Comments Template on **Discussion Paper on the review of specific items in the Solvency II Delegated Regulation**		**Deadline** **3 March 2017** **23:59 CET**
Name of Company:	Deloitte Touche Tohmatsu	
Disclosure of comments:	Please indicate if your comments should be treated as confidential:	Public
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Reference	**Comment**	
General Comment		
Q1.1		
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Q1.25		
Q1.26		
Q2.1	Article 4(5) requires companies to produce its own credit assessment for larger and more complex items. To ensure harmonized implementation, EIOPA should provide further guidance on how larger and more complex exposures are to be identified; and on how own assessments are to be performed.	

	The issue of reliance on external credit ratings becomes more significant in volatile or extreme market conditions. This is because credit ratings lag behind fundamental changes in probability of default and loss given default. Companies should be allowed to vary the timing, frequency and depth of internal assessments based on external market conditions.	
Q2.2		
Q2.3	The reliance on external credit ratings could be reduced in the assessment of reinsurance recoverables when calculating the technical provisions. To comply with article 42(5), companies usually use the probability of default calculated with the methodology proposed for the SCR counterparty default. EIOPA should provide further guidance in order to reduce the reliance on external credit ratings when assessing technical provisions. However, the methodology proposed should not be burdensome for small and medium size companies.	
Q2.4	Companies should be allowed to perform assessments qualitatively, and if the qualitative assessments indicate that the credit quality may be materially lower than that implied by external ratings; quantitative assessments should be performed. Companies should use available current market data and information when performing such assessments, as using old market data or stale credit ratings may lead to inaccurate assessments. To reduce the burden of implementation, companies should be allowed to use external assessments for significant and more complex exposures provided: ○ Companies can demonstrate an understanding of the data and methods used by external rating agencies to provide credit ratings, and if the companies believe that these are appropriate. ○ A qualitative assessment of whether the fundamentals of PD and LGD have not changed significantly since the exposure was last rated. Should the assessment above indicate that the credit assessments provided by rating agencies is not appropriate, companies should be allowed to use credit quality steps that are demonstrably	

	more prudent.	
Q2.5	Using market implied ratings could be an appropriate alternative to external credit. However, this could increase the complexity of the calculations and decrease the comparability of the standard formula. We suggest, if this solution is followed, that EIOPA calibrate these implied ratings. For example, for the vanilla bonds, EIOPA could provide a mapping table between credit quality steps, spread and durations. Since market implied ratings could be highly volatile during extreme market conditions, those mapping tables should take into account various parameters such as lag and trend to ensure a relative stability of the tables from one quarter to the next. Moreover, information to perform market implied ratings may not be easily available for certain exposures. If a methodology based on market implied ratings is prescribed by EIOPA, companies should not be mandated to apply it for any or all of their exposures. In fact companies should only apply it when it is appropriate to do so.	
Q2.6	The accountancy based measures may not be appropriate if the fundamentals of PD and LGD have changed significantly since financial information was last published in public domain. Further, the same accountancy ratio for different sectors and industries could have very different meanings. If a methodology based on accountancy based measures is prescribed by EIOPA, companies should not be mandated to apply those for any or all of their exposures. In fact companies should only apply it when it is appropriate to do so.	
Q2.7		
Q2.8		
Q2.9		
Q2.10		
Q3.1		

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Q4.1		
Q4.2		
Q5.1	We believe that the definition of $FP_{(future,s)}$ should be changed in line with the proposed wording. This is due to: 1. Elements of premiums for multi-year contracts entered into in year *N*+1 "missing" from the premium volume measure; and 2. Inconsistencies between the treatment of annual and multiyear contracts incepting in year *N*+1 In relation to 1. consider valuation date = 31/12/16 and a 3 year contract expected to be written on 01/07/17 (initial recognition = inception date and uniform earning ignoring discounting). Premium is expected to be €1m per annum.	

	The aim of the premium volume measure take into account the full premium of new contracts and contracts renewed in year *N*+1. However under the current definition this fails to do so. Earning is as follows: | | | GEP | P_s | $FP_{(future,s)}$ | 01/07/2017 31/12/2017 500,000 500,000 0 01/01/2018 30/06/2018 500,000 0 0 (highlighted) 01/07/2018 30/06/2019 1,000,000 0 1,000,000 01/07/2019 29/06/2020 1,000,000 0 1,000,000 The portion highlighted is earned from the multiyear contract but is not considered within the premium volume measure. Also the later in Year *N*+1 the contract is expected to be written the greater the amount of premium "missing". In relation to 2. there is an inconsistency between annual and multiyear contracts written in year *N*+1 as the unearned portion of an annual contract at the end of year *N*+1 is not considered within the premium volume measure.	
Q5.2		
Q5.3	The impact would depend on the type of policies written, the expected growth for the coming year and the distribution of initial recognition dates of policies written in year *N*+1. In the case of an undertaking only incepting business of Jan 1 each year there would be zero impact. For other insurers, if we assume: ○ Stable volumes; ○ Uniform earnings pattern; ○ Initial recognition date = policy inception;	

Embedded table (from the cell above):

