PEER REVIEW ON THE SUPERVISION OF STOCHASTIC VALUATION UNDER SOLVENCY II

EIOPA-BoS-25-066
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European Insurance and
Occupational Pensions Authority

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ACRONYMS

AFR	Actuarial Function Report
ALM	Asset Liability Management
BoS	EIOPA Board of Supervisors
BP	Best Practice
Delegated Regulation	Commission Delegated Regulation (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)
ECB	European Central Bank
EEA	European Economic Area
EIOPA	European Insurance and Occupational Pensions Authority
ESG	Economic Scenario Generator
EU	European Union
NCAs	National Competent Authorities
O&G	Options and Guarantees
ORSA	Own Risk and Solvency Assessment
PDV	Prudent Deterministic Valuation
PHRSS	Prudent Harmonized Reduced Set of Scenarios

PPP	Prudent Person Principle
PRC	Ad hoc Peer Review Committee for Stochastic Valuation
QRT	Quantitative Reporting Template
RA	Recommended Action
RAF	Risk Assessment Framework
RSR	Regular Supervisory Report
SAQ	Self-Assessment Questionnaire
SCR	Solvency Capital Requirement
SFCR	Solvency and Financial Condition Report
Solvency II Directive	Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)
SRP	Supervisory Review Process
SSC	Supervisory Steering Committee
SV	Stochastic Valuation
TP	Technical Provisions
TOR	Terms of Reference
TVOG	Time Value Options and Guarantees

EXECUTIVE SUMMARY

In accordance with its mandate, EIOPA regularly conducts peer reviews, working closely with National Competent Authorities (NCAs), with the aim of strengthening both the convergence of supervisory practices across Europe and the capacity of NCAs to conduct high-quality and effective supervision.

Background and objectives

Based on EIOPA's Peer review work plan 2023-2024[1], EIOPA performed a peer review on the supervision of the Stochastic Valuation (SV) for insurance and reinsurance undertakings under Solvency II according to Article 30 of EIOPA Regulation[2].

The peer review is performed by an ad hoc peer review committee (PRC), composed by EIOPA staff members (including the chair of the committee) and representatives of NCAs who are knowledgeable on the topic.

This review by peers addressed the supervision of stochastic valuation of best estimate for products with options and guarantees and, therefore, was focused on life insurance. Deterministic valuation cannot capture the time value of options and guarantees and, therefore, the use of stochastic valuation may have a material impact on the use of undertakings' solvency position depending on the characteristics of the product and the economic environment among other factors.

Stochastic Valuation (SV) is complex and requires high skills of undertakings and supervisors. We observed from countries with a well-developed practice that it has taken several years to develop a good market practice and supervision. It involves cooperation among undertakings, actuarial associations, consultants, academics and supervisors. This is an important issue for assessing proportionality. Our recommended actions take this into account.

Although not highly widespread at the inception of Solvency II, stochastic valuation is increasingly being used by insurance undertakings, also thanks to the availability of reserving software (which generate the stochastic scenarios of economic/financial assumptions for the projections of future cash-flows).

Concerning the participating NCAs, in this peer review EIOPA has used for the second time the option (provided by its Decision on peer reviews) to allow Member States not materially impacted

[1] Peer Review Work Plan 2023-2024

[2] Regulation (EU) No 1094/2010 of the European Parliament and of the Council on 24 November 2010

by the scope of the peer review to request a full exemption from the peer review (waiver) or a limited participation with a reduced scope. To this end, 21 Members States were selected to participate in the peer review, namely 14 Member States in the full scope and 7 Member States for the reduced scope.

Main findings

Following the discussion the January 2024 EIOPA Board of Supervisors (BoS) meeting on the lessons learned in previous Peer Reviews, following a gradual approach, EIOPA enhanced its risk-based approach in selecting Recommended Actions (RAs), focusing on areas where significant improvements in the quality and effectiveness of supervision by NCAs were identified, while also considering the materiality of the findings. As a result, the RAs issued to the NCAs conducting less advanced and comprehensive supervision of the valuation of Options and Guarantees (O&G) focus on the first steps they need to take to ensure a proper stochastic valuation supervision (identification of O&G) and recommend addressing the valuation of O&G as a second step when necessary.

The Peer Review Committee (PRC) identified 3 broad topics to assess (i.e., completeness of the regulatory framework, identification of O&G and valuation of O&G) leading to 3 different RAs. In total, 13 RAs were addressed to 12 NCAs, while 9 NCAs out of 21 participating ones did not receive any RA.

Identification of O&G: Materiality. Several NCAs reported low priority to the supervision of the valuation of options and guarantees because of their immaterial value compared to the total best estimate valuation. However, this value can be very sensitive to economic conditions and change rapidly overtime, becoming material. The PRC observed that in the period before 2022 when interest rates were very low, the time value of many products with options and guarantees was quite low. However, as the interest rates increased, the topic was given higher priority by most NCAs.

Fortunately, in the review of Solvency II the issue of materiality of options and guarantees was already identified, and the Prudent Deterministic Valuation (PDV) based on a small number of scenarios is being developed to provide a method to assess materiality. Our recommended actions regarding materiality refer to the outcomes of the amended Solvency II Directive[3], which entered into force in January 2025.

Valuation of O&G: In general, NCAs are expected to have in place a robust supervisory review process that allows regular monitoring and defining the right prioritisation level. Having national

[3] Directive - EU - 2025/2 - EN - EUR-Lex

specific guidance tailored to the specificities to each market is also recommended to ensure a sound and consistent approach for the supervision of options and guarantees.

The time value of options and guarantees can be captured with closed-formula approaches for some simple options and guarantees. However, simulation methods relying on future economic scenarios are usually needed. These scenarios are generated using Economic Scenario Generators (ESG). In some countries it is observed that the development and maintenance of ESGs is outsourced. This is for instance the case when in one country options and guarantees are mainly offered by subsidiaries who use the Economic Scenario Generator (ESG) developed by their parent undertaking from another country. As the use of the tools is supervised by the NCAs in the home country, it is understandable that the NCA supervising the subsidiary gives less priority to the supervision of the tool, as long as sufficient priority is given to the validation of the results. In these cases, cooperation between the NCAs supervising the parent undertaking and the subsidiaries, e.g., through colleges of supervisors, is particularly relevant.

Best Practices. 7 best practices were identified, which we expect that will serve as inspiration for other NCAs. Some of these best practices are specific to one NCA, as three tools that three NCAs developed to support the supervision of stochastic valuation (e.g. for benchmarking and validation). Other best practices are already being applied by several NCAs, as for example disclosing national specific guidance.

Supervisory Handbook. The EIOPA Guidelines and Supervisory Handbook are often the only/main source of guidance for an NCA. This underlines the importance of this guidance. At the next update of the Supervisory Handbook, in line the policy of keeping the content up-to-dated, EIOPA expects to update the stochastic valuation's section of the handbook to include the new findings and supporting guidance stemming from this peer review.

This final report outlines the recommended actions that the PRC has issued to the different NCAs in order to improve the supervision of stochastic valuation of options and guarantees. Each recommended action[4] issued as part of this peer review is based on the findings of the assessment carried out by the PRC and has been discussed with each NCA involved.

The table below provides a high-level overview of the areas to which the specific recommended actions apply. More detailed information about the individual recommended actions addressed to the relevant NCAs, taking into account the specific area of improvement identified, are reported in Annex 2.

[4] The recommended actions set out in this report, which are addressed to the relevant NSAs, should not be considered per se as EIOPA Recommendations for the purposes of Articles 16 and 30(4) of the EIOPA Regulation or of Article 25(4) of the EIOPA Decision on Peer Reviews

TABLE 1: OVERVIEW OF RECOMMENDED ACTIONS

Recommended Actions (RAs)	NCAs receiving the RAs
COMPLETENESS OF THE REGULATORY FRAMEWORK *No recommended actions*	
IDENTIFICATION OF O&G *Market Overview* 7 NCAs (all in full scope) received the recommended action to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their time value. NCAs are recommended to provide guidance for the implementation of the PDV-methodology for life insurers using deterministic valuation once it becomes available[5].	• ICCS-CY • FI-EE • HANFA-HR • MNB-HU • MFSA-MT • KNF-PL • NBS-SK
VALUATION OF O&G *Calibration and Validation* 3 NCAs (2 in full/1 in reduced scope) received the recommended action to issue guidance and/or implement supervisory activities related to the validation and calibration processes, as the development and maintenance of the Economic Scenario Generator (ESG) is usually outsourced in their countries (e.g. to the parent undertaking located in another country). Liaising with the NCA supervising the undertaking that provided the ESG, when relevant, can also benefit an efficient supervision. *Supervisory Review Process* 3 NCAs (all in full scope) received the recommended action to implement a robust supervisory review process in order to regularly monitor options and guarantees in their respective	• BoG-EL • CAA-LU • KNF-PL • DFSA-DK • DNB-NL • FI-SE

[5] The amendments to the Solvency II Directive entered into force in January 2025. However, it will be applicable from 30 January 2027.

markets and annually define the prioritisation of supervisory activities on them considering updated information on market practices, economic conditions and regulatory developments among others. Therefore, the main difference between the two recommended actions on valuation of options and guarantees is the characteristics of the market: the recommended action on calibration and validation addresses the cases where, due to the characteristics of the market, a limited approach to the supervision of the valuation of options and guarantees focusing on the validation is appropriate.	

Proportion of recommended actions per topic

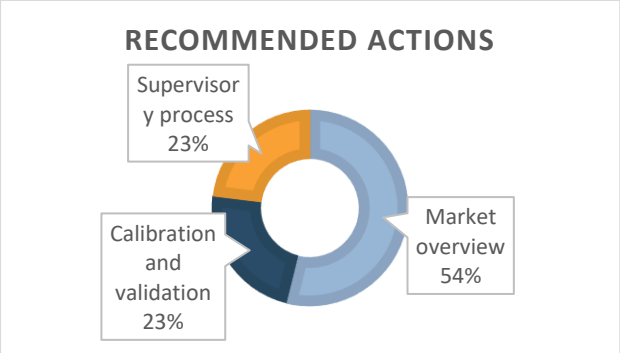


TABLE 2: LIST OF BEST PRACTICES [6]

Topic	Best practice (BP)
REGULATORY FRAMEWORK	• Measures implementing EIOPA's Guidelines
IDENTIFICATION OF O&G	• Materiality of options and guarantees
VALUATION OF O&G	• Qualitative reports • National specific guidance • Tooling: three use cases

[6] For the detailed overview of Best Practices, please refer to Annex III.

