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EAN re ESAP3 - DRAFT VERSION

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1 PREFACE

1.1 DUE PROCESS ON THIS EAN

This European Actuarial Note (EAN) is an educational document on ORSA and ESAP3 that has been adopted by the Actuarial Association of Europe (AAE) in order to advance the understanding of the subject by readers of the EAN, including actuaries and others, who use or rely upon the work of actuaries. It is not a European Standard of Actuarial Practice (ESAP) and is not intended to convey in any manner that it is authoritative. This EAN seeksTo assist actuaries in complying with an ESAP3, for example by offering practical examples of ways in which actuaries might implement ESAP3 in the course of their work.

This EAN is not authoritative in any means and therefore does not contain words such as “should” or “must”. Rather, this is descriptive and will convey meaning by the use of examples of actual practice, without suggesting that these examples are comprehensive.

1.2 THIS EAN ON THE ORSA AND ESAP 3

The intent of this EAN supplementing ESAP 3 on the ORSA is to provide further explanation of the ideas introduced in ESAP 3, for example, where it was inappropriate to include in the ESAP the level of detail in this EAN. Explanations and examples are provided with the hope of elucidating generalised topics or complex ideas.

This EAN is envisaged as a “living document” that will reflect developing good practice and address actuaries’ doubts and questions as they relate to the requirements set out in ESAP 3 and more widely in actuaries’ responsibilities in supporting the ORSA within their company and their profession.

The following sections may be read *en face* with the ESAP3. Section 2 below of this EAN clarifies definitions from the ESAP3. Section 3 and its subsections correspond directly to the sections of the ESAP3 with the same indices. Section 4 provides detailed examples and explanations which are relevant to the ORSA and the ESAP3, but not directly attributable to the sections of the ESAP3.

2 SUPPLEMENTARY NOTES TO ESAP 3 DEFINITIONS

In this section, the ESAP 3 articles are covered and additional explanations and clarifications are offered to help better understanding. Not all articles have been supplemented if covered sufficiently in the ESAP.

2.1 ADDITIONAL MATERIAL RELATING TO "RISKS", "UNCERTAINTIES" AND "EXPOSURES"

Within the ESAP, there is a distinction among "risks", "uncertainties" and "exposures". The distinction between "risks" and "uncertainties" is to facilitate the inclusion of "things" (for lack of a better word) which may not be well-defined or well understood but may still affect the company, for example, via its exposures, via its operations, or via its accounting, reserving or capital calculation methods. For this last area, it may be that errors in accounting or reserving, after being corrected, may adversely affect the company's balance sheet or solvency position. "Risks" are intended to be those "things" which are more commonly understood and dealt with on a regular basis—i.e. those "things" that the company manages and analyses as a core part of daily work. In more common parlance, a "risk" poses a risk to the company…an identifiable, immediately comprehensible risk. An "uncertainty" *may* pose a risk to the company, although it may not be immediately clear precisely *how* it does pose a risk, may pose a risk, or might eventually pose a risk. For an "uncertainty", the trigger, event or consequence may be unclear or unknown. For the remained of the EAN, the term "risk" will be understood to include both risks and uncertainties unless the distinction is particularly relevant.

"Exposures" are distinguished from "risks" and "uncertainties" in order to facilitate a cause-and-effect view of potential-loss-causing events. For example, a company may have complex exposures to movements in the equity markets. A life insurer's exposures to equity risk through its unit-linked products may be linear and one-for-one—in that a 40% fall in equity market values decreases policyholders' unit-linked equity holdings by 40% and the insurer's future expected asset management charges are reduced in line with asset values. For a life insurer's participating guaranteed savings, the insurer may have direct equity investments, equity futures to increase equity exposure efficiently and equity put options to protect from the downside and ensure that policyholders' guaranteed benefits can be paid in the future. In the case of guaranteed benefits, the insurer's exposures to equity risk are much more complex. Distinguishing between "risk" (potential event) and "exposure" (potential outcome) enables the actuary to follow the effects of a risk event through the business to determine the effect on asset holdings, liabilities, the balance sheet, et cetera.

2.2 ADDITIONAL MATERIAL RELATING TO AN "ORSA-TRIGGERING EVENT"

An ORSA-triggering event is a material change in the nature of the uncertainties or exposure thereto, or in the understanding of those uncertainties or exposures. An event which would trigger an update to the ORSA (an "ORSA Run") would have such an effect as to change a company's exposure to areas of known uncertainty (risks already included in the ORSA) or areas of new uncertainty (emerged risks). Instead of specifying a certain threshold above which the ORSA is triggered, we have left this judgment to the actuary and/or the business itself. It is the role of the company to determine whose role it is to understand the business in order to know when a re-run of the ORSA may be needed and also whose role it is to develop entity-specific limits or thresholds which provide objectivity and structure to "ORSA-triggering events", those limits or thresholds to be reviewed regularly in light of experience.

Examples of ORSA-triggering events

- A macro-economic event which materially increases or decreases a company's exposures (e.g. a fall in equity markets, credit spread widening or tightening, movements to a central bank's base rate or risk-free rates, a change in inflation, GDP or employment—insofar as these affect the company's exposures)
- Change in the state of the world (e.g. government action to change the economic outlook, e.g. UK government removing the compulsory purchase of an annuity on retirement, a legislative change allowing banks and asset managers to provide unit-linked savings products directly to consumers)
- Change in the nature of a company's exposures (e.g. deciding to cease selling new business on a certain product line, or purchasing reinsurance to reduce exposures hence changing the company's aggregate exposures)
- Change in the nature of an underlying risk or area of uncertainty (e.g. a cure for cancer, driverless cars, theft via cyber risk)
- Combined movements in multiple areas of uncertainty which materially change the company's aggregate exposures
- A change in the understanding and/or modelling of area(s) of uncertainty which materially alter a company's exposures (e.g. looking at surrender rates, a move from using only historical experience data to modelling surrenders dynamically, for example via a causal map to model policyholder behaviour)
- Otherwise, any events which may change the aggregate exposure, or the acceptable levels thereof, or include changes to: risk appetite, risk limits, risk tolerance, ERM/RM strategy, business plan, new business strategy, nature of the business (M&A…), etc.

It is important to note that events triggering ORSA runs may be specific to the company (e.g. a fall in equity markets causing an increase in the value of policyholder guarantees or a spike in surrenders on a certain insurance product) or may be shared by many companies in the market (e.g. 2008/9 credit crisis type event). In both cases, the company may wish to evaluate whether an event causes a material change in exposures or uncertainties which would require an ORSA run.

Structured thresholds to identify ORSA-triggering events

Examples of objective and structured thresholds to identify ORSA-triggering events in the normal day-to-day running of the business might include the following aspects. This list is in general terms and is followed by a list of corresponding real-world examples.

1. Links to risk appetite, risk limits, and risk tolerances (or any such related measures)
2. Risk movements: changes in quantifiable risk exposures, isolated or combined
3. Monetary Loss: actual, expected or potential losses quantifiable in money terms
4. Non-Monetary Damage: actual, expected or potential damage not quantifiable (reliably) in money terms
5. Change in the State-of-the-World-as-we-know-it
6. Breaching limits: e.g. SCR ratio, MCR, internal risk limits

Examples:

1. Links to risk appetite, risk limits, and risk tolerances (or any such related measures)
    - Risk Limit breach;
    - Risk Tolerance breach;

- Change to Risk Appetite, Limits or Tolerances
- Breaching SCR Ratio (e.g. 120% of SCR)
- Breaching MCR

2. Risk movements: changes in quantifiable risk exposures, isolated or combined
    - Mix of new business materially different from what is assumed in the SII SF/IM or ORSA, so that SII SCR changes by a threshold amount, e.g. EUR 10 million
    - Mix of in-force business materially changed (e.g. experiencing a mass lapse on a certain product), which changes SII SCR or SII Available Own Funds by a threshold amount, e.g. EUR 5 million.
    - Economic downturn, characterised by any of: equities -20%, properties -15%, credit spreads ±50 bps, change to the shape of the yield curve, inflation ±1%, etc
3. Monetary Loss: actual, expected or potential losses quantifiable in money terms
    - Actual or expected gain or loss (due to risk events which have occurred) above a certain threshold
    - Potential losses due to policyholder options or guarantees caused by change in the underlying risk(s) above a certain threshold
    - A change in markets, risks, or events requiring a material injection of funds into reserves or capital
4. Non-Monetary Damage: actual, expected or potential damage not quantifiable in money terms
    - Actual, expected or potential damage to reputation, affecting volume and quality for future new business and persistency on in-force business
    - Actual, expected or potential damage to the business following loss of key personnel
    - By "potential" in this context, we mean that following some actual or hypothetical event, the likelihood of a subsequent, damaging event has increased materially.
5. Change in the *state-of-the-world-as-we-know-it* that signals…
    - Underlying exposures need to be updated/reconsidered
    - Revisiting some existing Stress and Scenario Tests (SST) or reverse stress testing scenarios in light of new information or new understanding
    - Adding a new SST which incorporates a new potential understanding of the state of the world (e.g. identification of a new, material area of emerging risk to the business), for example a change in central banks' approach to monetary policy and managing inflation and the consequent potential effects on a company's contractual obligations (liabilities) or the nature of risks to assets.

Certain ORSA-triggering events may not require a full end-to-end re-run of the ORSA process. The company, the risk management function and the actuary, as appropriate, may need to determine which parts of the ORSA process require completion anew.

3 SUPPLEMENTARY NOTES TO ESAP 3 TEXT

3.1 ESAP 3, SECTION 3.1 "DESIGN OF THE ORSA PROCESS"

One purpose of the two paragraphs in section 3.1 is to communicate the extent to which an actuary working with the ORSA is responsible for complying with ESAP 3. Section 3.1 suggests that the actuary be held to high standards while being commensurate with the actuary's responsibilities regarding the ORSA. It could also be highlighted that an actuary's limited responsibility does not absolve him or her from acting with professional excellence and raising concern with the ORSA where appropriate. On the other hand, the actuary's involvement is not required in every aspect of the ORSA where this doesn't suit the business. It's important to understand and fulfill the appropriate amount of responsibility for an actuary working with the ORSA.