		GEP	P_s	$FP_{(future,s)}$
01/07/2017	31/12/2017	500,000	500,000	0
01/01/2018	30/06/2018	500,000	0	0
01/07/2018	30/06/2019	1,000,000	0	1,000,000
01/07/2019	29/06/2020	1,000,000	0	1,000,000

	○ No tacit renewed. the impact would be an increase of the premium volume measure by approximately: $\frac{x-1}{(k-1)\cdot 12*3+x-1}$ For *k*, an integer strictly higher than 1; $\frac{x-1}{12}$ For *k* = 1 With ○ *x* is the number of months after reporting date that policies are written (note if valuation date is yearend and contract are written as at 1st February then *x* = 2) ; ○ *k* is the premium weighted average policy length (in years) of policies. *k* is an integer hig her or equal to 1.	
Q5.4	We consider that the definition of the volume measure should be reviewed in order to decrease its dependency to pricing strategies. Indeed, this was one of the default of Solvency I which already penalized undertakings with a prudent pricing. Assuming stable volumes the volume measure will fluctuate depending on where an undertaking is on the insurance cycle. In terms of correcting it there may be some issues: ○ Inputting risk premiums is probably an ideal solution. However different companies will have different levels of pricing sophistication and unless both parties have perfect information two companies may have two different views of burning cost for the same risk. Secondly quoting burning cost would also highlight policies/lines of business which are knowingly being written below technical price (or even at capital destroying rates) ○ Any attempt to “normalize” for the underwriting cycle would be complex and would also need to answer what the “mean” level of (cycle adjusted) premium is. A factor could possibly be increase/decrease in premium to bring expected RoE on premiums to a target return.	

	Using an expected technical premium as a volume measure be a way to moderate this issue. This quantity could be derived using the Loss Ratios per LoB already used for Premium Best Estimate calculation. While not perfect it allows to scale risk differently depending on if we are looking at a 30% Loss Ratio LoB or a 70% Loss Ratio LoB. Associated standard deviation parameters should in that case be reviewed accordingly. Either of these suggestions may increase the complexity of the standard formula and not decrease it.	
	Issue 1 EIOPA clarified in Q&A 6 that premium volume measures should be net of reinsurance but gross of acquisition costs SCR | Non-life premium and reserve risk | SCR 9.9 | (SCR 9.9) (page 252) premium risk : Should premium measures be gross or commission and other acquisition expenses? | The premiums definition refers to earned premiums after deduction of amounts recoverable from reinsurance contracts. The commission expenses and other acquisition expenses would already be included in the earned premiums. However many contracts can have very different levels of commission/acquisition costs, and hence premium, depending on the channel through which it is written (e.g. a direct household policy versus one written through a bancassurer). This can lead to very different volume measures and capital charges for identical risks. This would especially be an issue for high commission products (e.g. PPI). An option here may be for undertakings to enter premiums net of commission (and possibly other acquisition costs). In these cases the premium risk parameters may need to be recalibrated based on this "new" definition of premium. Issue 2 There is also an element of double counting with the natural catastrophe module as premiums entered will have loadings for losses arising from natural catastrophe perils. These can vary greatly by geographical region (e.g. Hail).	

	A solution here could be for either: ○ Undertakings to reduce the volume measure based on loadings with appropriate documentation around the reduction; or ○ EIOPA to publish “reduction factors” based on geographical region (per Annex III) or by EEA country. <u>Issue 3</u> Art. 17 of the Delegated Acts situplates that obligations should be recognized either “at the date the undertaking becomes a party to the contract that gives rise to the obligation” or at the date when “cover begins” For group contracts for which the negotiation phase between the insurer and the client takes several weeks/ months, this sentence implies that the obligation shall be recognized before the cover begins. For instance, the obligation of an annual contract underwritten on 31.10.N for the period 01.01.N+1 – 31.12.N+1 starts on 31.10.N. This raises an issue for the premium volume calculation, as the FP_{future} factor relies on the recognition date.	
Q5.6	If the factors are recalibrated after application of any issues arising from points 4 and 5 the overall market impact may be negligible but could be significant for individual companies.	
Q6.1		
Q7.1	Entities operating in various geographical places present complexities. Requiring data with a granularity sufficient to match the predefined zone is a good test to ensure sufficient data is recorded. The current specifications permit increased risk sensitivity in the estimation of a risk. Therefore, they should not be simplified, subject to two conditions: provide with a helper tab related to the SCR CAT NAT assessment up-to-date (and provide the parameters in a format that undertakings could use – for instance excel) and introduce some simplifications (as detailed in Q7.2).	

