

Summary of Comments on Consultation Paper 74 - CEIOPS-CP-74/09 CEIOPS-SEC-176-09

CP No. 74 - L2 Advice on Correlation parameters

CEIOPS would like to thank ACA, AFA, AFS, AMICE, Association of British Insurers, Association of Danish Mortgage Banks (Realkreditrå, Belgian Coordination Group Solvency II, CEA, Centre Technique des Institutions de Prévoyance (C, CRO Forum, Danish Insurance Association, Deloitte, EMB Consultancy LLP, Equitable Life Assurance Society (UK), FFSA, GDV e.V., Gjensidige, GROUPAMA, Groupe Consultatif, Investment & Life Assurance Group Ltd, IUA, Just Retirement Limited, KPMG ELLP, Legal & General Group, Lloyd's, Lucida plc, Munich Re, PricewaterhouseCoopers LLP, RBS Insurance, ROAM, RSA Insurance Group, Unum Limited, and XL Capital Ltd

The numbering of the paragraphs refers to Consultation Paper No. 74 (CEIOPS-CP-74/09)

No.	Name	Reference	Comment	Resolution
1.	ACA	General Comment	<p>We note very important increases in correlation parameters. For most changes, no empirical evidence is provided.</p> <p>Furthermore, parameter changes are said to be based on the recent financial crisis, which is criticisable. Indeed future crisis could be based on other factors and other interdependencies.</p>	<p>CEIOPS has carried out extensive both qualitative and quantitative analysis to revise the correlation parameters of the market risk for the calculation of the SCR. This analysis shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate. More detailed background information on the</p>

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			<p>In the life module, there are also major changes in correlation parameters. We don't really understand changes in parameters which were fixed by expert judgment (in QIS4) and where no further empirical evidence was provided since then.</p> <p>There is a significant increase in the correlation parameters and hence in capital requirements. CEIOPS itself estimates a 24% increase in SCR for life undertakings. This is on top of the increase in SCR for market risk components. This is going to generate a considerable additional burden in order to comply with the requirements.</p> <p>Whilst drawing on the experience of the recent economic conditions, it is not clear to us that the conditions have been used realistically, but instead a greater degree of prudence has been introduced.</p> <p>The use of expert judgement seems to have materially changed over a short period.</p> <p>It is not clear to us why the correlation parameter between concentration risk and other market risk is so high.</p> <p>The cost of providing for this quarter increase in capital will need to be passed onto the policyholder. Whilst it gives them extra protection there is a level at which surely the policyholder must question if it is truly worth the cost?</p> <p>- We suggest that the standard SCR reporting would also include sensitivity calculations to various parameters and especially correlation parameters.</p>	<p>statistical quantitative analysis undertaken is now provided in the annex.</p> <p>Correlation parameters were adjusted after reconsidering the approach for independent risks. Cf. to section 3.1.6 for the impact assessment.</p> <p>Correlation factors for concentration risk were revised.</p> <p>Noted.</p>
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			<ul style="list-style-type: none"> - We also suggest that the terms of the parameters of the standard formula could vary according to criteria defined with each countries regulators and the CEIOPS on the basis of data analysis. - We think that it is necessary to take into account the timing of correlated events (even if two risks are dependent, it is different if those risks occur during the same year or if one occurs more than one year after the first will have occurred) 	
2.	AFA	General Comment	<p>As is mentioned in the consultation paper (§§ 3.67-3.71), empirical data is lacking. The recent crisis has caused estimates of the VaR for different market risks to be revised upward, see, e.g., CP69 & CP70. One might be tempted to also increase the correlations between different risks, but since the effects of such increases are large on the total SCR (cf. § 3.6) we think that a combined increased of individual VaR-estimates and correlations may overestimate the total VaR.</p>	<p>CEIOPS acknowledges that coefficients should not be solely based on crisis experience. However, crisis experience should be recognised, as it showed that correlations increase under adverse circumstances, so the issue of “tail dependence” is a legitimate concern. CEIOPS has undertaken further statistical analysis, which is included in the annex. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with</p>

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				the 1:200 VaR standard.
3.	AFS	General Comment	<p>The Association of Friendly Societies represents the friendly society sector in the UK. We have 45 friendly society members, who are all member-owned mutual organisations. Typically they offer long term savings and protection policies, with generally low minimum premiums. Friendly societies are typically small, though well-capitalised, and have a distinctly different business model to shareholder-owned insurers.</p> <p>We would like to thank CEIOPS for the chance to comment on this paper.</p> <p>There appears to be a lack of empirical evidence in the process followed to determine the correlation assumptions which is inconsistent with the requirements expected of firms under the internal model regime.</p> <p>As a consequence of the approach, a number of the assumptions are set at excessively prudent levels. In particular, parameters appear to have been calibrated to observations only over the past couple of years rather than correlations seen over the longest possible time series. If these proposals are adopted they may reduce the incentive for good risk management through diversification</p>	CEIOPS has undertaken further statistical analysis, which is included in the annex to the revised advice and shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate. However, CEIOPS agrees that some coefficients may be lowered in light of the further research undertaken by both CEIOPS and other stakeholders since the release of the Consultation Paper.
4.	AMICE	General Comment	<p>These are AMICE's views at the current stage of the project. As our work develops, these views may evolve depending in particular on other elements of the framework which are not yet fixed.</p> <p>AMICE members believe the current financial crisis cannot be used to justify these exceptional increases of correlation factors, since the crisis has not hit the insurance sector as much as banking / financial sector (either directly or</p>	Noted. Cf. to our resolution of comment 2.

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			<p>indirectly). If the underlying cause for the correlation adjustments upwards is to force the undertakings to adopt a full internal model, the discussion will be more productive for all involved parties to discuss this openly.</p> <p>We agree that in many cases it is not reasonable to have a correlation factor of 0 (zero), but it is hard to understand some suggested high correlation factors based on "feeling" and no concrete evidence. Correlation factor for life underwriting risk and health underwriting risk</p>	<p>Noted. However, there is no appropriate data base for the calibration of the life and health underwriting risk correlation factors. For the time being, the choice of these factors needs to be based on expert opinion.</p>
5.	Association of British Insurers	General Comment	<p>CEIOPS' choice of correlation parameters for market risks seem to have been heavily influenced by the recent financial crisis. As a consequence the correlation parameters between the main risk modules even exceed those set out in the directive annex IV.</p> <p>In our view it is doubtful that the rationales for the proposed standard formula correlation parameters would pass the calibration and statistical quality tests required for internal model approval, and in particular would result in capital requirements materially stronger than 99.5% 1-year VaR. Further, the proposed parameters also appear to have been heavily influenced by expert judgement and selective use of datasets.</p> <p>We accept that the calibration of the standard formula is qualitatively different to an internal model, with different objectives and constraints, but nevertheless we strongly believe that where feasible CEIOPS should abide by the spirit of the principles it has set out for internal model approval when calibrating the standard formula.</p>	<p>Noted. Cf. to our resolutions of comments 2 and 3.</p> <p>Noted. CEIOPS has aimed to setting correlation parameters consistent with the 99.5% VaR standard. CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and</p>

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		<p>The higher correlations in CP74 could be justifiable if they are, in part, explicitly to cover the statistical shortcomings of correlation matrices. By at least acknowledging this CEIOPS would go some way to allaying the fears of companies applying for IM approval, who will then have an incentive to overcome the statistical problems and not risk ending up being “expected” to use these higher correlations to underpin their models.</p> <p>Based on a limited sample we believe CP74 correlation matrices increases the SCR by around 50%. We emphasise that these estimates are indicative, and they have been produced in compressed timescales; nevertheless they indicate that the impact of CP74 is very onerous, particularly in addition to CP70.</p> <p>The factors making up for most of the increase in the SCR are the interest rate/credit and credit/property correlations.</p> <p>As noted in the core of this CP the use of correlation matrices in calculating aggregate capital requirements is subject to a variety of statistical issues. The proposed parameters appear to have been adjusted upwards somewhat to account for this. Many of these statistical issues are not present when the correlations are used to measure the co-dependencies in risk factors, for example in a real-world economic scenario generator. For the purpose of avoiding undue “anchoring” in internal model approval, it would be extremely useful for CEIOPS to break down the standard formula correlation parameters into their proposals for the co-dependency between risk factors, and the additional margin to cover statistical issues. For example, an assumption of 50% might consist of 25% economics and a further 25% statistical margin. Insurers using more sophisticated approaches to measure the co-dependency of risks in their internal models would then have a lower risk of an undue “anchoring penalty”.</p> <p>Many UK insurers intend to apply for the use of an internal model and so the direct impact of the correlation changes is limited. However, we are very</p>	<p>reliable methodologies using adequate data and assumptions.</p> <p>Noted. CEIOPS has clarified that the</p>
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			<p>concerned that the standard formula parameters may in practice act as an "anchor" with limited regulatory scope for divergence.</p> <p>Overly strong correlation parameters reduce the incentive to diversify their risks for those institutions which intend to use the standard formula.</p> <p>For Cat risk there is no justification at all for the proposal.</p> <p>No geographical diversification or size diversification is allowed, which does not reflect the underlying risks.</p>	<p>correlation parameters in the standard formula are intended to minimise the aggregation error and not necessarily need to coincide with linear correlation coefficients. It is not the intention to set a benchmark for internal models.</p>
6.	Association of Danish Mortgage Banks (Realkreditrådet)	General Comment	<p>This is a response from the Danish mortgage banks represented by the Association of Danish Mortgage Banks (Realkreditrådet), Danish Mortgage Banks Federation (Realkreditforeningen) and from Danish Ship Finance (Danmarks Skibskredit). Danish mortgage banks are specialised banks, which only grant loans against mortgages on real property by issuing covered bonds exclusively. Danish Ship Finance finance its operations through the issuance of bonds.</p> <p>The covered bond market plays a very important role in the Danish economy</p>	Noted.

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		<p>relative to its size. The market has an outstanding amount of nearly EUR 300 bn corresponding to app. 130 % of the Danish GDP. The Danish covered bond market is Europe’s second largest after the German Pfandbrief market. Furthermore, the Danish covered bond market is the primary source of funding for Danish retails and commercial enterprises with 70% of the total domestic lending. Annex 1 includes further details of the Danish mortgage credit system.</p> <p>We welcome the new Solvency II, which introduces more risk sensitive approaches to calculating capital charges, and we welcome the possibility to give input into the process of determining the capital charges. But we are worried about the markets being able to handle and absorb risk, if all the proposals are implemented and together with a number of other initiatives decided at European level. Especially we are worried about new rules giving sense at the level of the individual institution but not at level of the sector. It can imply a high correlation in the behavior of the sector.</p> <p>With regard to CP70 and CP74 we have identified 3 serious cases where the proposed measures seem excessive and incommensurate with the issues addressed – the rules concerning volatility risk, spread risk and concentration risk. Together, they could critically damage the Danish bond market. We therefore suggest modifications of these rules in the final advice to make them reflect risks more accurately. The issues are discussed in detail below.</p> <p>CP70 introduce stress scenarios reflecting the worst crisis in 200 years. The present financial crisis might not be the worst crisis in 200 years. Worse crises cannot, of course, be ruled out, but we find it extreme that the loss scenarios in CP70 reflect losses that are 3-5 times higher than the losses observed on the Danish market for callable mortgage bonds during the financial crisis and twice the observed losses on non-callable mortgage bonds.</p> <p>CP70 introduces stress scenarios for capital loss from spread widening.</p>	<p>Noted.</p>
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			<p>Scenarios are based on market data observed during the current financial crisis for corporate bonds. Even though a split view on financial and non financial corporate bonds is envisaged by CEIOPS, evidence from the current crisis strongly suggest spread widening to be diverse from market to market and from instrument to instrument.</p> <p>Compared to Danish covered bond market data spread widening suggested by CEIOPS are 3-5 times higher than observed spread widening for callable bonds (approx. 50 per cent of market volume) and 2 times higher than observed spread widening for non callable bonds (the remaining 50 per cent of the market volume). Please be aware that issuance and trade in the Danish covered bond market have taken place throughout the current crisis, therefore, market data on spreads are complete and fair.</p> <p>In our view the regulation suggested by CEIOPS on spread risk is therefore excessive. It could be strongly improved by calibrating scenarios to market data for the specific instruments under regulation, i.e. treating covered bonds as an individual instrument.</p> <p>For 200 years, all owners of Danish mortgage bond have received the promised payments. Furthermore, the Danish covered bond market was among the very few markets - both nationally as well as internationally - that were open all the way during the crisis.</p> <p>An overshooting of the capital charges for these bonds will not fulfill the objective of risk sensitive capital charges and furthermore will limit investors possibilities to invest in these low risk bonds. This will totally disrupt the Danish mortgage market.</p>	<p>Noted.</p> <p>Noted.</p> <p>Noted. CEIOPS has aimed to setting correlation parameters consistent with the 99.5% VaR standard. CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and</p>
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				reliable methodologies using adequate data and assumptions.
7.			Confidential comments deleted.	
8.	CEA	General Comment	<p>The CEA welcomes the opportunity to comment on the Consultation Paper (CP) No. 74 on Correlation parameters.</p> <p>It should be noted that the comments in this document should be considered in the context of other publications by the CEA.</p> <p>Also, the comments in this document should be considered as a whole, i.e. they constitute a coherent package and as such, the rejection of elements of our positions may affect the remainder of our comments.</p> <p>These are CEA's views at the current stage of the project. As our work develops, these views may evolve depending in particular, on other elements of the framework which are not yet fixed.</p> <p>Moreover, it should be noted that this consultation has been carried on an extremely short time frame which has not allowed a complete analysis of all the advice. Therefore, the following comments focus only on the main aspects of Ceiops' advice and are likely to be subject to further elaboration in the future.</p> <p>Please note: These comments should be read in conjunction with our separate paper setting out our own analysis of some of the key market risk correlations. This paper can be found here:</p> <p>http://www.cea.eu/uploads/DocumentsLibrary/documents/1260528556_cea-background-note-on-ceiops-cp74-09-historic-market-risk-correlations.pdf</p> <p>The impact of this advice on the insurance industry would be excessive</p>	<p>Noted.</p> <p>Noted.</p>

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		<p>Ceios is proposing significant increases in correlation parameters compared to the parameters used in QIS4. Compared to QIS4, Ceios now proposes a 25% increase in the Basic SCR solely due to increased correlation parameters. To this must be added increased capital requirements due to a more severe equity risk module and market risk module resulting in a significant increase in market risk capital as well as numerous other changes compared to QIS4 (e.g. the non-life risk module) which will further increase the burden of complying with the requirements. This would lead to higher prices for insurance and lower longer term yields for policyholders.</p> <p>The reflection of diversification of risks under Solvency II should not be eroded</p> <p>We do agree that some increase in correlation parameters for the market risk elements may make sense. But on the other hand, to the extent diversification benefits do exist, they must be recognised. This is necessary, because companies must maintain proper incentives to spread their financial risks. The severe increase in correlation parameters specifically in the market risk module could lead to perverse incentives not to diversify assets properly. This would run counter to the risk-based approach which is a cornerstone of Solvency II.</p> <p>It is imperative that the incentive to diversify assets and diversify risk remains. It must be foreseen that if adequate allowance for diversification of risks is not given in Solvency II, the problems of pro-cyclical selling off assets which we have experienced during the current crisis will be reinforced under a future crisis.</p> <p>Ceios' analysis is excessively prudent</p> <p>We agree that lessons should be learnt from the current crisis. However Ceios seems to base its advice "on the safe side", which in aggregate leads to a SCR requirement which is much more onerous than a 200 year event. Ceios states that the current crisis must be less than a 200 year event because it is referred to by some commentators as the most severe crisis since the Great Depression (i.e. less than 200 years ago). But, naturally, the fact that the current crisis</p>	<p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard. CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions.</p>
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			<p>happened less than 200 year after the Great Depression, is not in itself sufficient evidence that the current crisis represents a 200 (or more frequent) event.</p> <p>Moreover, it should be remembered and taken into account that the SCR is a soft, not a hard target. In case of a breach of the SCR there is a ladder of intervention for the authorities to put in place. This is an important reason to be careful not to overreact to the current crisis.</p> <p>In particular there is excessive prudence in:</p> <ul style="list-style-type: none"> <input type="checkbox"/> The market risk module, where historical data is available (e.g. equity and interest rates) Ceiops ignores the historical data and bases the correlation assumptions on expert judgment which appears excessively prudent. <input type="checkbox"/> Specifically, the concentration risk module is based on a totally different concept than other risk modules. As a consequence, setting a correlation parameter between concentration risk and other market risks has no meaning and the correlation parameters should be set to 0. 	<p>Noted.</p> <p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.</p> <p>Not agreed. The concentration risk sub-module covers the additional loss (compared to a well-diversified portfolio) that the undertaking may incur if concentrations in the equity, bond or property portfolio in respect to a single counterparty exist. This risk is not captured in the equity, property or spread risk and therefore adjustment for concentration risk has to be made for</p>
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		<p><input type="checkbox"/> The life underwriting risk module, where Ceiops applies prudent correlation coefficients between risks which are intuitively independent e.g. (lapse and mortality) without proper justification.</p> <p>Ceiops' analysis is not sufficiently subjective and seems to be based on a very volatile methodology</p> <p>For all factors an adequate justification is lacking. Due to the lack of rigour and repeatability in the process followed to determine the correlation assumptions, we fear that as a consequence a number of the assumptions are set at excessively prudent levels. Factors as high as 0.5 or 0.75 seem to have been applied very subjectively, despite the fact that these factors will result in material increases in the SCR.</p> <p>We consider that the calibration of market risk correlation factors should be based on historical correlation averages over long periods (e.g. 10 years). We urge Ceiops to define a methodology (including the range of data that should be analysed) enabling correlation factors to be calculated from historical observations. In addition, externally recognised studies could be used (for example work performed by the ECB on correlations between interest rate and equity).</p> <p>A quantitative assessment should be done through assessing whether the 2008 crisis has changed the long term correlation average. In practice, we consider that the crisis does not justify any change in correlation parameters, except for the equity-spread correlation which we calculated at a 50% level.</p> <p>Whenever there is no market data we do agree that expert judgement should be used, however our understanding was that the QIS4 correlation factors were set using expert judgement. Hence, we would like to understand on which basis this expert judgement has changed. Expert judgement should not introduce high volatility in capital requirements (as seen by the average 25% increase in the BSCR compared to QIS4) otherwise it cannot be considered as such. Ceiops</p>	<p>these risks.</p> <p>CEIOPS has undertaken further statistical analysis to revise the factors in the market risk module. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>Correlation parameters were adjusted after reconsidering the approach for independent risks.</p>
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			<p>should clearly justify any change from the QIS4 calibration.</p> <p>There should be no automatic write-across to Internal Models</p> <p>We should note – we would be very concerned if the correlation factors proposed here would spill-over into the use of Internal Models. The factors presented in this paper are significantly more prudent than the ones that insurers would expect to use in Internal Models. Companies should be in a position to introduce their own correlation coefficients or specific measures of tail dependencies in their internal models, when the arguments are sound.</p> <p>Bi-directional risks should not be assumed to have the same correlations with other risks independent of whether the up or down shock is the biting scenario</p> <p>For example, the assumption of +50% correlations between the interest rate stress and the equities, property, spread and currency stresses, regardless of whether interest rates are increasing or decreasing in the more onerous stress, points to an instability in the overall approach. The most appropriate treatment would be to analyse historical data to determine the correlation between interest rate increases and equity decreases, say x% and then the insurer will have to apply –x% if the onerous stress for that insurer is interest rate decreases.</p> <p>The same is true for other bi-directional risks such as currency risks and lapses. The correlations should be quantitatively measured through historical data, with a positive and negative factor available dependent on whether the up or down stress is the onerous stress for each insurer.</p>	<p>Noted. CEIOPS does not intend to set a benchmark for internal models.</p> <p>Noted. CEIOPS has further elaborated its advice on the possibility to introduce bi-directional or two-sided correlation factors for some risks to express the difference of the correlation in times of upward or downward movements of the risks.</p>
9.	Centre Technique des Institutions de Prévoyance	General Comment	<p>From the start of the project, it is understood that it will likely never be possible to really justify correlations between extreme risks from adequate data, for all insurance undertakings using the standard formula.</p> <p>As far as possible, it would be helpful to compare the correlations proposed in CP74 with correlations used in other models, and to get opinions from</p>	<p>Noted. CEIOPS has aimed to setting correlation parameters consistent with the 99.5% VaR standard.</p>

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	(C)		<p>reinsurers.</p> <p>In our opinion, the main priorities are to get from all correlations, all scenarios and parameters:</p> <ul style="list-style-type: none"> - a globally realistic SCR level, - and, between insurance undertakings, different SCR levels which could be broadly explained by their different activities. 	<p>CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions.</p>
10.	CRO Forum	General Comment	<ol style="list-style-type: none"> 1. The CRO forum has prepared a separate paper on risk correlations in the standard formula (CROF, 12/2009, Calibration recommendation for the correlations in the Solvency II standard formula). Here we repeat the main results of the CRO forum’s calibration paper, only, but refer for additional arguments to the separate text. 2. Compared to QIS4, CEIOPS proposes to increase 28 of 47 correlation factors - some of them quite significantly. CEIOPS provides two main arguments for the dramatic increase; (i) for some marginal probability distribution types (skewed or truncated distributions) the aggregation technique (square root formula) tends to underestimate the Value-at-Risk of the joint probability distribution, (ii) during the recent (or current) financial crisis increased market risk correlations could be observed. Although we generally follow these two main arguments we think CEIOPS has drawn unbalanced conclusions in some areas. Our key messages are: 3. 74.A The shortcomings of the aggregation technique do not warrant an increase of all zero correlations (to 25%). Assumptions on probability distributions should be provided and challenged (priority: high) 4. The CRO Forum recognises the shortcomings of the aggregation technique for particular distributions in the case of independence. However, we think it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability 	<p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>CEIOPS has clarified that where a standard formula correlation parameter has to be specified between two risks which can be</p>

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			<p>distributions. Whenever the argument is used, the assumptions on the probability distributions should be made transparent. One can easily construct examples (e.g. similar to §3.20) where the aggregation formula overestimates the joint VaR.</p> <p>5. Therefore, we do not agree with the proposed new correlation factor between non-life cat risk and non-life basis underwriting risk and the changed correlation factors within the life underwriting risk module but proposes to keep QIS4 correlations.</p> <p>6.</p> <p>7. 74.B Correlations in the standard model should be considered in conjunction with the calibration of the shocks to target a 1-in-200 level (priority: high)</p>	<p>assumed to be independent but there are uncertainties as to the exact nature of the independency, it appears to be acceptable to choose a low correlation parameter, reflecting that model risk may lead to an over- or under-estimation of the combined risk. Therefore, correlation factors for independent risks were revised.</p> <p>Noted. CEIOPS agrees that there should be a low or zero correlation between CAT and reserving risk. However, CEIOPS has clarified that as a clear distinction between both risks may not be feasible in practice, this should be taken into account in the choice of the correlation</p>
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			<p>8. Indeed, the diversification benefit implied by the CEIOPS proposal on market risk correlation matrix (16%) is equivalent to the diversification benefit effectively experienced in the financial markets in the year of the financial crisis in 2008; which is in fact quite conservative, as (i) in parallel the new calibrations for some individual shocks already reproduce the worst shocks observed ever (and even sometimes more), and (ii) the period with the worst correlation observed does not necessary coincide with the period with the worst shocks (see section 2.1 on back-testing).</p> <p>9. 74.C We challenge CEIOPS' proposal to modify the correlation matrix for the basic SCR (market, default, life, health, non-life), that is part of the Annex IV of the Directive, because the determination of these new correlation factors, especially for Health/ Life, should be documented and not only based on general considerations (priority: high)</p> <p>10. The CRO Forum disagrees with the increase of the correlation factor between life underwriting risk and health underwriting risk from 0.25 to 0.75. Different products within these two modules are exposed to different risks (e.g. mortality or longevity). CEIOPS proposal imply a high correlation of a life product exposed to mortality risk and a health product exposed to longevity risk which is implausible. The argument provided by CEIOPS can be best capture by a different aggregation technique as proposed in Calibration Principles for the Solvency II Standard Formula (CROF, May 2009), namely aggregating risk types in the health and life sub module rather than directly aggregating health and life risk.</p>	<p>factor.</p> <p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>Noted. Sub-section was deleted.</p>
11.	Danish Insurance Association	General Comment	CEIOPS has performed calculations on the effects of increasing the equity stress and the market risk correlations. However, CEIOPS does not show the combined effect of all changes which will be greater than the sum of the effects in isolation. Where the effects in isolation of each of the changes could be in the	Noted. CEIOPS has aimed to setting correlation parameters