3.1.1 ESAP 3, Section 3.1.1 "Establishing a structured approach to uncertainty"

Some of the key purposes of the ORSA (processes, models, etc) are to understand the reality of the business, increase a firm's understanding of its risk, exposures, activities and strategy, and to formalise that into a set of processes and capture learnings. One of the key unsung challenges will be to maintain that knowledge within the business without an unnecessary proliferation of documentation.

Maintaining such knowledge is always a challenge. A proliferation of documentation is a risk (or a certainty!) and there is an associated risk of loss of relevance of the ORSA. It is important that issues are recorded even if not planned to be addressed. The evolution of an actuary's understanding of risks, exposures and business realities is, at times, rather "stream of consciousness". When this leads to an increase in understanding, it should be captured (maintained within the business). This is an ongoing process, e.g. a feedback loop which is not forgotten. As a company's understanding of its risk and exposures improves over time, the ORSA may need to adapt to incorporate these improvements. The economic and commercial environments and the company's risks are not static—the actuary may need to ensure that the ORSA adapts accordingly.

Ensuring the ORSA assumption-setting process incorporates management plans

The business planning process and the ORSA

Normally, the base scenario is consistent with the business plan, unless those assumptions are so inconsistent or unrealistic that the resulting ORSA report would be misleading. If this is the case, it may be advised to document the reasons. Where the ORSA is not consistent with the Business Plan, it is good practice to disclose this and outline potential implications.

The business plan, business planning period (BPP), as well as related processes, protocols, decisions and committees are important to the ORSA. A company may have a strategy, company policies, and key performance indicators for monitoring the business. The ORSA could take into account, as far as possible and appropriate, the business plan—in its entirety as well as the various components. Actuaries may work to ensure that ORSA is consistent with business strategy, policies, KPIs, KRIs, and other policies. This may aid the actuary in getting all the relevant information into the ORSA process.

The business planning period is that natural time horizon over which the firm's strategy and business plan are considered into the future. It may be 5 years if the firm has a "5-year plan". A

"10-year plan" necessitates a 10-year business planning period. Projection assumptions 10 years into the future (or further or shorter) may be too uncertain to be credible. Different aspects of the business plan may be credible over different time horizons. The significance of each aspect, the credibility thereof, and the potential for misleading results may need to be considered for each aspect and in aggregate.

The BPP may be different for different types of product (e.g. term life assurance, auto, participating savings) and whether considering in-force business or new business. The company's overall BPP would incorporate all of these.

The business plan could be developed as with everything else ORSA-related—as appropriate for the business. This may include such activities as horizon scanning for forthcoming changes in the "world as we know it" and potential emerging risks—to the extent that these could reasonably affect the business or its plans in the "near" future. The business plan and the period over which it is considered, may be influenced by known changes coming in the future, for example IFRS, IAIS capital standards, or key policy documentation rules.

The ORSA is likely consistent with the company's future business plans, including new business strategy, strategy for in-force business, and long-term considerations. This facilitates the ORSA forming an integral part of the business's business planning process especially as relates to risk (quantifiable and qualitative) and capital (adequacy, availability, etc).

Projected Reserving and Capital Assumptions and an Aggressive Business Plan

The assumptions underlying a business plan may differ from those of an objective best estimate or those underlying the Solvency II balance sheet. Even an aggressive business plan (e.g. extreme cost savings, unrealistic future new business levels) may be run through ORSA process to estimate the effects on the business of that scenario. The main potential issue is that these aggressive assumptions affect the Solvency II Technical Provisions or capital, either within the ORSA projection or at a standard valuation date not connected to the ORSA.

In running an aggressive business plan through the ORSA it is vital that the actuary ensures that the underlying aggressive or optimistic assumptions do not unduly affect the "time-zero" SII balance sheet and that the incorporation into future SII balance sheets is done so with a focus on the credibility of information. An actuary would not blindly incorporate future predictions into experience analyses feeding into the assumption setting process for actuarial, investment or business assumptions. Put another way, it is important that the company cannot "monetise" an optimistic strategy (e.g. cost savings) simply by committing to do something in the future without having credible historical experience data. For this reason, such aggressive assumptions should not affect Solvency II assumptions (within or without the ORSA process) without sufficient credibility. In the absence of other guidance or regulation, it is the responsibility of the actuary to ensure forward-looking assumptions are used in a credible manner within the ORSA. This will serve to protect the actuary, the business, and the policyholders from overly aggressive business plans.

In order to reflect a cost-savings plan, for example, it may be appropriate to adjust future assumptions in one of the three following manners:

- Situation: initial capital outlay of EUR 1 million, cost savings of 10% after 1 year, an additional 10% after 2 years, and the final 20% savings after 3 years

- ORSA real-world assumptions reflect the business plan

- Option 1: reserving and capital assumptions reflect future cost-savings plans as the "Best Estimate" within the underlying calculations of reserves and capital. Future periods' reserves and capital fully reflect the forward-looking assumptions. This is the more aggressive option.

- Option 2: reserving and capital assumptions reflect new retrospective data fully to reflect a credible cost-savings plan. *Future* forward-looking assumptions are not reflected in future periods' reserves or capital.

- Option 3: reserving and capital assumptions reflect new data partially to reflect a potentially overly-aggressive cost-savings plan. There is a question whether cost-savings will be achieved in reality. Hence, forward-looking assumptions are assessed to be overly-aggressive and are made more prudent as they feed into the calculation of future periods' reserves and capital. This is the more prudent option.

Which option is most appropriate for the business plan and the company's ORSA may be decided by the actuary and the company. However, it would not be appropriate to reflect the first option in the calculation of regulatory reserves and capital under Solvency II outside of the ORSA process, i.e. for the calculation of the reported Solvency II balance sheet. That is, it would not be appropriate to release reserves or capital in respect of future business plans before those plans have been shown to be credible. This detail has not been addressed directly in the Solvency II regulation but is fundamental to the prudent management of an insurance business.

Incorporating Aggressive Assumptions into the ORSA and Future Periods' Reserves and Capital						
ORSA Projection Period (years)	0	1	2	3	4	5+
Cost-Savings Business Plan						
Capital Outlay	EUR 1m	-	-	-	-	-
Cost savings from expenses	-	10%	10%	20%	-	-
Future expenses (as% of t=0 Best Estimate)	100%	90%	80%	60%	60%	60%
Option 1: Reflect future cost-savings plans as the "Best Estimate"						
T=0 TP&C	100%	90%	80%	60%	60%	60%
T=1 TP&C	N/A	90%	80%	60%	60%	60%
T=2 TP&C	N/A	N/A	80%	60%	60%	60%
T=3 TP&C	N/A	N/A	N/A	60%	60%	60%
T=4 TP&C	N/A	N/A	N/A	N/A	60%	60%
T=5 TP&C	N/A	N/A	N/A	N/A	N/A	60%
Option 2: Reflect only retrospective data of future cost-savings plans as the "Best Estimate"						
T=0 TP&C	100%	*100%*	*100%*	*100%*	*100%*	*100%*
T=1 TP&C	N/A	90%	*90%*	*90%*	*90%*	*90%*
T=2 TP&C	N/A	N/A	80%	*80%*	*80%*	*80%*
T=3 TP&C	N/A	N/A	N/A	60%	60%	60%
T=4 TP&C	N/A	N/A	N/A	N/A	60%	60%
T=5 TP&C	N/A	N/A	N/A	N/A	N/A	60%
Option 3: Overly-aggressive assumptions are tempered for use in the "Best Estimate"						
T=0 TP&C	100%	*100%*	*100%*	*100%*	*100%*	*100%*
T=1 TP&C	N/A	*95%*	*95%*	*95%*	*95%*	*95%*
T=2 TP&C	N/A	N/A	*90%*	*90%*	*90%*	*90%*
T=3 TP&C	N/A	N/A	N/A	*80%*	*80%*	*80%*
T=4 TP&C	N/A	N/A	N/A	N/A	*70%*	*70%*
T=5 TP&C	N/A	N/A	N/A	N/A	N/A	*70%*

The underlying assumptions of option 3 are that only about half of the planned cost savings will materialize and that only a maximum of 30% savings is realistic after four years. This is only an example.

A structured approach to uncertainty

One of the aims of this section, 3.1.1, is to guide the actuary in the right direction: a robust approach to dealing with uncertainty…which is, of course, structured and documented. The intent is not to prescribe the approach, but to let the actuary develop as appropriate or required by the business.

Other related aims include encouraging the actuary to capture that knowledge and the process and promoting the sharing thereof within the business, especially with users of the ORSA and other professionals in similar activities.

If the actuary is involved in designing the ORSA process, ESAP 3 guides the actuary to establish a structured approach to uncertainty and to document it. Where the actuary is involved in the ORSA process, but not in its design, the actuary may wish to contribute to ensuring that the approach to uncertainty is structured, documented and sufficient given the business needs, complexity of the business, and the materiality and proportionality of risks and exposures.

In addition to the points of section 3.1.1 of ESAP 3, the ORSA process might:

- Facilitate the sharing of new information and best practices within the ORSA team and wider business
- When the approach to or understanding of areas of uncertainty changes, the ORSA process and/or ERM framework may need to be adapted.
- Where the ORSA process and/or ERM framework change, the approach to uncertainty may need to be adapted
- The current approach to uncertainty should not preclude the use of new or different methods, especially where these methods may be an improvement. Where materially improved methods are known, but not used, the actuary may wish to document the reasoning.
- The current ORSA and/or ERM framework should not preclude the use of new or different methods to dealing with uncertainty

A structured and documented approach to uncertainty might have some of the following components, according to the needs of the business.

- Differentiation among “types” of uncertainty
- Distinction between the real world and the modelled world
- Feedback loops and several points for capturing feedback
- Comfort in dealing with uncertainty
- Distinctions among past, present and future

The following sections provide more detail regarding the components of a structured approach to uncertainty.