1. BACKGROUND, SCOPE, TASKS AND DELIVERABLES

1.1 BACKGROUND

Article 30 of the EIOPA Regulation establishes that EIOPA must conduct peer reviews of some or all the activities of National Competent Authorities (NCAs), to further strengthen consistency and effectiveness of supervisory outcomes.

Detailed guidance on the rules governing the Peer Review and its methodology is included in EIOPA Decision on peer reviews[7].

A Peer Review on Stochastic Valuation was agreed in the two-year peer review work plan 2023-2024, published on EIOPA's website, to be performed in 2024.

The Peer Review is performed by an ad hoc Peer Review Committee (PRC), composed of EIOPA staff members (including the chair of the PRC) and representatives of competent authorities who are knowledgeable on the topic.

1.2 DESCRIPTION AND SCOPE

This peer review addressed the use of stochastic valuation for best estimate calculation purposes. Acknowledging the different levels of penetration of the use of stochastic valuation by insurance and reinsurance undertakings across Europe, the scope of this peer review was twofold, namely, to review supervisory practices by NCAs regarding:

1. the identification of relevant O&Gs and the assessment of the choice of method (deterministic valuation vs. stochastic valuation);

2. the valuation of options & guarantees, the assessment of the choice of economic scenario generators, their use and their ongoing appropriateness.

Any other aspect of best estimate valuation (e.g., contract boundaries or discount rates) were excluded from the scope of this peer review. Any other use of stochastic valuation beyond best estimate valuation (e.g., Solvency Capital Requirement (SCR) calculation, Own Risk and Solvency

[7] https://www.eiopa.europa.eu/sites/default/files/publications/2022_02_14_-_decision_on_peer_reviews.pdf

Assessment (ORSA) scenarios or hedging/Asset Liability Management (ALM) was also excluded from the scope of this peer review.

Concerning the participating NCAs, in line with the approach followed in the previous peer review (on PPP[8]), EIOPA used for the second time the option (provided by its Decision on peer reviews) to allow Member States that are not materially impacted by the scope of this peer review to request a full exemption from the peer review (waiver) or a limited participation with a reduction of scope[9].

In order to facilitate the application of this provision, an impact assessment was prepared by EIOPA staff, based on simple, clear and objective criteria to identify Member States that were expected to consider requesting a waiver or a reduction of scope.

Based on such impact assessment and the own internal assessment at national level, several NCAs requested for waivers and reductions of scope, which were approved by EIOPA's Executive Director when supported by sufficient evidence. Considering the actual requests for waivers and reductions of scope presented by NCAs, **21 Members States** were selected to participate in the peer review with different levels of engagement, representing a market share of 91.2% in terms of life gross written premiums[10].

This is the final scope:

- Full scope: **14 Member States** (CY, DK, EE, ES, HR, HU, LT, LU, MT, NL, NO, PL, SE and SK, (market share 23.4%) are included for both parts (identification of O&G and valuation of O&G)).

- Reduced scope: **7 Member States** (AT, BE, DE, EL, FR, IT and PT (market share 67.8%) are included only in the second part (valuation of O&G), as there is sufficient evidence of identification).

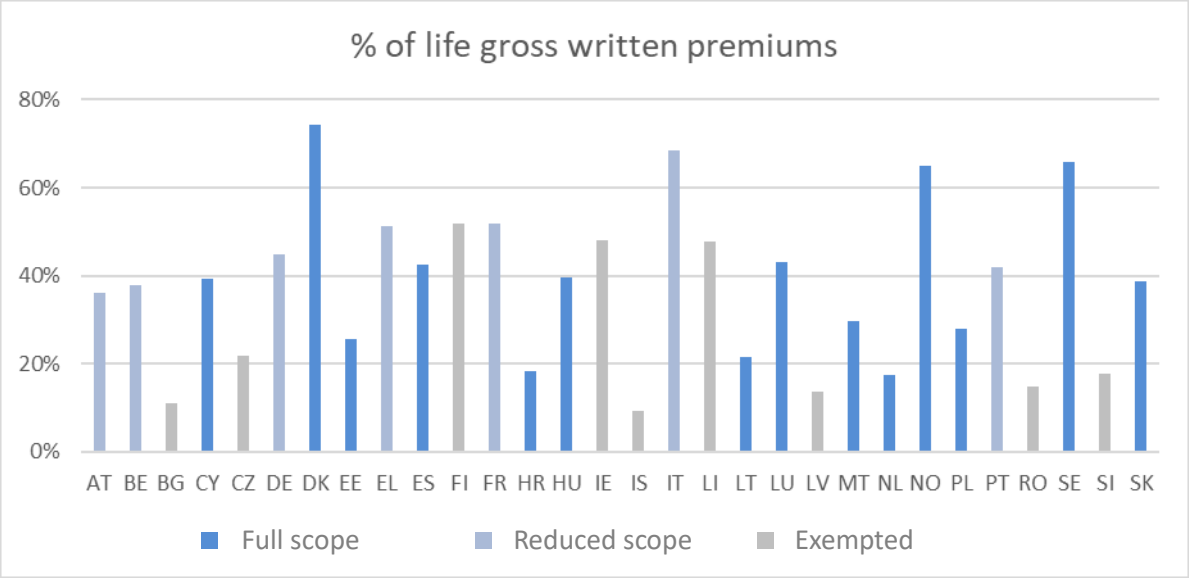
In addition, **9 Member States** (BG, CZ, FI, IE, IS, LI, LV, RO and SI, market share, 8.8%) were exempted from the peer review upon their request).

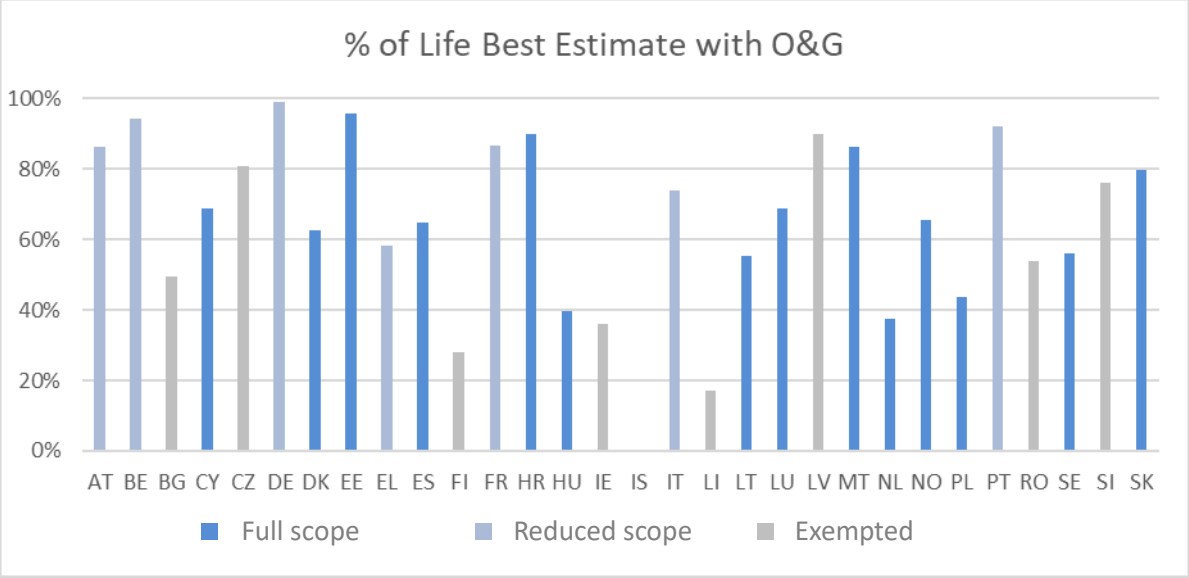
[8] https://www.eiopa.europa.eu/publications/peer-review-report-supervision-prudent-person-principle-under-solvency-ii_en

[9] See Article 10(1) of the EIOPA Decision on peer reviews on reduction of scope (lett. a) and waiver from the peer review (lett. b).

[10] 2023 annual data: Insurance statistics - EIOPA

For the countries excluded from the scope of the peer review, either life business represents a small share of the total written premiums[11] or most life technical provisions are related to products without options and guarantees[12].





[11] 2023 annual data: Insurance statistics - EIOPA

[12] 2023 annual data for life direct business from S.12.01. LoBs/portfolios considered to have material O&G: Insurance with profit participation (C0020), Index-linked and Unit-linked insurance with O&G (C0050), and Other life insurance with O&G (C0080).

The table below summarises the final scope in comparison with the result of the initial impact assessment (in red the difference between the proposed participation of NCAs in the impact assessment and the participation of NCAs in the peer review):

TABLE 3: FINAL SCOPE AND PARTICIPATING NCAS

	AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IS	IT	LI	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SI	SK
Initial Impact Asses.	R	R	E	F	**R**	R	F	F	R	F	E	R	F	F	E	E	R	E	**E**	**R**	**E**	F	**E**	**R**	F	**F**	E	F	E	F
Final Scope	**R**	**R**	**E**	**F**	**E**	**R**	**F**	**F**	**R**	**F**	**E**	**R**	**F**	**F**	**E**	**E**	**R**	**E**	**F**	**F**	**E**	**F**	**F**	**F**	**F**	**R**	**E**	**F**	**E**	**F**

F = Full scope R = Reduced scope E = Exempted

The reference period for this peer review was set from 1st January 2016 until 31st December 2023.

1.3 METHODOLOGY AND APPROACH

The peer review started formally in January 2024 under the rules laid down in article 30 of the EIOPA Regulation with the call for candidates for the ad-hoc Peer Review Committee (PRC), although some preparatory work was carried out in the last quarter of 2023.

The ad hoc Peer Review Committee (PRC) was led by EIOPA and included representatives from the NCAs of Austria (FMA), France (ACPR), Greece (BoG), Italy (IVASS), Netherlands (DNB), Poland (KNF), Spain (DGSFP) and EIOPA.

One of the main sources of information were the answers provided by the NCAs to a Self-Assessment Questionnaire (SAQ), which was distributed to the participating NCAs on 20th March 2024 with a deadline for providing responses by 17th April 2024 (4 weeks). The SAQ has been also published as an annex to this report in a separate document[13].

Taking into account the preliminary findings following the assessment of the responses to the SAQ and any additional information, for example, following additional written questions by the PRC aiming at clarifying the answers provided in the questionnaire, the PRC established priorities for the fieldwork.