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Q8.1		
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Q8.6		
Q8.7		
Q8.8	Yes, the calculation of the capital requirement for marine, aviation and fire risk should be	Dorian Pottier

	computed based on the net amount. Based on our experience, we observe that using gross amounts could lead to an underestimation of risk. However, these modules, in particular the fire one, are already complex to estimate. Using net amount would require much more information on reinsurance arrangements (notably for the FAC treaties on a policy basis) in order to identify the maximum exposure. The expected impact may be significant, in particular when the current exposure based on the gross sum insured is reinsured by facultative covers.	
Q8.9		
Q8.10		
Q8.11		
Q8.12	Yes, the fire risk sub-module needs to be simplified. The determination of the exposure under 200m radius is a challenge for most company, in particular when the zones/regions are outside the home country.	
Q9.1		
Q9.2		
Q9.3		
Q9.4		
Q9.5	Each country's supervisor could provide an average amount of the cost of a hospitalisation, consultation with a medical practitioner. In group insurance, in particular, where there is no medical selection, the amount should be the same for all health insurers.	
Q10.1	The Lee Carter model could be an appropriate model as it is transparent, robust, and is able to take into account parameter uncertainty in the stress factor. Further the Lee-Carter model generates confidence intervals which increase in time. As opposed by the current instantaneous shock of the Standard Formula, this is more in line with the true nature of longevity/ mortality	Fabian Kratz Redouan Hmami (France)

risk. It has however a number of limitations that should be considered:

- Consistency between projected mortality trends in the risk model and the best estimate model, e.g. in case best estimate assumptions are not based on a Lee-Carter model.
- Absence of cohort effects
- The Lee-Carter model is suitable for projection population mortality rates. However, the uncertainty in portfolio mortality rates should also be accounted for. In principle, this could be done by applying Lee-Carter directly on portfolio data, but in practice the amount of portfolio data might not be sufficient.

In general these limitation may make the Lee-Carter model less suitable for use in regions with strongly expressed cohort effects.

Considering alternative models, it is useful to take a more broad view on longevity risk in general. Longevity risk is typically long-term, i.e. the risk is of an adverse trend which unfolds over a long period of time. However, the SCR definition as used in the Solvency II guidelines indicates that is it useful to know how much expectations of future mortality rates might change over a single year.

The long-term nature of longevity risk has thus no natural fit to “1-out-200 over one year" approach. Therefore, the bulk of the currently available Trend Uncertainty approaches can be split into main categories:

- Risk Models based on a multi-year (or run-off) approach,
- Risk models based on a one-year risk horizon.

A one-year risk model assesses the potential consequences of an annual Best Estimate assumption update. During a one-year period, additional information from new mortality observations becomes available (resulting in recalibration of the model parameters) as well new insights in the underlying generating process (possibly resulting in model changes).

The Solvency II guidelines dictate the basic principle that the SCR amount for any risk type should reflect the Own Funds impact of a manifesting (one-year) shock. From this perspective, it feels natural to model the risk in terms of a one-year assumption update. This requires a dataset

	containing a sufficient volume of population mortality projections as used in the past by the risk taker. The Netspar study as well as the MRC approach (used references in the discussion paper) are both based on a so called multi-year approach. A multi-year approach is based on the principle that the consequences of all manifesting risk that can emerge during the run-off, should be modelled. In practice, the longer risk horizons are combined with a multi-year confidence level lower than 99.5%. Within the multi-year approach, the SCR for longevity risk should be able to absorb the potential impact of structural changes in mortality improvements. Lee-Carter type of models are not able to generate various trend regimes (i.e. account for trend breaches). Furthermore, the short term volatility should not dictate the long term uncertainty. As each mathematical model has its own specific view on the future trend uncertainty, model risk cannot be disregarded. There will be many models that are consistent with the used data. So, in the end, the specific choice of model will be subjective. Back testing seems to be crucial then in order to substantiate the calibration. As part of the validation of predictive models, the back testing compares the predicted (i.e. modelled) losses with the actually experienced losses in the past. In general, the value at risk (our SCR) should be reconsidered if the observed losses (generated by mortality assumption updates) are not in line with the risk modelling. Both approaches suffer from their own limitations. Unfortunately, there is no direct link between the two approaches; deriving a one-year longevity stress from a multi-year calculation is tricky. All in all, a stochastic model based on the multi-year approach should be preferred to provide an initial assessment of the required level of the SCR. It should be important to make a more general link between the mortality/longevity risk and underlying factors. Instead of having models that are purely relying on mortality historical data, it is very important to bridge the gap with the underlying factors that are related to mortality: such as adult smoking	

	trends, access to health care, car accident trends, general quality of the air, food… These kind of studies might allow insurers not only making appropriate reserving and capital management but can identify and manage underlying risks they are bearing and contribute to welfear. Insurance companies might therefor not only see the longevity or mortality as a consequence but anticipate their business depending on general economical, ecological and technological effects.	
Q10.2	There are two dimensions for parameter uncertainty and model risk. The first dimension relates to the concept that parameters are not eternal constants, but typically vary over time. This is implicit in the historical period over which a trend is fitted / the weighting scheme used in the estimation. If there were no parameter uncertainty, one would use the longest historical period, with equal weights for all observations. In practice, using a fixed rolling window, of, say, 40 years, is a pragmatic way to handle a slow moving longevity trend. The most straight forward way to obtain information on the amount of parameter uncertainty and/or model risk is to analyze what happened when re-estimating BE's annually using a rolling, say, 40-yr window, i.e. back testing. Richard Plat has performed such an analysis [« One-year Value-at-Risk for longevity and mortality », Insurance: Mathematics and Economics 49 (2011) 462–470)] and he arrived at longevity risks that are similar to the current standard formula. The second dimension relates to volatile parameter estimates, arising from a limited number of observations with error terms. Bootstrapping can help quantify this risk. E.g. by sampling model parameters from an assumed normal distribution. The normal distribution could be based on the standard errors of the parameters of the Lee-Carter time series. Please refer to a master thesis by David Plomp which provides an algorithm	
Q10.3	Following our earlier response to Q10.1, the stress parameters should be judged for their biological reasonableness by evaluating the impact of several scenario's (e.g. cure for cancer, growing obesity). These scenarios should not be the input on which to calibrate the stress parameters, but rather be	