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			<p>order of 25 – 35 per cent increase in the market risk, the combined effect would be in the order of 75 per cent.</p> <p>Simple calculations we have performed indicate that the SCR could more than double compared to QIS 4 because of the changes proposed in CP 69, 70 and 74. We doubt that the 200 year event has so far been that significantly underestimated by CEIOPS.</p> <p>The assumption in CP 74 that concentration risk is correlated with the market risk factors present in well-diversified investment portfolios implies that concentration risk can no longer be met with enhanced diversification. Hence, either the definition of concentration risk has been changed or the diversification effects are not entirely captured in the correlation matrices.</p>	<p>consistent with the 99.5% VaR standard. CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions.</p> <p>Noted. The concentration risk sub-module covers the additional loss (compared to a well-diversified portfolio) that the undertaking may incur if concentrations in the equity, bond or property portfolio in respect to a single counterparty exist. This risk is not captured in the equity, property or spread risk and therefore and adjustment for concentration risk has to be made for</p>
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				these risks.
12.	Deloitte	General Comment	Impact Assessment of Solvency II conducted by the European Commission. "Diversification effects (including correlations between lines of business)" is one of the policy issues and options dealt with by this impact assessment. As a consequence, we have restricted our comments to those areas where there is no overlap with the issues addressed in the Impact Assessment.	Noted.
13.	FFSA	General Comment	<p>FFSA strongly disagrees with the proposed approach, where CEIOPS considers that each correlation parameter should be based on a value at risk with a 99, 5% confidence level. Indeed, the current calibration approach leads to taking into account the worst possible correlations between all risks together with the worst possible shocks on all risks, without taking into account the fact that such events do not occur at the same time. In consequence, the currently proposed calibration approach leads to a calibration of the capital requirement that is far higher than the 99.5% confidence level.</p> <p>In addition, the CEIOPS gives no evidence concerning the quantitative studies performed in order to determine the new correlation parameters.</p> <p>FFSA strongly disagrees with the excess of prudence that this consultation paper proposes. Where historical data (life module) is not available the CEIOPS prefers to apply prudent correlation coefficients between risks which are intuitively independent e.g. (lapse and mortality) without a proper justification. Where historical data is available eg (equity and interest) the CEIOPS prefers to ignore the historical data and base the correlation assumptions on expert judgment which in our opinion is excessively prudent.</p>	<p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions which is now included in the annex.</p> <p>CEIOPS has clarified that where a standard formula correlation parameter has to be specified between two risks which can be assumed to be</p>

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		<p>FFSA expects that, whenever there are no market data such as for life underwriting risks, QIS4 correlation factors were set using expert judgement. Hence, FFSA would like to understand on which basis this expert judgement changed. Expert judgement should not introduce high volatility in capital requirements (overall impact : an average increase of 25% in the BSCR) otherwise it cannot be considered as such. CEIOPS should clearly justify any change from QIS4 calibration.</p> <p>Regarding market risk correlation factors:</p> <p>As a proxy, in order to reach the 99.5% level, FFSA considers that calibration of market risk correlation factors should be based on historical correlation averages on long periods (eg. 10 years). FFSA urges CEIOPS in defining a methodology (including the range of data that should be analysed), enabling correlation factors calculation based on historical observations. In addition, externally recognised studies could be used (for example work performed by the ECB on correlations between interest rate and equity).</p> <p>FFSA considers that any change in the correlation parameters calibration, compared to QIS4, should be justified by CEIOPS through a quantitative assessment ensuring that the SCR is consistent with (and does not exceed) a Value at Risk at 99,5% . This quantitative assessment could be done through assessing whether the 2008 crisis has changed the long term correlation</p>	<p>independent but there are uncertainties as to the exact nature of the independency, it appears to be acceptable to choose a low correlation parameter, reflecting that model risk may lead to an over- or under-estimation of the combined risk. Therefore, correlation factors for independent risks were revised.</p> <p>CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.</p>
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			<p>average. In practice, we consider that the crisis does not justify any change in correlation parameters, except for the equity-spread correlation which we calculated at a 50% level (see below).</p> <p>The concentration risk module is based on a totally different concept than other risk modules. In consequence, setting a correlation parameter between concentration risk and other market risks has no meaning. Hence, the correlation parameters should be set at 0.</p> <p>In addition:</p> <ul style="list-style-type: none"> - The proposed correlation matrices will have a significant impact on asset allocation as no diversification effects are observable. It will not encourage undertakings to perform any diversification effort; <p>Applying the proposed level of correlation in stressed markets would lead to pro-cyclical effects.</p>	<p>Not agreed. The concentration risk sub-module covers the additional loss (compared to a well-diversified portfolio) that the undertaking may incur if concentrations in the equity, bond or property portfolio in respect to a single counterparty exist. This risk is not captured in the equity, property or spread risk and therefore and adjustment for concentration risk has to be made for these risks.</p>
14.			Confidential comments deleted.	
15.	GDV e.V.	General Comment	GDV recognises CEIOPS' effort regarding the implementing measures and likes to comment on this consultation paper. In general, GDV supports the detailed comment of CEA. Nevertheless, the GDV highlights the most important issues for the German market based on CEIOPS' advice in the blue boxes. It should be noted that our comments might change as our work develops.	

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			<p>The reflection of diversification of risks under Solvency II should not be eroded</p> <p>The severe increase in correlation parameters specifically in the market risk module could lead to perverse incentives not to diversify assets properly. This would run counter to the risk-based approach which is a cornerstone of Solvency II. It is imperative that the incentive to diversify assets and diversify risk remains. It must be foreseen that if adequate allowance for diversification of risks is not given in Solvency II, the problems of pro-cyclical selling off assets which we have experienced during the current crisis will be reinforced under a future crisis.</p> <p>CEIOPS' analysis is excessively prudent.</p> <p>We agree that lessons should be learnt from the current crisis. However CEIOPS seems to base its advice "on the safe side", which in aggregate leads to a SCR requirement which is much more onerous than a 200 year event. CEIOPS states that the current crisis must be less than a 200 year event because it is referred to by some commentators as the most severe crisis since the Great Depression (i.e. less than 200 years ago). But, naturally, the fact that the current crisis happened less than 200 year after the Great Depression, is not in itself</p>	<p>parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions.</p> <p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions that is now included in the annex. However, CEIOPS agrees that some coefficients may be lowered in light of the further research undertaken by both CEIOPS and other stakeholders since the release of the Consultation Paper.</p> <p>CEIOPS acknowledges that coefficients should not be solely based on crisis experience. However, crisis</p>
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		<p>sufficient evidence that the current crisis represents a 200 (or more frequent) event.</p> <p>Moreover, it should be remembered and taken into account that the SCR is a soft, not a hard target. In case of a breach of the SCR there is a ladder of intervention for the authorities to put in place. This is an important reason to be careful not to overreact to the current crisis.</p> <p>CEIOPS' analysis is not sufficiently subjective and seems to be based on a very volatile methodology</p> <p>For all factors an adequate justification is lacking. Due to the lack of rigour and repeatability in the process followed to determine the correlation assumptions, we fear that as a consequence a number of the assumptions are set at excessively prudent levels. Factors as high as 0.5 or 0.75 seem to have been applied very subjectively, despite the fact that these factors will result in material increases in the SCR.</p> <p>We consider that the calibration of market risk correlation factors should be based on historical correlation averages over long periods (e.g. 10 years). We urge CEIOPS to define a methodology (including the range of data that should be analysed) enabling correlation factors to be calculated from historical observations. In addition, externally recognised studies could be used (for example work performed by the ECB on correlations between interest rate and equity).</p> <p>Whenever there is no market data we do agree that expert judgement should be used, however our understanding was that the QIS4 correlation factors were set using expert judgement. Hence, we would like to understand on which basis this expert judgement has changed. Expert judgement should not introduce high volatility in capital requirements (as seen by the average 25% increase in the BSCR compared to QIS4) otherwise it cannot be considered as such. CEIOPS should clearly justify any change from the QIS4 calibration.</p>	<p>experience should be recognised, as it showed that correlations increase under adverse circumstances, so the issue of "tail dependence" is a legitimate concern.</p> <p>Noted. CEIOPS has undertaken further statistical analysis to revise the factors in the market risk module.</p> <p>Noted. Correlations have been revised.</p>
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		<p>There should be no automatic write-across to Internal Models</p> <p>We should note – we would be very concerned if the correlation factors proposed here would spill-over into the use of Internal Models. The factors presented in this paper are significantly more prudent than the ones that insurers would expect to use in Internal Models. Companies should be in a position to introduce their own correlation coefficients or specific measures of tail dependencies in their internal models, when the arguments are sound.</p> <p>Bi-directional risks should not be assumed to have the same correlations with other risks independent of whether the up or down shock is the biting scenario</p> <p>For example, the assumption of +50% correlations between the interest rate stress and the equities, property, spread and currency stresses, regardless of whether interest rates are increasing or decreasing in the more onerous stress, points to an instability in the overall approach. The most appropriate treatment would be to analyse historical data to determine the correlation between interest rate increases and equity decreases, say x% and then the insurer will have to apply –x% if the onerous stress for that insurer is interest rate decreases.</p> <p>The same is true for other bi-directional risks such as currency risks and lapses. The correlations should be quantitatively measured through historical data, with a positive and negative factor available dependent on whether the up or down stress is the onerous stress for each insurer.</p> <p>Additionally we are concerned about the treatment of the LoB “accident” not in the nonlife-part of the correlations. We once more reiterate our request to shift “accident” completely from the “health”-modul into the nonlife-modul.</p> <p>We refer to our comments in CP 48, CP 50, CP 72 and CP 74.</p>	<p>Noted. CEIOPS does not intend to set a benchmark for internal models.</p> <p>Noted. CEIOPS has also further elaborated its advice on the possibility to introduce bi-directional or two-sided correlation factors for some risks to express the difference of the correlation in times of upward or downward movements of the risks.</p> <p>Noted.</p>
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16.	Gjensidige	General Comment	<p>CEIOPS are proposing to increase the market correlations sharply compared to QIS4. We are of the opinion that most of the correlations have been determined in a rather arbitrary and non transparent way, with little statistical analysis to support any of the parameters. If these proposals for higher correlations are adopted we are worried that the diversification assumptions will unduly steer the assessment of internal model co-dependencies.</p>	<p>Noted. CEIOPS has undertaken further statistical analysis to revise the factors in the market risk module. Cf. to our resolution of comment 3.</p>
17.	GROUPAMA	General Comment	<p>CEIOPS gives no evidence concerning the quantitative studies performed in order to determine the new correlation parameters.</p> <p>Regarding market risk correlation factors:</p> <p>We consider that any change in the calibration of the correlation parameters, compared to QIS4, should be justified by CEIOPS through a quantitative assessment ensuring that the SCR is consistent with (and does not exceed) a Value at Risk of 99.5%. This quantitative assessment could be done through assessing whether the 2008 crisis has changed the long-term correlation average. In practice, we consider that the crisis does not justify any change in correlation parameters, except for the correlation between spread and equity risks.</p>	<p>CEIOPS has carried out extensive both qualitative and quantitative analysis to revise the correlation parameters of the market risk for the calculation of the SCR. This analysis shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate. More detailed background information on the statistical quantitative analysis undertaken is now</p>

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			<p>The concentration risk module is based on a totally different concept from other risk modules. In consequence, setting a correlation parameter between correlation risk and other market risks makes no sense. Hence, the correlation parameters should be set at 0. (3.74)</p> <p>In addition, the proposed correlation matrices will have a significant impact on asset allocation as no diversification effects are observable. It will not encourage undertakings to make any diversification effort.</p>	<p>provided in the annex.</p> <p>CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>Not agreed. The concentration risk sub-module covers the additional loss (compared to a well-diversified portfolio) that the undertaking may incur if concentrations in the equity, bond or property portfolio in respect to a single counterparty exist. This risk is not captured in the equity, property or spread risk and therefore and adjustment for concentration risk has to be made for these risks.</p>
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18.	Groupe Consultatif	General Comment	<p>The general increase in proposed correlations is not very well supported, has the potential to be procyclical and a deterrent to long-term investment, and may be inconsistent with the concepts underlying the Level 1 text.</p> <p>The principal concern of the Groupe is that the proposed correlations in respect of market risk implicitly assume liabilities are payable on demand, which is not the case. Particularly for life insurers, most liabilities are illiquid to some degree. In respect of liabilities which are illiquid, short term tail correlations in asset values become less important if it can reasonably be assumed that longer-term relationships will be restored over the period for which the assets are likely to be held. This often the case – a good example being the substantial reversal in 2009 of some of the unusual market co-movements which took place in 2008. Specifically the value at risk calculation should not leave out of account the release of net assets which may plausibly be expected as short term stresses unwind. The comments which follow reflect this concern on our part.</p> <p>Compared to QIS4, CEIOPS proposes to increase the majority of correlation factors – in parts significantly.</p> <p>CEIOPS essentially gives two main reasons, one are observations made during and after the recent/current financial crises while the other is related to a general shortcoming of the aggregation technique used.</p> <p>Although we generally follow these arguments, we think that CEIOPS has drawn unbalanced conclusions.</p>	<p>Noted. CEIOPS has aimed to setting correlation parameters consistent with the 99.5% VaR standard.</p> <p>Noted. However, the setting of correlation coefficients needs to be consistent with the market-consistent valuation of assets as required in the Level 1 text.</p> <p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions. This analysis shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate. More detailed</p>
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			<p>We recognize the shortcomings of the aggregation technique for particular distributions in the case of independence. However, in our view it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability distributions. Whenever the argument is used, the assumptions on the probability distributions should be made transparent. One can easily construct examples (e.g. similar to §3.20) where the aggregation formula overestimates the joint VaR.</p>	<p>background information on the statistical quantitative analysis undertaken is now provided in the annex.</p> <p>CEIOPS has clarified that where a standard formula correlation parameter has to be specified between two risks which can be assumed to be independent but there are uncertainties as to the exact nature of the independency, it appears to be acceptable to choose a low correlation parameter, reflecting that model risk may lead to an over- or under-estimation of the combined risk. Therefore, correlation factors for independent risks were revised.</p>
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		<p>As far as market risk correlations are concerned, we agree that the QIS 4 correlations were out of line with the relationship one should expect in a one in two hundred year event.</p> <p>All parameters shouldn't be finally fixed without testing the quantitative assessment in QIS 5. All parameters should be therefore accepted only under reserve of a later adaption (due to QIS5).</p> <p>CEIOPS main justification for these increased parameters focuses on the events of the last 2 years, where extreme movements were observed simultaneously bond and equity markets. The calibration of correlations (and stresses for that matter) should not be based exclusively on data only from the last 2 years, this would not be sound from a statistical perspective. No doubt the events of last year were worse than 1-in-200, so therefore they would not be appropriate to calibrate the correlations for the standard formula.</p> <p>We recognize the shortcomings of the aggregation technique for particular distributions in the case of independence. However, in our view it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability distributions. Whenever the argument is used, the assumptions on the probability distributions should be made transparent. One can easily construct examples (e.g. similar to §3.20) where the aggregation formula overestimates the joint VaR.</p> <p>In accordance with the framework directive a best-estimate calibration should be used for the standard formula. If CEIOPS intends to move towards a conservative calibration of the standard formula, this should be clearly stated and founded.</p> <p>The CP does not provide enough empirical evidence to support the new calibration. We would appreciate empirical evidence very much, for this would</p>	<p>Cf. to our resolution of comments 2.</p> <p>See comment above.</p> <p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>CEIOPS undertook further statistical analysis to assess the appropriateness of its</p>
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		<p>be best practice and also consistent with the level of data and evidence CEIOPS are expecting firms to provide for their own calibrations under the internal models regime.</p> <p>GENERAL APPROACH</p> <p>The CP does not provide a great deal of empirical evidence to support the new calibration – this is not best practice and is inconsistent with the level of data and evidence CEIOPS is expecting firms to provide for their own calibrations under the internal models regime. Without seeing the empirical evidence, we would speculate that the parameters have been calibrated to the worst observed correlations over a short timeframe in the worst possible conditions – we would challenge whether this is appropriate and whether it is a framework that can be reliably updated in future years.</p> <p>An appropriate set of principles are set out below, we would like to see an approach along these lines to determining the calibration:</p> <ul style="list-style-type: none"> - A wide range of correlation measures and indices are taken into account (rather than just focusing on one observation or worst observation during crisis), as they give us different insights. - The statistical credibility (e.g. confidence interval around the maximum likelihood parameter estimates) of the estimates is quantified and explained in the paper. - It is well known that there is insufficient data with which to make credible estimates of tail correlations. Hence, we do need to rely to an extent on expert opinion, but the way in which the expert opinion has been validated should be set out in the advice. - Greater weight should be given to the statistics which are more stable/reliable (e.g. historical correlation over the longest possible time series). <p>ISSUE 1: Parameters have been increased without good justification</p> <p>The main priority issue is the inappropriateness of the new market risk</p>	<p>assumptions which can now be found in the annex.</p> <p>See comment above.</p> <p>CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions.</p> <p>Noted. See comments above.</p>
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		<p>correlation parameters calibration proposed in #3.31. The cross-risk correlations have been arbitrarily increased across the board (vs QIS4) to very strong levels of correlation (e.g. 75%).</p> <p>CEIOPS main justification (e.g. #3.1.5) for these increased parameters focuses on the events of the last 2 years, where extreme movements were observed simultaneously bond and equity markets. However, we reject this argument on the following grounds:</p> <ul style="list-style-type: none"> - the calibration of correlations (and stresses for that matter) should not be based exclusively on data only from the last 2 years, this would not be sound from a statistical perspective - it is not possible to determine whether the events of last year were worse than 1-in-200, so it would not be appropriate to calibrate the correlations for the standard formula using these data points without further validation - similar combined events would be observed with lower correlations, but higher univariate stresses <p>ISSUE 2: The approach to independent pairs is not well justified</p> <p>The CP also proposes (#3.1.4) that for independent pairs we should not use zero correlation. The argument given by CEIOPS is that the mathematics of the correlation matrix approach does not hold in certain situations (e.g. where the variables are not multivariate normal distributed). We reject this line of thinking – the correlation matrix approach only works per se if we assume the variables are linearly dependent multivariate normal – so in order to use the matrix we must accept this simplifying assumption, otherwise we cannot use the matrix at all (with any amount of tampering the parameters to compensate). Furthermore, in many circumstances the use of a correlation matrix to aggregate capital requirements is more onerous than would be generated using alternative, more accurate approaches (such as simulation) – adjusting correlations is too crude a mechanism to address weaknesses in the correlation matrix aggregation approach reliably.</p>	<p>Correlation parameters were adjusted after reconsidering the approach for independent risks. See comment above.</p>
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19.	IUA	General Comment	<p>As we have noted elsewhere, it is essential that the calibration of the SCR standard formula is considered as a whole unit and not solely on an individual basis. Our members anticipate that the aggregate impact of all the proposed SCR calibrations for the London Market could range from anything between 20% to 120% increase in SCR levels over QIS 4, based on recent work conducted by EMB the actuarial consultants. We accept QIS 4 was not rigorous in its calibration, but QIS 4 was considered to be capital neutral across industry. In any case, we are concerned that these proposals amount to excessive prudence and will require a significant increase in capital. Furthermore, all calibrations by their very nature have technical underpinnings and derivations, and whilst we appreciate that CEIOPS has provided us with its methodology, the length of the consultation period means a robust analysis and critique of the CEIOPS methodology is impossible to achieve. We have however tried to identify issues as best as we can within the allotted time.</p> <p>We would also comment that Solvency II is supposed to broadly relate to a credit rating of BBB, by virtue of the 99.5% VaR required by the Level 1 text. We believe CEIOPS should compare the aggregate impact of its requirements to a broadly equivalent credit rating. We believe the current proposals are far in excess of a BBB rating.</p>	<p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions. However, CEIOPS agrees that some coefficients may be lowered in light of the further research undertaken by both CEIOPS and other stakeholders since the release of the Consultation Paper.</p> <p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p>
20.	Just Retirement Limited	General Comment	<p>1. The increase in the market risk correlation parameters from their QIS4 values appears to have been very strongly determined by experience in the credit crisis. It is undoubtedly true that short-term movements in risk factors were strongly correlated at the peak of the crisis. However, looking over the 1-year horizon required by the Framework Directive, we believe that lower</p>	<p>Noted. CEIOPS has undertaken further statistical analysis, which is included in annex to the revised</p>

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			<p>correlation parameters, closer to those set out in the Annex to the Framework Directive, would be more reasonable and consistent with the available data.</p> <p>2. In our view it is doubtful that the rationale set out in CP74 for the proposed standard formula correlation parameters would pass the calibration and statistical quality tests required for internal model approval, and in particular would result in capital requirements materially stronger than 99.5% 1-year VaR. Further, the proposed parameters also appear to have been heavily influenced by expert judgement and selective use of datasets. We accept that the calibration of the standard formula is qualitatively different to an internal model, with different objectives and constraints, but nevertheless we strongly believe that where feasible CEIOPS should abide by the spirit of the principles it has set out for internal model approval when calibrating the standard formula.</p> <p>3. We agree that correlation matrices are subject to statistical shortcomings when applied to non-elliptical distributions, and have some sympathy with the broad adjustments that have been made to the underlying "economic" correlation parameters to account for this. However, for reasons of transparency, and to avoid biases in benchmarking statistically more sophisticated approaches against the standard formula parameters, we believe it is absolutely essential to break down the correlation parameters into an "economic correlation" and a "statistical adjustment".</p>	<p>advice and shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate.</p> <p>Noted. CEIOPS has carried out extensive both qualitative and quantitative analysis to revise the correlation parameters of the market risk for the calculation of the SCR.</p> <p>Noted. CEIOPS has clarified that the correlation parameters in the standard formula are intended to minimise the aggregation error and not necessarily need to coincide with linear correlation coefficients.</p>
21.	Legal & General Group	General Comment	We accept that there is not a great deal of data available to help with the calibration of these parameters and that therefore some expert judgement should be applied. However, we feel that the data that is available should be	Noted. CEIOPS undertook further statistical analysis to

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			<p>considered using a more thorough statistical methodology than has been applied here. We therefore recommend that such statistical work be carried out in order to help determine these factors. We have seen a draft paper prepared for the CEA (that will accompany their response) which we feel provides a useful starting point for this work.</p> <p>This work will be important in order to justify these parameters in the context of a 1 in 200 year event. In particular, a heavy reliance on references to the recent financial market turbulence should not be made without a more reasoned and detailed analysis of whether it represents a 1 in 200 year event.</p>	<p>assess the appropriateness of its assumptions which is now included in the annex.</p> <p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p>
22.	Lloyd's	General Comment	<p>We are concerned by a number of proposals made in this consultation.</p> <p>The Level 1 text is based on many foundation principles and allowance for correlations is one. It is obvious from the selections made in the previous QIS exercise and Annex IV of the Level 1 text that linear correlations have been strongly considered. This is evident given a 0 correlation parameter is selected for risks considered independent.</p> <p>It is inappropriate and potentially damaging to the whole Solvency II process if any of the foundation principles of the Level 1 text are publicly criticised. Given this, statements like "...the use of linear correlations lead to wrong or even absurd aggregation results" are wholly inappropriate.</p> <p>We agree that the selection of correlation factors is challenging. The selections have been made on the basis of weak, limited and subjective arguments. In none of the areas considered does there appear to have been a thorough review of the proposals and as a result a set of factors are proposed that are difficult to justify with empirical arguments, appear overly cautious and are sometimes</p>	<p>Noted. Wording has been amended.</p> <p>CEIOPS has undertaken further statistical analysis, which is included in annex to the revised</p>