[13] Link to the SAQ (to be updated once it is published)

Two different levels of engagement with NCAs during the fieldwork (please see Table 3) were selected based on the following criteria:

a) extent of the experience in a particular area with a view of exploring any potential best practice;

b) potential extent of the misapplication of any measures set out in the European Union (EU) regulatory framework;

c) the relative significance of the NCA as regards the topic under review, which was assessed, among other criteria, through relevant market size and level of activity;

d) relevance of the issue at national level and from a cross-border perspective, affecting more than one European Economic Area (EEA) jurisdiction;

e) non-contribution, insufficiency of responses to the self-assessment questionnaire or information requested;

f) inconsistency or lack of clarity of responses provided in the self-assessment questionnaire.

The fieldwork activities allowed the PRC to confirm their understanding of the answers provided and to discuss any potential issues identified, but also to exchange supervisory experiences and to further understand supervisory practices by NCAs to facilitate the identification of best practices.

TABLE 4: COMMUNICATION MEANS DURING FIELDWORK

Communication means	Number of NCAs	NCAs
Written procedure	**6**	AT, DE, EE, FR, IT, PT
Conference call	**15**	BE, CY, DK, ES, EL, HR, HU, LT, LU, MT, NL, NO, PL, SE, SK

Following the completion of the fieldwork, an analysis of the additional documents and evidence provided was undertaken and the key findings and proposed recommended actions were reported to each NCA.

The detailed timetable for the five phases[14] of the peer review is reported in the following table:

TABLE 5: PHASES AND TIMELINE OF THE PEER REVIEW

Phase	Start	End
Establishment Phase (preparatory work by EIOPA staff, drafting mandate, call for candidates for the ad-hoc PRC)	November 2023	December 2023
Preparatory Phase (drafting Terms of Reference (TOR) and Self-Assessment Questionnaire (SAQ))	January 2024	March 2024
Self-assessment Phase (NCAs to fill in the self-assessment questionnaire)	April 2024	April 2024 (1 month)
Review by ad hoc PRC (analysis of replies to self-assessment questionnaire, peer expectation, fieldwork, preparation of report)	May 2024	September 2024
Final outcomes and publication The draft assessment letters were shared on 23rd October 2024 for 2-week-consultation. The final assessment letters to NCAs were sent on 20th November 2024. The submission of peer review report to the Board of Supervisors (BoS) followed on 12th February 2025.	October 2024	March 2025

[14] The monitoring phase, following the publication of the peer review report and ahead of the launch of the follow-up of the peer review, is not included.

2. RESULTS OF THE ASSESSMENT

This peer review included two main macro topics in addition to the assessment of the relevant regulatory framework: the identification of options and guarantees and the valuation of options and guarantees. Both topics are clearly interlinked as adequate supervision of stochastic valuation can only follow an adequate identification of the relevant options and guarantees. In addition, stochastic valuation is a particularly complex topic, where building a sound supervisory practice might require significant efforts and time.

For these reasons, the PRC has adopted a two-step approach, i.e., the recommended actions related to the supervision of the valuation of options and guarantees have been addressed (when necessary) only to NCAs:

- from countries where a material market share of undertakings already uses stochastic valuation,
- which could already benefit from the specific recommended action on the valuation of options and guarantees considering their current supervisory framework.

Consequently, this approach led to most NCAs receiving only one recommended action (if any) either on the identification of options and guarantees or on the valuation of options and guarantees. After the consultation phase of the draft assessment letters, 13 recommended actions were addressed to 12 NCAs. In addition, 7 best practices currently followed by one or more NCAs have been identified.

TABLE 6: OVERVIEW OF RECOMMENDED ACTIONS (RAS) AND BEST PRACTICES (BPS) PER MACRO TOPIC

Macro topic	Description	NCAs receiving RAs	BPs associated
1) Regulatory framework	Implementation of EIOPA Guidelines	**0**	**1**
2) Identification of O&G	Market overview	**7**	**1**

3) Valuation of O&G	Calibration and validation	**3**	**0**
	Supervisory review process	**3**	**2**
	Tooling	**0**	**3**

2.1 REGULATORY FRAMEWORK

The assessment in this area did not lead to any recommended action as the regulatory framework of all countries complied with the relevant EU regulation (see Annex IV) and all NCAs met EIOPA's framework, process and style guide on Guidelines and Recommendations when implementing EIOPA Guidelines[15]. However, the assessment allowed the identification of one best practice.

A common supervisory culture and coherent supervisory practices are necessary to ensure a high, effective and consistent level of supervision, safeguarding a similar level of protection to all European policyholders and level playing field for all European undertakings.

With a view to establishing this consistent, efficient and effective supervisory practices within the Union, and to ensuring the common, uniform and consistent application of the Union law, EIOPA issues Guidelines addressed to NCAs (article 71(3) of Solvency II Directive). According to article 16 of EIOPA Regulation 1094/2010, NCAs shall make every effort to comply with these Guidelines and, within 2 months of the issuance of a Guideline, each NCA shall confirm whether it complies, intends to comply or does not intend to comply with it. Accordingly, EIOPA discloses compliance tables for each Guideline reflecting each NCA's decision.

As agreed in EIOPA's framework, process and style guide on Guidelines and Recommendations, NCAs complying or intending to comply with a Guideline should incorporate it into their regulatory or supervisory framework in an appropriate manner, report to EIOPA the internal or external implementing measures issued for this purpose and provide either a summary or the relevant links.

[15] Revised Guidelines on Valuation of Technical Provisions - EIOPA and Revised Guidelines on Contract Boundaries - EIOPA

BEST PRACTICE: MEASURES IMPLEMENTING EIOPA'S GUIDELINES

To ensure that the industry has a clear and consistent understanding on the compliance with EIOPA Guidelines, several NCAs issued external implementing measures.

In some countries, the regulator directly incorporated the content of each EIOPA Guideline into their national regulatory framework, allowing for a more integrated overview of the relevant regulation. In other countries, the regulator issued a legal provision stating the direct application of EIOPA's Guidelines, allowing for an efficient and agile compliance with European regulation.

Both approaches are considered Best Practices (BP) as they are transparent to the industry. In any case, it should be noted that during the September 2024 Board of Supervisors (BoS) meeting it was agreed to review EIOPA's framework, process and style guide on Guidelines and Recommendations and this review is expected to be finalised in 2025.

2.2 IDENTIFICATION OF OPTIONS AND GUARANTEES

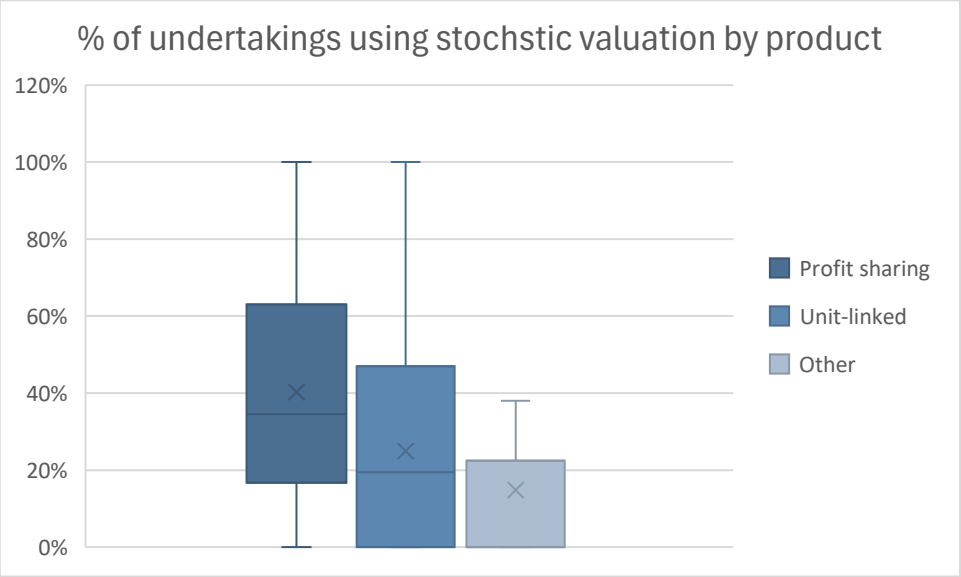
Options and guarantees, such as minimum return guarantees in savings products or guaranteed annuity options, have an asymmetric payoff structure and sensitivity to the uncertainty associated to market conditions such as interest rate movement and policyholder behaviour. While the intrinsic value represents the benefit of the option or guarantee based on current conditions, the Time Value of Options and Guarantees (TVOG) represents the additional value arising from the uncertainty and potential variability of future outcomes associated with these features, i.e., the possibility that market conditions may become more favourable before its expiry.

Deterministic valuation methods use a single predefined scenarios relying on average or expected future market variables to estimate the value of technical provisions. Consequently, deterministic methods fail to capture the asymmetry of options and guarantees, i.e., they cannot estimate their time value of options and guarantees.

Unlike deterministic methods, stochastic valuation allows to capture the time value of options and guarantees either following closed-formula approaches for simple products or, more frequently, simulation methods that model a wide range of possible future economic scenarios. This enables insurers to account for the variability and correlations in financial market conditions as well as their impact on the best estimate.

In practice, this means that in most cases stochastic valuation leads to a best estimate equal or higher than using deterministic valuation[16]. However, not all options and guarantees have the same sensitivity to market conditions and, consequently, in some cases the time value of options and guarantees would be immaterial under market conditions. Therefore, identifying the options and guarantees that may have a material time value is key when choosing the valuation methods.

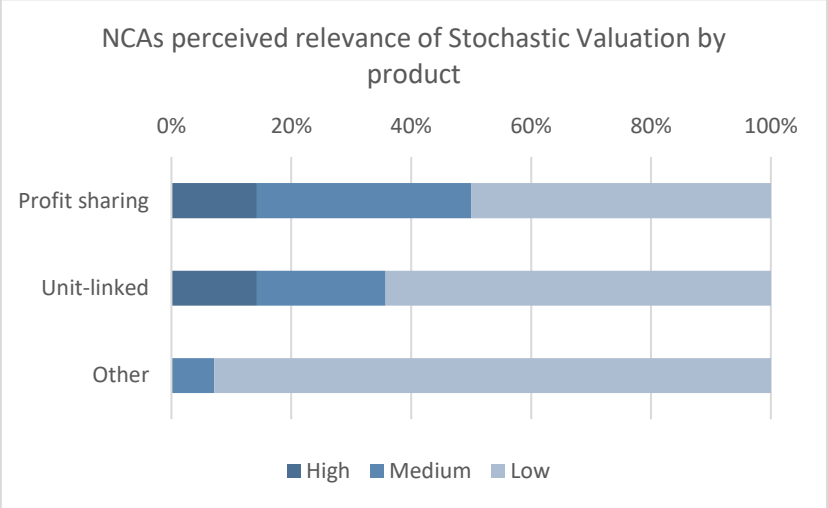
The identification of options and guarantees was assessed only for NCAs participating in the full scope of this peer review (14 NCAs). Therefore, the sample included mostly, although not only, countries where the share of undertakings using deterministic valuation is material.