	a tool to validate the model used. Otherwise one would use expert judgment to model the possible deviation from an expert judgement based best estimate mortality trend.	
Q10.4	Generally, portfolio data should be used when modeling mortality or longevity risk. This means policy data should be used, which are not publicly available and might differ a lot between companies. When using a multi-year model, HMD and EuroStat provide useful information.	
Q10.5	Differences between general and insured mortality should be taken into account as the insured subpopulation might have specific mortality characteristics. Differences could be taken accounted for by separately modeling portfolio mortality and experience factors (being the proportion between insured and population mortality). The insured mortality (which is the one that really matters, after all) can then be obtained by multiplying population mortality with experience factors. Portfolio risk characteristics with respect to level, trend and volatility could be based on the process and parameter uncertainty in the stochastic model that is used to forecast experience factors.	
Q10.6	Yes, from an actuarial point of view this would be more appropriate as different products can have different mortality characteristics. Benefits: ○ This would enable allocating capital to product groups more easily. This could be particularly important for SCR projections in the Risk Margin (as they require projecting risks over an ever older population). To the extent that there is a ‘wall of death’, longevity improvements at older ages faces limitations. ○ It improves consistency between assessing risks for mortality products and assessing risks for longevity products. Currently different shocks are applied for these to the same age group, while it is unlikely that longer-term mortality trends are different for people buying different products. The main reason for different shocks is that there may be a ‘twist’ in the mortality profile. Younger mortality rates may increase, where older mortality rates may decrease. The current -0.25% correlation between mortality and	

	longevity products is driven implicitly by a presumed age-distribution. Arguably, this correlation should be -100% for the same age. Costs ○ The costs would be a more complex model as stress factors have to be determined on a portfolio level. This could partly be solved by distinguishing between a generic population mortality module and an undertaking specific portfolio mortality module. ○ Further additional complexity and model risk is introduced by the need for specifying the aggregation structure of the capitals of different product groups.	
Q10.7	In general the increase in granularity with respect to age would lead to a more realistic shock. The current stress for high ages is too high as these ages will not benefit significantly from any mortality improvement. However one needs to take care to not directly considering the Lee-Carter levels of multi-year uncertainty as a one-year risk measure, as this would not lead to a risk measure as prescribed SII.	
Q10.8	For longevity risk, a model point approach could be adequate. The model points should then represent a model portfolio that represents for instance, in a condensed data format, insurance liabilities per age, gender and product type of the specific insurance portfolio. In that case, the model portfolio adequately reflects the longevity dynamics of that total insurance book.	
Q10.9	An idea might be to have an adjustment on the SCR to account for this. This adjustment might be positive (higher SCR) in case a company is sensitive to interest down and vice versa. The size of this adjustment should depend on the level of the correlation between interest risk and mortality risk. However the actual specification of such a mechanism is very tedious.	
Q10.10	As uncertainty accumulates over time, a shock that grows with future years better represents the nature of longevity/ mortality risk: drivers of changes in mortality rates are expected to slowly manifest themselves. One way to do that is to explicitly shock a mortality trend parameter.	

Q11.1	We illustrate below a possible method for estimating Undertaking-Specific Parameters (USP) defined in the Solvency II regime, in connection with the underlying theoretical foundations. The USP considered are unitary relative standard deviations of the life insurance sub-modules "mortality risk" and "longevity risk". The adjustment factor for reinsurance has not been included in the analysis. To define the calculation method used for unitary standard deviations, theoretical principles are mentioned and the necessary data needed to calculate and comment on the relevant computational aspects, is defined. In order to make more immediate use of the information, synthetic notions, which are considered as standards in operational practice, are occasionally mentioned. **Objective** The following theoretical model has the objective of determining (or calibrating), relative to a specific "segment" of life business, the variance of a random variable starting from the theoretical relations with one explanatory variable that acts as a volume measure. Applying the model for mortality risk, the dependent variable will be identified as the *aggregate cost of claims* for a fixed generation of policies and the independent variable will be the corresponding *annual premium equivalent*. **Method of calculation** The Life underwriting risk capital requirement is derived by combining the capital requirements for each life sub-risk namely, mortality risk, longevity risk, disability/morbidity risk, lapse risk, expense risk, revision risk and catastrophe risk. Mortality risk is equivalent to the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend, or volatility of mortality rates, where an	

increase in the mortality rate leads to an increase in the value of insurance liabilities.

The capital requirement should be equal to the loss in basic own funds of insurance and reinsurance undertakings that would result from an instantaneous permanent increase in the mortality rates used for the calculation of technical provisions.

