevent undertakings from liaising with the supervisory authority whenever it seems necessary. As a consequence, the quality of data and expert judgement may be, at least temporarily, compromised. For

example, the undertaking continues to use data that is outdated or that needs some adjustment to remain appropriate.

C.20. Option 2 seems to be best suited to instruct undertakings to develop and implement data quality standards that are highly tailored to their individual needs and requirements. However, the option bears the risk that supervisory authorities do not succeed in urging the undertakings to reach this goal. Undertakings may misuse the freedom given to them and establish a data policy with quality standards that are not sufficiently high and do not comply with regulatory guidelines.

C.21. Most likely larger undertakings or groups will be better prepared to establishing a useful data policy than SMEs. Especially for small undertakings this could be a challenging task and they might need guidance in addition to Level 2 implementing measures. However, smaller undertakings may have a shorter chain from initial input of data to use of data in an internal model and so may find some elements of developing a data policy easier.

C.22. In Option 3 and 4 the undertaking's incentive or self-discipline to develop and maintain data quality standards that are tailored to its individual needs is likely to be less strong in comparison to Option 1 or 2, as third parties are highly involved. The options bear the risk that undertakings are trying too much to conform with external specifications with respect to data, regardless if these really fit their internal needs.

C.23. Moreover, the restriction in Option 4 of the use of expert judgement data to the case when data is unavailable may probably compromise the acceptance of the internal model throughout the undertaking. Model users would have to put confidence in model results based on data that they consider to be inadequate without applying expert judgement in addition. As a consequence, undertakings may not make use of their internal model in a way that is compliant with the Use test. Furthermore, the restriction may discourage internal modelling.

C.24. For some risks it might prevent undertakings from developing internal models and applying for model approval as they would feel to be forced to use data that is not adequate. This is in conflict with the idea of integrated risk management enhanced by internal models where inner inconsistencies are absent.

C.25. In all, as opposed to Option 2 the options 1, 3 and 4 are very likely to impose – directly or indirectly - some restrictions that may reduce the use of data or expert judgement, and thereby lead to suboptimal precision and validity of internal model results.

- Supervisory authorities

C.26. Option 1 is very resource-intensive for supervisory authorities because it implies a large amount of interaction with the undertaking. As the use of data and expert judgement is approved on a case-by-case basis, supervisory authorities will have to take much effort in order to ensure harmonisation across the EU with respect to data quality standards.

C.27. Once the undertaking's data policy within Option 2 is approved, supervisory authorities will likely be involved in the control of data quality and the use of expert judgement only to a medium degree as the interaction undertaking-supervisory authority is then based on that policy. Accordingly, Option 2 is most likely to be less burdensome for supervisory authorities.

C.28. It is inherent in this option that supervisory authorities will likely meet the challenge to deal with major changes regarding the use of data and expert judgement (or changes to the policy itself) while not being deeply involved in the respected processes as it is likely to be the case in Option 1.

C.29. Both Option 1 and Option 2 require supervisory authorities to have in depth in-house knowledge on the use of data and expert judgement as prerequisite for the assessment of its quality. Corresponding experience on the part of supervisory authorities will be essential. This is all the more the case in Option 2 where the supervisory authorities agrees with the undertaking on the policy on data and data update as part of the initial model approval. Then supervisory authorities should not rely on a gain in expertise in the subsequent communication with undertakings.

C.30. As compared to "only insurance" supervisory authorities, merged insurance and bank supervisory authorities are likely to be more prepared because they may resort to cross-sectoral experience.

C.31. Options 3 and 4 will most likely impose the least burden on the supervisory authorities. In their assessment of the quality of data and expert judgement used in relation to data they would resort to the judgement by third parties. This implies that supervisory authorities generally have confidence in these external reviews. In the long-term, however, the two options bear the risk that supervisory authorities become more and more dependent on the judgement by external parties as valuable expertise is lost or is not acquired, respectively.

C.32. Furthermore, the delegation of the actual task to check the quality of data to third parties involves a considerable loss in detailed information about the undertaking and its economic situation.

C.33. Unlike Option 3, Option 4 it is seemingly easier and less burdensome for supervisory authorities to fulfil their task in control of the use of expert judgement to data as it is generally to be kept to a minimum. However, the restriction of expert judgement to the case when data is not

available, might also have the opposite effect: The assessment of the quality of available data might be even more involved.