For most countries in the sample, unit- linked and, especially, profit sharing products are the type of products where stochastic valuation is more frequently used. However, in most of the cases the percentage of undertakings using stochastic valuation is below, or significantly below 60% compared to other markets where the penetration of stochastic valuation is close to 100%.

These differences, however, might be explained by differences among products and the relevance of the options and guarantees embedded. Consistently with the overview above, NCAs' assessment of the relevance of options and guarantees followed a similar pattern: higher for unit-linked and, especially, profit-sharing products, and lower for other products with options and guarantees.

[16] EIOPA background analysis for its Opinion on the 2020 review of Solvency II showed that, under the economic conditions existing at that moment, in almost all cases the use of stochastic valuation led to an increase of technical provisions. This increase was higher than 1% of technical provisions in one third of the cases. Opinion on the 2020 review of Solvency II - EIOPA



However, achieving a robust, accurate and consistent overview is not an easy process, as it requires a clear and objective approach consistently implemented.

2.2.1 MARKET OVERVIEW

Changing economic conditions in the '90s led to severe problems at many insurance undertakings. The payout of benefits to policyholders due to options and guarantees embedded in insurance products rose suddenly, while no provisions were present, leading to the default of some undertakings. Solvency II addresses this risk requiring that all options and guarantees are considered for best estimate valuation article 79 of the Solvency II Directive), while meeting the necessary conditions (mostly articles 22(3), 26, 29, 30, 32, 34 and 35). This is also broadly described in Recital 58 of the Solvency II Directive:

"It is necessary that the expected present value of insurance liabilities is calculated on the basis of current and credible information and realistic assumptions, taking account of financial guarantees and options in insurance or reinsurance contracts, to deliver an economic valuation of insurance or reinsurance obligations. The use of effective and harmonised actuarial methodologies should be required."

To meet these requirements, undertakings should at least (i) identify all options and guarantees embedded in insurance contracts, and (ii) monitor their materiality. The identification may be implemented by means of a list of options and guarantees, by inclusion in the Actuarial Function Report (AFR) or Regular Supervisory Report (RSR), and/or by a structured way of using the Solvency II quantitative reporting templates S.14 and S.15.

For monitoring materiality, the time value of options and guarantees itself is a good measure on how 'material' the risk in the value of options and guarantees is. However, if an undertaking does

not use stochastic valuation, this value will not be known. The computation of the time value requires stochastic valuation, which is a more sophisticated and complex procedure, which complicates the application of the principle of proportionality. Therefore, NCAs are expected to provide guidance to insurers or to set up clear supervisory expectation about the identification and materiality assessment of the time value of options and guarantees to determine whether the use of stochastic valuation is necessary following an objective and consistent approach.

RECOMMENDED ACTION: IDENTIFICATION OF O&G – MARKET OVERVIEW

A recommended action to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their 'time value' was issued to NCAs that reported limited activity on this regard and/or insufficient objective criteria for such assessment.

It should be noted that EIOPA is currently developing – under the review of Solvency II[17] – a Prudent Deterministic Valuation (PDV) approach, which based on a small number of scenarios that will be regularly published by EIOPA. Therefore, NCAs will soon be able to use these scenarios for an annual assessment of materiality of the time value of options and guarantees and determine whether stochastic valuation is necessary. Therefore, these NCAs were also recommended to provide guidance for the implementation of the PDV methodology[18] for life insurers using deterministic valuation once it becomes available[19].

The following 7 NCAs received this recommended action: **ICCS-CY, FI-EE, HANFA-HR, MNB-HU, MFSA-MT, KNF-PL, NBS-SK.**

In case that such assessment leads to more undertakings starting using stochastic valuation, NCAs are also expected to reassess the prioritisation of stochastic valuation supervision and to ensure they have a sound supervisory framework for stochastic valuation.

Considering the relevance of stochastic valuation, as a second step, the **ICCS-CY** and the **MFSA-MT** were already recommended to start developing internal and/or external guidance for stochastic valuation of options and guarantees with material time value. For the **KNF-PL**, the recommended action focused on the materiality monitoring aspect. In addition, considering the relevance of stochastic valuation, the specificities of the Polish market and acknowledging the maturity of its current supervisory activity on the valuation of O&G, the **KNF-PL** also received a specific recommended action on valuation of O&G (see section 2.3).

[17] Directive - EU - 2025/2 - EN - EUR-Lex

[18] Also referred to as "PHRSS methodology" in the detailed list of recommended actions in Annex II.

[19] The amendments to the Solvency II Directive entered into force in January 2025. However, it will be applicable from 30 January 2027.

Some guidance on the supervision of the valuation of options and guarantees can be found in section 2.3 (Valuation of O&G) of this report and in EIOPA's Supervisory Review Process (SRP) Handbook.

For further details on the recommended action, please see Annex 2 – Overview of recommended actions to NCAs.

OUTLOOK: USE OF EIOPA APPROACH TO PRUDENT DETERMINISTIC VALUATION (PDV)

As part of the review of Solvency II, Article 77(7) of the Solvency II Directive allows undertakings that are classified as small and non-complex (SNCU) undertakings and undertakings that have obtained prior supervisory approval to use a prudent deterministic valuation (PDV) of the best estimate for life obligations with options and guarantees in cases where options and guarantees are not material. The main characteristic of the PDV approach is the use of a small number of scenarios, while a full stochastic valuation needs typically thousands or millions of scenarios. This small number of scenarios are used to assess materiality of options and guarantees without a full stochastic valuation.

EIOPA advised that the PDV approach should only be used if the resulting estimate of the time value is below 5% of the Solvency Capital Requirement (SCR). EIOPA considers that this condition should also apply to non-SNCU undertakings that apply for the use of the PDV approach. If the estimate is above the threshold, then this condition is not met. In this case, the time value of options and guarantees may be considered material. If it is material, then Guideline 53A of the Valuation of Technical Provisions recommends using stochastic modelling.

When the reviewed Solvency II regulations become applicable, the PDV scenarios will regularly be published by EIOPA and can be used by insurers for an annual assessment[20].

BEST PRACTICE: IDENTIFICATION OF O&G – MATERIALITY OF O&G

For the prioritisation of NCA supervisory activities regarding options and guarantees, assessing their materiality is paramount. The need for objectiveness and consistency makes quantitative

[20] The amendments to the Solvency II Directive entered into force in January 2025. However, it will be applicable from 30 January 2027.

approaches usually more suitable, but tailored qualitative approaches can also support the process and reduce the burden of a complete quantitative assessment.

The DGSFP-ES combines the characteristics of the products in the insurers' portfolios (micro), with the economic environment and market circumstances (macro).

For the micro part, a decision tree was defined to identify relevant options and guarantees. This tree contains several consecutive steps designed to qualitatively determine the materiality of the stochastic part of the options and guarantees (i.e. the time value). These steps may include:

I. Identification of products where the impact of the scenarios would not be symmetric.

II. In cases with an asymmetric impact, determine the potential existence of time value, distinguishing between products with guarantees and products with redemption rights.

III. In cases with a potential time value of options and guarantees, identification of very out-of-the-money or very in-the-money products (low time value, high intrinsic value).

IV. Products from step III with potential high time value, but with a very short duration might also be excluded.

V. For the remaining products, the assets and liabilities must be analysed to determine the materiality of the time value considering the duration of the assets and liabilities and the return versus the guaranteed rate.

For the macro part, the level of the interest rates and the level of the volatility of the interest rates can be used. The implied volatility of swaptions provides a forward-looking measure of overall interest rate volatility which is related to the time value of options and guarantees. The difference between the level of interest rates and the guaranteed rates is related to the intrinsic value of options and guarantees. This macro information can be used in steps III and V of the decision tree described above.

Before assessing materiality, relevant products must first be identified (step I). Typically, options and guarantees are associated to a class of insurance product, which could be captured by a homogeneous risk group.

For this purpose, the ASF-PT provided specific instructions to insurers to populate Quantitative Reporting Templates (QRT) S.14.01.01.02 and S.14.01.01.05 in a prescribed and uniform way adapted to the products existing in its market allowing for a more efficient and consistent identification of relevant options and guarantees. This may include using a table with products coding where each line contains a product (type) with specified characteristics of options, guarantees, or profit sharing.

2.3 VALUATION OF OPTIONS AND GUARANTEES

2.3.1 INTRODUCTION

In Solvency II, material options and guarantees should be valued using stochastic methods, either a closed-formula approach or simulation based, to adequately capture their time value[21]. The general requirements on the methodologies to calculate technical provisions[22] aim to ensure a prudent, reliable and objective calculation of technical provisions. However, the Delegated Regulation 2015/35 includes only a few specific requirements regarding the underlying assumptions used in stochastic valuation, mostly in article 22(3), which requires the scenarios used to be risk-neutral and consistent with EIOPA's risk-free rate.

The revised Guidelines on the valuation of technical provisions include some additional guidance on the use of stochastic valuation, mostly in the section on the methodologies for the valuation of contractual options and financial guarantees, and the section on Economic Scenario Generator (ESG).

When it comes to stochastic valuation of options and guarantees, undertakings must make fundamental choices, being the most relevant ones: the choice of calculation methods (e.g., simulation-based, closed-formula approaches, replicating portfolios, etc.) and the proportionality considered in its application, as well as the risk drivers considered (including market and non-market risks) and their modelling.

In addition, stochastic valuation requires setting assumptions for market and, especially, non-market risks. Among others, this includes biometric risk, policyholders' behaviour, i.e., the use of policyholders' options (in particular discontinuity options) and future management actions (undertakings' behaviour), including profit sharing and asset allocation modelling[23].

Risk-neutrality for market variables (interest rates, spreads, volatilities, inflation, etc.) can be achieved through the design of the economic scenario generator and verified when validating the scenarios. Undertakings may develop an ESG, use vendor-supplied ESG but run it themselves, directly use vendor-supplied ESG, or use a deterministic set of scenarios. Each choice comes with different risks and benefits in terms of application (methodological and operational), comprehension, and suitability of the scenarios that require a proper assessment.