In a similar manner to the one adopted by EIOPA for the determination of the Non Life capital requirement, limited to the premium and reserve sub-module, the following approach for the mortality risk has been proposed:

$$SCR\ life_{mort} = \rho(\sigma) * APE = 2{,}58 . \sigma(X) * APE$$

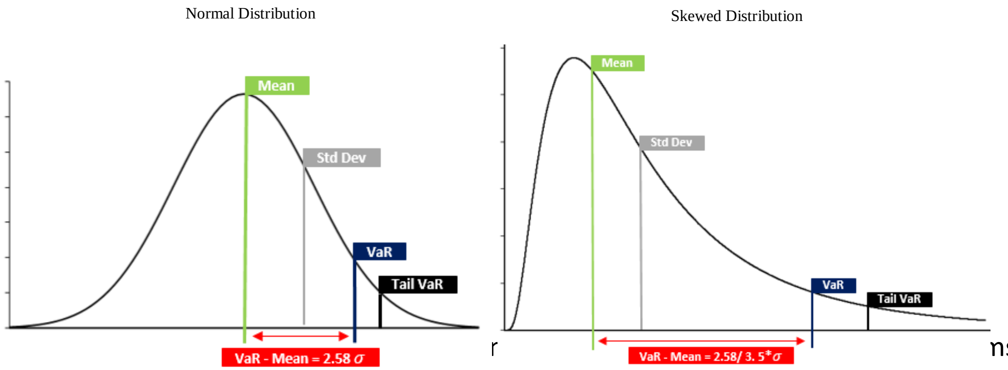
where:

- APE[1] (Annual Premium Equivalent) of insurance policies for which an increase in mortality rates leads to an increase in technical provisions without the risk margin;
- $\rho(\sigma) = VaR_{99.5}(X) - E(X)$.

As shown in the graph below, $\rho(\sigma)$ is the estimated distance between the expected value and the value at risk at the percentile of interest, which is referred to as the:

$$VaR_{99.5}(X) = min_x(\Pr(X > x))$$

[1] APE is a measure used for comparison of life insurance revenues (for each line of business as protection, saving and linked) by normalising policy premiums into the equivalent of regular annual payments.



r ns for a fixed generation of policies, we can approximate $\rho(\sigma)$ with $2{,}58\,.\,\sigma(X)$

This assumption is applicable[2] for risk factors such as mortality, longevity and disability, which are assumed to be binominally distributed.

As required in the Delegated Acts, to corroborate the fit of the model proposed to the data, the three assumptions underlying the model will be verified in the next section.

Stochastic method:

Numeric quantification and calibration of the standard deviation is done using the data of the company. For every life business segment, the model considers the variable Y, of which the variance should be estimated from the theoretical relationship with the explicit variable X. We assume

$$Y = aggregate\ cost\ of\ claims\ related\ to\ policies\ group$$

where *Y* is the dependent variable and,

$$X = annual\ premium\ equivalent$$

[2] If *n* is large enough, then the skewness of the distribution is not too great. In this case a reasonable approximation of the *B(n, p)* is given by the normal distribution.

where *X* is the indepent variable.

Hypothesis:

Considering an undertaking's portfolio u of annual term policies, the expected value of aggregate cost of claims would be:

$$E(Y) = \sum_{i=1}^{u} C_i * v * {}_{\frac{h-1}{1}}q$$

where:

$v = deflator$

$h = \ year\ of\ evaluation$

$C_i = positive\ capital\ at\ risk$

$q = expected\ average\ mortality\ rate\ over\ the\ year\ h$

and the variance would be:

$Var\ (Y) = E\ (Y^2) - [\ E\ (Y)]^2$

$= [\sum_{i=1}^{u} C_i^2 * v^2 * {}_{\frac{h-1}{1}}q^2] - [\sum_{i=1}^{u} C_i * \ v * {}_{\frac{h-1}{1}}q]^2$

where: $Var\ (Y) \propto Var\ (X)$

The hypothesis that the variance of Y is a linear function of X is justified given that the aggregate cost of claims mean and variance is a linear function of the size of the portfolio.

Distribution Hypothesis:

Under the Loss Distribution Approach, the mortality risk loss over a 1-one year time horizon is modeled as

$$Y = C_1 + C_2 + C_3 + \cdots + C_N$$

where the number of events per year (frequency) is a random variable *N*, and the sizes of the loss (severity), when the events, occur are C_1, C_2, ...

It is common to assume that frequency and severity are independent, and that the severities C_1, C_2, ... are independent and identically distributed.

Random variables representing frequency and severity are characterized by distribution functions formally defined as follows.

The most commonly used frequency distributions for the annual number of events N are the Poisson, Binomial, and Negative Binomial distribution. An interesting property, which is often used as a criterion to select a frequency distribution is the dispersion. The variance for a Binomial distribution is less than its mean and therefore it is under-dispersed; the variance of the Negative Binomial distribution is larger than its mean and therefore it is over-dispersed. For the Poisson distribution, the mean is equal to the variance.

For this purpose we assume that the random variable *N* has a Binomial distribution $N \sim Binom\,(n\,,p\,)$. Its probability mass function is:

$$p(k) = \Pr(X = k) = \binom{n}{k} p^k (1-p)^{n-k}, p \in (0,1), n \in 1,2,..$$

There are many standard parametric distributions that can be used to modelling severity. For our purpose the random variable C has a continous Uniform distribution $C \sim Uniform\,(a, b\,)$. Its probability density function is:

$$f(c) = \begin{cases} \frac{1}{b-a}, & a \leq c \leq b \\ 0, & c < a \; or \; c > b \end{cases}$$

where:

$a = minimun\,positive\;capital\;at\,risk$

$b = maximum\,positive\;capital\;at\;risk$

Often we need to calculate the distribution of the sum of independent random variables such as the aggregate loss i.e. $C_1 + C_2 + C_3 + \cdots + C_N$. It can be convenient to calculate this distribution with the convolution of corresponding distribution functions.