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		<p>incorrect.</p> <p>As the estimated increase in the capital requirements (based on these changes) is so large it is inappropriate to change the current factors on such limited research. It is also inappropriate to question one of the fundamental approaches contained in the Level 1 text on the basis of incomplete analysis.</p> <p>We strongly support a proposal that the factors are left unchanged until further, more complete analysis is undertaken. The consequences in terms of capital requirements and the reputation of Solvency II are too great to be made on the basis of analysis whose results are severely limited by complexity and time.</p> <p>As with other areas, a task force from industry, representative bodies and supervisors could be set up to consider this point and we would be happy to assist such a group.</p> <p>More specific concerns we have on the consultation paper are:</p> <ul style="list-style-type: none"> - the assertion that the recent financial crisis must be less than a 1:200 year event given the Great Depression occurred within the last 100 years is incorrect - the flat assumption that all risks, including independent risks, should have a 25% correlation factors is incorrect and based on weak subjective arguments 	<p>advice. CEIOPS agrees that the calibration of correlation parameters should be based on a appropriate and reliable methodologies using adequate data and assumptions.</p> <p>Noted. CEIOPS acknowledges that coefficients should not be solely based on crisis experience. However, crisis experience should be recognised, as it showed that correlations increase under adverse circumstances, so the issue of "tail dependence" is a legitimate concern.</p> <p>Noted. Approach for independent risks</p>
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			<p>- by design there should be no correlation between non-life catastrophe risk and premium and reserving risk. Any that does exist will be mainly due to double counting in the calibration of premium and reserving risk. It is wholly inappropriate to require a correlation which would only serve to magnify the initial double count issue</p> <p>- the proposed levels of concentration risk correlation appear particularly unjustified.</p> <p>We are very concerned that substantial capital increases are being proposed on such limited analyses without considering the wider impact on the insurance and reinsurance industry. A 25% increase in capital requirements does not necessarily improve policyholder protection; it could equally mean that the European insurance industry becomes less attractive or not commercially viable in segments. The impact could be that business is written outside, rather than inside, the European insurance industry. Commercial and reinsurance business is especially transferable and is easily written out of many insurance centres globally.</p>	<p>was revised.</p> <p>Noted. CEIOPS agrees that there should be a low or zero correlation between CAT and reserving risk. However, CEIOPS has clarified that as a clear distinction between both risks may not be feasible in practice, this should be taken into account in the choice of the correlation factor.</p> <p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.</p>
23.	Lucida plc	General Comment	<p>Lucida is a specialist UK insurance company focused on annuity and longevity risk business. We currently insure annuitants in the UK and the Republic of Ireland (the latter through reinsurance).</p> <p>We are concerned that by considering proposals on a paper by paper basis, the</p>	<p>Noted. Coefficients have been partly revised.</p>

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			overall impact of proposals may be underestimated. Almost every paper appears to be increasing capital requirements so more onerous correlations compounds this.	
24.	Munich Re	General Comment	<p>We fully support all of the GDV statements. Furthermore we strongly agree with the CRO forum comments in being as follows:</p> <p>The CRO forum has prepared a separate paper on risk correlations in the standard formula (CROF, 12/2009, Calibration recommendation for the correlations in the Solvency II standard formula). Here we repeat the main results of the CRO forum's calibration paper, only, but refer for additional arguments to the separate text.</p> <p>Compared to QIS4, CEIOPS proposes to increase 28 of 47 correlation factors - some of them quite significantly. CEIOPS provides two main arguments for the dramatic increase; (i) for some marginal probability distribution types (skewed or truncated distributions) the aggregation technique (square root formula) tends to underestimate the Value-at-Risk of the joint probability distribution, (ii) during the recent (or current) financial crisis increased market risk correlations could be observed. Although we generally follow these two main arguments we think CEIOPS has drawn unbalanced conclusions in some areas. Our key messages are:</p> <p>A. The shortcomings of the aggregation technique do not warrant an increase of all zero correlations (to 25%). Assumptions on probability distributions should be provided and challenged. (priority: high)</p> <p>The CRO forum recognizes the shortcomings of the aggregation technique for particular distributions in the case of independence. However, we think it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability distributions. Whenever the argument is used, the assumptions on the probability distributions should be made transparent. One can easily construct examples (e.g. similar to §3.20) where the aggregation formula overestimates the joint VaR.</p> <p>Therefore, the CRO forum does not agree with the proposed new correlation</p>	<p>Noted. Cf. to our resolutions of comments 2 and 3.</p> <p>Noted. Approach has been reconsidered.</p>

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			<p>factor between non-life cat risk and non-life basis underwriting risk and the changed correlation factors within the life underwriting risk module but proposes to keep QIS4 correlations.</p> <p>B. Correlations in the standard model should be considered in conjunction with the calibration of the shocks to target a 1-in-200 level. (priority: high)</p> <p>Indeed, the diversification benefit implied by the CEIOPS proposal on market risk correlation matrix (16%) is equivalent to the diversification benefit effectively experienced in the financial markets in the year of the financial crisis in 2008; which is in fact quite conservative, as (i) in parallel the new calibrations for some individual shocks already reproduce the worst shocks observed ever (and even sometimes more), and (ii) the period with the worst correlation observed does not necessary coincide with the period with the worst shocks (see section 2.1 on back-testing).</p> <p>C. We challenge CEIOPS' proposal to modify the correlation matrix for the basic SCR (market, default, life, health, non-life), that is part of the Annex IV of the Directive, because the determination of these new correlation factors, especially for Health/ Life, should be documented and not only based on general considerations. (priority: high)</p> <p>The CRO forum disagrees with the increase of the correlation factor between life underwriting risk and health underwriting risk from 0.25 to 0.75. Different products within these two modules are exposed to different risks (e.g. mortality or longevity). CEIOPS proposal imply a high correlation of a life product exposed to mortality risk and a health product exposed to longevity risk which is implausible. The argument provided by CEIOPS can be best capture by a different aggregation technique as proposed in Calibration Principles for the Solvency II Standard Formula (CROF, May 2009), namely aggregating risk types in the health and life sub module rather than directly aggregating health and life risk.</p>	<p>Noted.</p> <p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p> <p>Noted. Sub-section was deleted.</p>
25.	PricewaterhouseCoopers LLP	General Comment	<p>We strongly support the aims of the Solvency II project with its focus on good risk management. We note that the proposed correlations are much more onerous than previously tested under QIS4 and are now arguably on the</p>	<p>Noted. Coefficients have been revised. CEIOPS has</p>

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			<p>prudent side of best estimate. As such, there is less benefit for firms to spread their risks (as indicated by their own internal models). The proposed shift in correlations may therefore have the unintended consequence of degrading the rational and sensible spreading of risks due to the much reduced credit for it.</p> <p>While we acknowledge the arguments included in this paper, we question whether all of the proposed increases in correlation parameters are fully justified by available data and recommend that further research and analysis is carried out in order to ensure that the parameters are appropriate.</p>	<p>undertaken further statistical analysis, which is included in annex to the revised advice.</p>
26.	RBS Insurance	General Comment	<p>We have made a few detailed comments below regarding particular correlations (eg- the introduction of a correlation between cat risk and the other non-life underwriting risks).</p> <p>In addition our main concern is with the impact of this paper in conjunction with the other calibration papers for the SCR and MCR (eg- CP69, CP71, CP73) for non-life insurers. We believe the combined effect is a large increase in capital requirements for the SCR and the MCR over the QIS4 position, and that prudence has been built in to the latest set of calibrations. We also believe that an overall impact assessment of the combined effect of the changes should be performed.</p>	<p>Noted.</p>
27.	ROAM	General Comment	<p>While fully agreeing with AMICE's detailed comments, as a general comment, ROAM would like to state that if the current financial crisis has revealed other correlations than the ones put forward hitherto, the insurance sector would like to benefit from these new insights, if carefully measured, and without them being unduly conservative.</p>	<p>Noted. Cf. to our resolution of comment 2.</p>
28.	RSA Insurance Group	General Comment	<p>This paper has taken the existing QIS 4 factors and increased them. There is little scientific justification for the figures chosen - just a desire by CEIOPS for the correlations to be bigger. This appears to be a knee jerk reaction to the current credit crisis.</p>	<p>Noted. Coefficients have been revised. CEIOPS has undertaken further statistical analysis, which is included in annex to the revised advice.</p>

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			<p>It is not clear what the function of Annex B is. It is not mentioned anywhere in the main paper.</p> <p>The issues in this paper highlight one of the key weaknesses of the structure of the Standard Formula. It is very difficult to come up with a sensible correlation matrix. This fact should be taken into account when assessing firms who abandon this approach for their Internal Models. In our view the more rigorous holistic model that integrates all the risk types is a much better method for assessing Capital requirements. Thus a firm should not be penalised for adopting a method that moves away from the Standard Formula structure.</p>	<p>???</p> <p>Noted.</p>
29.			Confidential comments deleted.	
30.			Confidential comments deleted.	
31.	Unum Limited	General Comment	<p>CEIOPS' choice of correlation parameters for market risks seem to have been heavily influenced by the recent financial crisis. As a consequence the correlation parameters between the main risk modules even exceed those set out in the directive annex IV.</p> <p>In addition the method underlying the choice of parameters is not described in the CP and we have some doubt whether the calibration corresponds to a 99.55% 1 year var.</p>	Noted. Cf. to our resolutions of comments 2 and 3.
32.	ACA	3.6.	We completely agree that the choice of correlation parameters is critical.	Noted.
33.	Association	3.6.	Correlation factors are critical as they have a material impact on the outputs.	Noted.

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	of British Insurers			
34.	CEA	3.6.	<p>We agree that the correlation parameters chosen will have a significant impact on insurers</p> <p>Indeed the choice of correlation parameters has a very significant impact on the level of diversification to be obtained and hence on the overall capital requirements.</p>	Noted.
35.	IUA	3.6.	<p>We agree that the correlation parameters will have a significant impact on the diversification effect on the SCR. We strongly believe that Solvency II, whether through the standard formula, or the internal model, must provide a incentives towards good risk management practices. This was one of the reasons we were disappointed with the removal of geographical diversification from the standard formula, and the lack of risk sensitivity in the operational risk module. The revised correlations further reduce diversification benefits, and combined with other developments, is of further concern.</p>	Noted.
36.	Legal & General Group	3.6.	<p>Correlation factors are critical as they have a material impact on the outputs .</p>	Noted.
37.				
38.	Lloyd's	3.7.	<p>We agree that this is a challenging area and note that investigations have been limited due to time pressures.</p> <p>The appropriate course of action is to leave the current factors unchanged and continue the research, with active input from industry and other experts, to achieve the correct results.</p> <p>To produce such an important set of numbers on such limited and subjective</p>	<p>Noted.</p> <p>CEIOPS will continue to explore the issue of setting appropriate correlation factors.</p>

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			analysis is inappropriate.	
39.	RSA Insurance Group	3.7.	Agree this is a complex issue. What correlations to choose is the fundamental weakness of the structure of the Standard Formula. It would be desirable if this fact can be recognised for firms choosing to abandon this structure in their Internal Model.	Noted. The correlation technique was chosen as a practical expedient for the purposes of the standard formula. CEIOPS expects that models may apply aggregation techniques which are more tailored to the undertakings specific risk profiles.
40.	ACA	3.9.	We totally agree that the assumptions of linear dependence and normal distribution are false but easy to use.	Noted.
41.	RBS Insurance	3.9.	<p>We believe this statement is correct only in the case that the expected values are zero.</p> <p>Where this does not hold the aggregation approach does not produce the correct aggregate quantities, even for the case of the normal distribution. This is illustrated by a simple example below.</p> <ul style="list-style-type: none"> • Suppose we have 2 independent normally independent risks, $X \sim N(1, 1)$ and $Y \sim N(1, 1)$. • For a normally distributed risk $Z \sim N(\mu, \sigma^2)$, it can be shown that the 1-in-200 year value-at-risk capital is given by $VaR(Z) = 2.56\sigma - \mu$. • Thus $VaR(X) = VaR(Y) = 2.56 \times \sqrt{1} - 1 = 1.56$ • Using the aggregation approach, the combined capital requirement for 	<p>This is correct. The standard formula calculations make the simplifying assumption that the expected values are zero.</p> <p>A footnote was added to the para. to clarify this assumption.</p>

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			<p>both X and Y is given by $\sqrt{VaR(X)^2 + VaR(Y)^2} = \sqrt{1.56^2 + 1.56^2} = 2.21$</p> <ul style="list-style-type: none"> • However, the combined capital requirement can also be calculated by noting that $X + Y \sim N(1+1, 1+1) = N(2, 2)$ • Thus $VaR(X + Y) = 2.56 \times \sqrt{2} - 2 = 1.62$ which differs quite substantially from the figure of 2.21 obtained by the aggregation approach <p>In fact, it can be shown that for the case of the multivariate normal, aggregation with correlation matrices will only produce a correct aggregate capital requirement if the mean vector is 0 (For the case of value-at-risk). Thus, aggregation with correlation matrices will produce the correct aggregate of quantiles provided expected profits/losses are removed when computing the individual capital figures and then subtracting these profits/losses from the aggregation approach result. This is illustrated for same example:</p> <ul style="list-style-type: none"> • Removing expected profit, we have $X \sim N(0, 1)$ and $Y \sim N(0, 1)$. • We then have $VaR(X) = VaR(Y) = 2.56 \times \sqrt{1} - 0 = 2.56$. • Using the aggregation approach, the combined capital requirement for both X and Y is given by $\sqrt{VaR(X)^2 + VaR(Y)^2} = \sqrt{2.56^2 + 2.56^2} = 3.62$. • We then subtract the total expected profit off and obtain a final capital requirement for both X and Y of $3.62 - 1 - 1 = 1.62$ which is the correct total capital figure. <p>We thus recommend that an adjustments for expected profit be made in all applications of the risk aggregation approach suggested in CEIOPS and that a note is made in the consultation paper about the danger in applying the method without such an adjustment (For instance, the illustrative example in 3.20 makes no adjustment for expected profit/loss and can be misleading as to the correct application of the aggregation approach).</p>	
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42.	Lloyd's	3.10.	<p>We agree that the use of linear correlations do not always produce correct results.</p> <p>However it is not always the case that a higher capital requirement is necessary. For example, if VaR is used as a risk measure, then increased tail dependency can actually decrease the level of capital depending on the nature of the dependency structure and the selected confidence level. We note that the CP is silent on this point. The actual impact will depend on many factors which are not explored in the consultation.</p> <p>One extension of the arguments made in the consultation would be to criticise the aggregation formula itself in the Level 1 text itself and their inappropriateness when used with skew distributions.</p> <p>It is obvious from the selections made in the previous QIS exercise and Annex IV of the Level 1 text that linear correlations have been strongly considered. This is evident given a 0 correlation parameter is selected for risks considered independent.</p> <p>It is inappropriate and potentially damaging to the whole Solvency II process if any of the foundation principles of the Level 1 text are publicly criticised. Given this, statements like "...the use of linear correlations lead to wrong or even absurd aggregation results" are wholly inappropriate.</p>	Noted. The wording of the last sentence was revised to reflect the concern made.
43.	ACA	3.11.	We agree that it is necessary to take into account as much as possible the difference between the estimation and the reality.	Noted
44.	Association of British Insurers	3.12.	In the UK and using the ICA capital approach firms have demonstrated that risk based capital is a powerful tool. However CEIOPS did not find that a material strengthening of correlations was required. The aim here has to be in accord with the 1: 200 world as otherwise policyholders will be "very secure" but paying a high and hidden price for it. Whilst we can understand that many regulators want a no fail approach this is not what the level 1 directive is about.	Noted and agreed. But note that the approach suggested by CEIOPS to set the correlation coefficients in the standard formula

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				(see para. 3.15) is consistent with the 1:200 VaR target criteria of Solvency II as set out in the Level 1 text.
45.	CEA	3.12.	<p>The current financial crisis cannot be used to justify exceptional increases</p> <p>We think the current financial crisis cannot be used to justify these exceptional increases of correlation factors, since the crisis has not hit the insurance sector as much as banking / financial sector (either directly or indirectly). If the underlying cause for the correlation adjustments upwards is to force the undertakings to adopt a full internal model, the discussion will be more productive for all involved parties to discuss this openly. We agree that in many cases it is not reasonable to have a correlation factor of 0 (zero), but it is hard to understand some suggested high correlation factors based on "feeling" and no concrete evidence.</p>	<p>In this para., the reference to the current financial crises has been made to exemplify the occurrence of tail correlations, hence emphasising the need to look "beyond" just linear correlations in setting the correlation parameters in the standard formula.</p> <p>In terms of the actual calibration of the coefficients, the comment was acknowledged (see below); yet this has no immediate bearing to the wording of this para.</p>
46.	Legal & General Group	3.12.	We believe that CEIOPS is hiding behind the recent financial crisis. In the UK and using the ICA capital approach firms have demonstrated that risk based capital is a powerful tool. However they did not find that a material	Noted. Cf. to our resolutions of comments 44 and

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			strengthening of correlations was required. The aim here has to be in accord with the 1: 200 world as otherwise policyholders will be "very secure" but paying a high and hidden price for it. Whilst we can understand that many regulators want a no fail approach this is not what the level 1 directive is about.	45, above.
47.	Lucida plc	3.12.	Although we can see that adverse changes have happened simultaneously for credit spreads, property prices and equity prices, it seems equally clear to us that the "adversity" or otherwise of changes in currency exchange rates depends on the point of view of the observer. To claim that all currency exchange rates have been adversely impacted would be absurd.	Noted and agreed. Wording of para. was revised accordingly.
48.			Confidential comments deleted.	
49.	ACA	3.14.	Is the correlation parameter the only factor that we can use to adjust the calculation? Is this an acceptable methodology or should we implement another factor to take into account non linear dependence, non normal distribution and tail dependence?	Agreed and noted – the occurrence of non-linear dependence and skewed (fat-tailed) distributions is a more general issue. However, this would appear to go beyond the scope of this paper which is specifically concerned with the setting of correlation coefficients in the standard formula.
50.	Association of British Insurers	3.14.	While we agree that the assumption of independent normally distributions is not likely to hold for all risks, it is not appropriate arbitrarily adjust the correlations. These should be set by a detailed analysis of relevant data with expert judgment applied in order to determine parameters consistent with a 1 in 200 year event.	Agreed. But note that, equally, a derivation of linear correlation coefficients requires

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				<p>a detailed analysis of relevant data with expert judgement applied.</p> <p>The wording of the paras. 3.14 to 3.17 was amended to set out more fully these challenges and the objectives of setting correlation coefficients in the standard formula.</p>
51.	Groupe Consultatif	3.14.	<p>This should be looked into more detailed - an independent pair should be assumed to have a correlation of zero.</p> <p>The assumption underlying the correlation matrix approach is that the variables are linearly dependent and multivariate normal distributed – if we do not make this assumption then the approach is not valid per se.</p>	<p>Not (necessarily) agreed – see resolution to comments to sub-section 3.1.4, where this is discussed.</p> <p>Not agreed. CEIOPS considers that it is the intention of the Level 1 text to ensure that the aggregation of capital requirements using correlation matrices should be consistent with the solvency target criteria</p>

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			<p>The suggested approach of CEIOPS is to make arbitrary compensating adjustments to the parameters. We reject this approach the compensating adjustment suggested does not correct the problem identified that it seeks to address. Instead of this we should simply accept the simplifying assumptions of the model in order to use the matrix - an independent pair should be assumed to have a correlation of zero.</p>	<p>(99.5% VaR).</p> <p>We agree that the entries of the correlation matrices in the standard formula should not be set in an arbitrary manner.</p> <p>The wording of the paras. 3.14 to 3.17 was amended to set out more fully the intended aim of setting correlation coefficients in the standard formula, and the need to apply a consistent methodology.</p>
52.	Legal & General Group	3.14.	<p>While we agree that the assumption of independent normally distributions is not likely to hold for all risks, it is not appropriate arbitrarily adjust the correlations. These should be set by a detailed analysis of relevant data with expert judgment applied in order to determine parameters consistent with a 1 in 200 year event.</p>	<p>Agreed. The wording of the paras. 3.14 to 3.17 was amended to set out more fully the intended aim of setting correlation coefficients in the standard formula, and the need to apply a consistent methodology.</p>
53.	Lucida plc	3.14.	<p>We welcome the idea that the choice of the correlation factors should avoid</p>	<p>Noted.</p>

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			misestimating the aggregate risk.	
54.	EMB Consultancy LLP	3.15.	<p>We would agree that the correlation parameters used in the Standard Formula should be chosen to reflect the best approximation to the 99.5% VaR for the aggregated capital requirement.</p> <p>However we would caution that such a requirement means that these parameters may not be appropriate as benchmarks for use in internal models, and that this distinction should be made clear in the final level 2 guidance.</p>	<p>Noted.</p> <p>Agreed. The wording of the para. was clarified to point out that the intended "aggregation" coefficients do not (necessarily) coincide with the linear correlation coefficients between the risk drivers concerned.</p>
55.	Groupe Consultatif	3.15.	<p>We agree that correlation parameters should be chosen in a way to minimize the 'aggregation error'.</p> <p>However, in the rest of the document (articles 3.22, 3.41, 3.43, 3.44 and 3.50) the goal seems to be minimizing the probability of underestimating the aggregated capital. In other words, in cases of any doubt all correlations are increased. This will lead to an overall underestimation of diversification benefits.</p>	<p>Noted.</p> <p>Agreed. Amendments to the text have been made to clarify that the underlying aim of setting correlation coefficients is as set out in para. 3.15 (and not to minimise the probability of underestimating</p>

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				aggregated capital)
56.			Confidential comments deleted.	
57.	ACA	3.17.	Is the correlation parameter the only factor that we can use to adjust the calculation? Is this an acceptable methodology or should we implement another factor to take into account non linear dependence, non normal distribution and tail dependence?	Cf. our resolution of comment no. 49
58.	Lloyd's	3.18.	This point is correct but it is incorrect to then assume that all correlation selections should be positive. The examples serve to highlight the complexity of the issue, not to provide a solution. The examples do not demonstrate systematic trends – exactly what is inferred from the results.	Agreed. The analysis in this sub-section was amended to address this point.
59.	Association of British Insurers	3.19.	CEIOPS analysis here is weak and seems to be looking to justify an answer rather than taking an independent look.	Noted.
60.	CEA	3.19.	CeioPs' analysis of a uniform distribution provides no justification for increasing the correlation coefficients for independent risks As described by CeioPs in Para 3.11 the aggregation error is due to the fact that the marginal distributions are not normal distributions but uniform distributions. Applying a correlation matrix approach to aggregate the VaR of uniform distributions will produce a result which is lower than the actual VaR. This does show that the correlation matrix approach is not suited for aggregating the VaR for uniform distributions but gives no justification for systematically increasing the correlation coefficients for independent risks under Solvency II.	Noted. The analysis in this sub-section was amended to address this point.
61.	FFSA	3.19.	FFSA disagrees with this argument. As described in paragraph 3.11 the aggregation error is due to the fact that the marginal distributions are not normal distributions but uniform distributions. The fact that applying a correlation matrix approach to aggregate the VAR of uniform distributions yields an aggregated VAR which is inferior to the actual VAR shows that the correlation	The analysis in this sub-section was amended to address this point.