[21] See guideline 53a of the revised guidelines on the valuation of technical provisions

[22] Section 3 of Chapter III of Title I of the Delegated Regulation 2015/35.

[23] See articles 22, 23 and 26 of the Delegated Regulation (EU) 2015/35 and Guidelines 24B, 36, 37, 39, 42 and 43 of the EIOPA's Revised Guidelines on the valuation of technical provisions for additional details.

The choice of the market model should be compatible with insurance policies and meet the relevant risk drivers. In this regard, attention should be paid to the selection of the market instruments used for calibration with respect to quality, maturity, and availability, especially when traded in markets that lack depth, liquidity, and transparency. Interest rates often play an important role among risk drivers and frequently receive more attention, in particular during recent years when the economic environment required negative interest rates to be modelled and some models did not allow for this.

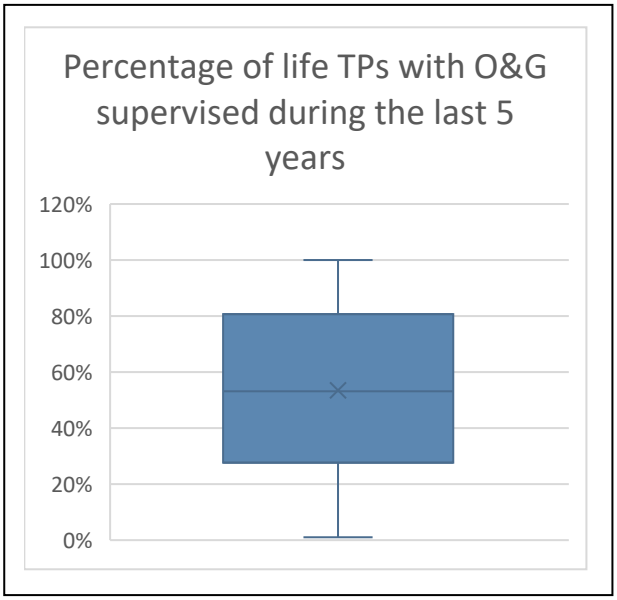
For non-market variables, risk-neutrality might be particularly challenging due to the absence of suitable market data and the existence of correlations. Therefore, special attention should be paid to other aspects of the process to ensure a robust calculation, including data quality, the use of expert judgement, the assessment of future management actions and the treatment of non-hedgeable risks.

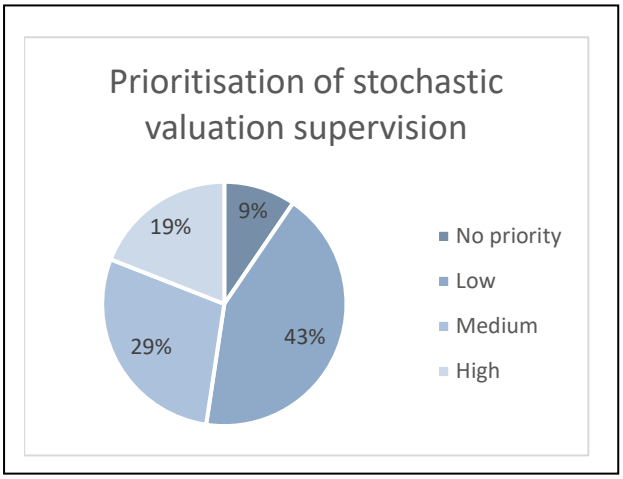
Scenario-based stochastic valuation requires several key choices such as the time step of the calculation, the number of scenarios or the use of variance reduction techniques. All these may influence the convergence of the stochastic valuation. Another relevant choice is the frequency of calculation and calibration, where undertakings need to strike a balance considering the significant amount of time and resources that revaluations require, the frequency when other parameters (e.g., lapse rates) are determined and the potential impact of specific events (e.g., sharp changes in interest rates).

Stochastic valuation is frequently based on some simplifications, in particular the segmentation into homogeneous risk groups and the use of the model points. However, they should not lead to a result that is materially different than the calculation on per policy basis nor misrepresents the risk. Sensitivity analysis can help identifying the relevant drivers, i.e., those driving the material risks associated to the contracts, to ensure that the model is a fair representation of the real contracts.

In line with article 84 of Solvency II Directive, a thorough validation of all the steps, with a sufficiently broad scope, is necessary to ensure that reliable results are produced. The validation process should cover the choice of the models (market, policyholder behaviour and undertaking's behaviour), its documentation, limitations, plausibility, calibration and the operational risk (model risk, uncertainty risk, parameter risk) as well as the use of expert judgement. A complete validation should also include statistical error analyses, back-testing and verification of compliance with the regulations and guidelines.

On average, during the last 5 years[24] NCAs have performed on-site inspections of technical provisions valuation[25] covering on average approximately half of their insurance market in terms of technical provisions with options and guarantees, although there have been material differences, with one NCA covering only 1% of its market and a few NCAs covering 100%. However, in most cases the share of the market covered was between 33% and 80%. It should be noted that several NCAs in the lower range reported more extensive activity either before or after the reference period.





Similarly, the prioritisation of the supervision of stochastic valuation by NCAs showed significant variability across NCAs, although in most cases it remained stable over time. A few NCAs reported a temporary increase in prioritisation during the COVID-19 crisis and/or the recent increase of interest rates. Out of 21 NCAs, 2 reported no prioritisation of stochastic valuation and 4 assigned a high priority, while the rest of the NCAs reported low to moderate prioritisation.

2.3.2 CALIBRATION AND VALIDATION

Often, insurance and reinsurance undertakings use Economic Scenario Generator (ESG) supplied by an external provider, the parent company, or another (re)insurance undertaking of the insurer's group. This situation does not exempt insurance and reinsurance undertakings from carrying out an adequate validation process. Where the calibration is external, it is important that insurance

[24] This is, from 1/1/2019 to 31/12/2023.

[25] This includes on-site thematic on-site inspection focused on technical provisions valuation and broader on-site inspections that had technical provisions valuation within its scope.

undertaking justifies the appropriateness for the local situation of the choice and calibration of the selected risk factors and parameters. Moreover, they should be able to demonstrate the data quality regarding accurateness, appropriateness and completeness.

NCAs are expected to supervise this validation process, even when the Economic Scenario Generator (ESG) is outsourced.

A thorough validation with a sufficiently broad scope is important to ensure that reliable and plausible outcomes are produced. For example, this can be done by:

- choosing another method and check if the valuations do not differ too much,
- back-testing during the initial validation to assess the quality of the valuation, and/or
- an ex-post/ex-ante analysis during the subsequent monitoring which compares the actual evolution of the quantities with the predicted evolution based on sensitivities to the risk drivers combined with the actual evolution of the risk drivers.

There are validation checks that can be done with market data like martingale tests and the prediction of the value of market instruments other than that used in calibration whose value is known. NCAs are expected to investigate whether these tests are performed correctly.

The errors around the outcomes can be analysed statistically, where attention can be paid to variance and other distribution parameters, and to sensitivities towards risks drivers and towards process parameters like the number of scenarios. Where appropriate, it is important that insurance undertakings perform statistical error analyses and tests with market data in a correct way[26].

Discussing the supervision of stochastic valuation during colleges or contacting the supervisor of the parent undertaking when relevant can also benefit an efficient supervision.

RECOMMENDED ACTION: VALUATION OF O&G – CALIBRATION AND VALIDATION

A recommended action on issuing guidance and/or implement supervisory activity related to the validation and calibration processes, was issued to NCAs that reported limited activity on this regard and/or insufficient specific guidance and belong to countries where most undertakings using stochastic valuation have outsourced the development and maintenance of Economic Scenario Generator (ESG).

The following 3 NCAs received a recommended action: **BoG-EL, CAA-LU** and **KNF-PL.**

[26] See Guidelines 83-88 of the revised Guidelines on the Valuation of Technical Provisions

Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP Handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to the Supervisory Steering Committee (SSC)'s mandate.

For further details on the recommended action please see Annex 2 – Overview recommended actions to NCAs.

2.3.3 SUPERVISORY REVIEW PROCESS

Article 36 of the Solvency II Directive requires NCAs to regularly review and evaluate the strategies, processes and reporting procedures established by insurance undertakings, including the valuation of technical provisions with options and guarantees. NCAs shall also have in place appropriate monitoring tools that enable them to identify deteriorating financial conditions and assess undertakings' methods and practices to identify and withstand adverse changes in the economic conditions.

According to Guidelines on the supervisory review process, NCAs should include market-wide analysis in the supervisory review process (Guideline 7) and use a Risk Assessment Framework (RAF) to identify current and future risks that undertakings may face and use this outcome, among others, to conduct and prioritize supervisory activities, as well as to determine the scope, depth and frequency of supervisory activities (Guideline 12). To ensure an adequate prioritisation, NCAs should also consider several aspects of its environment such as changes on the economic conditions or to the relevant regulatory and supervisory framework, as well as how this could affect the solvency of insurance and reinsurance undertakings.

It should be noted that economic conditions can change fast, and the time value of options and guarantees can increase or decrease in a very volatile way. Consequently, a risk-based and forward-looking approach to supervision in general and to the supervision of options and guarantees in particular is necessary to ensure the resilience of the insurance industry.

Therefore, NCAs are expected to have a clear and updated understanding of the use of options and guarantees, the valuation methods applied and their impact on the solvency of the undertakings from their markets. As part of the regular supervisory review process, NCAs are expected to perform the necessary monitoring and supervisory activities with a minimum frequency to ensure that current and future risks are properly identified and managed based on updated inputs.

For that purpose, performing thematic reviews every few years, defining regular off-site analysis and/or including every year on-site inspections explicitly covering the supervision of options and guarantees are appropriate examples of relevant supervisory activities that allow NCAs to gather

the relevant input, ensuring ongoing compliance with options and guarantees valuation requirements and adopting any necessary measures in time.

According to Guideline 2 on the supervisory review process, the supervisory review process should be applied in a consistent manner over time, across insurance and reinsurance undertakings and the NCA to ensure a level playing field.

Therefore, to ensure a common understanding with the industry based on a consistent supervisory review process, NCAs are expected to have in place appropriate tools, in particular national specific guidance on options and guarantees, either internal (e.g., national specific handbook or specific templates/checklists for supervisory activities) or external.