Differentiation among “types” of uncertainty

Errors vs uncertainties

The AIAA (American Institute of Aeronautics and Astronautics) defines "errors" as recognisable deficiencies of models and algorithms and "uncertainties" as potential deficiency due to lack of knowledge.[1]

Aleatory uncertainty vs epistemic uncertainty

Physicists often distinguish between aleatory and epistemic uncertainties. "Aleatory uncertainty (also referred to as variability, stochastic uncertainty or irreducible uncertainty) is the physical variability present in the system being analysed or its environment. It is not strictly due to a lack of knowledge and cannot be reduced. […] Epistemic uncertainty (also called reducible uncertainty or incertitude) is a potential deficiency that is solely due to a lack of knowledge."[2]

Non-immediacy, non-specificity, entropy-like uncertainty, and fuzziness

This distinction is borrowed from mathematics and information theory. "Non-immediacy" is characterised by lack of knowledge locally where sufficient knowledge exists elsewhere. "Non-specificity" is characterised by lack of precision, perhaps due to the dimensional size or the complexity of a system. "Entropy-like uncertainty" is characterised by the unpredictability of information content. "Fuzziness" arises from information loss due to interpretation and use.[3]

These are examples of classifications of uncertainty due to origin, properties or characteristics. In practice, it would be useful for such a classification to be mutually exclusive and collectively exhaustive (MECE), but it is not a requirement. The third grouping from above may be translated to actuarial work as follows:

Non-immediacy: lack of knowledge within the local team (e.g. actuarial or modelling team) where this knowledge exists elsewhere (e.g. personal tax rules, precise policy terms and conditions), for example, incomplete knowledge by a junior modelling actuary.

Non-specificity: incomplete understanding of the situation or system, a system which is too large or too complex to model completely, too many sources of uncertainty or "randomness", for example, modelling equity prices as a random process and ignoring the potential effects on equity prices of, for example, changes in interest rates, forward guidance, QE, or equity analysts' recommendations.

Entropy-like uncertainty: in an actuarial situation, entropy-like uncertainty might be best understood as the uncertainty arising from the reliability (or lack thereof) of information, data and model output. A common actuarial example of entropy-like uncertainty is the "funnel of doubt" associated with the increasing imprecision of financial projections with increasing distance (time) into the future.

Fuzziness: loss of content of a given piece of information when only a portion of that information is extracted for use; for example, not leveraging the knowledge or intuition of policyholder

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[1] Stanford Uncertainty Quantification Laboratory, "YouQ: A self-guided tour of Uncertainty Quantification". Web. Stanford. Accessed 12 February 2016. http://web.stanford.edu/group/uq/uq_youq.html

[2] Ibidem

[3] Dubois & Prade, Fundamentals of Fuzzy Sets. Print. Springer, New York, 2000. Chapter 8 "Measures of Uncertainty and Information."

behaviour which may be known by the salesforce or "front line", but unknown to the modelling actuary.

Core traditional actuarial work lies in the reduction of non-specificity via analyses, calculations and sophisticated modelling. Quotidian actuarial work may also include reducing non-immediacy in the implementation of actuarial models. Reducing entropy-like uncertainty has come to the forefront of actuarial work with the introduction of Solvency II and the focus on data reliability and model validation. Actuaries collaborating with other business functions often work to reduce fuzziness.

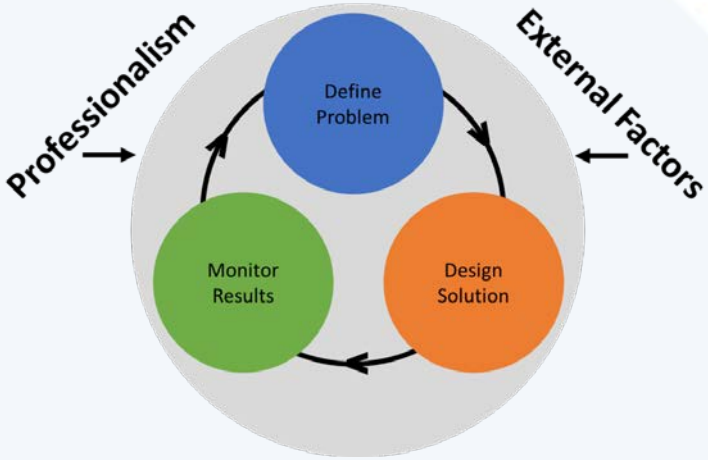
Some of the most common actuarial techniques address different types of uncertainty. The following list of examples lists some of these:

- Working to understand causal factors affecting policyholder behaviour and claims
- Building coherent macro-economic stresses for use in stress and scenario testing
- Specifying dependency relationships (e.g. copula or covariance matrix) among different risks
- Analysing the future data to understand th way risk have been affecting the business
- Taking into account future trends and expert judgement to get better estimate for the risks the insurer is facing

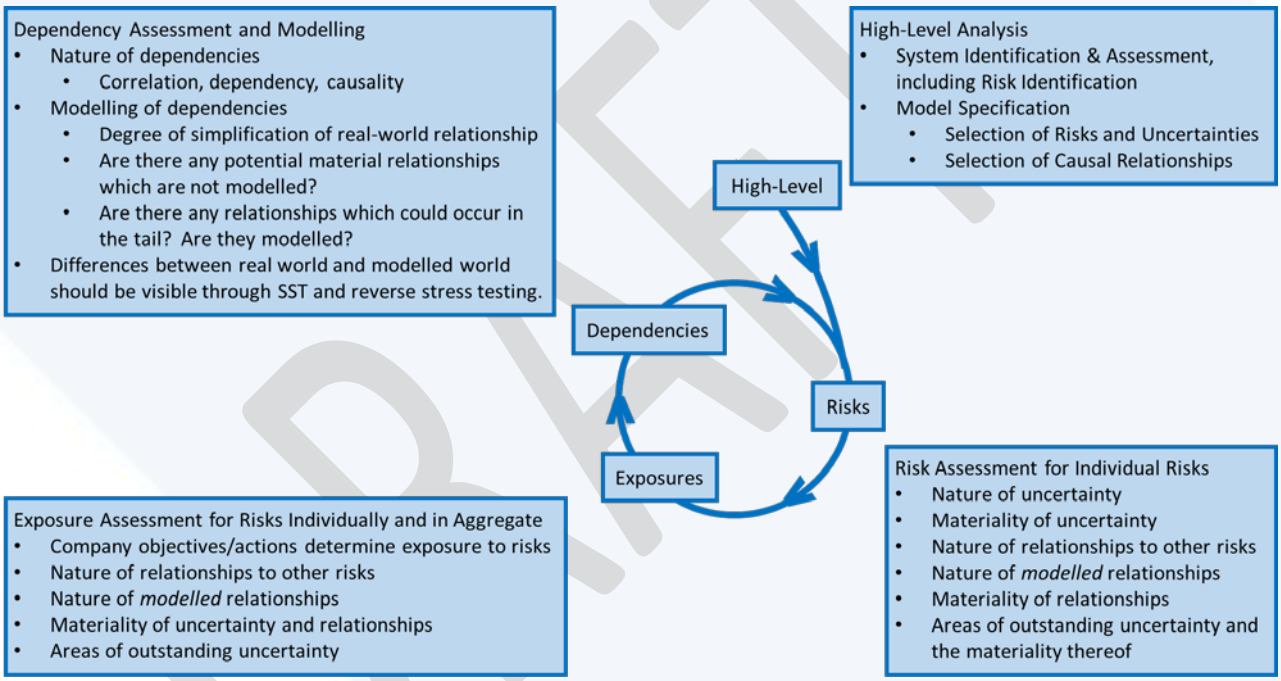
Feedback loops and several points for capturing feedback

At the very least, there may need to be a connection between business objectives and business actions, e.g. via Objectives, Actions, Feedback ("OAF"). This is a minimal feedback loop which may be expanded depending on the situation.

For many actuarial processes or investigations, the traditional cycle doesn't fully capture the adaptive process undertaken by an actuary.

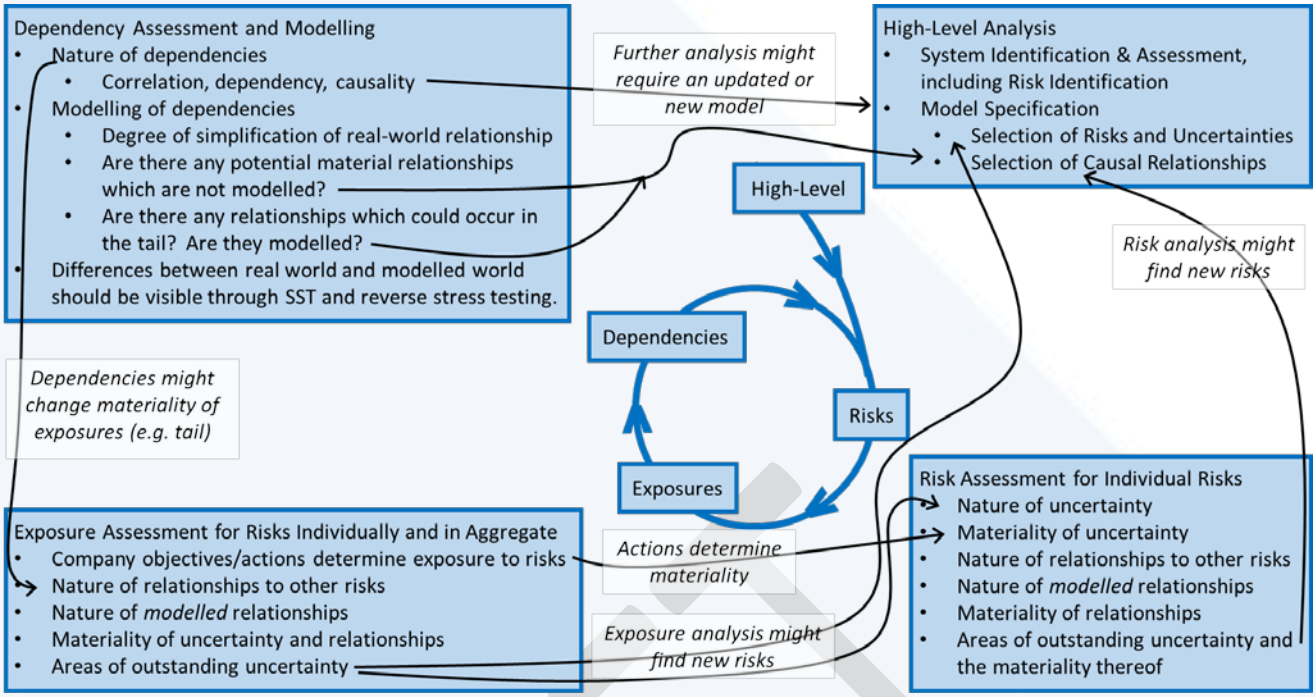


A more detailed example for risk modelling is given below.