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			matrix approach is not suited for aggregating the VAR for uniform distributions. This does not justify increasing the correlation coefficients for independent risks.	
62.	Groupe Consultatif	3.19.	<p>It is stated that a correlation of 0 may not be appropriate for independent risks which would justify the use of positive correlations for independent risks.</p> <p>However, independent risks by definition have a correlation, linear or other, of 0, and the error occurs not due to the choice of correlation but due to the aggregation method, as discussed in 3.13. One may attempt to compensate this model error by adjusting the correlation parameters, however the impact will be different in every case, depending on the individual risks and their dependence structure.</p> <p>Also, this approach invalidates the intuitive interpretation of the concept of correlation as a measure of the degree to which different risks are related.</p> <p>The first example given in 3.19 discusses a case of two uniform independent variables, for which it is argued a positive correlation is required to obtain the correct result. As stated, however, this example is artificial and does not occur very often in practice. On the other hand, if one considers the more practical case of two highly skewed and independent risks, then following the same approach, a negative correlation would often be required.</p> <p>An example is as follows: Suppose X and Y are independent and both follow a centralised lognormal distribution with $\mu=1$ and $\sigma = 0.75$. Then $\text{Var } X = \text{Var } Y = 15.15$. Aggregating X and Y with a linear correlation coefficient of 0 leads to a value for $\text{Var } (X+Y)$ of 21.43. Using simulation however, we find a value for $\text{Var}(X+Y)$ of 19.52. The latter is considerably lower, and could be achieved by adjusting the</p>	<p>Not agreed – the setting of correlation parameters in the standard formula should be consistent with the 1:200 VaR target criteria of the Level 1 text. The fact that the impact may depend on the individual risks was recognised in the revised section 3.1.3.</p> <p>The example was deleted.</p> <p>Noted. The analysis of this sub-section was amended to reflect that the mis-</p>

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			<p>linear correlation in the square root formula to -17%.</p> <p>Also, due to the choice of a VaR-type risk measure, one will in some cases find that</p> $\text{Var}(X+Y) > \text{Var}(X) + \text{Var}(Y)$ <p>which would require a correlation of greater than 100% to arrive at the correct answer using the 'square root' aggregation method.</p> <p>In the most extreme case, one may even find that $\text{Var}(X) = \text{Var}(Y) = 0$ whilst $\text{Var}(X+Y) > 0$ so that there is no correlation coefficient that generates the right answer when using the 'square root' method.</p>	<p>estimation risk is two-sided, i.e that it could lead to cases of over- as well as underestimation.</p> <p>Indeed. But this is a weakness of the VaR risk measure (failure to be sub-additive), rather than of the aggregation technique.</p>
63.	Legal & General Group	3.19.	CEIOPS analysis here is weak and seems to be looking to justify an answer rather than taking an independent look.	Noted.
64.	Lloyd's	3.19.	This does not infer that all correlation factors should be positive for independent risks.	Noted and agreed. The analysis in this sub-section was amended to address this point.
65.	CEA	3.20.	<p>CeIops' analysis of a capped log-normal distribution provides no justification for increasing the correlation coefficients for independent risks</p> <p>Again this example proves that the correlation matrix is not suited for aggregations the VaR for capped log-normal distributions. The example does not justify systematically increasing the correlation coefficients for independent risks under Solvency II.</p>	Noted, cf. resolution to comment 60.

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66.	CRO Forum	3.20.	<p>There is an error in the example. The cap has to be applied at 1.2 (instead of 0.2) to get the displayed results.</p> <p>The statements derived from the example are very sensitive to the parameters. For example, if only one of the distributions is capped (but not both) the aggregation formula overestimates the true value. Thus, the example does not justify the broad application of not-zero correlations for independent risks.</p>	<p>The result has been re-produced in the analysis undertaken by other stakeholders (see e.g. analysis by Llyods and EMB), so no change.</p> <p>Noted. This is reflected in the amended text.</p>
67.	EMB Consultancy LLP	3.20.	<p>While we accept and agree with the point that the true linear correlation may not result in the best approximation to the aggregate 99.5% VaR, this example still appears somewhat artificial to us.</p> <p>We have recreated this example and agree with the results, but note that if the cap applied rises from 0.2 to 0.3, then the required correlation parameter to best approximate the 99.5% VaR changes from the 0.445 published to -0.11.</p> <p>Further, if the cap is removed altogether, the required parameter becomes -0.13.</p> <p>Finally, if the cap is removed and the distribution made more volatile (sd=0.2) then the required parameter becomes -0.15.</p> <p>In our experience the latter example is most suited to non-life insurance, since the combination of perils and territories, and the convolution of frequency and severity risk, all of which are often protected by separate reinsurance programmes, results in aggregate distributions for which the cap does not, in practice, apply in such a strict fashion.</p> <p>We would hence caution against over-reliance on this analysis.</p>	<p>Noted. See revised text.</p>

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68.	FFSA	3.20.	FFSA disagrees with this argument. Again this example proves that the correlation matrix is not suited for aggregations the VAR for capped log-normal distributions. The example does not justify increasing the correlation coefficients for independent risks.	Noted. See revised text.										
69.	Groupe Consultatif	3.20.	<p>We realise that assuming a linear correlation is not the right representation of the truth. However, this example as well as the one in article 3.19 are very specific and are not representative. Therefore they can not be the basis of increasing the correlation coefficients with percentages mentioned here.</p> <p>Further, footnote 8 states that the premium and reserve risk is based on truncated distributions. This is not true, because the mitigating effect of non-proportional reinsurance is highly underestimated in the standard formula. It only takes into account the reinsurance premium, which can be seen as an average effect and does not reflect the 1 in 200 year event.</p>	<p>Noted. See revised text.</p> <p>Footnote was deleted.</p>										
70.	Lloyd's	3.20.	<p>This paragraph cites the example of two independent LogNormal variables with mean 0, standard deviation 0.1, capped at 0.2. When using the correlation matrix method, a correlation of 0.445 is required to re-produce the correct capital amount. In addition to being subjective and not necessarily representative of insurance liabilities, selecting a different cap for each variable results in a different required linear correlation factor, which can be negative. Examples:</p> <table border="1" data-bbox="676 1073 1417 1367"> <thead> <tr> <th data-bbox="676 1073 898 1161">"Cap" Selection</th> <th data-bbox="898 1073 1417 1161">Required Linear Correlation</th> </tr> </thead> <tbody> <tr> <td data-bbox="676 1161 898 1214">0.15</td> <td data-bbox="898 1161 1417 1214">0.99</td> </tr> <tr> <td data-bbox="676 1214 898 1268">0.20</td> <td data-bbox="898 1214 1417 1268">0.44</td> </tr> <tr> <td data-bbox="676 1268 898 1321">0.25</td> <td data-bbox="898 1268 1417 1321">0.10</td> </tr> <tr> <td data-bbox="676 1321 898 1367">0.30</td> <td data-bbox="898 1321 1417 1367">-0.10</td> </tr> </tbody> </table>	"Cap" Selection	Required Linear Correlation	0.15	0.99	0.20	0.44	0.25	0.10	0.30	-0.10	Noted. See revised text.
"Cap" Selection	Required Linear Correlation													
0.15	0.99													
0.20	0.44													
0.25	0.10													
0.30	-0.10													

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			<table border="1"> <tr> <td>Uncapped</td> <td>-0.06</td> </tr> </table> <p>The result of this paragraph (3.20) is cited later in the document as justification for increasing the correlations between variables.</p> <p>The example chosen only represents one view – and opposite conclusions can be drawn from similar examples. Given the inconsistency in results from the same example, it is unsuitable to use it to support the proposals.</p>	Uncapped	-0.06	
Uncapped	-0.06					
71.	Munich Re	3.20.	<p>There is an error in the example. The cap has to be applied at 1.2 (instead of 0.2) to get the displayed results.</p> <p>The statements derived from the example are very sensitive to the parameters. For example, if only one of the distributions is capped (but not both) the aggregation formula overestimates the true value. Thus, the example does not justify the broad application of not-zero correlations for independent risks.</p>	Cf. resolution to comment 66.		
72.	RBS Insurance	3.20.	We believe this example could be misleading. See comment to 3.9 above.	Noted.		
73.	AFS	3.21.	The examples demonstrate that using a zero correlation can understate the VaR. However there are other cases where the opposite is true.	Noted. See revised text.		
74.			Confidential comments deleted.			
75.	CEA	3.21.	<p>Evidence would be required as to the shape of the probability distributions in question</p> <p>We recognize the shortcomings of the aggregation technique for particular (non-elliptical) distributions in the case of independence. However, we think it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability distributions.</p>	Noted. See revised text, which reflects this concern.		

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			<p>Zero correlations may also overstate the VaR</p> <p>While the examples given in sections 3.18 to 3.20 demonstrate that using a zero correlation can understate the VaR, we would note that there are other examples where the opposite would be the case.</p> <p>For example, the upwards yield curve stress is higher than the downwards yield curve stress indicating that yields cannot be Normally distributed - and in particular that the distribution of yield curve moves must have a positive skewness. For firms which are vulnerable to yields falling, using a correlation matrix to generate the VaR will overstate the capital requirement.</p> <p>Therefore, although the examples in 3.19 and 3.20 demonstrate that the correlation matrix is not appropriate when the marginal distributions are not normal, it doesn't justify systematically increasing the correlation coefficients under Solvency II.</p>	
76.	Deloitte	3.21.	We note that the example relies for its construction on the use of thin-tailed marginal distributions. If fat tailed distributions – more plausible for most financial risks – had been used in the independent combination, then the appropriate adjustment in the tail is to “reduce” correlations.	Noted.
77.	FFSA	3.21.	<p>The examples in 3.19 and 3.20 demonstrate that the correlation matrix is not appropriate when the marginal distributions are not normal, however it doesn't justify systematically increasing the correlation coefficients.</p> <p>CEIOPS should prove that marginal distributions do not follow an elliptic distribution.</p>	Noted. The analysis in this sub-section was amended to address this point.
78.	Groupe Consultatif	3.21.	We agree that in the standard formula, a degree of conservatism in the choice of correlation coefficients, as well as other parameters, may be justified for several reasons. The first reason is to compensate for the model risk arising	Noted.

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			<p>from the relative simplicity of the square root calculation method. A second motive is to encourage individual firms to develop internal models.</p> <p>In order for the second motive to be effective, the correlations used in internal model by individual companies should be allowed to deviate from the correlations in the standard formula. Therefore, firms should be given the possibility to assess correlations that are best suited to their specific risk exposures.</p> <p>Particularly in cases where reinsurance and other risk mitigation instruments are in place, the standard formula can prove to be highly inaccurate as demonstrated in the example in the CP. It would be therefore be preferable to assess these cases on an individual basis as part of the Supervisory Review, instead of attempting to make such adjustments in the standard formula through the correlation coefficient.</p>	<p>Agreed.</p> <p>Noted. However, CEIOPS considers that correlation parameters should be set as to reflect (as best as possible) the 1:200 VaR standard. This does not preclude the option to assess specific cases in more detail in context of the ORSA and the SRP.</p>
79.	IUA	3.21.	<p>This assertion is made on the basis of the examples given. We would urge CEIOPS to do more rigorous testing, for example by looking at the sensitivity of changes in the input parameters to the output correlation parameter. We understand that a small change in parameters could yield significant changes in the suggested "independent" correlation parameter given in this example.</p>	<p>Noted and agreed. The analysis in this sub-section was amended to achieve a more balanced view.</p>
80.	ACA	3.22.	<p>There seems to be an excessive level of prudence being introduced here, based on subject being difficult. It would make more sense to us to try and tackle the difficulties rather than err on the cautious side.</p> <p>We don't think that all correlation parameters should be at least 0.25 without</p>	<p>Noted.</p>

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			even analyzing the shapes of the probability distributions.	
81.	AFS	3.22.	<p>We disagree with the proposal to use a +25% correlation even when it is believed that the risks are independent.</p> <p>The correlation matrix only works per se if we assume that variables are linearly dependent multivariate normal, so in order to use the matrix we must accept this simplifying assumption, otherwise we cannot use the matrix at all. Adjusting correlations is too crude a mechanism to address weaknesses in the correlation matrix aggregation approach reliably.</p>	<p>Noted.</p> <p>Not agreed. The correlation parameters should be set consistent with the 1:200 VaR target.</p>
82.	AMICE	3.22.	<p>We have another example which proves that the implied correlation between two independent variables could be less than 0.</p> <p>For instance, two independent lines of business (X and Y), following a lognormal distribution (0,1), with a non-proportional reinsurance contract defined as a stop loss, starting from 15 without limit :</p> <p>$VaR (X+Y) = 15$</p> <p>$VaR (X) = VaR (Y) = 12,6$</p> <p>Implicit correlation between X and Y : rho defined as</p> <p>$(12.6^2 + 12.6^2 + 2*rho*12.6*12.6)^{(1/2)} = 15$</p> <p>$=> rho = -30\%$</p>	<p>Noted.</p> <p>The text following the example was amended to clarify that setting a correlation coefficient of zero may also lead to an over-estimation of the aggregated risk.</p>
83.	CEA	3.22.	<p>We disagree with the proposal to use a +25% correlation even when it is believed that the risks are independent</p> <p>We request information as to on what basis Ceiops has decided to set a minimum level of correlation for all risks at 0.25. Since Ceiops has calibrated all the underlying marginal market risk distributions, we think that it should be possible to estimate whether any adjustment to the correlations is required and if so, what the adjustment should be. We request that Ceiops discloses the study used to assess the level of correlations.</p>	<p>Noted. The analysis in this sub-section was amended to address this point.</p>

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			This excessive level of prudence without any concrete justification puts companies in a very difficult position as Ceiops imposes a relatively high correlation coefficients (namely 0.25) even when it is reasonable to assume that the risks are independent. When the risks are independent, companies should use a correlation coefficient of 0 unless Ceiops can justify an alternative with a disclosed study.	
84.	FFSA	3.22.	FFSA wonders on which basis CEIOPS sets a minimum level of correlation for all risks at 0.25. FFSA would like CEIOPS to disclose the study used to assess the level of correlations. This excessive level of prudence without any concrete justification puts companies in a very difficult position as the CEIOPS imposes relatively high correlation coefficients 0.25 even when it is reasonable to assume that the risks are independent. When the risks are independent, companies should use a correlations coefficient of 0.	Noted.
85.			Confidential comments deleted.	
86.	GROUPAMA	3.22.	We have another example which proves that the implied correlation between two independent variables could be less than 0. For instance, two independent lines of business (X and Y), following a lognormal distribution (0.1), with a non-proportional reinsurance contract defined as a stop loss, starting from 15 without limit: VaR (X+Y) = 15 VaR (X) = VaR (Y) = 12,6 Implicit correlation between X and Y: rho defined as $(12.6^2 + 12.6^2 + 2 \cdot \rho \cdot 12.6 \cdot 12.6)^{1/2} = 15$ $\Rightarrow \rho = -30\%$	Cf. resolution to comment 82.
87.	Just	3.22.	We have some sympathy with need to make the broad adjustments to the	Noted.

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	Retirement Limited		<p>underlying “economic” correlation parameters to account for statistical shortcomings of correlation matrices.</p> <p>However, for reasons of transparency, and to avoid biases in benchmarking statistically more sophisticated approaches against the standard formula parameters, we believe it is absolutely essential to break down the correlation parameters into an “economic correlation” and a “statistical adjustment”. In the example give, the economic assumption would be 0% and the statistical adjustment 25%.</p> <p>It is perfectly possible for the statistical adjustment to be negative (e.g. if lapsation is driven by poor asset returns and higher lapses reduce the burden of guarantees).</p>	<p>We agree it should be clarified that the correlation parameters in the standard formula are not necessarily “linear” correlations – this is indeed stated in the second para. of the “blue box”.</p> <p>However, we think it would be too difficult to always carry out the decomposition as suggested.</p>
88.	Lloyd’s	3.22.	The flat assumption that all risks, including independent risks, should have a 25% correlation factor is incorrect and based on weak subjective arguments.	Noted. See revised wording of sub-section, which addresses this concern.
89.	Lucida plc	3.22.	<p>We appreciate the work that CEIOPS has done to investigate the need for positive correlation parameters even if the risks are independent. However, there does not appear to be sufficient evidence that the underestimation is systemic. Different distributions might result in a correlation parameter of 0 producing an over-estimate of the combined risk. Equally, in the two examples given, 0.25 would not avoid underestimating the combined risk.</p> <p>It is clear that using 0.25 instead of 0 will increase the combined risk, which makes it more likely that the calibration will be at least as secure as 99.5%. However that does not mean that 0.25 will avoid a systemic underestimation as</p>	Noted and agreed. See revised wording of sub-section, which addresses this concern.

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			claimed in the text. This also seems to us to be introducing an unnecessary additional level of prudence.	
90.	PricewaterhouseCoopers LLP	3.22.	<p>We understand the arguments set out in the preceding paragraphs on the difficulties of selecting a correlation factor for risks which are believed to be independent. However, the choice of 0.25 is not justified beyond the fact that it is a “slightly positive” number, an argument which could similarly be made in favour of a lower factor of 0.1, for example.</p> <p>We recommend that CEIOPS carries out further analysis and considers expert advice and opinion on the appropriate correlation factor to use for aggregating the capital charges for risks which are believed to be independent, in order not to impose excessively onerous capital requirements on insurers using the standard formula.</p> <p>These comments are also relevant to paras 3.45, 3.51, 3.76 and 3.77.</p>	Noted and agreed. See revised wording of sub-section, which addresses this concern.
91.			Confidential comments deleted.	
92.	Investment & Life Assurance Group Ltd	3.23.	We note that under the current proposals, all correlation factors are a multiple of 0.25. In view of the significant impact that the proposed changes in Market Risk correlation factors have on overall SCR results, we suggest that not all correlation factors should be increased in multiples of 0.25. For example, if a previously suggested correlation of 0.25 is now deemed inadequate, it should not simply be automatically increased to 0.5 without first considering it would be more appropriate for it to lie somewhere in between 0.25 and 0.5.	Noted. However, for reasons of simplicity approach was kept.
93.	ACA	3.24.	It would be helpful to publish the observed correlations during the crisis to support the evidence of difference against long term normal trend.	Further statistical analysis was undertaken to assess the factors (see revised text).
94.				
95.	CEA	3.24.	We request that Ceiops publishes what the observed correlations were during the current financial and economic crisis (and for what observation frequency)	Further statistical analysis was

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			<p>in order to compare these figures with the proposed standard formula correlations</p> <p>CeioPs discusses only actual correlations during the current crisis, but does not separate clearly cause and effect. As an example it is stated that the reaction of central banks to an economic downturn usually is to lower interest rates. But that is not always true depending on the cause of a downturn. If a crisis arises because of a shock to inflation or a currency crisis, the response from central banks would most likely not be to lower interest rates.</p> <p>The current financial crisis was, in general, caused by sustained and unsound macroeconomic policies in the major economic centres on a global basis. Hopefully, policymakers have learned lessons from the crisis which will prevent a similar crisis happening again for the same reasons. The next crisis may be caused by other factors leading, possibly, to new and different insight into the interdependencies between market risks.</p> <p>We note that the increased dependence in this crisis was not evident across the board, for example for the real estate market in Germany the yield reaction was surprisingly low as investors were looking desperately for real estate but the supply is highly limited (oligopolistic market). The yield movement in the CeioPs benchmark-market (the UK) cannot be compared to all other European markets and especially not to the German real estate market.</p> <p>Furthermore, it is not an entirely new observation that the dependence</p>	<p>undertaken to assess the factors (see revised text).</p> <p>Noted. See resolution to comments to para. 3.32</p> <p>Noted. But this is not inconsistent with CEIOPS analysis – CEIOPS does not assert that the crises will repeat itself, but points out that it gives further empirical evidence to the existence of tail correlations between market risks.</p> <p>Noted. A footnote was added to the para. to reflect this.</p> <p>Noted. The text is not intended to assert</p>
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			<p>structure of market risk changes in stressed situations. This was also the case during the dot.com crisis after the turn of the century and during the crisis in Southeast Asia in 1997. However, Ceiops' arguments give the impression that increased tail dependence is a totally new phenomenon. This is not the case. Hence, the correlation parameters used during the QIS rounds must have already incorporated some knowledge of increased correlation during times of financial distress. The crisis should, in that respect, not influence an actuarial or mathematical goal, quantified with a 99.5% confidence level. Against this background, we question whether the very heavy increase in correlation parameters suggested by Ceiops can really be justified by reference to the latest events.</p> <p>We would also like to point out that the ORSA may be a more appropriate instrument than the SCR for crisis-situations.</p>	<p>that an occurrence of tail dependencies in market risks is a new phenomenon. A para. was added to reflect this.</p> <p>Noted.</p>
96.	Danish Insurance Association	3.24.	<p>It is not an entirely new observation that the dependence structure of market risk changes in stressed situations. This was also the case during the dot.com crisis after the turn of the century and during the crisis in Southeast Asia in 1997. However, CEIOPS' arguments give the impression that increased tail dependence is a totally new phenomenon. This is not the case. Hence, the correlation parameters used during the QIS rounds must have already incorporated some knowledge of increased correlation during times of financial distress. Against this background, the DIA questions whether the very heavy increase in correlation parameters suggested by CEIOPS can really be justified by reference to the latest events.</p>	<p>Agreed. See footnote added.</p>
97.	EMB Consultancy LLP	3.24.	<p>We would agree that such affects should be considered in the tail of the distribution, but would caution that using parameters calibrated to tail events at more common adverse scenarios (such as the 80% VaR), which may well become embedded in operating practice for firms using internal models, may</p>	<p>Noted. The advice clarifies that the suggested correlation parameters do not</p>

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			<p>overstate the volatility at these risk appetite levels. We would thus caution against the use of these parameters as benchmarks for internal models.</p> <p>We would note, however, that these are externally driven data, and hence reconciliation between internal models and the Standard Formula parameters in these areas may well be required for fairness between firms.</p>	necessarily coincide with the linear correlation coefficients between the risks.
98.	Just Retirement Limited	3.24.	<p>For transparency, and given the material impact the change in parameters is expected to have, the analysis underpinning this statement should be published.</p> <p>We agree that for relatively short periods correlations were elevated. However, the SCR is by design a 1-year test. The published analysis should also cover the appropriateness of elevated correlation parameters over a 1-year time horizon.</p>	Further statistical analysis was undertaken to assess the factors (see revised text).
99.	Unum Limited	3.24.	We would like CEIOPS to publish the result of their observation following the recent market crisis.	Further statistical analysis was undertaken to assess the factors (see revised text).
100.	AFS	3.25.	The events over the past couple of years should not be used exclusively to determine the calibration of correlations – this would not be sound from a statistical perspective. The shocks appear to consider just 1 datapoint for each correlation pair. A wide range of correlation measures and indices should be taken into account that would give us different insights to making reliable statistical conclusions.	Agreed, see revised text and clarifications added.
101.	CEA	3.25.	This analysis is inadequate for the real estate market: The property prices in very few markets reacted sharply and so a high tail correlation does not appear to be the case for most real estate markets in Europe. This can be underlined with market transactions reported. For example (as Ceiops uses the case Stiller index) the residential price movement in Germany was close to Zero (as there is and was a low volatility in Germany for decades – very unlike a market such as the UK).	Noted. A footnote was added to reflect this.