RECOMMENDED ACTION: VALUATION OF O&G - SUPERVISORY REVIEW PROCESS

A recommended action to implement a robust supervisory review process in order to regularly monitor options and guarantees in their markets and annually define the prioritisation of supervisory activities on them considering updated information on market practices, economic conditions and regulatory developments among others was issued to NCAs that reported limited supervisory activity on the stochastic valuation of options and guarantees.

A recommended action to develop national specific guidance, either internal or external, tailored to the specificities of its market was issued to NCAs that have not issued complete guidance on the stochastic valuation of options and guarantees.

The following 3 NCAs received this recommended action: **DFSA-DK, DNB-NL and FI-SE.**

Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP Handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to SSC's mandate.

For further details on the recommended action please see Annex 2 – Overview recommended actions to NCAs.

BEST PRACTICE: VALUATION OF O&G - NATIONAL SPECIFIC GUIDANCE

Following its transfer value principle, Solvency II sets different requirements regarding best estimate valuation, some of which are high-level, or principle based and require additional

guidance for a convergent application. While EIOPA revised Guidelines on the valuation of technical provisions addresses this, for some complex and market-specific topics as stochastic valuation additional market-specific guidance is an efficient way to improve consistency and, at the same time, enhances transparency with stakeholders. Different NCAs have implemented this best practice in various ways facilitating that the expectations of supervisors are incorporated and broadly taken up in the market:

For example, the BaFin-DE[27] and the ACPR-FR[28] published comprehensive and practical guidance on their respective websites on various aspects as to interpreting the Solvency II framework tailored to the local situation and product specificities in their market.

Involvement with stakeholders in the market may contribute to guidance that is clear, practical and achievable, facilitating its acceptance in the market. The collaborative effort may even result in commonly developed modelling approaches or even fully standardized evaluation models, enhancing the efficiency of analysis by restricting to the necessity of checking parametrisation only.

Large markets are comprised of many undertakings, with a significant number of them potentially having material exposures to options and guarantees. In such cases, national specific guidance developed in collaboration with stakeholders might be particularly more efficient to achieve compliance with supervisory expectations than performing only ex-post evaluations within on- or off-site supervisory activities.

For example, the BaFin-DE collaborates with the German actuarial association and German industry interest groups on developing guidelines for the industry, therefore guaranteeing that they are aligned with its supervisory expectations. Also following a collaborative process, the ACPR-FR developed a basic model for dynamic policyholder behaviour widely used in France.

BEST PRACTICE: VALUATION OF O&G - QUALITATIVE REPORTS

In addition to the quantitative reporting templates, Solvency II also requires undertakings to produce other qualitative reports, including the RSR, Solvency and Financial Condition Report (SFCR), AFR and ORSA. In exchange for this effort, NCAs thoroughly analyse these reports before requesting any additional information during their supervisory activities. This is particularly

[27] https://www.bafin.de/DE/RechtRegelungen/Verwaltungspraxis/Auslegungsentscheidungen/ae_node.html

[28] https://acpr.banque-france.fr/system/files/import/acpr/medias/documents/20201204_article_gse_revue.pdf

relevant for complex topics where quantitative information is limited as stochastic valuation of options and guarantees.

The NBB-BE pays particular attention to the actuarial report and has significantly improved its quality by providing additional guidance on its expectations for the documentation of technical provisions calculation[29], emphasizing its comprehensive and systematic nature. The guidance focuses on maintaining up-to-date documentation that includes explanations and justifications for several elements of technical provisions valuation and historic information about past changes. Some of the elements covered are the assumptions used, methodological choices, parameterization, changes to the data used at different calculation dates (e.g., exclusion of certain historical data), the use of expert judgement, the validation of technical provisions, back testing and sensitivity analysis among others.

For 2021 and 2022[30], the IVASS-IT performed an analysis of the changes introduced by the undertakings in the RSRs. The analysis covered disclosures on future management actions and policyholder behaviour from two dimensions, quality of the modelling and the disclosure, including a qualitative judgement for each one based on a scale (e.g., sufficient compliance and/or disclosure, improvements needed, insufficient compliance and/or disclosure). Based on the combination of the qualitative judgments and regulatory compliance check, the supervisory action to be taken is defined.

In addition to regular reports, ad-hoc additional requests of available information may allow for efficient supervisory activities, in particular to assess whether undertakings have a sufficient understanding of the model used and its appropriateness for their portfolios, for which documentation on the validation process and the data used might be particularly relevant.

For example, the ASF-PT eventually requests and evaluates additional documentation produced by undertakings and/or vendors. These requests can include, among others, the characteristics of the mathematical models, the approach used to model volatility (constant, deterministic or stochastic), the financial assumptions and data used in the calibration and the validation process.

2.3.4 TOOLING

Stochastic valuation requires complex and time-consuming calculations which complicate supervisory activity. The use of different tools can significantly improve efficiency when performing

[29] https://www.nbb.be/fr/articles/nbb202226-communication-concernant-les-taches-incombant-la-fonction-actuarielle-ainsi-que

[30] A more regular analysis is currently under consideration.

supervisory activities by providing benchmarks, allowing the identification of outliers, checking compliance with specific requirements or even performing stress tests at macro level. Such tools may be provided by external suppliers, although more frequently they are developed internally to be tailored to the needs of the NCA and the characteristics of its market. Moreover, the development and integration of supervisory tools encourage consistency and transparency across supervisory review processes.

In some cases, the adoption of these tools enables supervisors to process vast datasets more effectively and draw meaningful insights that would be impossible to achieve manually. By automating repetitive tasks and ensuring accuracy, such tools help in focusing supervisory resources on critical areas that require human judgment and intervention. In other cases, smart designs allow to develop tools following approaches that do not require vast datasets and can even run with readily available information (e.g., information form quantitative reporting templates).

BEST PRACTICES: VALUATION OF O&G – TOOL FMA-AT

In the calculation of the best estimate of products with profit sharing features, the value of the future discretionary benefits should be calculated separately, as described by article 25 of the Delegated Regulation. The present value of future discretionary benefits is closely related to the level of financial guarantees included in the product and the assumptions used for stochastic valuation such as future management actions, policyholder behaviour or economic scenarios.

Being aware of this connection, the FMA-AT developed a two-level control based on the value of future discretionary benefits. As a first step, the FMA-AT uses a closed-formula approach based on a research paper[31] to estimate upper and lower thresholds for future discretionary benefits for each undertaking. This calculation is easy to implement and does not require any specific ad-hoc data request. If the future discretionary benefits reported by an undertaking fall outside this range, then a second check is performed. For this second step, the FMA-AT uses an in-house validation tool that performs a full stochastic valuation. This calculation is more complex and requires the undertaking to report ad-hoc data (assets, liabilities, risk neutral scenarios, etc.).

Different ESGs may be used in the same market, as each undertaking might choose a different provider or even develop its own ESG. Therefore, it makes sense to compare statistics of the distribution of scenarios that are produced by the ESGs. Outliers can be detected, and trends can be discerned. This delivers useful information for supervision on undertakings using ESGs.

[31] https://doi.org/10.1017/asb.2022.16

BEST PRACTICES: VALUATION OF O&G – TOOL NFSA-NO

The NFSA-NO developed a tool, coded in R, to transform and present ESG data received from biennial ad-hoc data requests to undertakings. It allows for an easy comparison between peers, and for comparison with market benchmarks. The data request concerns data used for the calibration, correlation assumptions and several percentiles of simulated aggregated asset returns with annual time steps up to 30 years. It also asks for the aggregated return at the final (undertaking-specific) simulation horizon, its mean and its standard deviation. The data is provided at asset class level and at portfolio level for two different portfolios: the real portfolio of the undertaking and a standard asset mix specified by the NCA.

Some tools may not be used or designed for individual group/undertaking supervision but to provide a better understanding of the market at an aggregate level. Such macro tool can provide variable inputs when prioritising supervisory activities or performing different stress tests to assess the impact of potential changes in the economic environment and/or the regulatory framework.

BEST PRACTICES: VALUATION OF O&G – TOOL ACPR-FR

The ACPR-FR developed "France vie" to estimate sensitivities to macroeconomic scenarios in the context of a stress tests or to regulatory changes[32]. The tool applies a projection model to a portfolio that aggregates the main life insurance participants in France (based on a sample of 16 undertakings). The main risk factors to be projected under shock scenarios are: interest rates, spreads, probabilities of default, transition in ratings, equities, real estate, surrenders, and death. Coded in Python, it is significantly automated, including an Excel interface for parametrisation and visualisation that facilitates its use.

When used for stress testing, 'France Vie' produces nested projections: real-world projection through the stressed scenarios provided by the user and risk-neutral projection for Solvency II valuation. The tool projects the balance-sheet through the real-world scenarios, so each year of the real-world projection represents the starting point for a risk-neutral projection. For example, using the 'France Vie' aggregate portfolio, several interest rate scenarios (+/- bps) can be tested using a central scenario based on the European Central Bank (ECB) forward rates to project different accounting and prudential indicators. Similarly, various spread shocks can be tested to

[32] The tool was initially developed to recalculate best estimate of life undertakings during on-site inspections, but this use case was later replaced by the best practices described in the text.

assess the impact of a likely downgrade in the country rating (simulating, for example, an unlikely sovereign debt crisis).

ANNEXES

ANNEX I - COUNTRIES AND COMPETENT AUTHORITIES PARTICIPATING IN THIS PEER REVIEW AND THEIR ABBREVIATIONS

NCAs not taking part in the peer review: 9

Bulgaria, Czech Republic, Finland, Ireland, Iceland, Lichtenstein, Latvia, Romania and Slovenia.

The NCAs below were in the (full or reduced) scope of the peer review and were invited to complete the self-assessment questionnaire.