The "high-level analysis" is portrayed outside of the loop as this is commonly what happen in practice. For example, risks not included within the model are unlikely to be incorporated at a later date unless very material. From experience, it is the logical interactions among risks and cash flows that are the most difficult (or time consuming) to change once a model has been implemented. This is often an impediment to the improved modelling of risks or of the contractual terms of an insurance policy.

The following variation on the above diagram illustrates a more adaptive process, due to the depiction of "live feedback points", a bit like chutes and ladders. Each "live feedback point" could result in a note being made (perhaps to be addressed at a later date) or an immediate action (e.g. returning from exposure assessment to risk assessment to analyse a risk which has increased in materiality).



Comfort in dealing with uncertainty

There will be incomplete knowledge within the actuary's understanding of a given system, within the modelling thereof and within the risk system capturing (some of) that information. The materiality and proportionality of the areas of uncertainty could be captured, even if not modelled, so that this information is not lost in the flow of "risk information".

Different types of liability models or ALM models, risk models and risk aggregation models may deal with uncertainty in different ways. Some models may deal with uncertainty using probabilities, some stochastically, and some without regard to likelihood may deal with uncertainty via stress and scenario testing. Different approaches may be appropriate to meet different needs. The actuary may wish to strive to be comfortable that the uncertainty is captured materially within the risk system and is communicated as necessary, e.g. within the ORSA process.

Uncertainty might be due to an incomplete understanding of the situation or system or the incomplete capture of the system within the models (uncertainty in the parameters, models, or algorithms). If possible, for each area of uncertainty the sources of uncertainty and levels of materiality could be assessed and communicated as necessary. Where material, it could be valuable to communicate the downstream *compounded* uncertainty.

Distinctions among past, present and future

Data is from the past, even if the immediate past (e.g. current market data). When using past data to project future events (e.g. probabilities of life/death, cash flows, asset returns, defaults), the distinction between past data and future projection may either be reflected in the model or noted as an assumption.

For different areas of uncertainty, there is a *range* of validity of the assumption that past data can be used for future projection or prediction. It is not "either/or", i.e. that it "is valid" or "it is not valid", but rather a *range* of validity.

It is the actuary's judgment as to whether such an assumption is sufficiently valid. This may depend upon the inherent validity of the assumption, relative validity of any alternative data available, alternative modelling methods, resource and time constraints, materiality and proportionality of the assumption itself or its potential affects downstream.

3.1.2 ESAP 3, Section 3.1.2 "Deviation from Solvency II balance sheet approach and methodology"

A company's motivations in deviation from the Solvency II methodology may be to seek a better understanding and hence management of the company's risks and exposures, facilitated by methods which cover all material risks, especially where the SII methodology may miss some risks, or measure them differently from how those risks are perceived by the company, the actuary, the shareholders, the policyholders, or other stakeholders. Deviations may occur in how quantitative risks are assessed, measured, and how stresses are calculated. Other deviations may be in the accounting methods, methods for calculating technical provisions and capital, and methods for assessing the appropriateness thereof. In order to do this, it may be useful to distinguish between the "modelled world" and the "real world", as well as between the Solvency II methodology and an otherwise objective assessment of risk, if appropriate.

Distinction between the real world and the modelled world

Strictly speaking there are three reference points here: the real world, our understanding thereof, and the modelling of our understanding. Between points, information is lost: we do not understand the world completely and our models either do not capture or do not need to capture our full understanding of the real world. For example, when assessing the suitability of the models underlying the ORSA, it is important to re-evaluate the extent to which those models are able to reflect reliably the risks and uncertainties of the business and to accommodate fully the complex stress and scenario tests appropriate to the business. As the ORSA requires the business to include all material risks, the actuary may want to assess the materiality of any risks or uncertainties which cannot be accommodated by the ORSA process or supporting models.

The actuary may want to evidence his or her understanding of (and document) the key similarities and differences between the real world and ORSA model. In considering this the actuary may wish to consider:

- the appropriateness of the risk measures used;
- the appropriateness of the risk modelling, especially where the modelled risk may differ in nature from its counterpart in the real world, and what this means for the ORSA;
- whether there are alternative models which enable the actuary to explore a risk or combination or risks more thoroughly;
- the stresses and scenarios used and the appropriateness of the results;
- management actions assumed as mitigating factors, their associated time delay and any track record of their effectiveness;
- the appropriateness of the model to the risks of the Company;
- the risks not covered by the model;
- the reasonableness and robustness of the business assumptions underlying the base scenario used for the projections; and
- whether there are any concerns over the appropriateness, completeness and accuracy of the data used and document the reasons of use professional judgement.

Consistency or inconsistency of the ORSA with the Solvency II principles

A convincing argument for adopting methods or assumptions which may differ from Solvency II in calculating capital needs (at fixed points in time), for example for Own Solvency Needs or an internal "objective economic capital" basis, is to facilitate the identification of any and all material risks and exposures over the ORSA consideration period. This is especially important where the company may wish to assess the potential upsides and downsides of, for example, removing the Ultimate Forward Rate from the Solvency II discount curve or assessing the credit spread and default risks arising from sovereign bonds.

In order to facilitate the discussion of deviations from the Solvency II, this is preceded by a brief discussion of "business projection models" and Solvency II's Risk Profile Assessment.

The ORSA as a simplified "business projection model"

The ORSA is also a "business projection model", it intends to project the balance sheet (and perhaps annual accounts) and the underlying business into the future. This necessitates the calculation of the expected SII position and SII balance sheet components at given points in the future. The ORSA may project the business on solely the SII basis or it may include all balance sheet and accounting bases relevant to the company (e.g. local accounting rules, IFRS, ratings agency capital).

In projecting the Solvency II balance sheet into the future periods of the ORSA, the company may wish to calculate future balance sheet components on the SII SF (or Internal Model) basis, i.e. consistently with current methods. The ORSA then serves to project the future SII capital position (and other balance sheet components) as the company expects it to evolve in reality. This may provide insight into, for example, movements in the solvency ratio, reserve or capital injections or releases, future dividends, and the drivers of profit and loss.

In order to get the full picture of future profit and loss, the company may need to project the full accounts on all bases used by the company. While useful, this extends beyond the requirements or suggestions of the ORSA.

In addition to, or in lieu of, the regulatory basis (SII SF or SII IM), the company may wish to reflect risk on an objective basis (commonly known as "an internal economic capital framework" or, specifically for the ORSA, the "Own Solvency Needs"). Projecting the ORSA on the SII SF (or SII IM) basis should be considered a necessity. Projecting on an additional basis may be useful for managing or understanding the underlying risk exposures. Some of the areas of deviation from the SII principles are described below.

Underlying the projection of the business into future ORSA periods is a set of assumptions of how the business and world may evolve in the near future (5-10 years). One such set of assumptions may reflect a "Best Estimate" scenario, another may reflect the management's business plans, and additional scenarios may test other positive and adverse future scenarios.

The SII Standard Formula and OSN are used for calculating the total asset requirement (reserves plus capital) of a company while the ORSA is used to project the balance sheet items into the future, perhaps annually for the next five years.

The Risk Profile Assessment: Assessing the Appropriateness of the Standard Formula

As part of the ORSA, the actuary may assess the significance with which the risk profile of the undertaking or group concerned deviates from the assumptions underlying the Solvency Capital Requirement[4].

The results of the assessment may lead the actuary to opine that the Standard Formula is suitable for the company or that the company could consider calculating their Own Solvency Needs. Calculating OSN may range from adjusting the stress factors applied the individual sub-modules or otherwise adjust the parameterisation of the Standard Formula to a complete reworking of the methodology. Potential variations to parameters, methods and modelling is provided in the appendix.

Potential deviations from the Solvency II principles

As regards consistency, or inconsistency, of the ORSA methodology, process or modelling with the Solvency II principles and rules, the actuary may need to understand and communicate the effects thereof. In some cases, consistency with SII principles and rules may mean that the ORSA does not reflect otherwise objective assumptions. In some cases, consistency may be the best or only option. Examples of the main areas of potential discrepancy are given below.

In principle, Solvency II is risk-based. However, the Level 2 guidance deviates in various respects, both for Standard Formula (SF) and Internal Model (IM), from otherwise objective assessments of risk. One of the fundamental goals of the ORSA is to reflect reliably the reality of the business, currently and in the future. For this reason, it may be useful to project, within the ORSA, the SII standard basis as well as an additional basis intended to more reliably reflect the risk exposures of the company.

There are some areas of the SII SF and IM guidance which deviate from an objective best estimate, for example, the ultimate forward rate (UFR), cash flow matching and discounting at other than the net yield. If the actuary wishes to use alternative objective assumptions (which are credible in their own right), s/he may wish to justify and explain the deviation and the effects thereof (i.e. difference between the ORSA run on SII assumptions vs the objective best estimate assumptions which aims to reflect reality).

Insofar as SII capital is projected within the ORSA, it should be consistent with the SF or IM. However, the underlying projection assumptions for the ORSA (a best estimate baseline, the business plan, or a sensitivity) need not be consistent with the SII Pillar 1 or 2 assumptions. That is, the projection for the ORSA may be a real-world projection (if the SII IM/SF is not) to reflect RW expected defaults, RW investment yields, which may not be specified in the SII guidance (as some are overly prudent when compared to a RW BE). This may be appropriate in two respects: the "outer scenario" for the projection between future ORSA periods (e.g. to take the company from the current valuation date, e.g. year-end 2017, into future year-end reporting dates) as well as the "inner scenario" as used within the calculation of the SII balance sheet components at future ORSA periods (e.g. future year-end reporting dates).

Another way to distinguish "inner" and "outer" assumptions is that "inner" assumptions are used as at a specific point in time (e.g. year-end 2020) to calculate the components of a balance sheet (or multiple balance sheets and P&Ls), whereas the "outer" scenarios define how the outside world evolves (is expected to evolve within the given ORSA scenario) to get us from one reporting period to the next. Inner assumptions are reserving and capital assumptions needed to evaluate

[4] https://eiopa.europa.eu/Publications/Standards/EIOPA-14-322_Underlying_Assumptions.pdf

balance sheets and other financial statements at fixed points in time (e.g. YE17, YE18, YE19, etc) whereas outer assumptions define how the world evolves between those fixed points in time.