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102.	Groupe Consultatif	3.25.	<p>The events of 2007-2008 should not be used exclusively to anchor the calibration.</p> <p>The events of 2007-2008 should not be used exclusively to anchor the calibration. It could be argued that this exceptional period was a “worse than 1-in-200” event and hence, not appropriate for the standard model calibration. Furthermore, anchoring the calibration on only 2 years of annual movements is weak from a statistical perspective (even if we were to take monthly datapoints for this 2 year window, this would give us insufficient data with which to make a reliable estimate of the average correlation).</p> <p>It would seem more appropriate to consider the correlation of monthly (or even weekly) returns given that there are simply not enough observations of annual returns to make reliable statistical conclusions. The shocks referred to in #3.25 effectively constitute 1 datapoint for each correlation pair.</p>	<p>Acknowledged. Further statistical analysis was undertaken to assess the factors (see revised text).</p> <p>However, CEIOPS believes that the crises gave empirical evidence to the existence of tail correlations between market risks, which should be considered in deriving correlation factors. Consideration of only linear correlation coefficients would seem to be inappropriate in this context.</p>
103.	AFS	3.26.	<p>It would be useful for CEIOPS to provide evidence to back their claim that “no diversification” was observable.</p>	<p>See revised wording. The para. is intended to point out that under the current crises there was only very limited scope to diversify losses by offsetting them with</p>

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				gains in other risk categories.
104.	Association of British Insurers	3.26.	The statement that no diversification was observable is not correct since anything less than exact correlation implies there is some form of diversification benefit.	Indeed there was diversification benefit insofar as for some risk categories the shock/decline experienced during the crises is less than the 1:200 year shock in the risk category regarded on its own. However, this does not invalidate the intended statement of the para. (see resolution to comment 103).
105.	CEA	3.26.	This article states that "no diversification is observed". Of course it is apparent that the credit spread, the equity and property prices all moved in the way and had a negative effect on balance sheets. However, the degree with which they moved did indeed differ. This means that there are still some diversification effects. See also comments to Para 3.24 and 3.25.	Agreed. The statement was revised to reflect that there was still some diversification effect. Howeverm rthis does not invalidate the observation that under the current crises there was only very limited scope to diversify losses by offsetting them with gains in other risk

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				categories.
106.	Deloitte	3.26.	This anecdotal assertion of high correlations makes no statistical sense. If one look for a correlation in one data point, of course one will not find it. The fact that correlations cannot be calculated from one data point does not imply that correlations are high, as this paragraph suggests.	Noted. See revised wording.
107.	Groupe Consultatif	3.26.	<p>This point should be looked into more detailed. The claim that “no diversification” was observed is misleading. Furthermore, the extent of the “diversification” that was observed over this period would also depend on whether we were looking at the daily/weekly/monthly/annual movements.</p> <p>The claim that “no diversification” was observed is misleading. In order to ascertain whether any diversification was observed, we would need to know:</p> <ul style="list-style-type: none"> - what is the multivariate distributional form for spreads, equity returns, interest rates, property returns and FX? - what probability are we assigning to the events that were observed for each of these drivers? <p>We would need a view on the above questions in order to make inference as to what the correlations actually were. CEIOPS does not provide any such empirical evidence or justification – it merely states “no diversification was observed” without any evidence to prove this.</p> <p>Furthermore, the extent of the “diversification” that was observed over this period would also depend on whether we were looking at the daily/weekly/monthly/annual movements.</p> <p>This article states that: ‘no diversification is observed’. Of course it is apparent that the credit spread, the equity and property prices all moved in the way which had a negative effect on balance sheets. However, when another crisis comes along the effects will most probably be in the same direction, but with a different impact also in relation to the different investment categories. This means that the correlation will not be perfect.</p>	<p>Noted. However, the para. is not intended to make a precise quantitative assertion on the level of diversification achieved.</p> <p>Rather, it is intended to simply note that under the current crises there was only very limited scope to diversify losses by offsetting them with gains in other risk categories.</p>

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108.	Just Retirement Limited	3.26.	This statement seems overly strong; in our view it would be more accurate to say that a diminished degree of diversification was observed over a relatively short time period.	Noted and agreed. See revised wording.
109.	Legal & General Group	3.26.	The statement that no diversification was observable is not correct since anything less than exact correlation implies there is some form of diversification benefit.	Noted. See revised wording.
110.	Lucida plc	3.26.	Where risks have a two-sided nature it appears to us that the correlation matrix can only be calibrated to one of the two sides. In this case, it seems appropriate to acknowledge that the calibration could lead to a mis-estimation of the aggregate risk.	Noted. CEIOPS has considered two-sided correlations with respect to the interest rate risk module.
111.	RSA Insurance Group	3.26.	I disagree with this statement.	Noted.
112.	Groupe Consultatif	3.27.	<p>In general we follow the statement made that empirical evidence provided by the current crisis should not be ignored. However the reasoning in 3.29, 3.30 3.32 – 3.34 is mainly of qualitative nature and leads to the conclusion that there were many observable dependencies.</p> <p>The probability of the recent crisis occurring cannot be easily estimated, but if CEIOPS wish to take a view they could attempt to fit some distributions (or even use bootstrapping) on the risk drivers using historic data and then observe where on the simulated distribution the events of last year lie. Again the comment that “no diversification” was observed is misleading and made with no evidence to back it up.</p>	Noted. See revised wording of paras. 3.27 to 3.29.
113.	IUA	3.27.	Whilst we appreciate lessons from the current crisis must be learned, we do not think it can be automatically assumed the current crisis is more frequent than a	Noted. See revised wording of paras.

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			<p>1-in-200 year event. The frequency of 1-in-200 year events will not be uniformly distributed. For example it is possible to have two 1-in-200 year events in relatively short succession, followed by a prolonged period of one not occurring. Not enough information is known about the frequency or the distribution of such events to make such generalised assertions.</p> <p>Furthermore, the current observations relate to the specificities of the current crisis. Other economic downturns may have different causes, and trigger different correlation effects. Therefore when considering correlations, a wider set of possibilities should be considered rather than solely those that fit the specificities of the current crisis.</p>	3.27 to 3.29.
114.	Just Retirement Limited	3.27.	<p>We agree that the empirical evidence in the recent crisis should be taken into account, but it should not be allowed to dominate statistical evidence from longer historical periods.</p> <p>In relation to the Great Depression, it is not necessarily the case that broadly 200 years should be expected to elapse between 1-in-200 year events.</p>	Noted. See revised wording of paras. 3.27 to 3.29.
115.	Lloyd's	3.27.	<p>The assertion that the recent financial crisis must be less than a 1:200 year event as the Great Depression occurred within the last 100 years is incorrect. Subjective references to the current situation as the "most severe crisis since the Great Depression" cannot be used to determine whether its frequency is higher than a 1-in-200 event. Such a determination requires a much more analytical approach.</p>	Noted. See revised wording of paras. 3.27 to 3.29.
116.	RSA Insurance Group	3.27.	<p>The reference to the great depression in this context is not very helpful.</p> <p>Firstly the current crisis is not over. It may or not get worse - nobody knows this yet. There may well be a short recovery followed by another collapse. Look no further than the experience of Japan over the last 20 years to observe this pattern in practice. Thus, in ten years time, it is possible (but hopefully not</p>	Noted. See revised wording of paras. 3.27 to 3.29.

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			likely) that we will be describing this event as worse than the great depression. Secondly, the proximity of other events does not disprove the severity. For example in 1990 there had been 2 very large storms in the UK in the past 3 years (1987 & 1990) This did not make very large storms a 1 in 3 event. NB: The longer term nature of both this crises and others also highlight the weakness of a one year model.	
117.	XL Capital Ltd	3.27.	Whilst we appreciate lessons from the current crisis must be learned, we do not think it can be automatically assumed the current crisis is more frequent than a 1-in-200 year event. The frequency of 1-in-200 year events will not be uniformly distributed. For example it is possible to have two 1-in-200 year events in relatively short succession, followed by a prolonged period of one not occurring. Not enough information is known about the frequency or the distribution of such events to make such generalised assertions.	Noted. See revised wording of paras. 3.27 to 3.29.
118.	CEA	3.28.	From a theoretical point of view it is questionable whether the crisis implies there needs to be an increase in correlation factors We agree that the lessons learned from the current crisis should be reflected in the correlation parameters. But Ceiops delivers no statistical background for its heavy increase in market risk correlation parameters. Too much weight is simply put on the latest events. Ceiops needs to calibrate the SCR to a 200 year event, and we acknowledge this exercise is difficult. However, this is merely an argument to be careful not to rely too much on the most recent events. If the SCR is not calibrated to best estimate 99.5% VaR, it could give a strong negative impact on the incentive structures facing insurance companies.	Noted. See revised wording of paras. 3.27 to 3.29. The main point is the empirical evidence for a significant degree of tail dependence. CEIOPS has provided further statistical analysis to assess the appropriateness of its suggested settings of correlation factors.

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			Furthermore, with respect to property the findings are not correct and hence so are the assumptions for the correlation matrix. For example for the office markets if the economy declines there will be job losses. By job losses there will be less demand for space to rent. BUT: there are Leases in place which will be fulfilled. The impact of an economic decline is time wise deferred by the capital (rental) value of the lease term. To measure this you can look at the average lease length by country. Given an average lease length of – conservatively 5 years – the correlation between equity and property is highly overestimated.	Noted.
119.	Groupe Consultatif	3.28.	We would follow CEIOPS when stating that the correlation factors consequently need to be increased, but the significant increases suggested would in our view need additional quantitative reasoning.	Noted. The para. was deleted.
120.	RSA Insurance Group	3.28.	It is not clear from this paper how the original factors were chosen. So it is difficult to justify an increase based on what has been written. Where is the evidence that the current correlation is incorrect? (NB This does not mean we disagree with the answer - just that no evidence, except a for a few anecdotes on the current crises has been provided.)	The para. was deleted.
121.	Association of British Insurers	3.30.	It is far more onerous than the 99.5% VaR to assume that all the most adverse outcomes will happen at once	Agreed. But this is not asserted in the para.
122.	CEA	3.30.	<p>It is far more onerous than the 99.5% VaR to assume that all the most adverse outcomes will happen at once</p> <p>While there may be evidence for non-zero dependencies between market risks it does not follow that all the most adverse outcomes will happen over the same 12 month period. For example while the yield on long bonds did fall during 2008 the change was not as large as has been observed in the past. Similarly, while implied sterling swaption volatilities did increase during the recent financial crisis, larger rises have been seen in the past.</p> <p>Correlation between property and equity</p> <p>Following a study performed on the French, UK and US markets we observe that</p>	<p>Agreed. But the analysis in the para. is not intended to make this assertion.</p> <p>Noted. However,</p>

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the correlation between equity and property ranges between 0.13 and 0.47 which is lower than the suggested correlation factor of 0.75 by Ceiops. We believe that a correlation factor of 0.25 is more aligned with market observations:

CEIOPS statistical analysis indicates that a setting of 75% (as proposed) would be more appropriate.

France sur la période 1986-2008 (données annuelles)²

Indices (annuels)	IPD Résidentiels	IPD Bureaux	EPRA France	CAC 40
IPD Résidentiel	1,00			
IPD Bureaux	0,90	1,00		
EPRA France	0,43	0,23	1,00	
CAC 40	0,14	0,21	0,59	1,00

France sur la période 1999-2008 (données trimestrielles)

Indices (trimestriels)	IPD Résidentiels	IPD Bureaux	IPD Commerces	EPRA France	CAC 40
IPD Résidentiels	1,00				
IPD Bureaux	0,72	1,00			
IPD Commerces	0,81	0,87	1,00		
EPRA France	0,40	0,27	0,40	1,00	
CAC 40	0,27	0,39	0,42	0,41	1,00

UK sur la période 1986-2008 (données annuelles)

Indices (annuels)	IPD Résidentiels UK	IPD Bureaux UK	IPD Commerces UK	EPRA UK	FOOTSIE 100
IPD Résidentiels UK	1,00				
IPD Bureaux UK	0,83	1,00			
IPD Commerces UK	0,67	0,86	1,00		
EPRA UK	0,54	0,72	0,78	1,00	
FTSE 100	0,30	0,43	0,47	0,40	1,00

UK sur la période 1987-2009 (données trimestrielles)

Price Index Appreciation UK: 1987Q1-2009Q2

	FTSE 100	All Property	All Retail	All Office	All Industrial
FTSE 100	1,00				
All Property	0,18	1,00			
All Retail	0,19	0,97	1,00		
All Office	0,15	0,97	0,88	1,00	
All Industrial	0,18	0,97	0,91	0,94	1,00

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USA sur la période 1986-2009 (données trimestrielles)

Price Index Appreciation U S: 1986Q1-2009Q2

	<i>US Equity REITs</i>	<i>DJ Industrial Average</i>	<i>Office</i>	<i>Retail</i>	<i>Industrial</i>	<i>Residential</i>
US Equity REITs	1,00					
DJ Industrial Average	0,53	1,00				
Office	0,24	0,16	1,00			
Retail	0,18	0,12	0,70	1,00		
Industrial	0,29	0,18	0,94	0,75	1,00	
Residential	0,30	0,18	0,84	0,76	0,91	1,00

Data is based on the following indexes:

- IPD (International Property Databank <http://www.ipd.com/>) for France and UK
- EPRA (European Public Real Estate Association <http://www.epra.com/>) for France and UK
- (National Council of Real Estate Investment Fiduciaries <http://www.ncreif.com/>) for the US market
- US Equity REITS published by NAREIT (National Association of Real Estate Investment Trusts <http://www.reit.com/>) for the US market
- Equity index: CAC40 for France, Footsie 100 for UK and DJ Industrial Average for the US market

123.	IUA	3.30.	<p>This Consultation Paper when discussing correlations between the various market risk factors, does not make any reference to timescales for such correlations to occur. For example, the revised calibration suggests that property and equity prices are 75% correlated, yet no mention is made as to whether that 75% correlation is expected in a one-year timeframe. There is often a "lag" involved between the various factors. Given that this has not been mentioned, we would question whether CEIOPS has considered this in the derivation of these correlations.</p>	<p>The correlation assumptions are made with respect to year on year changes of the underlying risk factors.</p>
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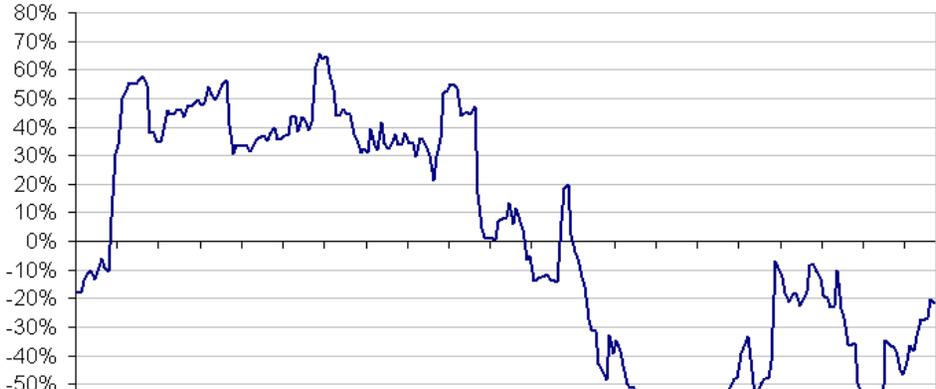
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124.	Just Retirement Limited	3.30.	We agree with the qualitative argument, but believe that these interrelationships were already captured in the QIS4 correlation assumptions. The argument in this paragraph appears to equate "stronger" dependencies (in a relative sense) with "close to perfect dependence" (in an absolute sense). The overriding requirement is the calibration to 99.5% VaR over 1 year and in our view the CP does not provide a clear justification that this has been achieved.	Noted. We refer to the results of CEIOPS' statistical analysis of individual correlation pairs.
125.	Legal & General Group	3.30.	For life insurers, in particular, rather than banks the business model does not result in instant adverse outcomes. Liquidity issues that impacted banks do not have the same effect on life insurers as can be seen from a historical look at insurance crises in the UK.	Noted. However, the solvency assessment under Solvency II is based on a market-consistent valuation of assets and liabilities, hence where market prices of assets decline this has an affect on the insurer's own funds.
126.	Lucida plc	3.30.	Although there may be correlation between equity prices and other market parameters, it is more onerous than the 99.5% VaR to assume that all the most adverse outcomes will simultaneously occur.	Agreed. This is not the intended meaning of this para.
127.	Unum Limited	3.30.	It is far more onerous than the 99.5% VaR to assume that all the most adverse outcomes will happen at once	See resolution to comment 126.
128.	ACA	3.31.	We believe that interest rate correlation factor should be replaced by two different correlation factors: one for upwards changes and another one for downwards changes in interest rates.	This is considered by CEIOPS.
129.	AFA	3.31.	AFA Insurance side with the minority in this issue; we think the correlation between equities and interest rates should be set to 0. (Also § 3.75)	Noted.
130.	AMICE	3.31.	We support the CEIOPS minority view to set at 0 the correlation factor between equity and interest rate. The impact on the final capital requirements could be very high and it is not clear whether a correlation factor set at 50% as	Noted. See further statistical analysis carried out by

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			<p>suggested does not exceed the 99,5% confidence level. It could be very hazardous to change this parameter based only on qualitative judgement linked to the recent crisis.</p> <p>Furthermore, if CEIOPS states that the fall of equity is linked to the downward shock of interest rates, in this case a medium correlation set at 50% to take into account the two-sided nature of the interest rate module does not make sense. A symmetric correlation should in this case be used.</p>	CEIOPS.
131.	CEA	3.31.	<p>The correlation between interest rates and equities should be revised</p> <p>It is important to secure incentives to diversify insurance assets on different financial instruments. In a possible future crisis dependencies between market risk elements may be lower than observed during the current crisis and correlation parameters which are too high may reduce incentives to appropriately diversify risk. This could increase the problems of pro-cyclicality. Furthermore, interest rate risk is a stress that can either be an up or a down scenario depending on the insurer's risk profile and, as discussed in our general comments, the most appropriate treatment would be different correlations (likely one positive, one negative) depending on which is the stress that is the most onerous for the insurer. It is theoretically impossible that both have the correlation of +50%. Attempting to define the same correlation parameter for either stress is inappropriate and would result in a high degree of prudence in the correlation factor.</p> <p>Below, we show the negative correlation between values of equities and values of government bonds. This negative correlation was permanent for the last 10 years and true on average for the last 20 years.</p> <p align="center">2Y Rolling Correlation between DJ Eurostoxx & ML EMU Govies</p> 	<p>Noted.</p> <p>CEIOPS considers to treat the two shocks separately.</p>

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			<p align="right">Correlation full period : -18.0%</p> <p>If Ceiops, on the other hand, retains its proposal to set the same correlation parameter for both up and down stresses then we would have to agree with the minority of Ceiops members who believe this correlation factor should be kept at zero. See also comments to Para 3.33.</p>	
132.	Danish Insurance Association	3.31.	3.31. Concentration risk is characterized by the fact that it can be avoided by ensuring that the investment portfolio is sufficiently diversified. This is due to the fact that company specific risks, which are not related to general market developments, tend to net out in portfolios with exposure to many names. Conversely, drivers of market risk which can be attributed to general market conditions such as unemployment or risk aversion cannot be circumvented by diversifying the investments on more company names.	Noted.
133.	Deloitte	3.31.	We agree with this minority of CEIOPS members that a zero correlation between	Noted.

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			equity and interest rate moves is appropriate. For firms exposed to an interest fall, the use of a 50% correlation implies a 50% correlation in equity and interest rate market movements. Although not supported by the data, this could be an internally consistent view. For firms exposed to an interest rise, the use of a 50% correlation implies a minus 50% correlation in equity and interest market movements. This is also not supported by the data but could perhaps be an internally consistent view. The proposed use of 50% correlation regardless of the direction of interest rate exposure, is statistically flawed with neither data nor internal consistency support.	
134.			Confidential comments deleted.	
135.	GROUPAMA	3.31.	<p>We support the CEIOPS minority view of setting at 0 the correlation factor between equity and interest rate. The impact on the industry could be very high and we do not know if a correlation factor set at 50% as suggested does not exceed the 99.5% confidence level. It could be very hazardous to change this parameter based only on qualitative judgement linked to the recent crisis.</p> <p>Furthermore, if CEIOPS states that the decline in equity is linked to the downward shock of interest rates, in this case a medium correlation set at 50% to take into account the two-sided nature of the interest rate module, does not make sense. A symmetric correlation should be used in this case.</p>	Noted.
136.	Groupe Consultatif	3.31.	There are indeed some serious open issues. Therefore we expect that the correlation coefficients proposed here are not open for discussion when insurance companies propose their internal models. In other words, companies should be in a position to introduce their own correlation coefficients in their internal models, when the arguments are sound.	Agreed.
137.	Just Retirement Limited	3.31.	For a given institution, the interest rate SCR could be an upwards or downwards movement depending on which direction bites. Using a correlation with equity risk capital of 50% regardless of the direction of interest rate movement seems overly strong, lacks a theoretical basis and could encourage management actions which reduce the SCR but increase the actual risk to the undertaking.	Noted.
138.	Lloyd's	3.31.	We agree there is not enough evidence to change the assumptions from QIS4.	Noted.

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			In this case, there are other examples where there has been negative correlation between equities and interest rate risk.	
139.			Confidential comments deleted.	
140.	CEA	3.32.	<p>We do not agree with the qualitative assessment of currency risk correlations</p> <p>The calibration of correlation factors between currency risks and the other market risks should be quantitatively measured through historical data, taking into account diversification effects between currencies.</p> <p>Ceios states that between currency risks and other market risks “a medium correlation factor seems to be justified” with the conclusion to use a factor of 0.5. This does not take account of the fact that currency risk is a two-sided risk and so could cause a loss or a profit in the balance sheet. Thus the correlation factor could range from -1 to 1. The medium correlation factor would then be 0 rather than 0.5.</p> <p>Therefore, we believe that a correlation of zero, rather than 0.5, is appropriate for currency risk relative to the other market risks, with the exception perhaps of interest rate risk. With regards to interest rate risk the correlation should be quantitatively measured through historical data, with a positive and negative factor available dependent on whether interest rates up or down is the onerous stress for each insurer.</p>	<p>Noted. CEIOPS has undertaken additional statistical analysis which supports the proposed factors.</p> <p>Not agreed. The shock considers the worst of two scenarios (a fall or rise in the value of the foreign currency against the local currency).</p>
141.	FFSA	3.32.	FFSA believes that the calibration of correlation factors between currency risks and the other market risks should be quantitatively measured through historical data, taking into account diversification effects between currencies.	Noted. CEIOPS has undertaken additional statistical analysis which supports the proposed factors.
142.	IUA	3.32.	We note the reinforcing effect that may occur, but again would question whether timescales between such reinforcing effects has been considered.	Noted.

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143.	Lloyd's	3.32.	<p>The CP correctly states that currency is a two-sided risk, yet decides to take a very one-sided view by increasing the correlation to 0.5.</p> <p>There is no strong evidence to change the selection.</p>	Noted. CEIOPS has undertaken additional statistical analysis which supports the proposed factors.
144.	Lucida plc	3.32.	<p>We agree that currency exchange rates can become volatile when markets are turbulent. We do not agree that this causes or reinforces movements in other market parameters. In particular we have not observed this in the current financial crisis.</p> <p>There does not appear to be any justification for a medium correlation factor. If CEIOPS believes that currency risk is highly correlated then this will mis-estimate the combined risk for all firms.</p>	Noted. CEIOPS has undertaken additional statistical analysis which supports the proposed factors.
145.	AMICE	3.33.	Correlation between interest rate risk and other market risks should be carefully measured based on historical data.	Agreed. Cf. CEIOPS statistical analysis on this matter.
146.	CEA	3.33.	<p>The correlation between interest rate risk and other market risks should be carefully measured based on historical data</p> <p>The assumption of +50% correlation between the interest rate stress and the equities, property, spread and currency stresses, regardless of whether interest rates are increasing or decreasing in the more onerous stress, points to an instability in the overall approach. The most appropriate treatment would be to analyse historical data to determine the correlation between interest rate increases and equity decreases, say x% and then the insurer will have to apply -x% if the onerous stress for that insurer is interest rate decreases.</p>	<p>Agreed. Cf. CEIOPS statistical analysis on this matter.</p> <p>Not agreed. If a two-sided correlation is used, this should consider the correlation of (say) interest rates going</p>

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Again, we believe that the correlation matrix with respect to property is not correct. The correlation between real estate and fixed income has to be higher compared to equity as the yield demand of real estate is the risk free return plus a risk adjusted return expectation minus the implied rise in rental value. We are aware that this argument is not in favour of the asset allocation models, but even though it should show that the Ceiops correlation matrix just does not work out. Empirically first interest rates move and with a time lag (12 to 24 month) property yields follow.
See also comments to Para 3.32.

Please note that in the last sentence of this paragraph in the CP, "currency risk" should be replaced by "interest rate risk".

Correlation between property and interest rate

From the below data we conclude that the correlation between bond prices and property prices is negative i.e. the correlation between interest rates and property is positive. Therefore, if interest rate falls are the biting stress, then the correlation with property should be positive, however, if interest rate rises are the biting stress then the correlation with property would be negative.

France: Quarterly observations between 1999 and 2008

	IPD Résidentiel	IPD Bureaux	IPD Commerces	EPRA France	CAC 40
JPM EMU FRANCE ALL MATS	-0,27	-0,42	-0,44	-0,37	-0,23

France: Annual observations between 1994 and 2008

	IPD Résidentiel	IPD Bureaux	EPRA France	CAC 40
JPM EMU FRANCE ALL MATS	-0,51	-0,54	-0,16	-0,27

down and equity values going down.