Using a well-known property that the characteristic function of the sum of independent random variables is just a product of their characteristic functions, the characteristic function of the annual loss $C_1 + C_2 + C_3 + \cdots + C_N$, denoted by Y(t), can be expressed through the probability generating function of the frequency distribution and characteristic function of the severity

distribution as:

$$Y(t) = \sum_{k=0}^{\infty} (\varphi(t))^k * p_k$$

Given the characteristic function, the density of the annual loss Y can be calculated via the inverse Fourier transform. Based on the assumption adopted for the marginal distribution the random variable *Y*, the aggregate cost of claims, has a Normal distribution $Y \sim Normal\ (\mu, \sigma\ )$

Where:

- $\mu = \bar{C}np$

- $\sigma = unknown$

- $\bar{C} = average\ capital\ at\ risk$

In order to apply this model, an estimate of the parameters is needed, which will be based on the company's data.

For such risk factors, an empirical approach to estimate the coefficient of variation $CoV(Y)$[3], might be to adopt a maximum likelihood estimator for the probability of incidences, q.

The maximum likelihood estimator is:

$$\hat{q} = \frac{D}{L}$$

Where:

$D = number\ of\ incidences\ observed$

$L = number\ of\ exposures$

3 $$CoV(Y) = \frac{Std\ (Y)}{E\ (Y)}$$

The relative deviation of the number of incidences is determined by the relative deviation from the true probability i.e. $\hat{q}/q$.

Using the binomial distribution properties, the variance and standard deviation of the relative deviation can be derived as

$$Var\left(\frac{\hat{q}}{q}\right) = \frac{1}{q^2} * Var\,(\hat{q}) = \frac{1}{q^2} * \frac{q.\,(1-q)}{L} = \frac{(1-q)}{q*L} \approx \frac{1}{q*\,L}$$

$$Std\left(\frac{\hat{q}}{q}\right) \approx \frac{1}{\sqrt{q*L}} \approx \frac{1}{\sqrt{Expected\ number\ of\ incidences}}$$

The relative deviation is assumed to be symmetric and therefore it can be approximated using the normal distribution. A relevant volatility factor can be defined as:

$$\sigma = \frac{\lambda_{99.5}}{\sqrt{Expected\ number\ of\ incidences}} \cong \sigma(X)$$

where:

$\lambda_{99.5} = the\ 99.5\ quantile\ of\ the\ standard\ normal\ distribution$

Therefore, only the expected number of claims for the following year is needed to calculate the mortality risk. The expected number of claims is based on the availability of data from the company.

Conclusion:

This approach is also applicable for other life underwriting risk factors such as longevity

	and disability, which are assumed to be binominally distributed. Finally, since the assumptions underlying the model are known, it would also be appropriate to extend the application to the amounts paid in the event of the death of the persons insured under the contract, instead of the number of deaths in order to consider the variability of the capital at risk. This possible extension would result in the consideration of the uncertainty around the mean sum insured. Further consideration could be taken on the credibility of the parameters calculated for the portfolio and market wide standard deviation for the segment considered.	
Q11.2	C.f. Q11.1	
Q11.3	C.f. Q11.1	
Q11.4		
Q11.5		
Q11.6		
Q11.7		
Q11.8		
Q11.9		
Q12.1		
Q12.2	Calculation of « F » in art.192.2(e)	
Q12.3		
Q12.4	<u>Issue 1</u> Variance of the loss distribution of type 1 exposures (Delegated Acts art. 201): definition of V_{inter} and V_{intra}.	

	The application of the formulae requires all possible combinations (*j*,*k*) of different probabilities of default on single name exposures. This implies constructing a large matrix of *PDs*, for which maintaining an audit trail can be burdensome. Issue 2 Demonstrating whether receivables from intermediaries are due for more or less than three months can be burdensome. Issue 3 For type 1 exposure, the calculation of the LGD depends on whether the reinsurance arrangement is with a company which has 60 % or more of its assets subject to collateral arrangements. As this information is not always public, it can be impossible for undertakings to justify the use of the 50% or 90% parameter for the calculation of the LGD.	
Q12.5		
Q12.6		
Q12.7		
Q13.1		
Q13.2		
Q13.3		
Q13.4		
Q13.5		
Q13.6		
Q14.1	The fact that concentration risk is not applicable to exposures covered in counterparty risk might be questionable (e.g. mortgages concentrated in one specific location). Solvency II only assess name level (ultimate parent) concentration. We would propose also to include sector level and	

	geographical concentration (see 14.2). In this case, one would definitely want to include mortgages within the scope of the concentration risk.	
Q14.2	The exposure w.r.t. unrated Single Name Exposure under the assumption of local authorities being assimilated with the EU parent country government, is not significant. Only in the absence of look through on funds, this would be more significant. ***Assumption on Single Name exposure:*** A common issue that companies have faced is determining the Single Name Exposure groupings – in particular when it deals with different judicial frameworks. The determination of this could perhaps be made clearer in the EIOPA documentation. Given the fundamental idea of the concentration risk, this should represent name concentrations (and capture non-diversified idiosyncratic risks). If, however, a Belgian company is actually a subsidiary of a Chinese holding company, which in turn has a Chinese daughter, one could question whether the Belgian firm and it's Chinese sister firm are subject to the same idiosyncratic risks. Cases such as these might want to be taken when defining the Single Name Exposure. Perhaps a systematic approach could be prescribed by EIOPA.	
Q14.3		
Q14.4		
Q14.5		
Q14.6		
Q14.7		
Q14.8		