In this manner, the "inner" assumptions, especially when they are used in calculating future periods' Solvency II reserves and capital, are point-in-time snapshots of market data, risk data, variability, volatility, etc. These inner assumptions may be determined in line with Solvency II guidance and do not allow for expert judgment in the *evolution* of stressed scenarios. This is precisely the purpose of the outer scenarios: to allow the actuary and the business to explore the longer-term, developing effects of various positive or adverse scenarios. For example, experts may believe that following a 40% loss, equity markets will recover fully over the following two years. While it is inappropriate to incorporate that information into the calculation of the Solvency II *risk capital* for equity risk, it may be incorporated via the outer scenarios in the *projection* of the balance sheet(s).

Additionally, there may be a "core set" of assumptions (an "objective best estimate") from which to derive the various sets of assumptions to support Solvency II reserves and capital, IRFS accounts, local accounting rules and reserves.

Importantly, SII capital should be projected consistently with SII guidance. This means that the company needs to project the SII balance sheet and capital into the future as it expects it will calculate the SII components in the future (perhaps the company is considering moving to an Internal Model).

The ORSA provides the company to use an alternative measure of capital needs, specifically within the ORSA projection, which the regulation refers to as the "Own Solvency Needs" (OSN). The assumptions feeding into OSN may be distinct from those underlying the Solvency II Standard Formula (and Technical Provisions) in both the calculation of reserves and of capital. In this case, the entity may wish to describe the deviations and the effects in isolation and in aggregate compared to the Solvency II balance sheet.

The outer scenarios driving the ORSA projection may also differ from the assumptions underlying reserves and capital. Some of the main areas where SII and ORSA assumptions may differ are summarised here and discussed below. The groupings are not perfect and noting that one such area may logically belong to multiple groupings.

Topics are given here, details are provided in the appendix.

Differences in methodology:

1) Risk measure: VaR, CVaR, TVaR, burn-through, long-term ALM & liquidity, etc
2) Risk measurement time frame: 1-year, 1-day, 5-year plan, policy lifetime, etc
3) Projection basis: what is Best Estimate and why?
4) Total Balance Sheet approach to risk capital versus policyholders' protective risk capital
5) Fungibility of capital
6) Nature of stresses: isolated stresses + aggregation vs causal SST vs combined stresses
7) Risk-neutral ESG implementation
8) BEL assumes risk free (MA&VA relax this a bit), SII capital addresses the risks, but some BEL > Economic BEL

Differences in modelling:

9) Nature of the market stress model: causal or combined vs silo'ed
10) Longevity-mortality model: combined vs separate
11) Longevity-mortality-morbidity(-disability) model: combined vs separate
12) Lapse model: SII simplistic, SII strict vs coherent

13) Interest rate up/down model: single model (e.g. Monte Carlo) vs "worst-of" two stresses model
14) Interest rate stresses & the UFR
15) Dependencies & correlations
16) Loss absorbing capacity of deferred taxes
17) Defaults, downgrades, credit spreads, and market values: modelling needs and risk exposures (different exposures to different SII TBS components)

Differences in assumptions:

18) Contract boundaries
19) Counterparty default
20) Future new business
21) Transitional measures (equity type 1, TMTP)
22) Equity symmetric adjustment
23) Discount curves:
    - The ultimate forward rate
    - The last liquid point
    - The credit risk adjustment
    - The volatility adjustment or the the matching adjustment
24) Sovereign credit risk: spread movements, MV movements, risk capital, etc
25) Cash flow matching
26) Reinvestment risk (implicitly hidden b/t CF matching and the RFR)
27) Risks not covered in the SII SF/IM
28) SII SCR (SF/IM) stress magnitudes (e.g. mort, long, lapse)
29) The SII Best Estimate is benign. Could a market crash feature in a Best Estimate?

3.1.3 ESAP 3, Section 3.1.3 "The ORSA consideration period"

The ORSA is an assessment of the company's ability to maintain solvency over the "ORSA consideration period", allowing for the company's plans and the risks and uncertainties to which it is exposed. The "ORSA consideration period" needs to be long enough to test the resilience to the company's stated plans and strategy, and to give sufficient advance warning to allow the company to address any projected "squeeze" on capital resources.

The "ORSA consideration period" as used in ESAP 3 is intended to encompass (1) the overall time horizon over which the ORSA process (and all of its individual ORSA "runs") is considered or applied as well as (2) the individual ORSA runs. That is, when considering how far into the future the ORSA is to be used, the points in ESAP 3 section 3.1.3 should be considered. Also, within an individual ORSA run, the same considerations should be made (i.e. section 3.1.3).

The actuary should not be constrained how he or she thinks about time periods and the ORSA. The actuary can distinguish among various time horizons relevant to the ORSA and offer some definitions and terms, being as precise as possible.

In theory, and in the minds of regulators, the ORSA is a vital tool in managing an insurance company. Currently for many companies, the ORSA may not be fully integrated within the business or within its business planning processes. Especially in that case, it's suggested to consider the following discussion points and the applicability thereof to your company's current situation as well as future state.

Time horizons related to the ORSA

There are numerous timeframes, time horizons and time periods relevant to the ORSA. These might include: the business planning period; time periods and horizons within actuarial, capital and risk models; risk-related timeframes such as measurement periods, timeframes for the evolution or treatment of risk events; timeframes for policyholder considerations such as security of benefit payments, inter-generational equity, company solvency—which may extend well beyond business plans or the ORSA.

The ORSA aims to project the business, its plans, as well as the current state and thinking into the uncertain future. Hence, the ORSA aims to predict what will be business as usual (BAU) in, for example, three years' time. At that point in the future, the company would use its actuarial and capital models, think about its risks, risk appetite, strategy, et cetera and revise them appropriately given what has transpired in the theoretical past (i.e. three years of deterministic, assumed a priori, modelling).

The ORSA will only be used to project things 5 or 10 years into the future, beyond which timeframe it may be difficult to create a credible prediction of the ORSA projection (i.e. period before liability and capital models begin).

The following gives an overview of such timeframes, with the focus being on the distinction of timeframes specific to the ORSA.

1. Liability-related timeframes

    a. "Actuarial projection horizon": e.g. 50 to 100 years for some life assurance products, 5 to 10 years for some general insurance products

    b. "Horizon for long-term considerations": run-off of existing portfolios (and planned new business) and associated considerations (cross-generational equity, fairness, security of benefit payments, company solvency, Prudent Person Principle, etc)

2. ORSA-related timeframes

    a. "ORSA projection period": each of the ORSA projection terms from 1 year, 2 years,…, 5 years, i.e. the amount of time that is assumed to pass before the company were to rethink its strategy, plan its business and run its actuarial models. For example, there may be an ORSA run with an "ORSA projection period" of 1 year into the future, another ORSA run with an "ORSA projection period" of 2 years, and so forth.

    b. "ORSA projection horizon": the maximum term the ORSA is used over, something like five years. The ORSA projection horizon is fixed as the longest "ORSA projection period".

3. Business planning timeframes

    a. "Business planning period": this could reflect what it is actually in the business. If the company has a 5-year plan that feeds into its strategy, that's it. If it has a 10-year plan which reliably feeds into its planning, that may form part as well. This leads to what one might call the…

    b. "Business's strategy horizon": given where a company is today, how far are they looking into the future as it relates to their strategic initiatives and moves? Let's say they look about 10 years into the future. This ten-year focus could be considered within the ORSA at each future time point in the ORSA process (e.g. 1,2,3,4, and 5

years into the future). That is, with a 3 year ORSA projection period, the company could consider what their strategy would look like between 3 years in the future (the "present time" in that future scenario, i.e. it is known what has happened in the first 3 years) and 13 years in the future.

Regarding that last point, a company may think that applying a 10-year strategy horizon on the end of a 5-year ORSA projection period is insufficiently credible. However, if a company has a "10-year plan" today, it will likely have a 10-year plan next year and the following year. Hence, it would be more appropriate to retain the full strategy horizon at each point in time for the ORSA. While it may be difficult to decide what the 10-year plan may look like five years into the future, this is precisely the task set to the business under the ORSA, among other tasks. There may be aspects of a company's current strategy which the ORSA "runs through", e.g. the company's plans to achieve cost savings over the next 3 years. It would be inappropriate to consider this as always three years into the future for each ORSA projection period. However, more general aspects of strategy, e.g. a forward-looking 10-year focus on the reliability of future dividends and debt affordability should be projected forward as suggested in point 3(b) above. The extent to which it is necessary to fully incorporate the full strategy horizon within the ORSA is left to the discretion of the actuary and the company.

The liability-related timeframes above should also be projected forward, for example, in that during the 3rd ORSA projection period, a 50-year "actuarial projection horizon" should apply between future years 3 and 53.

There is an important distinction between business planning and long-term considerations: the business's strategy horizon may not extend as far into the future as some long-term considerations need to, for example security of policyholder annuity payments. However, it is vital that the long-term considerations be addressed at each point in time when the business plan is revisited (both in the real world and within ORSA projections). Some of the long-term considerations will naturally be included as the foci of regulations while other long-term objectives, goals and considerations are not required to be addressed (i.e. by legislation or regulation). The actuary may find it necessary that all significant long-term considerations, explicit and implicit in the business's plans and strategy, are included within the business planning process and within the ORSA. Emphasising this focus and the distinction may give comfort to regulators and the business itself that the business is being managed well and prudently.

3.1.4 ESAP 3, Section 3.1.4 "Inconsistency with the undertaking's risk management approach"

Models, including those supporting the ORSA, will be necessary simplifications of reality. For example, for actively traded asset portfolios or complex hedging strategies, the actuarial projection models will likely simplify the ALM approach used in reality. Where a simplification either causes risks to be ignored or for the ORSA to differ from business reality, the actuary may need to assess the significance of the deviation.