Noted. Cf. to annex C on this matter.

Noted. Wording has been amended.

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			<p>UK Price Index Appreciation UK: 1987Q1-2009Q2</p> <table border="1"> <thead> <tr> <th></th> <th><i>UK Bonds Basket</i></th> <th><i>All Property</i></th> <th><i>All Retail</i></th> <th><i>All Office</i></th> <th><i>All Industrial</i></th> </tr> </thead> <tbody> <tr> <td>UK Bonds Basket</td> <td align="center">1.00</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>All Property</td> <td align="center">-0.29</td> <td align="center">1.00</td> <td></td> <td></td> <td></td> </tr> <tr> <td>All Retail</td> <td align="center">-0.25</td> <td align="center">0.97</td> <td align="center">1.00</td> <td></td> <td></td> </tr> <tr> <td>All Office</td> <td align="center">-0.30</td> <td align="center">0.97</td> <td align="center">0.88</td> <td align="center">1.00</td> <td></td> </tr> <tr> <td>All Industrial</td> <td align="center">-0.33</td> <td align="center">0.97</td> <td align="center">0.91</td> <td align="center">0.94</td> <td align="center">1.00</td> </tr> </tbody> </table> <p>USA Price Index Appreciation US: 1986Q1-2009Q2</p> <table border="1"> <thead> <tr> <th></th> <th><i>US Bonds Basket</i></th> <th><i>Office</i></th> <th><i>Retail</i></th> <th><i>Industrial</i></th> <th><i>Residential</i></th> </tr> </thead> <tbody> <tr> <td>US Bonds Basket</td> <td align="center">1.00</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Office</td> <td align="center">-0.07</td> <td align="center">1.00</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Retail</td> <td align="center">-0.12</td> <td align="center">0.70</td> <td align="center">1.00</td> <td></td> <td></td> </tr> <tr> <td>Industrial</td> <td align="center">-0.07</td> <td align="center">0.94</td> <td align="center">0.75</td> <td align="center">1.00</td> <td></td> </tr> <tr> <td>Residential</td> <td align="center">-0.10</td> <td align="center">0.84</td> <td align="center">0.76</td> <td align="center">0.91</td> <td align="center">1.00</td> </tr> </tbody> </table>		<i>UK Bonds Basket</i>	<i>All Property</i>	<i>All Retail</i>	<i>All Office</i>	<i>All Industrial</i>	UK Bonds Basket	1.00					All Property	-0.29	1.00				All Retail	-0.25	0.97	1.00			All Office	-0.30	0.97	0.88	1.00		All Industrial	-0.33	0.97	0.91	0.94	1.00		<i>US Bonds Basket</i>	<i>Office</i>	<i>Retail</i>	<i>Industrial</i>	<i>Residential</i>	US Bonds Basket	1.00					Office	-0.07	1.00				Retail	-0.12	0.70	1.00			Industrial	-0.07	0.94	0.75	1.00		Residential	-0.10	0.84	0.76	0.91	1.00	
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147.	FFSA	3.33.	<p>Correlation between interest rate risk and equity risk</p> <p>FFSA is in favour of the following correlation factors between equity and interest rate:</p> <ul style="list-style-type: none"> - For upward shocks on interest rates: 0 - For downward shocks on interest rates : 0.5 - FFSA considers that a correlation of 0 should be retained as in QIS4 	Noted. Cf. CEIOPS statistical analysis on this matter.																																																																								
148.	Groupe Consultatif	3.33.	<p>The underlying assumption is a scenario of decreasing interest rates. In case of a scenario of increasing interest rates, a negative correlation between interest rate risk and the other market risks should be allowed. This is a likely scenario for entities with large investments in bonds.</p>	Noted. Text was revised to clarify that the analysis is focused on the correlation between a fall in interest rates with an adverse change in other																																																																								

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				market risks.
149.	IUA	3.33.	The most significant falls in the FTSE 100 could be observed between May and October 2008, similarly the most significant fall in the UK base rate occurred largely from October 2008 to March 2009 indicating a notable lag. By virtue of such lagged correlations we would question whether the correlations are necessarily right or whether under certain circumstances firms might have time to react and mitigate potential consequential impacts on their business.	Noted.
150.	Lucida plc	3.33.	We agree that there is a high correlation between interest rates being reduced and equity prices falling. There does not appear to be any justification for a medium correlation factor, as this will mis-estimate the combined risk for all firms. There appears to be a mis-print with the word "currency" being used where "interest rate" would seem more appropriate.	Noted. Cf. CEIOPS statistical analysis on this matter. Noted. Wording has been amended.
151.	PricewaterhouseCoopers LLP	3.33.	The last sentence of this paragraph should refer to interest rate and not currency risk	Noted. Wording has been amended.
152.			Confidential comments deleted.	
153.	CEA	3.34.	The following statement is unclear: "the correlation factors should properly describe the dependence between the risk of concentrations "in names" We request clarification.	See revised wording.
154.	FFSA	3.34.	Concentration risk The following statement is unclear: "the correlation factors should properly describe the dependence between the risk of concentrations in names" FFSA requests CEIOPS to disclose further explanations.	See revised wording.

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158.	RSA Insurance Group	3.35.	There has been a desire to increase correlations. This appears to be a knee jerk produced as a reaction to the current crises. There is little scientific justification for the parameters chosen.	Noted. Cf. to resolution comment 157. on
159.	ACA	3.36.	There is a material step change in correlation parameters against QIS4. It would seem an element of over prudence has been introduced.	Noted. Cf. to resolution comment 157. on
160.	AFS	3.36.	We note that some of the correlations seem particularly hard to understand. In particular the assumption of +50% correlation between the interest rate stress and equities, property, spreads and currency risks, regardless of whether interest rates increasing or decreasing is the more onerous stress, points to an instability in the overall approach.	Noted. Cf. to resolution comment 157. on
161.	CEA	3.36.	<p>Most of the factors are too high, a substantial increase compared to QIS4 and not evidenced</p> <p>Some of the correlations seem particularly hard to understand. See comments to Paras 3.31, 3.32, 3.33 and 3.35 for details.</p> <p>The correlation between equity and property risk is excessively prudent</p> <p>There is no explanation as to on what basis Ceiops has set the correlation factor between equity risk and property risk to 0.75, whilst diversification is recognised between property and some other risks. Looking at the French market, for example:</p> <ul style="list-style-type: none"> • During the period 1994 – 1998: The French equity index (CAC40) increased by 100% while property fell by 12.5% • During the period 2000 – 2002: The French equity index (CAC40) dropped by 45% while property increased by 42% <p>In our view the correlation between property and equity risk was already set too high in QIS4 (where it was also 0.75).</p> <p>The correlation between equity and spread risk is excessively prudent</p>	CEIOPS has carried out extensive both qualitative and quantitative analysis to revise the correlation parameters of the market risk for the calculation of the SCR. This analysis shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate. More detailed

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Ceios has increased to correlation factor between equity and spread risk from 0.25 in QIS4 to 0.75. Although we do agree that the 0.25 assumption was perhaps too low, the 0.75 assumption appears far too large. We would suggest a factor of 0.5 was more appropriate.

The table below shows correlations over the time period from 1.1.1999 to 30.06.2009 for AAA to A-rated bonds. The correlations are negative since decreases in equity values typically occur alongside increases in spreads.

	DAX	SX5E	CAC	FTSE	SPX	SMI	NKY
SPREAD EUR A	-0.46	-0.45	-0.46	-0.48	-0.5	-0.43	-0.48
SPREAD EUR AA	-0.38	-0.38	-0.37	-0.44	-0.41	-0.33	-0.41
SPREAD EUR AAA	-0.24	-0.25	-0.25	-0.31	-0.25	-0.21	-0.26
SPREAD USD A	-0.43	-0.42	-0.41	-0.5	-0.51	-0.38	-0.46
SPREAD USD AA	-0.3	-0.32	-0.31	-0.4	-0.4	-0.31	-0.37
SPREAD USD AAA	0.31	0.31	0.29	0.39	0.39	0.32	0.39
SPREAD GBP A	-0.43	-0.42	-0.42	-0.5	-0.47	-0.43	-0.48
SPREAD GBP AA	-0.31	-0.29	-0.29	-0.39	-0.33	-0.33	-0.35
SPREAD GBP AAA	-0.23	-0.2	-0.2	-0.28	-0.24	-0.21	-0.28
SPREAD JPY A	-0.03	-0.01	-0.02	-0.06	-0.17	-0.09	-0.18
SPREAD JPY AA	-0.19	-0.17	-0.15	-0.17	-0.24	-0.13	-0.14
SPREAD JPY AAA	0.12	0.18	0.19	0.13	0.12	0.17	0.07
SPREAD CHF A	-0.39	-0.4	-0.39	-0.39	-0.43	-0.43	-0.45
SPREAD CHF AA	-0.23	-0.23	-0.23	-0.27	-0.26	-0.24	-0.26
SPREAD CHF AAA	-0.19	-0.2	-0.19	-0.21	-0.2	-0.18	-0.21
SPREAD AUD A	-0.2	-0.18	-0.19	-0.26	-0.21	-0.24	-0.21
SPREAD AUD AA	-0.18	-0.14	-0.15	-0.19	-0.15	-0.2	-0.12
SPREAD AUD AAA	-0.18	-0.14	-0.16	-0.19	-0.19	-0.18	-0.16
SPREAD CAD A	-0.38	-0.39	-0.39	-0.41	-0.47	-0.37	-0.44
SPREAD CAD AA	-0.3	-0.31	-0.32	-0.33	-0.36	-0.35	-0.31
SPREAD CAD AAA	-0.18	-0.15	-0.17	-0.23	-0.2	-0.17	-0.21

The table shows that the correlation between single A-rated bonds and equity is on average close to 50% (more precisely slightly below 50%). As we can consider single A-rated investments are fairly representative of an insurer's corporate portfolio, we propose a correlation of 50% between equity and spread

background information on the statistical quantitative analysis undertaken is now provided in the annex. However, CEIOPS agrees that some coefficients may be lowered in light of the further research undertaken by both CEIOPS and other stakeholders since the release of the Consultation Paper.

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			risk.	
162.	Deloitte	3.36.	These factors have increased, but have they increased enough? Example 1 and Example 2 show two non sum-stable distributions where, using this method, a correlation of 44% and 65% are required in order to produce the sum of values where there is no dependence. In particular, when trying to cover a 1 in 200 event, where the extremes could be more correlated than the average, this should justify higher correlations than expected under average conditions.	Noted. Cf. to resolution on comment 161.
163.	IUA	3.36.	We would also observe that it is paramount that CEIOPS correctly calibrates the market risk correlations, as these are parameters which are not undertaking specific. We would therefore anticipate that these will influence the parameters required under internal models. In our view it is important that the correlations are reflective of reality.	Noted. Cf. to resolution on comment 161. CEIOPS does not intend to set a benchmark for internal models.
164.	Just Retirement Limited	3.36.	We consider that the proposed correlation parameters are overly strong and that the QIS4 parameters were more appropriate.	Noted. Cf. to resolution on comment 161.
165.	Lloyd's	3.36.	The correlation factors should be left unchanged from QIS4 without a far more complete and detailed review with input from industry experts. The substantial increases proposed are not properly justified.	Noted. Cf. to resolution on comment 161.
166.	PricewaterhouseCoopers LLP	3.36.	We acknowledge the arguments that correlations between risks in the recent financial crisis have turned out to be higher than those believed to exist in benign market conditions and those tested in QIS 4. However, we question whether the justification is sufficient for the significant increases in almost all correlations within the market risk sub-module proposed in this paragraph. In particular, we question the increase from 0 to 0.75 of the correlation between concentration risk and most other market risks. This comment also applies to para 3.74.	Noted. Cf. to resolution on comment 161. Noted. Correlation parameters have been revised.

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167.	ACA	3.37.	We agree with the CEA comments about positive diversification effects on the market risks.	Noted.
168.	AFS	3.37.	If these proposals are adopted they may reduce the incentive for good risk management through diversification, particularly for less extreme scenarios.	Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.
169.	CEA	3.37.	The proposals introduce reduced incentives for diversification of market risks We would note that if these proposals are adopted they may reduce the incentive for good risk management through diversification, particularly for less extreme scenarios.	Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.
170.	Equitable Life Assurance Society (UK)	3.37.	The proposals for market risk correlations are significantly higher than under QIS4 and seem to take too much account of the recent financial crisis. High correlations reduce the incentives for practising good risk management through diversification. The proposals should be amended to reflect that reduced correlations would be appropriate once a shock (e.g. large fall in market values) has already taken place.	Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.
171.	Groupe Consultatif	3.37.	This should be observed more carefully for the impact will vary between companies because different companies have different weightings in each risk factor – so the average increase of 32% could be somewhat misleading.	Agreed. For single undertakings the impact of the proposed changes can differ significantly from the estimated impact in this analysis, if the

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			Clearly the impact will vary between companies because different companies have different weightings in each risk factor – so the average increase of 32% could be somewhat misleading. Maybe a view on the range of different outcomes for this number might help?	relative importance of the undertakings' risks differs from the average order of risks. Noted.
172.	Just Retirement Limited	3.37.	The impacts quoted are very substantial particularly if applied in addition to the strengthening of stress tests proposed in CP70. It is very disappointing that no cost/benefit analysis of this proposed strengthening of regulatory capital has been carried out.	Noted. Cf. to resolution on comment 161.
173.	Deloitte	3.38.	A negative correlation could be too optimistic here, particularly as a change in mortality is unlikely to affect the whole mortality curve equally, and different lives could have different risks covered at different ages – for example, the main risk for young people could well be term assurance (mortality at young ages), and they could have very little longevity coverage. Old people are unlikely to have term assurance, and more likely to have longevity coverage. A change in the shape of the mortality curve can affect one and not the other. If the correlation is negative, and a company sold term assurance (mortality risk) to young people (e.g. to home owners), this company could reduce the SCR by selling annuities to older people, but the risks would not necessarily offset each other.	Noted.
174.	Groupe Consultatif	3.38.	This comment refers to the whole section 3.1.6. This section needs further advice especially concerning empirical evidence and justification. CEIOPS should provide more detail on the assumptions used for setting correlation.	Noted.

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175.	Just Retirement Limited	3.38.	There is no quantitative justification that the resulting factors are consistent with 99.5% VaR of basic own funds over a 1-year time horizon.	Noted.
176.	EMB Consultancy LLP	3.40.	This argument would seem to apply as a mitigating factor to other correlations considered elsewhere, for example between non-life premium and reserve risk, and CAT risk.	Noted.
177.	FFSA	3.40.	The justification provided is very vague and could just as easily justify a correlation coefficient of -0.5 or -0.75.	Noted.
178.	Groupe Consultatif	3.40.	<p>The mortality and longevity risks do not refer to total different age cohorts as presented here, because the older insureds, most prone to longevity also have a mortality component in the widow's pension.</p> <p>Furthermore, the statement that the mortality and longevity risks refer to different age cohorts is apparently not based on any research.</p>	<p>Noted. However, this may not always be the case.</p> <p>The statement is intended to illustrate an example.</p>
179.	Investment & Life Assurance Group Ltd	3.40.	We support of a correlation greater than -1 for the correlation between mortality and longevity risk; a frequently cited example of this is the 1918 swine 'flu pandemic, where the young people (the insured lives) suffered extremely high mortality, while the elderly (the annuitants) were not significantly affected.	Noted.
180.	Lucida plc	3.40.	We agree that the intuitive diversification between longevity and mortality can be misleading. However use of -0.25 as the correlation factor may understate the benefit of hedging.	Noted.
181.	Belgian Coordination Group Solvency II	3.41.	<p>We stress our concern about the correlation factor between mortality risk and longevity risk.</p> <p>This negative factor appears as relatively low.</p> <p>We agree on the fact that populations in both sub-portfolios can be significantly different and that different tables can be used. But in any case, any trend of</p>	Noted.

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			change in the mortality rates will have the same impact for both-portfolios with opposite consequences.	
182.	CEA	3.41.	<p>We request more realistic analysis of the correlation between mortality and longevity risk</p> <p>The justification provided for a correlation of -0.25 between mortality and longevity is very vague and could just as easily justify a correlation coefficient close to -1.</p> <p>The statement that the mortality and longevity risks refer to different age cohorts is not based on any research. Both risks cannot occur at the same time.</p> <p>We note that Ceiops refers to the CEA feedback in QIS4 on this parameter. However this was a proposal purely for testing in QIS4, as we were firmly of the opinion that the correlation should not be zero. The proposal of -0.25 should not be considered as the final CEA position on the issue.</p> <p>In Ceiops' analysis it first concludes that the correlation factor should not be -1 and then conclude that it would be appropriate to use -0.25. By appropriate we understand that Ceiops can mean that -0.25 contains a lot of prudence and conservatism.</p> <p>Ceiops accepts that there is hedging between these two risks - which we strongly support. A concrete analysis should be performed to determine the most appropriate figure, and we believe that this will result in a correlation parameter close to -1.</p>	<p>Noted.</p> <p>Not agreed. For the reasons given, setting a correlation coefficient of -1 is likely to underestimate the aggregate risk.</p> <p>This has been included as an example.</p> <p>Noted. Reference to CEA position was deleted.</p> <p>Not agreed. The setting of correlation coefficients should be consistent with the 1:200 year target.</p> <p>We believe such analysis will be difficult to perform, given the diversity of risk portfolios across</p>

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				different insurers.
183.	Groupe Consultatif	3.41.	<p>See comment on 3.38.</p> <p>It could equally be argued that an extreme systematic shock to mortality experience (e.g. an earthquake, a medical advance) would have an “across the board” impact on mortality that affects a wide cross section of policyholders and does not differentiate between young vs old or annuities vs term assurances – this is a powerful argument in favour of a stronger negative correlation. We feel that reducing from -1 to -0.25 may in fact overcompensate for the dynamic CEIOPS seeks to address and that something in the range [-0.5,-0.75] may be more appropriate.</p>	Noted. See revised text, which reflects this thought.
184.	Just Retirement Limited	3.41.	The justification set out for -25% for the longevity/mortality correlation is not based on any analysis and could equally be applied to justify a correlation of -50% or -75%.	Noted.
185.	RBS Insurance	3.41.	Whilst we accept that the correlation between mortality and longevity should not be -1, we feel that the selected factor of -0.25 does look very light.	Noted.
186.	ACA	3.42.	It is quoted the observation is casual, the event is likely to be a one off. The correlation parameter seems too high and is not strongly supported by historical evidence.	Noted.
187.	CEA	3.42.	<p>We do not agree with a correlation of 0.5 between expense risk and lapse risk</p> <p>In case of a mass lapse event, management expenses related to in-force business would significantly decrease, offsetting any increase in expenses related to lapses.</p> <p>The correlation of 0.5 is too high.</p>	Noted. It does not appear evident that in the case of a mass lapse event relative management expenses related to in-force business would significantly decrease.

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188.	FFSA	3.42.	<p>Life underwriting correlation factors</p> <p>In case of a mass lapse event, management expenses related to in-force business would significantly decrease, offsetting any increase in expenses related to lapses.</p>	See resolution to comment 187.
189.	ACA	3.44.	<p>It is not clear to us why there is an increase in correlation between lapse and mortality.</p>	See revised text, correlation was left unchanged at zero.
190.	CEA	3.44.	<p>Ceiofs has set the correlation factors for all other risks which have not been discussed in the paper to 0.25. As explained in our comments to Para 3.21 there is no sufficient justification to increase a number of correlation coefficients to 25% or 50% as there is no empirical evidence that the distribution of all life underwriting risks are similar to the one example described in Para 3.20. Therefore, we oppose the changes in the life underwriting correlation matrix as long as there is no stronger evidence.</p> <p>We have specific concerns relating to the following factors:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Correlation between lapse and disability risk: For life insurance products, disability is often a rider which cannot be surrendered on a standalone basis. Hence an increase in lapse rates would lead to lower exposure of the undertaking to disability risk (as the whole policy is surrendered). As lapse risk is a two-sided risk, maintaining the correlation of 0, as was used in QIS4, seems appropriate. <input type="checkbox"/> Correlation between lapse and mortality risk: We do not understand on which basis the correlation factor increased from 0 (in QIS4) to 0.25. <input type="checkbox"/> Correlation between lapse and revision risk: As lapse risk is a two-sided risk (i.e. it might cause losses or profits), maintaining the correlation of 0, as was used in QIS4, between lapse and disability seems appropriate. In addition, generally insured cannot surrender annuities. <input type="checkbox"/> Correlation between revision and mortality risk: We do not understand on which basis the correlation factor increased from 0 (in QIS4) to 0.25. 	Noted. See revised text, which reflects this concern.

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191.	Groupe Consultatif	3.44.	As explained at article 3.20 this is a very shaky basis to increase a number of correlation coefficients to 0,25 or 0,50.	Noted. See revised text.
192.	Investment & Life Assurance Group Ltd	3.44.	<p>We note that several correlations between insurance risks that were previously 0 have been increased to 0.25. The justification for this seems to be that a correlation of 0 is not sufficiently prudent even if risks are theoretically independent (or almost independent). Whilst we have some sympathy with the idea that this may be true for some pairings of risks, where tail correlations may exist even if there is no theoretical reason to assume correlation in "normal" circumstances. Where it can be assumed that risks are almost independent, we feel that 0.25 is too high a correlation factor; the impact of the proposed changes in correlation factors could be much reduced if the assumed correlations for theoretically independent (or almost independent) risks could be calibrated as 0.1 rather than 0.25.</p> <p>We further note that there are some pairings for which, in our opinion, a positive correlation of any magnitude is clearly unsuitable. The most obvious example is the correlation between longevity risk and life catastrophe risk, which would reasonably be assumed to be negatively correlated.</p>	Noted. See revised text, which reflects this concern.
193.	Just Retirement Limited	3.44.	See comment under 3.22.	See resolution there.
194.	Lucida plc	3.44.	<p>We agree that independence does not imply that zero is an adequate correlation factor. We note that there is insufficient evidence implying that 0.25 is any more appropriate than zero.</p> <p>If the risks captured in the life underwriting risk are similar to the example described in paragraph 3.20 then using 0.25 rather than the accurately calculated 0.445 appears to miss the calibration objective of the standard formula.</p>	Noted. See revised text.
195.	Unum	3.44.		Noted.

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	Limited		<p>The justification provided for a correlation of -0.25 between mortality and longevity is very vague and could just as easily justify a correlation coefficient of -0.5 or -0.75.</p> <p>We believe that the correlation factor should at least be -0.5 as this better reflects the nature of dependence between mortality risk and longevity risk i.e. we believe that in general there is a higher degree of young people with longevity risk and a higher degree of old people with mortality risk than is assumed when assessing this correlation factor.</p>	
196.	CEA	3.45.	<p>Justification of the correlation factors is requested</p> <p>Adequate justification is not given for the correlation factors of 0.25. Similarly, why certain correlation factors are 0.5 is not justified.</p> <p>We expect that the QIS4 correlation factors were set using expert judgment. Hence, we would like to understand on which basis this expert judgment has changed. Expert judgment should not introduce high volatility in life underwriting capital requirements (about 11% in life risk as stated in Para 3.46) otherwise it cannot be considered as such. Ceiops should clearly justify any changes from the QIS4 calibration.</p>	Noted.
197.	Deloitte	3.45.	<p>Why is the correlation for catastrophe and mortality the same as that for catastrophe and longevity? What is an example of catastrophe and longevity correlation?</p>	Noted – see revised text which specifies a correlation of 25% between mortality and Cat and a correlation of zero between longevity and CAT.
198.	Just Retirement	3.45.	<p>There is no quantitative justification that the resulting factors are consistent with 99.5% VaR of basic own funds over a 1-year time horizon.</p>	Noted. In the absence of sufficient

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	Limited			statistical data, CEIOPS considers that expert judgement needs to be applied.
199.	PricewaterhouseCoopers LLP	3.45.	We refer to our comments at para 3.22 questioning whether 0.25 is an appropriate correlation factor to assume for risks which are believe to be independent. This comment also applies to para 3.76.	Cf. resolution to comment above.
200.	Unum Limited	3.45.	There is no allowance for diversification here between inception and termination risk for disability business	Noted.
201.	Association of British Insurers	3.47.	The following comment, whilst not specific to the correlation parameters used, has an impact on the suggested correlation matrix. We suggest that premium and reserve risk should be split, rather than amalgamated (as is the current QIS 4 approach) in coming up with the underwriting risk charge.	Not agreed – cf. resolution of comments to CP on the calibration of non-life uw risk.
202.	CEA	3.47.	We have seen that premium and reserve risk show very different correlation assumptions – we suggest that consideration should be given to aggregating these risks separately We note that the level 1 text does not restrict the number of sub-modules that can be used for aggregating non-life risk: Article 105 (2) states that “The non-life underwriting risk module shall...be calculated ... as a combination of the capital requirements for at least the following sub-modules: (a) ...Non-life premium and reserve risk (b) ...Non-life catastrophe risk.” We have seen strong evidence that the premium and reserve risk should be separated and the aggregation of the reserve risk for all lines of business should	Not agreed – cf. resolution of comments to CP on the calibration of non-life uw risk.