Q14.9		
Q14.10		
Q14.11		
Q14.12		
Q15.1	No, this is not a real risk but a different type of risk: the currency risk to prepare group reporting differs from currency risk exposures on assets and liabilities at solo level. The question is however strongly related to own funds availability and diversification benefits.	
Q15.2		
Q15.3	In line with the group capital management, a qualitative and quantitative information on any significant restriction to the fungibility and transferability of own funds eligible for covering the group Solvency Capital Requirement should be performed. The currency stress should not be different from the other stresses.	
Q15.4		
Q16.1		
Q16.2		
Q16.3	Using a look-through approach to investment related undertakings would lead to a better estimation of the underlying market risk: the diversification of the underlying assets would be better reflected (then, this would improve the accuracy of the concentration module) and, in the same time, the calculation of the other sub-modules would be more accurate. The analysis should be sufficiently granular to take into account all Market Risk calculations. In other words, the data provided by the fund, should cover the distributions across rating classes, currency exposures, sector exposures (EU govie, corporate,…)… The cost of this approach may be an increase in workload when data is not available easily	

Q16.4		
Q16.5		
Q16.6	20% is rather low – inherently, there is no significant difference in risk when comparing a target asset allocation (provided this is sufficiently granular – see 16.3) versus a full line-by-line calculation. The approach is very accurate for equities. For bonds the spread risk and interest rate risk calculations will have to be performed at aggregated levels (using aggregated durations or – if provided by the fund – duration buckets). For spread risk, a duration-based is relatively accurate. For interest rate risk, a proxy will have to be made using the durations. This proxy works very well when the interest rate shock is a parallel shift – for a non-parallel shift, one would have to ensure that the interest rate risk is calculated in a sufficiently prudent manner. Should the 20% not be changed, an exception may be considered for the concentration risk module. As it can really be argued that funds do not contribute to the concentration risk SCR.	
Q16.7	The 20% threshold is too low for investments backing unit-linked products. As far as the risk is supported by the policy holders, the investments related to unit-linked products could be entirely allowed for a simplified approach like a data grouping approach.	
Q16.8		
Q16.9		
Q17.1	EIOPA demonstrates that the current approach underestimates the interest rate risks and is not consistent with most of the stochastic scenarios used by insurers that consider potential lower negative interest rates than the central swap curve. We agree with this demonstration and note that government yield curves (Bund, OAT for instance) have also dropped significantly in recent years and have been negative for short and long term maturities. However, the impact of a down rate stress even when interests rates are negative could reinforce the difference between the real investment return and the time value of money (based swap rate curve + UFR + with/without VA). It is unlikely that many insurers would invest a large part of their	

	assets in risk free assets with negative returns.	
Q17.2	A minimum downward shock would be needed. A floor could be based on the maximum loss that would face an insurer when investing in alternative assets with a negative return due to asset management fees (like "cash storage").	
Q17.3	As tested in stress tests, the main risks for insurers is a very low flat yield curve over a long period. A sudden increase in interests rates is also a risk in markets where there is no constraints to surrender insurance saving contracts.	
Q17.4		
Q17.5	The historical data set of daily EIOPA risk free rate curves is suitable to perform the calibration but data of the extrapolated part should be excluded.	
Q17.6		
Q17.7	The shock factors could be calibrated on the input data for the consistency between the own fund valuation and SCR.	
Q17.8		
Q17.9		
Q17.10	A monthly basis is reasonable.	
Q17.11	An additive approach is not always appropriate especially with the current volatility of interest rates. The risk of change in interest rate in not the same when interest rates are -1% and 4%.	
Q17.12	See Q17.16	
Q17.13		
Q17.14		
Q17.15		
Q17.16		

Alternative approach to relative or additive shock:

EIOPA uses a relative shock for their IR risk, which breaks down when rates go negative. A trend observed in option pricing is using "shifted relative shocks". Indeed, instead of calculating relative interest rate changes as *(Rate_t – Rate_t-1)/ Rate_t-1*, one calculates them as *(Rate_t – Rate_t-1)/ (Rate_t-1 + shift).* (This approach coincides with the shifted lognormal approaches used in many interest rate models, e.g. Shifted SABR or shifted Black). The "*shift*" can then be set at some lower bound (e.g. -2%). The calibration of the shocks would work in exactly the same way as before (instead of looking at a quantile of a lognormal distribution, one would look at a quantile of a *shifted* lognormal distribution). In different industry models, it has been shown that, provided the calibration has been performed correctly, the choice of the shift doesn't hugely impact the resulting quantiles of the distribution. However, for consistency, a lower bound should be set by EIOPA, as this also defines a fixed level below which interest rates can never drop (and can hence be used in other modelling applications and stresses). This lower bound should be derived from a macro-economic analysis involving the "cost of holding cash".