3) Operational Objectives

C.34. In CEIOPS' opinion the operational objectives that are most relevant for the policy issue at hand are the following two:

- Objective 1: Introduce risk-sensitive harmonized solvency standards.
- Objective 2: Harmonise supervisory powers, methods and tools.

C.35. The assessment and comparison of the policy options and eventually CEIOPS' decision is based on these objectives. Additionally, the more general quality criteria "sustainability" and "consistency" are taken into account.

4) Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives defined in Section 3 of this Annex

C.36. The comparison and ranking of the policy options will be based on the effectiveness and efficiency of each option in reaching the relevant objectives. Effectiveness refers to the extent to which the policy option realizes the objective. Efficiency refers to the extent to which the overall benefits of the policy option outweigh the costs associated with that option, or at least minimise them. The source of evidence is mainly the qualitative information that CEIOPS has gathered in its continuing dialogue with insurance industry's stakeholders, especially when preparing the Stock-Taking Report and this Advice.

<u>Effectiveness</u>

- Objective 1: Introduce risk-sensitive harmonized solvency standards

C.37. As pointed out in the costs and benefits analysis, while every option is in principle suited to realize the objective to introduce risk sensitive standards, in practice shortcomings may arise in every option that might interfere with this objective. In CEIOPS' opinion the potential shortcomings of Option 1 and 2 in this respect are less severe than those of Option 3 and 4, especially because in Option 1 and 2 supervisory authorities are more directly involved and have therefore a better chance to react on any adverse implications.

C.38. In all four options harmonisation is not fully provided at the outset. In any case efforts have to be taken that standards for the use of data quality and expert judgement are applied consistently across the EU. Key to harmonisation is in options 1 and 2 supervisory authorities having an intensive dialogue and in options 3 and 4 supervisory authorities urging third parties providing reviews on data to ensure consistent standards, respectively. However, it is rather difficult to anticipate the effectiveness of the different options in this respect.

C.39. Combining the two aspects of objective 1, it can be reasonably assumed that for the reasons stated Options 1 and 2 will meet this objective to a high degree whereas Options 3 and 4 do only to a medium degree.

- Objective 2: Harmonise supervisory powers, methods and tools

C.40. Option 1 is suitable to meet the second objective only to a certain, probably low degree, as the proceeding of supervisory authorities, in particular the methods and tools used, will differ considerably between authorities and even between undertakings. CEIOPS believes that the options 2, 3 and 4 are in general better suited to meet Objective 2 and do not differ considerably in their effectiveness. As efforts will still be necessary in order to ensure harmonisation, CEIOPS considers the effectiveness of the options 2, 3 and 4 to be medium.

Efficiency

C.41. The degree of efficiency to which the various options meet the two objectives is determined primarily by the burden they impose on the various stakeholders (insurance industry and undertakings in particular, policy holders and beneficiaries, supervisory authorities) and their demands with respect to resources. According to the statements made above (cf. cost-benefit analysis), CEIOPS classifies the options as follows: Option 1 is efficient only to a low degree; the efficiency of Option 3 and 4 is medium; while Option 2 is highly efficient because data quality standards can be tailored individually to the undertaking's requirements.

Sustainability

C.42. CEIOPS considers Option 2 as most sustainable as undertakings will benefit in the long-term from having established data quality standards that are highly tailored to their individual needs, and which can be adapted to the changing requirements as the internal model develops. For this reason, CEIOPS qualifies the level of sustainability of Option 2 as high and, in contrast, the level of the other options only as medium.

Consistency

C.43. CEIOPS classifies the level of consistency provided by Option 4 as low due to the associated risk that inconsistencies regarding data quality may arise due to the restriction of the scope of expert judgement in this option. Furthermore, the absence of internal pressure on data quality that is inherent in options 3 and 4 may also lead to data standards that are applied inconsistently throughout the undertaking. Accordingly, the level of consistency of Option 3 is classified as medium. Option 1 treats every data source separately and individually, which again might give rise to inconsistencies which are not easy to detect. Therefore, the level of consistency of Option 1 is medium. Option 2 provides a high level of consistency because all data sources are treated comprehensively in a single policy paper, and inconsistencies are easy to detect.

C.44. In conclusion, taking into account the potential costs and benefits for policy holders and beneficiaries, the insurance industry and undertakings in particular, and supervisory authorities, the effectiveness and efficiency level in meeting the relevant objectives, and the degree of sustainability and comparability, CEIOPS recommends Option 2.