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			<p>be done using a certain correlation matrix and a separate/different correlation matrix should be used for the aggregation of premium risk for the lines of business.</p> <p>Afterwards the overall reserve and premium risk can be aggregated applying a correlation factor and a correlation factor of 50% appears suitable.</p> <p>Therefore it appears that three different sub-modules would be appropriate for the non-life underwriting risk module: premium risk, reserve risk and catastrophe sub-module.</p> <p>We have noted, as discussed in our comments to Para B.6, that premium risk correlations appear to be near the QIS4 assumptions, however, reserve risk assumptions appear to be near zero. Therefore it is unlikely to be appropriate to attempt to combine these using one correlation matrix.</p>	
203.	Groupe Consultatif	3.47.	3.47-3.48, 3.77: The matrix is based on the fact, that premium and reserve risk has been already aggregated. We would propose the aggregation of the reserve risk for all lines of business using a certain correlation matrix and separate aggregation of the premium risk for the lines of business using another correlation matrix, which might be different to the first one. Afterwards the overall reserve and premium risk can be aggregated applying a correlation factor of 50%. I.e. we propose three different sub-modules for the non-life underwriting risk: premium risk, reserve risk and catastrophe sub-module.	Not agreed – cf. resolution of comments to CP on the calibration of non-life uw risk.
204.	IUA	3.47.	We suggest that premium and reserve risk should be split, rather than amalgamated (as in the QIS 4 approach) in coming up with the underwriting risk charge. We include this comment here as it would impact the suggested correlation matrix.	Not agreed – cf. resolution of comments to CP on the calibration of non-life uw risk.
205.	Groupe Consultatif	3.48.	<p>The reasoning made in 3.48 – 3.50 appears to be very general.</p> <p>We do not follow the argument that even in case of conceptually independent variables one should use a correlation factor of 0.25.</p>	<p>Noted.</p> <p>Accepted, see revised text.</p>

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			It would be helpful if CEIOPS provides more details of their argumentation which may relate to the risks considered in 3.1.7.	
206.	Lloyd's	3.48.	We agree that premium and reserve risk and non-life catastrophe risk are independent.	Noted.
207.	CEA	3.49.	<p>A material adjustment to correlations is not necessary for the issue discussed by Ceiops</p> <p>This line of reasoning is very vague indeed. What side effects are meant here? And why are they modelled in the reserve and premium risk module?</p> <p>For companies using the factor-based or standardised scenario method to assess catastrophe risk, the modelling practicability argument is not appropriate. Even for personalised scenarios, the elements of a catastrophe loss not captured within the catastrophe module are expected to be immaterial (particularly net, as the loss may be covered by excess of loss reinsurance).</p>	Noted.
208.	EMB Consultancy LLP	3.49.	<p>This comment refers to both 3.49 and 3.50.</p> <p>We have tested this assumption with a simple model whereby modelled premium and reserve risk excluding all elements of CAT is modelled by $PPR \sim \text{Lognormal}(\text{mean}=100, \text{sd}=15)$, and modelled CAT risk is modelled by $PC \sim \text{Pareto}(1, 1.0259)$ distribution. The total premium and reserve risk was set as the modelled premium and reserve risk excluding all elements of CAT, plus a percentage of the modelled CAT risk ($TPR = PPR + k\% * PC$).</p> <p>A true (rank) correlation of 25% between the modelled CAT risk (PC) and the total premium and reserve risk (TPR) was only achieved by setting the proportion of CAT added to the modelled premium and reserve risk to approximately 100% ($k=100\%$). It seems unreasonable that as large a CAT loss may arise from "hidden" cat exposures, as those managed and measured. We would also question whether this argument is valid for those using the CAT risk factor method.</p>	Noted.

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			<p>Having said that, the correlation parameter required to best approximate the aggregate 99.5% VaR through the correlation matrix approach, derived from the example above is approximately 50%, even when $k=0$. So in this case the argument in 3.50 appears to dominate. The factor of 50% varies depending on the assumptions of the modelled distributions.</p> <p>We would thus tentatively suggest that this parameter appears reasonable, though we would recommend further testing based on firms internal models if possible.</p> <p>However we would caution that this parameter should not be used as a benchmark for internal models, since the appropriate value is highly dependent on the aggregation method applied. We believe it would be beneficial if the final level 2 guidance made this distinction explicitly.</p>	
209.	Lloyd's	3.49.	<p>As fed back in other consultations, there will be some correlation between the two modules, but only due to an element of double counting of catastrophe risk in the calibration of premium and reserving risk.</p> <p>As a result, it is wholly inappropriate to require a correlation which would only serve to magnify the initial double count issue.</p>	Noted.
210.	CEA	3.50.	<p>A 25% correlation between CAT risk and premium and reserve risk is totally inappropriate</p> <p>We understand the argument that 0% correlation may not be correct, but it is difficult to quantify what the right correlation should be. 25% seems to be very high to allow for this issue alone. As discussed in our comments to Para 3.21, as no analysis has been carried out to support the selected correlation, the selection of a 25% correlation to capture non-linearity appears to be arbitrary. We feel that a lower correlation or zero correlation would be more appropriate, and more in line with the approach taken by the vast majority of undertaking within their existing capital models, unless Ceiops has clear evidence to prove otherwise.</p>	Noted. See revised text which provides further reasoning.

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			As an aside: The wording seems incorrect: "... in the non-life underwriting risk..."	
211.	Groupe Consultatif	3.50.	As mentioned above, article 3.20 is not convincing at all due to the ad hoc nature of the argument.	Noted.
212.	Lloyd's	3.50.	<p>Catastrophe events by their nature have very skew and heavy tailed loss distributions. In these circumstances, as stated in para 3.10 above, the standard aggregation formula can understate the diversification credit between risks. The argument for increasing the correlation factor under these circumstances is much weaker when very skew distributions exist.</p> <p>To justify this change the example in paragraph 3.20 is given. As discussed earlier, this example does not adequately reflect the reality of the underlying distributions and is inappropriate.</p>	Noted. See revised text, which provides further reasoning.
213.	RBS Insurance	3.50.	<p>The correlation factor between cat risk and premium and reserve risk has not been fully justified and appears prudent to us.</p> <p>We believe the allowance for catastrophe risk is already potentially prudent,</p> <ul style="list-style-type: none"> <input type="checkbox"/> No geographical diversification between territories has been allowed <input type="checkbox"/> There is an element of double counting between use of past claims experience for underwriting risk and the cat risk <p>The final cat risk allowance is not yet certain, but we believe with the above prudence already built in, that a correlation of 0% is appropriate.</p>	Noted.
214.			Confidential comments deleted.	
215.	CEA	3.51.	<p>Please see comments to Para 3.49 and 3.50.</p> <p>Furthermore, we note that we will have a double counting between premium and CAT risk because a share of the CAT-Risk is part of the premium risk.</p>	Noted.

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216.	Deloitte	3.51.	Referring to given examples of independent distributions – catastrophe distributions are unlikely to be normal. Therefore, using the given formula to calculate the non-life SCR, a correlation of 0 is unlikely to be appropriate, even if these were completely independent. Further investigation should be undertaken as to what an appropriate given correlation should be for assumed distributions. Assuming this to be 40% - with reference to examples 1 and 2, and given that catastrophe and premium and reserve may not be completely independent, a correlation factor of 50% seems to be more justifiable than 25%.	Noted.
217.	Groupe Consultatif	3.51.	<p>This would result in a double counting between premium and CAT because a share of the CAT-Risk is part of the premium risk.</p> <p>In section 3.1.4 it is illustrated that even in the case of independent risks, there might be a need for using a non-zero correlation factor. This is due to the fact that we probably do not have normal distributions and so the aggregation of VaR values in the same way as standard deviations may not be correct. However, when estimating a standard deviation at the aggregated level, independent risks should always be given correlation zero. Hence, if we first aggregate standard deviations, using true correlations like zero in the independent case, and then finally assume a Lognormal (LogN) for the total risk (at any level), then we make no error in assuming zero correlation. So let us aggregate standard deviations and then use the typical LogN formula for finding VaR, and there will be no errors. This is much more appealing than inventing an artificial correlation between Cat and PR.</p> <p>Furthermore, if the correlations of the standard model are to serve as a benchmark for internal models, then we must work with true correlation and not this kind of adjusted correlations, since in internal models we really simulate independent risk for Cat and PR. Since it is up to the undertaking to prove why a different value than in the standard value is used, this is an important issue</p>	Noted.

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			for internal models. This may result in a double counting between premium and CAT because a share of the CAT-Risk is part of the premium risk.	
218.	Just Retirement Limited	3.51.	There is no quantitative justification that the resulting factors are consistent with 99.5% VaR of basic own funds over a 1-year time horizon.	Noted.
219.	Lloyd's	3.51.	We strongly oppose the proposed increase in the correlation parameter to 0.25. It should remain at 0. The justification is extremely weak for this change and subjective. The proposal would magnify the failing (and overstatements) in the calibration of the premium and reserve risk due to double counting of catastrophe risk. The justification is based on para 3.20 which we have shown to be an inconsistent and thus unreliable support for the proposal.	Noted.
220.	PricewaterhouseCoopers LLP	3.51.	We refer to our comments at para 3.22 questioning whether 0.25 is an appropriate correlation factor to assume for risks which are believe to be independent. However, we acknowledge that it is conceivable that, in extreme tail risk cases, the correlation between the sub-modules may be greater than zero, due to the effect that catastrophes may have on the pricing of alternate lines or in the legal environment. This comment also applies to para 3.77.	Noted.
221.	RSA Insurance Group	3.51.	There is little scientific justification for the parameter chosen.	Noted.
222.	Unum Limited	3.51.	[We encourage members to share which factors they have identified as critical on non life underwriting risk. Any additional argument whether numerical or not to challenge CEIOPS' calibration would also be appreciated.]	Noted.
223.	PricewaterhouseCoopers LLP	3.52.	The extent of any additional risk arising from a previously unconsidered	Noted.

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	useCoopers LLP		correlation between catastrophe and premium&reserve risk sub-modules is likely to be small, in light of the limited set of scenarios under which the two would interact. This is reflected in previous assumptions that the modules were uncorrelated. Using a 0.25 correlation factor results in an estimated increase in the non-life risk capital requirements of 7% and Basic SCR of 3%. This appears high in light of the above comments and suggests that the 0.25 factor may be too high.	
224.	Groupe Consultatif	3.53.	This comment refers to the whole section 3.1.8. This section needs further advice. We would like to suggest to explain more in detail how the operational risk interacts with the basic SCR in this section.	Noted.
225.	Investment & Life Assurance Group Ltd	3.53.	We note that under the current proposals, all correlation factors are a multiple of 0.25. In view of the significant impact that the proposed changes in correlation factors between SCR components have on overall SCR results, we suggest that not all correlation factors should be increased in multiples of 0.25. For example, if a previously suggested correlation of 0.25 is now deemed inadequate, it should not simply be automatically increased to 0.5 without first considering it would be more appropriate for it to lie somewhere in between 0.25 and 0.5.	Noted. However, for reasons of simplicity current approach is kept.
226.	CEA	3.54.	The emphasis on the high dependence between the risks of life insurance and health are exaggerated. This is so, because a substantial part of the life portfolio consists of endowments which are in payment. These insurance contracts are not related to health at all. Disability rates are substantially higher than mortality rates, moreover they have different drivers and these different drivers should be used in determining the correlation factors.	Noted.
227.	Groupe Consultatif	3.54.	The emphasis on the high dependence between the risks of life insurance and health are exaggerated. This is so, because a substantial part of the life portfolio consists of endowments which are in payment. These insurances are not related to health at all.	Noted. See revised text.

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			Disability rates are substantially higher than mortality rates, moreover they have different drivers. For example, disability can be caused by stress. Mortality is hardly affected by stress factors.	
228.	PricewaterhouseCoopers LLP	3.54.	We continue to stress the importance of further clarification on the criteria that should be used to determine whether the health component of a contract can be unbundled from other components and how to assess the materiality of the health risk. It would be helpful if, where practical and relevant, the requirements for unbundling are aligned with those in IFRS.	Noted.
229.	Groupe Consultatif	3.55.	The argument held here that the mortality and longevity changes are applicable both to the health and the life portfolio seems likely. However, the disability rates are still significantly higher than the mortality rates for worker's compensation insurance. This means that the life uncertainty is of minor importance in relation to the disability rates here.	Noted.
230.	AMICE	3.58.	Correlation factor for life underwriting risk and health underwriting risk Setting a correlation factor of 0.75 (compared to 0.25 in level 1 text) to avoid undertakings arbitrage opportunities seems restrictive and does not sound like expert judgment. Indeed, in France, most health riders within life contracts concern only disability and they are handled in the disability sub-module of the life underwriting risk module. Selling the same health cover on a stand-alone basis requires the undertaking to launch a non-life company which is unlikely to happen.	Noted. See revised text.
231.	Association of British Insurers	3.58.	Correlation factors are not sufficiently justified	Noted.
232.	CEA	3.58.	Correlation factor between life and health underwriting risks is not sufficiently justified Setting a correlation factor of 0.75 (compared to 0.25 in the level 1 text) to avoid arbitrage opportunities is excessively restrictive and not based on expert judgment.	Noted.

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			<p>For a life undertaking to sell the same health cover on a stand-alone basis it will need to launch a non-life company which is unlikely to happen as a result of the correlation factors set out in the Framework Directive.</p> <p><input type="checkbox"/> This correlation factor is not in line with the level 1 text and should be kept at the level specified there.</p>	
233.	FFSA	3.58.	<p>Correlation factor for life underwriting risk and health underwriting risk</p> <p>Setting a correlation factor of 0.75 (compared to 0.25 in level 1 text) to avoid undertakings' arbitrage opportunities seems restrictive and does not sound like expert judgment.</p> <p>Indeed, in France, most health riders within life contracts concern only disability and they are handled in the disability sub-module of the life underwriting risk module. Selling the same health cover on a stand-alone basis requires the undertaking to launch a non-life company which is unlikely to happen.</p>	Noted.
234.	GROUPAMA	3.58.	<p>Correlation factor for life underwriting risk and health underwriting risk</p> <p>Setting a correlation factor of 0.75 (compared to 0.25 in the level 1 text) to avoid undertakings' arbitrage opportunities seems restrictive and does not indicate expert judgment.</p> <p>Indeed, in France, most health riders within life contracts only concern disability and they are handled in the disability sub-module of the life underwriting risk module. Selling the same health cover on a stand-alone basis requires the undertaking to launch a non-life company which is unlikely to happen.</p>	Noted.
235.	Unum Limited	3.58.		
236.	CEA	3.59.	Please see comments to Para 3.58.	Noted. Sub-section was deleted.

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237.	Groupe Consultatif	3.59.	In the light of the arguments above 0,5 seems more appropriate.	Noted. Sub-section was deleted.
238.	Lloyd's	3.59.	We disagree with the increase from 0.25 to 0.75. It is inappropriate to change the Level 1 text based on weak and limited analysis.	Noted. Sub-section was deleted.
239.	Lucida plc	3.59.	We agree with the reasoning that it might be necessary to have a high correlation factor between life underwriting risk and health underwriting risk, to avoid arbitrage. We note that this does not attempt to meet the calibration objective of the standard formula.	Noted. Sub-section was deleted.
240.	PricewaterhouseCoopers LLP	3.59.	We agree that increasing the correlation factor for life and health underwriting risks is appropriate given the restructuring of the health underwriting risk module and is necessary to reduce regulatory arbitrage opportunities.	Noted. Sub-section was deleted.
241.	Unum Limited	3.59.	Correlation factors are not sufficiently justified	Noted. Sub-section was deleted.
242.	Association of British Insurers	3.60.	Correlation factors are not sufficiently justified	Noted.
243.	CEA	3.60.	Correlation factor between non-life and health underwriting risks is not sufficiently justified The correlation factor for the non-life underwriting risk and the health underwriting risk should be quantitatively justified. There is no reason to assume a (material) correlation at all (more sickness mean more fires?). We question why it is necessary to depart from the Level 1 text. Furthermore, we note that we will have a double counting between premium and CAT risk because a share of the CAT-Risk is part of the premium risk.	Noted.
244.	GDV e.V.	3.60.	We are concerned about the lack of the LoB "accident" in the nonlife-modul. We	Noted.

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			once more reiterate our request to shift "accident" from the "health"-modul into the nonlife-modul. We refer to our comments in CP 48, 50, 71 and CP 72.	
245.	Groupe Consultatif	3.60.	It would be better to regard accident as a part of non-life than setting a correlation parameter. Setting a correlation of 0.25 will be wrong in all cases, when one has no accident or only pure health business.	Noted.
246.	PricewaterhouseCoopers LLP	3.60.	Similarly, we support the decision to increase the correlation factor for non-life and health underwriting risk modules to bring it into line with that used in QIS 4.	Noted.
247.	CEA	3.61.	No empirical proof is given for the stated correlations. These arguments relate to a "correlation feeling" rather than a scientifically based approach.	Noted.
248.	EMB Consultancy LLP	3.61.	This comment refers to paragraphs 3.61-3.64. These arguments seem to rely heavily on the counterparty default risk being at least strongly influenced, and possibly dominated, by the default risk in relation to financial derivatives. In our experience, the counterparty default for non-life insurance firms is dominated by reinsurance default risk, with additional exposure to broker defaults. The arguments applied here hence would not be expected to apply to non-life insurance firms, and so this parameter may be prudent in this case.	Noted.
249.	Groupe Consultatif	3.61.	The article says: 'The counterparty default risk module captures in particular the default risk in relation to financial derivatives'. However, for most insurers the counterparty default risk is especially applicable to fixed interest investments.	Noted.
250.	Lloyd's	3.61.	The argument put forward here is centred around financial derivatives. For most non-life insurers the biggest counterparty default risk by far is from reinsurers, who have faired well in the recent crisis. These comments are focussed on the financial crisis in the banking sector, instead of on significant issues such as links to reinsurer failure, from which very different conclusion would be drawn. There is no justification for increasing the correlation between market risk and	Noted.

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			reinsurance failure.	
251.	Groupe Consultatif	3.64.	This is too high due to the fact that the counterparty default risk relates primarily to fixed interest investments.	Noted.
252.	Just Retirement Limited	3.64.	This correlation seems unreasonably high for reinsurance counterparties who are likely to be much less exposed to market risk than derivative counterparties.	Noted.
253.	Lloyd's	3.64.	It is inappropriate to change the Level 1 text based on weak and limited analysis.	Noted.
254.	CEA	3.66.	Taking account of the effect of the recent crisis on insurance companies, we don't see the rational of such an increase in the SCR.	Noted.
255.	FFSA	3.66.	Regarding the effect of the actual crisis on insurance companies, we don't see the rational of such an increase of the SCR.	Noted.
256.	IUA	3.66.	This is only an average and different firms will observe differing impacts; the variation of those differences will also be important. This increased capital requirements combined with other changes proposed elsewhere will amount to significant increases in overall capital requirements and appears unjustified in light of insurers' resilience to the current financial crisis.	Noted.
257.	Just Retirement Limited	3.66.	See comment under 3.37.	Noted.
258.	ACA	3.67.	We agree that it is necessary to build a process to update standard formula parameters in order to be more consistent year after year.	Noted.
259.	IUA	3.67.	SECTION 3.1.10: Article 109(1c) states that implementing measures shall be provided on "the correlation parameters, including if necessary, those set out in Annex IV and	Not agreed. We consider that the "if necessary" refers to the correlation

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			the procedures for the updating of those parameters". This section makes no justification to whether or not implementing measures are required for the procedure of updating the correlation parameters, and it remains unclear under what circumstances those parameters can be adjusted; for example, such as in instances where there was sufficiently robust evidence suggesting an increase or decrease in those parameters were justified, and any change would be subject to public consultation.	factors set out in Annex IV.
260.	Just Retirement Limited	3.68.	While we accept the lack of data for underwriting risks, we disagree that there is little empirical data for market risks; many well-developed time series of asset returns are readily available (and have been used in other consultation papers, e.g. CP70, as well as much academic and professional research). It is disappointing that the use of empirical data has been overlooked in favour of the primarily qualitative arguments advanced in the paper, particularly in relation to the tests set out for internal model approval, the spirit of which should equally apply to the calibration of the standard formula.	Noted and agreed. See revised text.
261.	Lloyd's	3.68.	We agree that there is a lack of empirical data. This supports the argument that it is inappropriate to change the requirements for such an important topic without further, detailed analysis and consultation with industry experts.	Noted.
262.	XL Capital Ltd	3.69.	Instead of making such large changes that are not based on empirical data, perhaps it would sense to only make changes when the empirical data has been assessed or surveying companies that this will affect. Otherwise it is difficult to see how this will pass a validation test.	Noted.
263.	CEA	3.71.	See comment on Para 3.79	Cf. resolution taken there.
264.	ACA	3.72.	The impact of the change in correlation parameters value is a 25% increase of the BSCR, it is quite significant. We are not always convinced with the CEIOPS justification of the assessment of the change of the correlation parameter value.	Noted.

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265.	CRO Forum	3.72.	CEIOPS should provide evidence that the proposed calibration parameters are best-estimate parameters rather than conservative ones.	Noted. CEIOPS has undertaken further statistical analysis to support the estimation.
266.	Just Retirement Limited	3.72.	See comment under 3.38.	Cf. resolution taken there.
267.	KPMG ELLP	3.72.	<p>The changes in the correlation parameters do not appear to have been developed in a robust manner and rely principally on expert judgement and heuristic arguments.</p> <p>We note that the estimation of correlations and dependency is difficult and that the estimation of tail dependency is even more difficult. Therefore we accept that that the correlations cannot always be based on quantitative analysis and must to a degree rely of general reasoning for the basis of their argument.</p> <p>Quantitative analysis, albeit that it would be subject to a great deal of sampling error, would nonetheless have been helpful in explaining the expert judgement being made with regard to these correlations. Having said this we agree that in the market conditions of late 2008 many markets all moved downward at the same time. Taking this event as the 1-in-200 event could suggest a lack of diversification.</p> <p>We would question however whether the strength of correlation between interest rates and equity was as high as 50%. The paper argues that central banks tend to lower interest rates when markets crash, which was true during the 2008 crisis. However even then one needs to consider the movements in the longer end of the yield curve which will not be 100% correlated with the short end controlled by the central bank rate policy. The longer end is arbuably much more important for many long term insurers.</p>	Noted. We refer to the additional statistical analysis carried out by CEIOPS.
268.	Munich Re	3.72.	CEIOPS should provide evidence that the proposed calibration parameters are best-estimate parameters rather than conservative ones.	Noted. CEIOPS has undertaken further

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				statistical analysis to support the estimation.
269.	Association of British Insurers	3.73.	Correlation factors are not sufficiently justified We agree that the correlations should allow for tail dependence between risks but do not agree with deviating from linear correlation coefficients to make up for potential shortcoming in the calculation approach.	Noted. CEIOPS has undertaken further statistical analysis to support the estimation.
270.	CEA	3.73.	There is a significant lack of justification for the correlation parameters chosen we support the comments in this Para that correlation parameters may deviate from the linear correlation coefficients if they do not consider appropriately the tail dependencies between risks. However Ceiops does not provide empirical evidence - or at least expert judgement (sometimes needed due to the lack of data) - before adjusting the correlation coefficient to a value higher than zero as proposed in section 3.1.4 (independent risk).	Noted. CEIOPS has undertaken further statistical analysis to support the estimation. Noted.
271.	CRO Forum	3.73.	Where CEIOPS believes that the standard aggregation of a pair of risk factors is not adequate, assumptions on the underlying stochastic model should be provided. This should be done case by case. <input type="checkbox"/> What typical distributions are assumed for the risk factors? (e.g. skewed, truncated) <input type="checkbox"/> What assumptions are made with respect to the typical dependency structure? (e.g. tail dependency)	Noted.