Country	**Abbreviation**	**Name of concerned Competent Authority**	**Abbreviation used in the report (if any)**
Austria	**AT**	Finanzmarktaufsicht (Financial Market Authority)	**FMA**
Belgium	**BE**	National Bank of Belgium	**NBB**
Cyprus	**CY**	Αρμοδιότητα της Υπηρεσίας Ελέγχου Ασφαλιστικών Εταιρειών (Cyprus Insurance Companies Control Services)	**ICCS**
Croatia	**HR**	Hrvatska agencija za nadzor financijskih usluga	**HANFA**
Denmark	**DK**	Finanstilsynet (Danish Financial Supervisory Authority)	**DFSA**
Estonia	**EE**	Finantsinspektsioon	**FI-EE**
France	**FR**	Autorité de Contrôle Prudentiel et de Résolution	**ACPR**
Germany	**DE**	Bundesanstalt für Finanzdienstleistungsaufsicht	**BaFin**
Greece	**EL**	Τράπεζα της Ελλάδος (Bank of Greece)	**BoG**
Hungary	**HU**	Magyar Nemzeti Bank	**MNB**
Italy	**IT**	Istituto per la Vigilanza sulle Assicurazioni	**IVASS**

Country	Abbreviation	Name of concerned Competent Authority	Abbreviation used in the report (if any)
Lithuania	**LT**	Lietuvos Bankas (Bank of Lithuania)	**BoL-LT**
Luxembourg	**LU**	Commissariat aux Assurances	**CAA**
Malta	**MT**	Malta Financial Services Authority	**MFSA**
Netherlands	**NL**	De Nederlandsche Bank	**DNB**
Norway	**NO**	Finanstilsynet (Norwegian Financial Supervisory Authority)	**NFSA**
Poland	**PL**	Komisja Nadzoru Finansowego	**KNF**
Portugal	**PT**	Autoridade de Supervisão de Seguros e Fundos de Pensões	**ASF-PT**
Slovakia	**SK**	Národná Banka Slovenska	**NBS**
Spain	**ES**	Dirección General de Seguros y Fondos de Pensiones	**DGSFP**
Sweden	**SE**	Finansinspektionen	**FI-SE**

ANNEX II: DETAILED LIST OF RECOMMENDED ACTIONS

RECOMMENDED ACTIONS APPEARING IN ALPHABETICAL ORDER PER MEMBER STATE		
CROATIA -HANFA	**IDENTIFICATION OF O&G:** **Market overview**	The HANFA is recommended to ensure that all undertakings actively identify all options and guarantees and monitor the materiality of their time value. For life insurers using deterministic valuation for options and guarantees, the NCA is recommended to provide guidance for the implementation of the PHRSS methodology[33] once it becomes available (expected in 2025). In case the value according to the PHRSS methodology of options and guarantees for some companies is material according to the threshold described in the methodology, or is likely to become material, so more undertakings would have to start using stochastic valuation, the NCA is recommended to reassess and document the prioritisation of the supervision of options and guarantees and start developing internal or external guidance on proper stochastic valuation of options and guarantees with material time value.
CYPRUS - ICCS	**IDENTIFICATION OF O&G:** **Market overview**	The ICCS is recommended to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their time value. For life insurers using deterministic valuation for options and guarantees, the ICCS is recommended to provide guidance for the implementation of the PHRSS methodology once it becomes available (expected in 2025). Considering the market share of the undertakings using stochastic valuation, as a second step, the ICCS is recommended to start developing internal

[33] Referred to as PDV methodology in this report

		and/or external guidance for stochastic valuation of the options and guarantees with material time value to ensure a consistent and sound approach
DENMARK -DFSA	**VALUATION OF O&G:** **Supervisory process**	To ensure a consistent Supervisory Review Process fostering a common understanding with the industry regarding the valuation of options and guarantees, the DFSA is recommended to develop national specific guidance, either internal or external, tailored to the specificities of its market. Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to SSC's mandate.
ESTONIA - Finantsinspektsioon	**IDENTIFICATION OF O&G:** **Market overview**	The Finantsinspektsioon is recommended to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their time value. For life insurers using deterministic valuation for options and guarantees, the Finantsinspektsioon is recommended to provide guidance for the implementation of the PHRSS methodology once it becomes available (expected in 2025).
GREECE -BoG	**VALUATION OF O&G:** **Calibration and validation**	The BoG is recommended to issue guidance and/or implement supervisory activity related to the validation and calibration processes, even when the development and maintenance of the Economic Scenario Generator is outsourced. Liaising with the supervisor of the parent undertaking that provided the Economic Scenario Generator when relevant can also benefit an efficient supervision. Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP handbook, whose content on stochastic valuation is to be

		updated and extended in 2025 according to SSC's mandate.
HUNGARY- MNB	**IDENTIFICATION OF O&G:** **Market overview**	The MNB is recommended to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their time value. For life insurers using deterministic valuation for options and guarantees, the MNB is recommended to provide guidance for the implementation of the PHRSS methodology once it becomes available (expected in 2025). In case the value according to the PHRSS methodology of options and guarantees for some companies is material according to the threshold described in the methodology, or is likely to become material, so more undertakings would have to start using stochastic valuation, the NCA is recommended to reassess and document the prioritisation of the supervision of options and guarantees.
LUXEMBOURG - CAA	**VALUATION OF O&G:** **Calibration and validation**	The CAA is recommended to issue guidance and/or implement supervisory activity related to the validation and calibration processes, even when the development and maintenance of the Economic Scenario Generator is outsourced. Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to SSC's mandate.
MALTA - MFSA	**IDENTIFICATION OF O&G:** **Market overview**	The MFSA is recommended to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their time. For life insurers using deterministic valuation for options and guarantees, the NCA is recommended to provide guidance for the implementation of the

		PHRSS methodology once it becomes available (expected in 2025). Considering the market share of the undertakings using stochastic valuation, as a second step, the MFSA is recommended to start developing internal and/or external guidance for stochastic valuation of the options and guarantees with material time value to ensure a consistent and sound approach.
NETHERLANDS -DNB	**VALUATION OF O&G:** **Supervisory process**	The DNB is recommended to implement a robust supervisory process in order to regularly monitor options and guarantees in its market and annually define the prioritisation of supervisory activities on them considering updated information on market practices, economic conditions and regulatory developments among others. For this purpose, the NCA is recommended to regularly perform supervisory activities focusing on options and guarantees as on-site inspections, off-site analysis and/or specific ad-hoc thematic reviews. To ensure a consistent supervisory process fostering a common understanding with the industry regarding the valuation of options and guarantees, the DNB is recommended to develop national specific guidance, either internal or external, tailored to the specificities of its market. Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to SSC's mandate.

POLAND - KNF	**IDENTIFICATION OF O&G:** **Market overview**	The KNF is recommended to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their 'time value'. For life insurers using deterministic valuation for options and guarantees, the KNF is recommended to provide guidance for the implementation of the PHRSS methodology once it becomes available (expected in 2025).
	VALUATION OF O&G: **Valuation and calibration**	The KNF is recommended to issue guidance and/or implement supervisory activity related to the validation and calibration processes, even when the development and maintenance of the Economic Scenario Generator is outsourced. Liaising with the supervisor of the parent undertaking that provided the Economic Scenario Generator when relevant can also benefit an efficient supervision. Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to SSC's mandate.
SLOVAKIA - NBS	**IDENTIFICATION OF O&G:** **Market overview**	The NBS is recommended to ensure that all undertakings identify all options and guarantees and actively monitor the materiality of their time value. For life insurers using deterministic valuation for options and guarantees, the NCA is recommended to provide guidance to implement the PHRSS-methodology once it becomes available (which is expected to be in 2025). In case the value according to the PHRSS methodology of options and guarantees for some companies is material according to the threshold described in the methodology, or is likely to become material, so more undertakings would

		have to start using stochastic valuation, the NCA is recommended to reassess and document the prioritisation of the supervision of options and guarantees and ensure that there is robust and complete internal guidance in place for supervising proper stochastic valuation of options and guarantees with material time value.
SWEDEN -FI	**VALUATION OF O&G:** **Supervisory process**	The FI-SE is recommended to implement a robust supervisory process in order to regularly monitor options and guarantees in its market and annually define the prioritisation of supervisory activities on them considering updated information on market practices, economic conditions and regulatory developments among others. For this purpose, the NCA is recommended to regularly perform supervisory activities on options and guarantees as on-site inspections, off-site analysis and/or specific ad-hoc thematic reviews, focusing on the areas already identified by the NCA (i.e., assessment of the appropriateness of undertaking's models and their use of assumptions proposed by external providers "Economic Scenario Generators" and scenarios used by companies in comparisons with their portfolios). To ensure a consistent supervisory process fostering a common understanding with the industry regarding the valuation of options and guarantees, the FI-SE is recommended to develop national specific guidance, either internal or external, tailored to the specificities of its market. Some general guidance on stochastic valuation can be found in the technical provisions chapter of EIOPA's SRP handbook, whose content on stochastic valuation is to be updated and extended in 2025 according to SSC's mandate.

ANNEX III: DETAILED LIST OF BEST PRACTICES

A relatively large number of good practices were identified during the peer review, compared to the previous peer review, either coming from the self-assessment questionnaire or the fieldwork.

Initially, 21 good practices were identified coming from 9 NCAs, although the final report has included only 7 best practices due to overlaps, applicability to other NCAs and quality control after the PRC review. The range of topics proposed varies from regulatory framework to supervisory process, convergence, disclosure and reporting.

BEST PRACTICES	
REGULATORY FRAMEWORK: **Measures implementing EIOPA's guidelines**	To ensure that the industry has a clear and consistent understanding on the compliance with EIOPA Guidelines, several NCAs issued external implementing measures. In some countries, the regulator directly incorporated the content of each EIOPA Guidelines into their national regulatory framework, allowing for a more integrated overview of the relevant regulation. In other countries, the regulator issued a legal provision stating the direct application of EIOPA's Guidelines, allowing for an efficient and agile compliance with European regulation. Both approaches are considered Best Practices (BP) as they are transparent to the industry. In any case, it should be noted that during the September 2024 Board of Supervisors (BoS) meeting it was agreed to review EIOPA's framework, process and style guide on Guidelines and Recommendations and this review is expected to be finalised in 2025.
IDENTIFICATION OF O&G: **Materiality of options and guarantees**	For the prioritisation of NCA supervisory activities regarding options and guarantees, assessing their materiality is paramount. The need for objectiveness and consistency makes quantitative approaches usually more suitable, but tailored qualitative approaches can also support the process and reduce the burden of a complete quantitative assessment. The DGSFP-ES combines the characteristics of the products in the insurers' portfolios (micro), with the economic environment and market circumstances (macro). For the micro part, a decision tree was defined to identify relevant options and guarantees. This tree contains several consecutive steps designed to

Continuation of **Materiality of options and guarantees**	qualitatively determine the materiality of the stochastic part of the options and guarantees (i.e. the time value). These steps may include: I. Identification of products where the impact of the scenarios would not be symmetric. II. In cases with an asymmetric impact, determine the potential existence of time value, distinguishing between products with guarantees and products with redemption rights. III. In cases with a potential time value of options and guarantees, identification of very out-of-the-money or very in-the-money products (low time value, high intrinsic value). IV. Products from step III with potential high time value, but with a very short duration might also be excluded. V. For the remaining products, the assets and liabilities must be analysed to determine the materiality of the time value considering the duration of the assets and liabilities and the return versus the guaranteed rate. For the macro part, the level of the interest rates and the level of the volatility of the interest rates can be used. The implied volatility of swaptions provides a forward-looking measure of overall interest rate volatility which is related to the time value of options and guarantees. The difference between the level of interest rates and the guaranteed rates is related to the intrinsic value of options and guarantees. This macro information can be used in steps III and V of the decision tree described above. Before assessing materiality, relevant products must first be identified (step I). Typically, options and guarantees are associated to a class of insurance product, which could be captured by a homogeneous risk group. For this purpose, the ASF-PT provided specific instructions to insurers to populate Quantitative Reporting Templates (QRT) S.14.01.01.02 and S.14.01.01.05 in a prescribed and uniform way adapted to the products existing in its market allowing for a more efficient and consistent identification of relevant options and guarantees. This may include using a table with products coding where each line contains a product (type) with specified characteristics of options, guarantees, or profit sharing.