Comments on current calibration methodology:

EIOPA currently does not seem to take into account the correlation between different maturities in its calibration – they calibrate the 99.5^{th} (or 0.5^{th}) percentile of each point in the curve (each maturity), and then let that be the shock. This shock is greater than a 1 in 200 year event, as it assumes a 100% correlation between the different maturities in the curve.

The actual level of the correlation should be investigated, in order to assess the impact of this assumption. A historical analysis can be performed on the correlation of different points in the curve.

If one would want to capture correlations in practice, one would choose number of key points in the curve, determine the marginal distributions of these points, and impose a copula to determine the joint distribution of the curve. Determine the 99.5^{th} percentile of each point straightforward: one would have to determine a proxy interest rate sensitive portfolio – and determine the loss distribution of this portfolio depending on the underlying interest rates (at

	different maturities). Then, one would calculate the 99.5th percentile loss, and see the contributions from the different points. The current approach is hence on the conservative side (assuming that interest rates are positively correlated). Calculating the distribution to the swap rate market also has the issue of correlation – to be completely correct, a similar approach to the above (i.e. determining a loss distribution on an interest rate sensitive portfolio) would have to be devised for the calibration of swap rates as well.	
Q18.1	EIOPA should provide guidance on the treatment of transitionals on technical provisions when calculating DTA/DTL in accordance with Article 15 of the Delegated Acts. EIOPA should provide clarity on whether the DTL calculated in accordance with Article 15 of the Delegated Acts be used to recover the LACDT? In particular, can the part of DTL relating to the differences in valuation of technical provisions on a Solvency II basis and tax basis (which is mostly future profits) be used to recover the LACDT? Companies should be required to ensure that they are not double counting profits on existing business that are already captured through the future profits on the Solvency II balance sheet.	
Q18.2	Companies adhere to the principles under IAS 12 in relation to the assumptions for returns on assets and liabilities following a stress event.	
Q18.3	Companies adhere to the principles under IAS 12 in relation to the uncertainty in relation to return on assets.	
Q18.4	The difference between the SII technical provisions and the technical provisions calculated for tax purposes will generally change under a stressed event. For many companies, this is a significant driver of the DTA/DTL calculated under Article 15 of the delegated acts. The change in DTA/DTL calculated under article 15 following a stressed event should be explicitly considered.	

Q18.5	Companies should take into account the principles of IAS 12 when projecting new business following a shock loss.	
Q18.6	It is likely that market recovery will be sluggish and new business volumes would be lower following a shock loss. Therefore, companies should take a conservative view of new business following a shock loss. Premiums not included in the calculation of best estimate due to contract boundaries should be projected as a source of likely future taxable profits.	
Q18.7	Companies should consider the time horizon for their business planning as well as IAS 12 when projecting future taxable profits.	
Q18.8	Companies should be allowed to choose and justify the projection horizon in accordance with their business plans and IAS 12.	
Q18.9	Companies should be allowed to do this if such an offset would be allowed in their local tax regimes.	
Q18.10	Companies should be allowed to do this if such an offset would be allowed in their local tax regimes.	
Q18.11		
Q18.12		
Q18.13		
Q18.14	EIOPA should provide guidance on the treatment of transitionals on technical provisions when calculating DTA/DTL in accordance with Article 15 of the Delegated Acts.	
Q18.15		
Q18.16		
Q19.1	The observed very low interest rates question the 6% CoC: a risk premium of 6% seems unrealistic	

	for shareholders investing in undertakings with a sufficient S2 ratio. The current formula is not only procyclical under credit risk but also under low interest rates: the discounting is at risk free rate without any adjustment such that the RM naturally increases under low interest rates. It should also be noted that you can hedge your interest rate risk w.r.t. BE but not w.r.t. RM.	
Q19.2	Similarly to the UFR, the cost-of-capital of 6% in the Risk Margin should not be fixed but reflect an adjustable long-term average.	
Q19.3		
Q19.4	There should be consistency between the different components of the rates used in the TP (UFR, VA, CoC). We can also question whether some market risk should be included to cover market uncertainty (e.g. lower bound for interest rates, UFR, reinvestment risk...) while avoiding a circular reference. The RM calculation should however not represent an unduly complex calculation. We note that the absence of any transitional measure in the RM requires a second SCR calculation without any VA for the submodules taken in RM calculation. The proportionality principle should still apply. We would suggest to clarify the requirements for the calculation of the material market risk other than interest rate risk of the SCR of the reference undertaking. In particular which assumptions/management actions and data (internal vs external) could be used to assess if the market risk is material and how to exclude properly interest rate risk. A common simplification is to consider that there is no market risk which could lead to an underestimation of the risk margin.	
Q20.1		
Q20.2		
Q20.3		

Q20.4		
Q20.5		
Q20.6		
Q20.7		
Q20.8		
Q20.9		
Q21.1		
Q21.2		
Q21.3		
Q21.4		
Q21.5		
Q21.6		
Q21.7		