For example, some asset and hedging strategies may be too complex to incorporate into actuarial or ALM models. The actuarial or ALM model may serve as an input into asset selection and hedging, but the reflection of asset and hedging strategies within the actuarial or ALM model is likely to be a simplification. Where the actuarial or ALM model does not capture fully the asset and hedging strategy, it may fail to capture the extent or nature of the underlying risks, either within the calculation of Solvency II capital or in the projection of the ORSA. In this situation, the actuary may need to work closely with the asset and hedging professionals to understand the real-world risks and exposures and incorporate these into the ORSA.

Another example of where the models supporting the ORSA may not fully capture the company's reinsurance arrangements. Reinsurance may be complex and the company's actuarial models may not incorporate the full detail thereof. In this situation, the actuary may wish to assess the materiality of this deviation between the models and the company's actual risk management practices arising from reinsurance.

The business strategy considered within the ORSA may also deviate from the company's risk appetite or underwriting policy, for example a strategic plan to achieve greater market share may cause the company to break certain risk limits or it may not be clear whether the strategy is feasible given the stringency of underwriting requirements.

The company's use of management actions (both those narrowly defined per Solvency II and those more widely used but not within the first group) should be realistic and credible given the company's past performance, past reactions to risk developments, and planned strategic reactions to potential future events. For, example, when constructing and performing an adverse ORSA scenario, the hypothetical management actions serving to mitigate the adverse ORSA scenario should be credible and achievable. Where they are not, the actuary should consider raising concern over the reliability of the outcome of the adverse ORSA scenario in question.

3.2 ESAP 3, Section 3.2 "Performance of the ORSA process"

The intent of this section can be considered threefold: to encourage the actuary to be steadfast in his/her attention to detail as it relates to the assessment of risk and how it flows through the company; to encourage the actuary to address both quantifiable risks and non-quantifiable risks appropriately giving consideration to the downstream use of risk information; and to encourage the actuary to take a broader view or the ORSA beyond the assessment of risk and to extend to the overall ORSA process, the business and the company.

3.2.1 ESAP 3, Section 3.2.1 "Quantitative risk assessment and financial projections"

This section of the ESAP touches on simplifications and reliable representations of risk; the use and derivation of assumptions; and the appropriateness and completeness of stress-testing, reverse stress-testing, and scenario-testing. For ease in understanding, these three topics are addressed individually in the reverse order from the preceding sentence.

Appropriateness and completeness of stress and scenario testing

The projections, or point-in-time stresses, used in the ORSA process may include a base scenario and several plausible adverse scenarios. Each scenario may take into account not only in-force policies but also the policies assumed to be sold during the projection period (where applicable). It may also be useful to include positive scenarios in order to understand the potential upside of future decision making and to investigate potential outcomes of achieving the company's corporate strategy, including the effects and potential increased need for capital.

The base scenario may reflect a realistic set of assumptions used to forecast the expected financial position over the projection period. However, the actuary may need to be cognisant that the past relationships between assumptions may be different from those applicable in the future.

In determining the stresses and scenarios to be considered, the actuary may consider the exposures of the particular entity to risk concentrations.

Where there is a significant risk exposure, the actuary may also consider stresses and scenarios that may be considered more extreme in the current environment or that have not occurred in the recent past.

In determining the stresses and scenarios to be considered, the actuary may want to be aware that:

- Risks and exposures may exhibit non-linear, unexpected behaviour and interactions, especially under stress;
- Risk measures exhibit non-linear behaviour, especially when various individual risks are aggregated.

The actuary may need to document the approach used and its justification. The actuary may want to set out his or her justification for the use of particular scenarios.

Reverse stress tests may be considered to identify various combinations of risks that may lead to the failure of the business, whether that failure is defined as insolvency, loss of a certain credit rating, parental difficulties or other outcome. These reverse stress tests may be more extreme than plausible scenarios.

In testing variations in the outcomes above, the actuary may need to allow for plausible management actions. The actuary may also pay heed to stress and scenario tests issued by insurance and/or banking supervisors and other relevant bodies.

Scenario testing is in the very core of ORSA and therefore it is vital to use realistic assumptions in the base scenario. This might be done by using models allowing also for future trends, non-fixed correlations (e.g. copulas), real world ESG data and management actions that are in line with the way business is managed. Also, the assumptions regarding new sales is important and helps to give the needed realism to the model, for example what products are being sold and how aggressively. After the base scenario is ready and modelled then the focus can be set on the scenarios.

The ORSA scenarios could also utilise a “reverse stress test”. Building this kind of stress starts usually from what could be the series of events that will drive the business into a serious failure or into loss of confidence in the company by markets.

Appropriate use and derivation of assumptions

The actuary may wish to understand whether the company has robust processes for the analysis of relevant data (historical policy data, market data, etc) in the setting of assumptions feeding into both the ORSA process as well as the day-to-day actuarial processes of setting assumptions for insurance-related risks. With the ORSA, the actuary may also wish to assess the robustness of the processes used to set economic assumptions (i.e. those assumptions used to determine "market" risks), business risks, operational risks, etc. Part of this assessment may include understanding whether risks and uncertainties which may be expected to be related (in a benign or a stressed scenario) either causally or in a correlated manner, and why such relationships have been used.

A plausible adverse scenario is a set of adverse, but plausible, assumptions about matters to which the Company’s financial condition is sensitive. Plausible adverse scenarios will vary

between companies and may vary over time for a particular company. These scenarios could normally include plausible combinations of adverse developments in multiple factors as well as adverse developments in individual factors. In constructing or reviewing plausible adverse scenarios and the underlying assumptions, the actuary may need to consider the potential impact of shareholder, policyholder, cedant and broker behavior (if applicable) in adverse conditions.

Certain assumptions, in particular those which are a consequence of the economic environment, may need to be treated as a group. The company's ability to withstand a period of inflation or recession, rising or falling stock markets, increasing market sizes or increasing competitiveness, is normally investigated using coherent sets of assumptions. Where non-economic assumptions are expected to react in a certain manner to changes in the economic environment, these changes might also be incorporated into the combined scenario.

Simplified or approximate calculations and the potential downstream effects on the understanding of risks

Deterministic, stochastic, and approximate calculations

For the appraisal of some risks, the projections can be on a deterministic basis. However, the actuary may need to consider, depending on the circumstances and nature of the risk profile, whether stochastic techniques are necessary to exhibit the variability in outcomes that could take place in the future. For the calculation of Solvency II technical provisions where the underlying products contain financial options or guarantees stochastic methods may be needed, but there may also be accurate approximations such as closed-form option pricing formulae (e.g. Black-Scholes). Deterministic methods may suffice where the underlying policies do not contain non-linearities with respect to the underlying risks. Deterministic methods may also suffice where the exposure to the average risk (formal mathematical expectation of the risk distribution) is equivalent to the average exposure (expectation of the outcome of the risk distribution fed through the actuarial model). Some form of proxy model[5], such as closed-form approximations of stochastic calculations, may suffice where policy features are simple enough to permit the use thereof. Where policy features are very complicated or dynamic, full stochastic calculations may be needed.

3.2.2 ESAP 3, Section 3.2.2 "Qualitative risk assessment"

Ensuring difficult-to-quantify risks are incorporated in the ORSA

Material risks which are difficult or impossible to quantify should be incorporated into the ORSA using qualitative methods regardless of:

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[5] "All models model something; however, it is useful to distinguish between those models which approximate reality and those which simply approximate a more complex model. The distinction of a proxy model, therefore, is that it models another model." UK Actuarial Profession Proxy Model Working Party, http://www.actuaries.org.uk/documents/heavy-models-light-models-and-proxy-models-working-paper

Proxy models aim to replicate a given risk metric (gain/loss, cash flow profile, change in Basic Own Funds, etc) that would be produced by the company's normal liability or ALM models ("heavy models") under a variety of risk stresses. Proxy models include polynomial approximations, radial basis functions, Least Squares Monte Carlo, replicating portfolios, replicating polynomials, and Delaunay triangulation.
See also, http://www.theactuary.com/features/2014/04/erm-proxy-models/

- whether reliable probabilities can be assigned to various outcomes, e.g. via a discrete probability function or a continuous probability distribution,
- whether the whole range of outcomes can be understood, or
- the extent to which the company's exposures can be measured accurately.

Somewhere there could be thoughts of some risks being difficult to quantify but it still being relevant to have capital to cover risks – or the other way round, risks being possible to quantify but being treated (at least depending on the time horizon) with something else than capital.

The difficulty in assigning a probability to a given scenario (e.g. removal of compulsory purchase annuity in the UK prior to the 2014 budget announcement) should not prevent the scenario being included as a stress test, in order to understand the effects on the business.

Scenario testing and "what-if" testing do not necessitate precision in measuring a company's exposures to a risk or an area of uncertainty which is difficult to quantify. If the risk or uncertainty is difficult to measure or if the exposure thereto is difficult to ascertain, an approximate (back-of-the-envelope) calculation may suffice. Also, such approximations may be reduced over time as the company's understanding of the risk or the exposure evolves.

Regarding probabilities and qualitative risks, it may be inappropriate to utilise continuous probability distributions for qualitative risks. Qualitative risks should be incorporated as appropriate. In some cases, it may be most appropriate to assign discrete probabilities to representative risk events. In other cases, it may not appropriate to assign probabilities at all. Consideration may need to be given to the ultimate use or users of aggregated risk information and how the inclusion of qualitative risks may affect this.

While it is desirable to understand all possible outcomes relating to an area of uncertainty, it may not always be possible. **Incomplete understanding of a risk need not preclude its inclusion in the ORSA.**

Combining quantitative and qualitative risks coherently

The actuary may need to determine which risks can and should be quantified and which cannot easily or should not be quantified. In the case of the latter, the actuary may need to be aware of the qualitative tools to identify, describe and report those risks and should consider whether it would be appropriate to carry out separate scenario tests to demonstrate the effect of particular scenarios on the group or entity. The actuary could ensure or contribute to ensuring, whichever is appropriate, that these scenarios are coherent and can allow for management actions. These scenario tests could include scenarios the entity can survive and which it cannot.

Consideration may need to be given to the ultimate use or users of aggregated risk information and how the inclusion of qualitative risks may affect this.

The actuary could quantify risks to the extent possible, taking account of the precision required for the intended purposes. Where the required precision is not possible, risks may need to be handled qualitatively. The qualitative measurement thereof may consider the nature of the remaining uncertainty as well as the need for precision (proportionality).