VALUATION OF O&G: **Qualitative reports**	In addition to the quantitative reporting templates, Solvency II also requires undertakings to produce other qualitative reports, including the RSR, Solvency and Financial Condition Report (SFCR), AFR and ORSA. In exchange for this effort, NCAs thoroughly analyse these reports before requesting any additional information during their supervisory activities. This is particularly relevant for complex topics where quantitative information is limited as stochastic valuation of options and guarantees. The NBB-BE pays particular attention to the actuarial report and has significantly improved its quality by providing additional guidance on its expectations for the documentation of technical provisions calculation[34], emphasizing its comprehensive and systematic nature. The guidance focuses on maintaining up-to-date documentation that includes explanations and justifications for several elements of technical provisions valuation and historic information about past changes. Some of the elements covered are the assumptions used, methodological choices, parameterization, changes to the data used at different calculation dates (e.g., exclusion of certain historical data), the use of expert judgement, the validation of technical provisions, back testing and sensitivity analysis among others. For 2021 and 2022[35], the IVASS-IT performed an analysis of the changes introduced by the undertakings in the RSRs. The analysis covered disclosures on future management actions and policyholder behaviour from two dimensions, quality of the modelling and the disclosure, including a qualitative judgement for each one based on a scale (e.g., sufficient compliance and/or disclosure, improvements needed, insufficient compliance and/or disclosure). Based on the combination of the qualitative judgments and regulatory compliance check, the supervisory action to be taken is defined. In addition to regular reports, ad-hoc additional requests of available information may allow for efficient supervisory activities, in particular to assess whether undertakings have a sufficient understanding of the model used and its appropriateness for their portfolios, for which documentation on the validation process and the data used might be particularly relevant.

[34] https://www.nbb.be/fr/articles/nbb202226-communication-concernant-les-taches-incombant-la-fonction-actuarielle-ainsi-que

[35] A more regular analysis is currently under consideration.

	For example, the ASF-PT eventually requests and evaluates additional documentation produced by undertakings and/or vendors. These requests can include, among others, the characteristics of the mathematical models, the approach used to model volatility (constant, deterministic or stochastic), the financial assumptions and data used in the calibration and the validation process.
VALUATION OF O&G: **National specific guidance**	Following its transfer value principle, Solvency II sets different requirements regarding best estimate valuation, some of which are high-level, or principle based and require additional guidance for a convergent application. While EIOPA revised Guidelines on the valuation of technical provisions addresses this for some complex and market-specific topics such as stochastic valuation, additional market-specific guidance is an efficient way to improve consistency and, at the same time, enhances transparency with stakeholders. Different NCAs have implemented this best practice in various ways facilitating that the expectations of supervisors are incorporated and broadly taken up in the market: For example, the BaFin-DE[36] and the ACPR-FR published comprehensive and practical guidance on their respective websites on various aspects as to interpreting the Solvency II framework tailored to the local situation and product specificities in their market. Involvement with stakeholders in the market may contribute to guidance that is clear, practical and achievable, facilitating its acceptance in the market. The collaborative effort may even result in commonly developed modelling approaches or even fully standardized evaluation models, enhancing the efficiency of analysis by restricting to the necessity of checking parametrisation only. Large markets are comprised of many undertakings, with a significant number of them potentially having material exposures to options and guarantees. In such cases, national specific guidance developed in collaboration with stakeholders might be particularly more efficient to achieve compliance with supervisory expectations than performing only ex-post evaluations within on- or off-site supervisory activities.

[36] https://www.bafin.de/DE/RechtRegelungen/Verwaltungspraxis/Auslegungsentscheidungen/ae_node.html

	For example, the BaFin-DE collaborates with the German actuarial association and German industry interest groups on developing guidelines for the industry, therefore guaranteeing that they are aligned with its supervisory expectations. Also following a collaborative process, the ACPR-FR developed a basic model for dynamic policyholder behaviour widely used in France.
VALUATION OF O&G: **Tool FMA-AT**	In the calculation of the best estimate of products with profit sharing features, the value of the future discretionary benefits should be calculated separately, as described by article 25 of the Delegated Regulation. The present value of future discretionary benefits is closely related to the level of financial guarantees included in the product and the assumptions used for stochastic valuation such as future management actions, policyholder behaviour or economic scenarios. Being aware of this connection, the FMA-AT developed a two-level control based on the value of future discretionary benefits. As a first step, the FMA-AT uses a closed-formula approach based on a research paper[37] to estimate upper and lower thresholds for future discretionary benefits for each undertaking. This calculation is easy to implement and does not require any specific ad-hoc data request. If the future discretionary benefits reported by an undertaking fall outside this range, then a second check is performed. For this second step, the FMA-AT uses an in-house validation tool that performs a full stochastic valuation. This calculation is more complex and requires the undertaking to report ad-hoc data (assets, liabilities, risk neutral scenarios, etc.).
VALUATION OF O&G: **Tool NFSA-NO**	The NFSA-NO developed a tool, coded in R, to transform and present ESG data received from biennial ad-hoc data requests to undertakings. It allows for an easy comparison between peers, and for comparison with market benchmarks. The data request concerns data used for the calibration, correlation assumptions and several percentiles of simulated aggregated asset returns with annual time steps up to 30 years. It also asks for the aggregated return at the final (undertaking-specific) simulation horizon, its mean and its standard deviation. The data is provided at asset class level and at portfolio level for two different portfolios: the real portfolio of the undertaking and a standard asset mix specified by the NCA.

[37] https://doi.org/10.1017/asb.2022.16

VALUATION OF O&G: **Tool ACPR-FR**	The ACPR-FR developed "France vie" to estimate sensitivities to macroeconomic scenarios in the context of a stress tests or to regulatory changes[38]. The tool applies a projection model to a portfolio that aggregates the main life insurance participants in France (based on a sample of 16 undertakings). The main risk factors to be projected under shock scenarios are: interest rates, spreads, probabilities of default, transition in ratings, equities, real estate, surrenders, and death. Coded in Python, it is significantly automated, including an Excel interface for parametrisation and visualisation that facilitates its use. When used for stress testing, 'France Vie' produces nested projections: real-world projection through the stressed scenarios provided by the user and risk-neutral projection for Solvency II valuation. The tool projects the balance-sheet through the real-world scenarios, so each year of the real-world projection represents the starting point for a risk-neutral projection. For example, using the 'France Vie' aggregate portfolio, several interest rate scenarios (+/- bps) can be tested using a central scenario based on the European Central Bank (ECB) forward rates to project different accounting and prudential indicators. Similarly, various spread shocks can be tested to assess the impact of a likely downgrade in the country rating (simulating, for example, an unlikely sovereign debt crisis).

[38] The tool was initially developed to recalculate best estimate of life undertakings during on-site inspections, but this use case was later replaced by the best practices described in the text.

ANNEX IV: LIST OF RELEVANT REGULATION AND GUIDANCE

- Solvency II Directive, in particular articles 76 to 86.
- Solvency II Delegated Regulation 2015/35, in particular articles 17 and 35
- EIOPA Revised Guidelines on the valuation of Technical Provisions, in particular Guidelines 53 to 60.
- EIOPA Supervisory Handbook[39] chapter on Technical Provisions.

[39] https://www.eiopa.europa.eu/publications/supervisory-handbook_en

ANNEX V: RECOMMENDED LITERATURE

1. American Academy of Actuaries, 2009, "Embedded Value (EV) Reporting",
   Although EV is not precisely the same as Solvency II, the same considerations apply. Section E is about the treatment of options and guarantees, Embedded Value (EV) Reporting (actuary.org)
2. Burkhart, Reuss, Zwieser, 2016, "Allowance for Surplus Funds under Solvency II: Adequate reflection of risk sharing between policyholders and shareholders in a risk-based solvency framework?"
   The article discusses the use of Surplus Funds for profit-sharing with policyholders in a Solvency II context.
   https://www.uni-ulm.de/fileadmin/website_uni-ulm/mawi2/dokumente/preprintserver/2016/Surplus_Funds-Burkhart_Reuss_Zwiesler.pdf
3. CFO Forum, 2016, "Market Consistent Embedded Value Principles",
   Although MCEV is not precisely the same as Solvency II, the same principles apply.
   https://cfoforum.eu/publications/embedded-value
4. FSA, 2006, "GN47: Stochastic Modelling for Life Insurance Reserving and Capital Assessment",
   This is the Guidance Note on Stochastic Modelling for UK actuaries in the pre-Solvency II context. The file is archived by the FRC (search for "GN47")
   Actuarial Standards Archive (frc.org.uk)
5. Gatzert, Schmeiser, 2009, "Implicit Options in Life Insurance: Valuation and Risk Management"
   The article gives an overview of options and guarantees embedded in insurance products.
   h ps://core.ac.uk/download/pdf/159151036.pdf
6. Milliman Research Report, Boekel e.a., 2009, "Replicating Portfolios, An Introduction: Analysis and Illustrations",
   The report gives an overview of the concept and the use of replica ng portfolios.
   Replicating Portfolios An Introduction: Analysis and Illustrations | Society of Actuaries in Ireland
7. Schrager, 2008, "Replicating Portfolios for Insurance Liabilities", The paper introduces the concept of replicating portfolios.
   https://www.ressources-actuarielles.net/EXT/ISFA/1226.nsf/0/0518872b71bcff4bc12576b00061de71/$FILE/59Schrager.pdf

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