With regard to incorporating qualitative risks coherently within the ORSA:

- professional judgment may be used when incorporating qualitative risks into the ORSA or the models supporting the ORSA;

- material risks which cannot be quantified reliably may be incorporated into the ORSA using qualitative methods; similarly, when quantification of a risk is not sufficient in comparison to qualitative methods and qualitative methods manage the risk more efficiently, the actuary may wish to use those qualitative methods for the purposes of the ORSA;

- it would be inappropriate if the inclusion of such risks and exposures introduced spurious accuracy into the ORSA; and

- when risks could be captured quantitatively but are captured only qualitatively, then a proper explanation may need to be given and documented.

The actuary may wish to document the process involved and justification for the conclusions.

4 OTHER RELEVANT SUBJECTS RELATING TO ORSA WORK

This appendix provides details of potential deviations from the Solvency II methodology which may be appropriate to use within the ORSA, the outer assumptions, or the Own Solvency Needs calculation.

4.1 DIFFERENCES IN METHODOLOGY

4.1.1 Risk measure: VaR, CVaR, TVaR, burn-through, long-term ALM & liquidity, etc

The undertaking may decide to use something other than the 1-year 1-in-200 likelihood Value-at-Risk measure of Total Balance Sheet risk. There are four components here which are specified by Solvency II which the undertaking may decide to adopt or change to suit its needs in managing its business and its risks: confidence level, timeframe, risk measure (e.g. VaR), and extent of exposure (e.g. the SII total balance sheet or a subset which only protects policyholders, but not PVFP).

The undertaking will likely use the SII risk measure (1-year, 1-in-200 likelihood VaR) for its SII SCR capital and may which to use this as well within the ORSA. The undertaking may wish to supplement or replace the VaR with a measure of risk which suits its business and strategy, its risks and risk management policies and objectives, and its capital policy. The risk measure (VaR, TVaR, etc) should support the undertaking's approach to capital allocation, be that implicit or purposeful, as is reflected in the business, for example in the pricing of various insurance products, as used in remuneration, or as used in assessing profitability. That is, the return on capital, is used, should reflect the manner in which capital is allocated within the undertaking.

The undertaking may wish to use additional or alternative risk measures for the assessment of reserves and capital. For example, the undertaking may wish to incorporate a long-term risk measure such as "burn-through"[6] to set or assess capital levels and compare this to Solvency II reserves and capital.

The undertaking may also wish to vary the confidence level or likelihood of the stress, e.g. the 99.5th percentile adverse stress. This may arise from the undertakings desire to attain or maintain a certain credit rating. However, there may be non-trivial interaction of risk as viewed by the credit rating agency compared to risk as viewed through Solvency II.

The "Total Balance Sheet" approach is discussed below in #4.

4.1.2 Risk measurement time frame: 1-year, 1-day, 5-year plan, policy lifetime, etc

The undertaking may utilise different risk measurement timeframes within its business, e.g. daily or weekly market risk VaRs, and risks may be viewed on a shorter or longer timeframe than one year. For example, the undertaking may also focus on, for example, the risks over the same timeframe as its five-year strategic plans, or on a timeframe more suited to the nature of its products, which may differ among portfolios.

Risks with distinct measurement periods should be brought onto a consistent measurement period, where possible. The risk measurement period should be incorporated into the ORSA coherently (e.g. via a multi-year projection using 1-year risk distributions).

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[6] The risk-neutral likelihood and magnitude of potential future capital injections needed to support guaranteed policy benefits.

4.1.3 Projection basis: what is Best Estimate and why?

This is a question of what comprises the undertaking's true view of reality. From the collection of assumptions arising from Solvency II, IFRS, local accounting, etc, the actuary may be able to produce an objective combined best estimate set of assumptions, taking aspects from each paradigm as appropriate. The undertaking may opt to use this objective best estimate in two manners: inside and/or outside the SII capital and reserving model.

When used within the SII capital model or within the ORSA, the undertaking may wish to incorporate the objective best estimate in lieu of or in addition to the standard SII SCR (Standard Formula or Internal Model per Pillar 1). In this sense, the capital model is comparable to the SII SF or IM. These are the "inner" assumptions discussed above.

When used outside the SII capital model (Pillar 2), the undertaking may wish to perform projections into the future of various balance sheets and profit and loss accounts, e.g. SII, IFRS, local GAAP. In this sense, the objective best estimate should be used to move from the valuation date (broadly "the present") to the point in time when the accounts are to be recalculated or restated (i.e. modelled). That is, the objective best estimate should be used to arrive at the future point in time at which, for example, the SII balance sheet is modelled. In this manner, the objective best estimate should feed into the future assumptions bases (as required by regulation) for each set of accounts to be projected into the future. In this sense "outside the SII capital and reserving model", the objective best estimate may be thought of as the "outer scenario" analogous to a stressed ORSA scenario. Moreover, as within a stressed ORSA scenario, the future Best Estimate (e.g. SII BE) should take into account the experience or assumptions leading up to the point in time when the "inner scenario" assumptions are required. For example, in a scenario where mortality is reduced by 10%, this should inform the setting of the mortality (and longevity) basis for the calculation of the SII balance sheet as at, for example, five years into the future.

It should be clear what the real-world, BE assumptions are that feed into the ORSA. That is, within the ORSA, reserves and capital should be projected consistently with the Transitional Measures, if being used. In order to do this, the company will be projecting Solvency I as well as Solvency II reserves and capital within the ORSA (consistent with SI/SII assumptions).

However, Solvency I and/or Solvency II assumptions driving the above reserves and capital calculations may differ from what the company chooses to use as the assumptions underlying the ORSA model(s) and process.

For the best estimate ORSA scenario, the (re)insurer may choose the outer ORSA assumptions to be of the following, noting that the best estimate should be fully justifiable:

- Fully consistent with SII BE assumptions; or
- What the (re)insurer expects on an objective best estimate basis—the "true real-world basis". This may mean that some assumptions are the same as the Solvency II basis while others differ. When they differ, the actuary should explain why.

It is vital to keep in mind the realities—in addition to and as opposed to SII modelling, SF/IM, prescribed assumptions, e.g. in SII MA—when evaluating risks, potential risk events both at extremes and as expected, the distribution of risk events (if appropriate), exposures to those risks, as well as related things such as management actions, regulatory actions, and policyholder behaviour.

A vital aspect related to the discussion above is that the actuary should understand the differences, both individually and in aggregate, between the Solvency II principles and rules and any deviations appropriate for the ORSA.

4.1.4 Total Balance Sheet approach to risk capital versus policyholders' protective risk capital

Solvency II takes a "total balance sheet" approach to evaluating an insurance company and its risk. The total balance sheet (TBS) approach incorporates risks from the perspective of various stakeholders, notably policyholders, shareholders and debtholders. The TBS approach aims to assess the risks to the viability of the insurer by evaluating the nature and behaviour of the underlying insurance risks on a market values basis for both assets and liabilities. For an insurer, different risks affect different components of the Solvency II Balance Sheet, depending on the nature of the insurance policies, the assets, the approach to ALM, etc.

An undertaking's risk exposures may be understood by looking at how each risk affects the components of the SII Balance Sheet and how each risk affects the SII capital components. Risk exposures to shareholder capital are different from exposures to future profits through the nature of the capital held, whether additional capital might be required to be injected, what such capital protects and how certain risk exposures are managed.

An undertaking's Own Funds (capital) may include shareholder equity, future profits (PVFP), and subordinated debt. Both shareholder equity and sub debt have the capacity to absorb losses on existing business when such losses require an injection of capital or a transfer of capital to policyholders to meet a shortfall of assets backing liabilities. PVFP is a measure the future profitability of the business and generally does not provide for capital injection. Moreover, capital protecting PVFP generally protects the balance sheet (and hence shareholders and debtholders), but does not protect policyholders directly.

PVFP generally protects the business against business and operational expenses and risks not directly connected to policyholders. It keeps an insurer in business and is what will provide for future salaries, business costs, dividends and debt service, should any of these exceed the Best Estimates already implicit in the Solvency II framework. Within the projection of the business, future profits materialise, if available, and then belong to shareholders, being distributed as dividend or retained as working capital. Shareholder equity and sub debt protect against losses not supportable by future profits and protect policyholders in the short term should the insurer have insufficient means to meet its liabilities. The sub debt is subordinated to policyholder liabilities.

In summary, different risks affect the components of Own Funds differently and the components of Own Funds protect the business from different risks over different time frames. Hence, within an undertaking's business practices, it is possible to treat different risks and capital components differently. For example, an undertaking's internal view of required capital could focus solely on risk capital which protects policyholders (and not PVFP). Alternatively, the undertaking could apply different risk metrics to different capital components, e.g. a 1-year 99.5^{th} VaR for policyholder protective capital and a 1-year 97.5^{th} VaR for PVFP protective capital. Moreover, the undertaking may wish to distinguish how these distinct risks are managed or how their allocated portions of risk capital are managed or invested.

From another perspective, for a given portfolio of in-force insurance business, it may be useful to consider the total assets available to pay those benefits ("policyholder protective capital"), with or without the allocated risk capital, *but without PFVP, VIF or goodwill* especially as arising from other product portfolios. Considering asset-liability "matching" from this perspective should help

the actuary identify and assess potential reinvestment risks (as well as all other common risks) without muddying the assessment by including SII capital arising from PVFP or from future premiums on existing business or new business.

This type of analysis may suggest that after a shock, loss-making business may be subsidised by profitable business (going concern). However, this assumption of cross-subsidy should be reviewed, especially given the total level of profit (return on capital) across the business— primarily because the amount of cross-subsidy may not be maintainable as competitors or new entrants may be able to offer similar profitable products *but will not need to subsidise loss-making legacy business*. For these reasons, the actuary may wish to assess the reserve and capital adequacy of a given portfolio of liabilities and corresponding assets although this does not form the basis of regulatory reserves and capital.

4.1.5 Fungibility of capital

From EIOPA[7]:

> "Fungibility at group level means that an element of own funds can fully absorb any kind of losses within the group, regardless of the undertaking within which those own funds are held or where the commitments arise (in compliance with the local prudential and legal rules). Fungible own funds in this sense are thus not dedicated to a certain purpose. Fungibility of own funds at solo level doesn't automatically imply fungibility at group level.
>
> "Transferability refers to the ability to transfer own funds from one undertaking to another within the group. Transferability leads to increase/decrease of own funds in a solo entity without increasing/decreasing the group own funds, except the likely cost of the transfer. The time and the costs of the transfer have indeed to be taken into account."

Within the ORSA, the fungibility and transferability of capital, and funds more generally, within a solo undertaking among business units or liability portfolio, or within a group undertaking, should reflect the reality of the undertaking including at least the appropriate local legal, local accounting and regulatory aspects.

The nature of the components of Own Funds should be assessed for its ability to meet capital shortfalls within its product portfolio as well as within other business units or group affiliates. The time-related restrictions of fungibility should also be considered (e.g. PVFP arising from unit-linked policies cannot immediately and fully absorb overnight losses on guaranteed savings because those future profits will only materialise over time).

Diversification among risks and among portfolios or entities should reflect the real-world fungibility and transferability of capital. For example, where capital is not transferable outside a particular portfolio, the diversification at the level of that portfolio should be the minimum capital amount as seen from a more aggregated level of the undertaking.

4.1.6 Nature of stresses: isolated stresses + aggregation vs causal SST vs combined stresses

For the purposes of calculating the SII SCR, he SII SF SCR calculates the amount of required risk capital via the two-tier covariance aggregation of isolated, single-risk stresses. A Monte Carlo SII IM may perform multi-variate risk stresses where the severity of individual risks is jointly sampled

[7] https://eiopa.europa.eu/CEIOPS-Archive/Documents/Advices/CEIOPS-L2-Final-Advice-Group-solvency-assessment.pdf

according to a dependency structure (e.g. copula). The SCR is then taken by ranking the Monte Carlo Simulations at the correct level of diversification and taking the capital needed for the 99.5th adverse event (or interpolated to the 99.5th percentile).

For the purposes of the ORSA, isolated stresses do not suffice. Stress and scenario tests (SST) are required. SST should include combined-risk events. The undertaking may wish to adopt a framework to develop combined stresses. This may be either ad hoc or causal[8], or both.

Similarly, if a causal model is sufficient for the ORSA, it might also be appropriate for the SII SCR.

4.1.7 Risk-neutral Economic Scenario Generator (ESG) implementation

The SII guidance for the implementation of a stochastic asset model (ESG) requires that the SII discount curve, with or without volatility adjustment or matching adjustment and with the last liquid point and ultimate forward rate, is used as the "risk-free rate" within the ESG which drives the other random asset processes (i.e. the SII discount curve is the "short rate"). This requires careful adjustments to market data (volatilities and market prices) to ensure risk neutrality and correct discounting.

An alternative implementation could use the market risk-free rate (without LLP, UFR, MA or VA) as the short rate to drive the other asset processes. This simplifies calibration and minimises error. In this implementation, the Solvency II discount curve (or all of them, if using MA for some liabilities and VA for others) could be calculated formulaically within each simulation from the market risk-free curve. The VA, MA and UFR are non-market-consistent adjustments arising from SII which should not be used as the stochastic risk-free reference point for other assets. The SII curves are discount curves.

4.1.8 BEL assumes risk free (MA&VA relax this a bit), SII capital addresses the risks, but some BEL > Economic BEL

On the overriding assumption that liabilities are cash flow matched with risky assets on a net basis (net of expected defaults and net of asset-related expenses), then this portfolio of assets could be viewed as an "economic BEL" as "the amount of assets required to meet liabilities on a best estimate basis." The margin in the SII BEL above this economic BEL is "economic risk capital" and within the Best Estimate projection that margin should be expected to materialise and accrue to the undertaking. The size of the margin is decreased by the VA or the MA (as the effective discount rate approaches the net yield).

On the other hand, the UFR may decrease the SII BEL below the economic BEL if there are material long-term liabilities. However, beyond the LLP, there may not be available assets to match long-term liabilities. In this case, relaxing the assumption of cash flow matching, there are liquidity and/or reinvestment risks which should be assessed.

[8] https://bankunderground.co.uk/2015/09/21/bringing-together-stress-testing-and-capital-models-a-bayesian-approach/

4.2 DIFFERENCES IN MODELLING

4.2.1 Nature of the market stress model: causal vs "silo"-ed

4.2.2 Longevity-mortality model: combined vs separate

4.2.3 Longevity-mortality-morbidity(-disability) model: combined vs separate

4.2.4 Lapse model: SII simplistic, SII strict vs coherent

4.2.5 Interest rate up/down model: single model (e.g. Monte Carlo) vs "worst-of" two stresses model

4.2.6 Interest rate stresses & the UFR, then updated IR shocks

Firstly, reality: SII SCR uses UFR – insurers would like reassurances from EIOPA that the capital regime will remain as per regulations (i.e. step down by max 15 bps each year);

Secondly, there's a need for a second (objective) basis for the management of interest-rate related risks and reinvestment risks, which is not smoothed as SII in fact is.

4.2.7 Dependencies, correlations, interactions and cause-and-effect relationships

Correlations (covariances) are prescribed for the SII SF. For the SII IM, companies may use their own correlation/dependency assumptions/models as long as they are credible. Insofar as the company believes that correlations or dependencies differ from those used for SII capital (SF or IM), the company may wish to reflect this within the ORSA.

For example, dependencies within financial markets may differ from those assumed in the SII SF.

For example, if a company uses causal models to model certain relationships among areas of uncertainty, this should be reflected in the ORSA, if not already within the SII SF or IM.

4.2.8 Loss absorbing capacity of deferred taxes

The "Adjustment for the Loss-Absorbing Capacity of Deferred Taxes" (ALACDT) can be allowed for explicitly within a *business projection model* which projects the appropriate balance sheets and profit and loss accounts into the future, as with the ORSA, perhaps on multiple bases such as SII, IFRS, local accounting as required to reliably model the company's tax reality.

Using a business projection model will enable to company to understand in what circumstances, to what extent, and over what timeframe a loss may be expected to absorbed via deferred taxes. Making the simplistic assumption that loss-absorbing capacity of deferred taxes is the full tax rate may overestimate the relief realisable in the real-world, thus under-stating the Solvency II capital requirement. Such a business model would need to incorporate Solvency II, tax rates, and the company's annual accounts (local GAAP and/or IFRS, as appropriate) in order to calculate reliably the company's future tax liabilities and tax relief.

4.2.9 Defaults, downgrades, credit spreads, and market values: modelling needs and risk exposures (different exposures to different SII TBS components)

4.3 DIFFERENCES IN ASSUMPTIONS:

4.3.1 Contract boundaries

Under the SII Standard Formula and Internal Model, contract boundaries may truncate certain products in various ways.

Insofar as SII contract boundaries cause the projection of such products to deviate from otherwise economic, real-world, BE assumptions, these assumptions may be used within the ORSA to project the expected effects (profits, EOF/BOF, future capital needs, etc) of such products.

Note that at each point in time within the ORSA projection, SII capital and reserves should be calculated consistently with SII guidance, i.e. applying the contract boundaries rules. Additionally, if the company wishes to calculate reserves and/or capital on the Own Solvency Needs basis, the contract boundaries may be adjusted to reflect the company's own views of future business levels and future capital needs.

4.3.2 Counterparty default

Complicated (lots of data, reliable) but simplistic (1-year VaR) where you may not only be concerned with events over the next year, but over the product lifetime. [TBC]

4.3.3 Future new business

The ORSA should reflect the company's BE expectations of new business in the future, keeping in mind that there is a funnel of doubt the further into the future we go.

The ORSA should also enable the company to understand what the effects on the company (e.g. Solvency Ratio, BOF/EOF, capital requirements) would be in various scenarios relating to new business.

It is important to note that within the future projection within an ORSA, once future new business comes onto the books (was written in the projection's past which is future as of today) it should be treated per SII Standard Formula/Internal Model rules in calculating reserves and capital.

4.3.4 Transitional measures (equity type 1, TMTP)

In general, transitional measures allow a (re)insurer to gradually run off legacy business which was written before Solvency II came into force and which may not be profitable on a Solvency II basis or would otherwise have required sizable capital injections on day one. While these are beneficial from a reserving and capital perspective, they may not necessarily reflect reality. This potentially necessitates three assumption bases for the ORSA: Solvency I, Solvency II, and a true real-world best estimate (to the extent that Solvency II does not reflect reality).

4.3.5 Equity symmetric adjustment

[TBC]

4.3.6 Discount curves (UFR, LLP, VA, MA)

The UFR determines the distant end of the SII discount curves (risk-free with or without Volatility Adjustment or Matching Adjustment). In calculating SII reserves, the UFR should be used. This includes future points in time within an ORSA projection.

However, within the ORSA, it may appropriate not to use the UFR in within the projection. For example, an economic scenario generator (ESG) used for the ORSA may not use the UFR. It is important to note that an ESG used for SII reserves and capital should use the UFR within the discount curve, which may or may not be the "risk-free" curve as discussed above. Also, if the ORSA uses inner and outer simulations (inner reflects SII assumptions, outer reflects ORSA), then the inner ESG should use the UFR while the outer may not. That is, there is a choice within the outer ESG whether to use the UFR. The choice should be explained and documented by the actuary.

4.3.7 Sovereign credit risk: spread movements, MV movements, risk capital, etc

The SII Matching Adjustment reduces the net investment yield on bonds by the SII Fundamental Spread. This incorporates expected losses due to credit defaults and credit downgrades. Within the ORSA, it may be appropriate to model explicitly and separately the effects (losses, economic risk capital needs, etc) of credit defaults from the effects of credit downgrades. In a stressed scenario, credit downgrades may not cause losses in their own right, especially if the company's management actions do not disinvest, e.g. in a global market stress.

SII assumes the sovereign debt will not default. Financial markets and companies may have different beliefs. Insofar as these assumptions differ, the latter (economic assumptions) should be incorporated within the ORSA (see discussion of outer and inner simulations below).

4.3.8 Cash flow matching

4.3.9 Reinvestment risk (implicitly hidden b/t CF matching and the RFR)

4.3.10 Risks not covered in the SII SF/IM

4.3.11 SII SCR (SF/IM) stress magnitudes (e.g. mort, long, lapse)

4.3.12 The SII Best Estimate is benign. Could a market crash feature in a Best Estimate?