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272.	GDV e.V.	3.73.	There is a significant lack of justification for the correlation parameters chosen we support the comments in this Para that correlation parameters may deviate from the linear correlation coefficients if they do not consider appropriately the tail dependencies between risks. However CEIOPS does not provide empirical evidence including the resp. methods - or at least expert judgement (sometimes needed due to the lack of data) - before adjusting the correlation coefficient to a value higher than zero as proposed in section 3.1.4 (independent risk).	Cf. resolution to comment 270, above.
273.	Just Retirement Limited	3.73.	See comment under 3.22.	Cf. resolution taken there.
274.	Legal & General Group	3.73.	We agree that the correlations should allow for tail dependence between risks but do not agree with deviating from linear correlation coefficients to make up for potential shortcoming in the calculation approach.	Noted.
275.	Lloyd's	3.73.	There needs to be great care in deriving simple solutions to the complex issues outlined. The solutions in this CP are based on limited data and analysis.	Noted.
276.	Munich Re	3.73.	Where CEIOPS believes that the standard aggregation of a pair of risk factors is not adequate, assumptions on the underlying stochastic model should be provided. This should be done case by case. <input type="checkbox"/> What typical distributions are assumed for the risk factors? (e.g. skewed, truncated) <input type="checkbox"/> What assumptions are made with respect to the typical dependency structure? (e.g. tail dependency)	Noted. Cf. revised section 3.1.4.
277.	Unum	3.73.	Correlation parameters are not sufficiently justified	Noted.

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	Limited			
278.	AFS	3.74.	We note again that some of the correlations seem particularly hard to understand. Also if these proposals are adopted they may reduce the incentive for good risk management through diversification	Noted.
279.	AMICE	3.74.	<p>Correlation between equity and property</p> <p>We do not see on which basis CEIOPS sets the correlation factors of equity risk and property risk to 0.75. We note that there is a diversification effect between property and other risks. For example :</p> <p>So the correlation suggested in the CP or in the QIS 4 is too high.</p> <p>Correlation between concentration risk and other market risks</p> <p>The concentration risk module is based on a totally different concept than other risk modules. In consequence, setting a correlation parameter between correlation risk and other market risks has no meaning. Hence, the correlation parameters should be set at 0.</p>	<p>Cf. the statistical analysis CEIOPS has undertaken.</p> <p>Cf. resolution to comments made in context of section 3.1.5.</p>
280.	Association of British Insurers	3.74.	We do not believe that these factors are consistent with a 1 in 200 year event and encourage CEIOPS to consider further statistical work on these parameters based on the paper prepared for the CEA (the paper will accompany their response).	Cf. the statistical analysis CEIOPS has undertaken.
281.	Association of Danish Mortgage Banks (Realkreditrådet)	3.74.	<p>Correlations between concentration risk and other market risks.</p> <p>The table is CEIOPS's updated correlation factors for market risk. The correlation factors now include high correlations between concentration risk and market risks (i.e. interest rate risk, equity risk, spread risk and currency risk).</p> <p>Such measures should only be introduced if there is empirical evidence to support them.</p>	Cf. resolution to comments made in context of section 3.1.5.

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			We suggest that the correlation should be 0 as in QIS4.	
282.			Confidential comments deleted.	
283.	CEA	3.74.	See comments to Paras 3.31, 3.32, 3.33, 3.35 and 3.36.	Cf. resolution taken there.
284.	CRO Forum	3.74.	<p>Correlations in the standard model should be considered in conjunction with the calibration of the shocks to target a 1-in-200 level.</p> <p>Indeed, the diversification benefit implied by the CEIOPS proposal on market risk correlation matrix (16%) is equivalent to the diversification benefit effectively experienced in the financial markets in the year of the financial crisis in 2008; which is in fact quite conservative, as (i) in parallel the new calibrations for some individual shocks already reproduce the worst shocks observed ever (and even sometimes more), and (ii) the period with the worst correlation observed does not necessary coincide with the period with the worst shocks (see section 2.1 on back-testing).</p> <p>The CRO forum has prepared a separate document on the calibration of correlation factors with a particular focus on market risk correlations (CROF, 12/2009, Calibration recommendation for the correlations in the Solvency II standard formula). We refer to the study for further arguments on market risk correlations and a quantitative proposal for QIS5.</p>	<p>Agreed, cf. section 3.1.3.</p> <p>Noted. CEIOPS has aimed to setting correlation parameters consistent with the 99.5% VaR standard. CEIOPS agrees that the calibration of correlation parameters should be based on appropriate and reliable methodologies using adequate data and assumptions.</p> <p>CEIOPS has undertaken further statistical analysis to revise the factors in the market risk module.</p>

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285.	FFSA	3.74.	<p>Correlation between equity and property</p> <p>FFSA does not see on which basis CEIOPS sets the correlation factors of equity risk and property risk to 0.75. FFSA notices that there is a diversification effect between property and other risks. For example :</p> <ul style="list-style-type: none"> - During the period 1994 – 1998: French equity index (CAC40) increased by 100% while property fell by 12.5 % - During the period 2000 – 2002: French equity index (CAC40) dropped by 45% while property increased by 42 % <p>This example shows that the CEIOPS calibration is excessively prudent</p> <p>Hence, FFSA considers that the correlation between property and other risks was already too high in QIS4.</p> <p>Indeed, following a study performed on the French, UK and US markets we observe that the correlation between equity and property ranges between 0.13 and 0.47 which is lower than the suggested correlation factor of 0.75 by CEIOPS. FFSA believes that a correlation factor of 0.25 is aligned with market observations</p>	<p>CEIOPS has carried out extensive both qualitative and quantitative analysis to revise the correlation parameters of the market risk for the calculation of the SCR. This analysis shows that the overall level of diversification effect resulting from the correlation matrix as proposed in the Consultation Paper is broadly adequate. More detailed background information on the statistical quantitative analysis undertaken is now provided in the annex. However, CEIOPS agrees that some coefficients may be lowered in light of the further research undertaken by both CEIOPS and other stakeholders</p>
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France sur la période 1986-2008 (données annuelles)²

Indices (annuels)	IPD Résidentiels	IPD Bureaux	EPRA France	CAC 40
IPD Résidentiel	1,00			
IPD Bureaux	0,90	1,00		
EPRA France	0,43	0,23	1,00	
CAC 40	0,14	0,21	0,59	1,00

France sur la période 1999-2008 (données trimestrielles)

Indices (trimestriels)	IPD Résidentiels	IPD Bureaux	IPD Commerces	EPRA France	CAC 40
IPD Résidentiels	1,00				
IPD Bureaux	0,72	1,00			
IPD Commerces	0,81	0,87	1,00		
EPRA France	0,40	0,27	0,40	1,00	
CAC 40	0,27	0,39	0,42	0,41	1,00

UK sur la période 1986-2008 (données annuelles)

Indices (annuels)	IPD Résidentiels UK	IPD Bureaux UK	IPD Commerces UK	EPRA UK
IPD Résidentiels UK	1,00			
IPD Bureaux UK	0,83	1,00		
IPD Commerces UK	0,67	0,86	1,00	
EPRA UK	0,54	0,72	0,78	1,00
FTSE 100	0,30	0,43	0,47	0,40

UK sur la période 1987-2009 (données trimestrielles)

Price Index Appreciation UK: 1987Q1-2009Q2

	FTSE 100	All Property	All Retail	All Office	All Industrial
FTSE 100	1,00				
All Property	0,18	1,00			
All Retail	0,19	0,97	1,00		
All Office	0,15	0,97	0,88	1,00	
All Industrial	0,18	0,97	0,91	0,94	1,00

since the release of the Consultation Paper.

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USA sur la période 1986-2009 (données trimestrielles)

Price Index Appreciation U S: 1986Q1-2009Q2

	<i>US Equity REITs</i>	<i>DJ Industrial Average</i>	<i>Office</i>	<i>Retail</i>	<i>Industrial</i>	<i>Residen</i>
US Equity REITs	1,00					
DJ Industrial Average	0,53	1,00				
Office	0,24	0,16	1,00			
Retail	0,18	0,12	0,70	1,00		
Industrial	0,29	0,18	0,94	0,75	1,00	
Residential	0,30	0,18	0,84	0,76	0,91	

Data is based on the following indexes:

- IPD (International Property Databank <http://www.ipd.com/>) for France and UK
- EPRA (European Public Real Estate Association <http://www.epra.com/>) for France and UK
- (National Council of Real Estate Investment Fiduciaries <http://www.ncreif.com/>) for the US market
- US Equity REITS published by NAREIT (National Association of Real Estate Investment Trusts <http://www.reit.com/>) for the US market
- Equity index: CAC40 for France, Footsie 100 for UK and DJ Industrial Average for the US market

Correlation between property and interest rate

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France: Quarterly observations between 1999 and 2008

	IPD Résidentiel	IPD Bureaux	IPD Commerces	EPRA France
JPM EMU FRANCE ALL MATS	-0,27	-0,42	-0,44	-0,37

France: Annual observations between 1994 and 2008

	IPD Résidentiel	IPD Bureaux	EPRA France	CAC 40
JPM EMU FRANCE ALL MATS	-0,51	-0,54	-0,16	-0,27

UK

Price Index Appreciation UK: 1987Q1-2009Q2

	UK Bonds Basket	All Property	All Retail	All Office	All Industrial
UK Bonds Basket	1,00				
All Property	-0,29	1,00			
All Retail	-0,25	0,97	1,00		
All Office	-0,30	0,97	0,88	1,00	
All Industrial	-0,33	0,97	0,91	0,94	1,00

USA

Price Index Appreciation US: 1986Q1-2009Q2

	US Bonds Basket	Office	Retail	Industrial	Residential
US Bonds Basket	1,00				
Office	-0,07	1,00			
Retail	-0,12	0,70	1,00		
Industrial	-0,07	0,94	0,75	1,00	
Residential	-0,10	0,84	0,76	0,91	1,00

FFSA concludes that correlation between interest rate and property is negative

Correlation between equity and spread

FFSA proposes a 50% correlation parameter between equity and spread

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(against 0.75)

Indeed, the table below shows correlations over the time period from 1.1.1999 to 30.06.2009 for AAA to A bonds. The correlations are negative since decreases in equities typically go along with increases in spreads.

	DAX	SX5E	CAC	FTSE	SPX	SMI	NKY
SPREAD EUR A	-0.46	-0.45	-0.46	-0.48	-0.5	-0.43	-0.48
SPREAD EUR AA	-0.38	-0.38	-0.37	-0.44	-0.41	-0.33	-0.41
SPREAD EUR AAA	-0.24	-0.25	-0.25	-0.31	-0.25	-0.21	-0.26
SPREAD USD A	-0.43	-0.42	-0.41	-0.5	-0.51	-0.38	-0.46
SPREAD USD AA	-0.3	-0.32	-0.31	-0.4	-0.4	-0.31	-0.37
SPREAD USD AAA	-0.31	-0.31	-0.29	-0.38	-0.38	-0.32	-0.38
SPREAD GBP A	-0.43	-0.42	-0.42	-0.5	-0.47	-0.43	-0.48
SPREAD GBP AA	-0.31	-0.29	-0.29	-0.39	-0.33	-0.33	-0.35
SPREAD GBP AAA	0.23	0.2	0.2	0.28	0.24	0.21	0.28
SPREAD JPY A	-0.03	-0.01	-0.02	-0.06	-0.17	-0.09	-0.18
SPREAD JPY AA	-0.19	-0.17	-0.15	-0.17	-0.24	-0.13	-0.14
SPREAD JPY AAA	0.12	0.18	0.19	0.13	0.12	0.17	0.07
SPREAD CHF A	-0.39	-0.4	-0.39	-0.39	-0.43	-0.43	-0.45
SPREAD CHF AA	-0.23	-0.23	-0.23	-0.27	-0.26	-0.24	-0.26
SPREAD CHF AAA	-0.19	-0.2	-0.19	-0.21	-0.2	-0.18	-0.21
SPREAD AUD A	-0.2	-0.18	-0.19	-0.26	-0.21	-0.24	-0.21
SPREAD AUD AA	-0.18	-0.14	-0.15	-0.19	-0.15	-0.2	-0.12
SPREAD AUD AAA	-0.18	-0.14	-0.16	-0.19	-0.19	-0.18	-0.16
SPREAD CAD A	-0.38	-0.39	-0.39	-0.41	-0.47	-0.37	-0.44
SPREAD CAD AA	-0.3	-0.31	-0.32	-0.33	-0.36	-0.35	-0.31
SPREAD CAD AAA	-0.18	-0.15	-0.17	-0.23	-0.2	-0.17	-0.21

In particular, the table shows that correlation between single A rated bonds and equity is on average close to 50% (more precisely slightly below 50%). As we can consider single A rated investments as representative of the insurer's corporate portfolio, we propose to use a correlation of 50% between equity and spread.

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			<p>Correlation between equity and interest rates</p> <p>FFSA is in favour of the following correlation factors between equity and interest rate:</p> <p>— For upward shocks on interest rates: 0</p> <p>For downward shocks on interest rates : 0.5</p> <p>FFSA considers that a correlation of 0 should be retained as in QIS4</p> <p>Correlation between concentration risk and other market risks</p> <p>The concentration risk module is based on a totally different concept than other risk modules. In consequence, setting a correlation parameter between correlation risk and other market risks has no meaning. Hence, the correlation parameters should be set at 0,as in QIS4</p>	<p>Not agreed. The concentration risk sub-module covers the additional loss (compared to a well-diversified portfolio) that the undertaking may incur if concentrations in the equity, bond or property portfolio in respect to a single counterparty exist. This risk is not captured in the equity, property or spread risk and therefore and adjustment for concentration risk has to be made for these risks.</p>
286.	GROUPAMA	3.74.	<p>The concentration risk module is based on a totally different concept from other risk modules. In consequence, setting a correlation parameter between correlation risk and other market risks makes no sense. Hence, the correlation parameters should be set at 0.</p> <p>We cannot see the basis on which CEIOPS sets the correlation factors of equity risk and property risk at 0.75. We notice that there is a diversification effect between property and other risks. For example:</p>	<p>Cf. to resolution on comment 285.</p>

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			<p>- During the period 1994 – 1998: the French equity index (CAC40) increased by 100% while property fell by 12.5%</p> <p>- During the period 2000 – 2002: the French equity index (CAC40) dropped by 45% while property increased by 42%</p> <p>So the correlation suggested in the CP or in the QIS4 is too high.</p>	
287.	Groupe Consultatif	3.74.	<p>We suggest to increase correlation factors, but moderately unless there is no further quantitative evidence from recent experience.</p> <p>Interest Rate/Equity The realized correlation is historically very unstable. The one year correlation computed based on weekly data (which arguably underestimates the relationship due to leads and lags) ranges between +/-65% for the EUR, +65%/-70% for GBP, +67%/-52% for JPY and +/-61%/-66% for the US. As deflation and high inflation, and correspondingly low and high rates is related to bad economic performance it makes sense for the “two sided risk” to be positively correlated to an equity drop. Moreover this is supported by the data. Based on realised correlation, the 50% level is rather at the lower range of what the data suggests. However, more important than weekly correlations is to what extent the extreme historical events coincide. There, one can find a strong relationship, like the largest decline in German rates corresponds to the largest equity drop (2008), the largest rate spike in the UK in 1974/75 coincides with the worst post-war one year equity performance in the UK (equities dropped by 55%). However, there are also clear diversification effects, like the largest one year spike in Germany was related to the reunification in the context of rising equities.</p> <p>Equity/Spread One could argue that spread risk is an asymmetric version of equity risk which is simply more senior in the capital structure. At least in the extremes, both risks should be driven largely by the same risk factors, the financial viability of the companies, or at least the markets perception of it. As such one should expect extreme equity crashes to be accompanied by extreme movements in spreads, which is confirmed by the data available to us. The two worst equity scenarios in the past 100 years (Great depression and credit crunch) correspond also to the worst performances of spread risk. While there</p>	<p>Noted. CEIOPS has undertaken further statistical analysis to support the estimation which can now be found in the annex. We refer to the results of CEIOPS’ statistical analysis of individual correlation pairs.</p>

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			<p>may be some diversification effect in the central scenarios, one should not expect any diversification in the one in two hundred years event.</p> <p>Spread/[Rate,...] Adopting the point in the previous comment would imply using correlation factors identical to the corresponding equity factors.</p> <p>Property/[Rate, Equity,...] This correlation risk is probably one of the hardest to assess. There is limited available data, property markets across Europe follow different dynamics and the type of properties follow also different dynamics. While the recent boom and busts coincided with similarly performing property markets in the UK, US and Spain, there seems to be a much weaker relationship for example in Germany. While the correlation factors are probably adequate e.g. for UK property investors, they are arguably too high for other markets like e.g. Germany and correspondingly penalizing relatively the local investors there. That being said, there is no easy way out without generating excessive complexity.</p> <p>FX/[Rate,...] While it seems easy to us to justify the positive correlation between equities and interest rates, irrespective of the direction of the shock, it seems more difficult to make a corresponding argument for FX. While it is understandable not to complicate the standard formula too much, not differentiating between currencies will penalize insurance companies with exposure in relatively safe currencies relative to others.</p> <p>We suggest to increase correlation factors, but moderately unless there is no further quantitative evidence from recent experience.</p>	
288.	Just Retirement Limited	3.74.	See comment under 3.36.	
289.	Legal & General Group	3.74.	We do not believe that these factors are consistent with a 1 in 200 year event and encourage CEIOPS to consider further statistical work on these parameters based on the paper prepared for the CEA (the paper will accompany their response).	Noted. CEIOPS undertook further statistical analysis to assess the

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				appropriateness of its assumptions. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.
290.	Lloyd's	3.74.	The parameters should be left unchanged from QIS4 without a far more complete and detailed review, with input from industry experts.	Noted. Cf. to resolution on comment 289.
291.	Munich Re	3.74.	<p>Correlations in the standard model should be considered in conjunction with the calibration of the shocks to target a 1-in-200 level. Indeed, the diversification benefit implied by the CEIOPS proposal on market risk correlation matrix (16%) is equivalent to the diversification benefit effectively experienced in the financial markets in the year of the financial crisis in 2008; which is in fact quite conservative, as (i) in parallel the new calibrations for some individual shocks already reproduce the worst shocks observed ever (and even sometimes more), and (ii) the period with the worst correlation observed does not necessary coincide with the period with the worst shocks (see section 2.1 on back-testing).</p> <p>The CRO forum has prepared a separate document on the calibration of correlation factors with a particular focus on market risk correlations (CROF, 12/2009, Calibration recommendation for the correlations in the Solvency II standard formula). We refer to the study for further arguments on market risk correlations and a quantitative proposal for QIS5.</p>	<p>Noted. See the general aim of setting correlation parameters as set out in section 3.1.3.</p> <p>CEIOPS has carried out extensive both qualitative and quantitative analysis to revise the correlation parameters of the market risk for the calculation of the SCR.</p>

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292.	PricewaterhouseCoopers LLP	3.74.	Refer to comment at para 3.36.	Noted.
293.	RSA Insurance Group	3.74.	There is little scientific justification for the parameters chosen.	Noted. CEIOPS has undertaken further statistical analysis to support the estimation which can now be found in the annex.
294.			Confidential comments deleted.	
295.	AMICE	3.75.	We share the minority view that there is not correlation between interest rate and equities (sometimes is positive and sometimes is negative)	Noted. CEIOPS has further elaborated its advice on the possibility to introduce bi-directional or two-sided correlation factors for some risks to express the difference of the correlation in times of upward or downward movements of the risks.
296.			Confidential comments deleted.	
297.	CRO Forum	3.75.	There is an indication that the QIS4 market risk results are optimistic compared to internal models, see CRO forum QIS4 Benchmarking study (CROF, October	Noted. CEIOPS has undertaken further

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			2008).	statistical analysis to revise the factors in the market risk module.
298.	Lloyd's	3.75.	<p>We agree there is not enough evidence to change the assumptions from QIS4.</p> <p>In this case, there are other examples where there has been negative correlation between equities and interest rate risk.</p>	<p>Noted. CEIOPS undertook further statistical analysis to assess the appropriateness of its assumptions.</p> <p>Noted. Cf. to resolution on comment 295.</p>
299.	Munich Re	3.75.	<p>There is an indication that the QIS4 market risk results are optimistic compared to internal models, see CRO forum QIS4 Benchmarking study (CROF, October 2008).</p>	<p>Noted. Cf. to resolution on comment 297.</p>
300.	AMICE	3.76.	<p>Life underwriting correlation factors</p> <p>QIS4 correlation factors were set using expert judgment. Hence, we would like to understand on which basis this expert judgment changed. Expert judgment should not introduce high volatility (about 11% as stated in 3.46) in life underwriting capital requirements otherwise it cannot be considered as such. CEIOPS should clearly justify any change from QIS4 calibration.</p> <p>Moreover :</p> <p><input type="checkbox"/> Correlation between lapse and disability: in life insurance products, disability is often a rider which cannot be surrendered on a standalone business. Hence an increase in lapse rates would lead to lower exposure of the undertaking to disability risk (as the whole policy is surrendered). As lapse risk is a two-sided risk, maintaining the correlation to 0 between lapse and disability</p>	<p>Noted. Correlation parameters have been partly revised after reconsidering the approach for independent risks.</p>

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			<p>seems appropriate as in QIS4.</p> <p><input type="checkbox"/> Correlation between revision and lapse: As lapse risk is a two-sided risk, maintaining the correlation to 0 between lapse and disability seems appropriate as in QIS4. In addition, generally insured cannot surrender annuities.</p>	
301.	Association of British Insurers	3.76.	<p>We are concerned that these factors, when taken with the stresses proposed in other draft CEIOPS advice, represent a situation significantly in excess of a 1 in 200 year event.</p>	<p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p>
302.	CEA	3.76.	<p>See comments to Paras 3.40, 3.41, 3.42, 3.44 and 3.45.</p>	<p>Noted.</p>
303.	CRO Forum	3.76.	<p>We recognise the shortcomings of the aggregation technique for particular distributions in the case of independence. However, we think it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability distributions. In particular, the CRO forum believes the argument is not valid for the sub risks of life underwriting risk where is has been used extensively.</p> <p>For life underwriting risk, the CRO forum proposes to maintain the correlation factors used for QIS4.</p>	<p>Noted. CEIOPS has clarified that where a standard formula correlation parameter has to be specified between two risks which can be assumed to be independent but there are uncertainties as to the exact nature of the independency, it appears to be acceptable to choose</p>

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				<p>a low correlation parameter, reflecting that model risk may lead to an over- or under-estimation of the combined risk. Therefore, correlation factors for independent risks were revised.</p> <p>Cf. revised section 3.1.4.</p>
304.	FFSA	3.76.	<p>Life underwriting correlation factors</p> <p>FFSA expects that QIS4 correlation factors were set using expert judgment. Hence, FFSA would like to understand on which basis this expert judgment changed. Expert judgment should not introduce high volatility (about 11% as stated in 3.46) in life underwriting capital requirements otherwise it cannot be considered as such. CEIOPS should clearly justify any change from QIS4 calibration.</p> <p><input type="checkbox"/> Correlation between lapse and disability: in life insurance products, disability is often a rider which cannot be surrendered on a standalone business. Hence an increase in lapse rates would lead to lower exposure of the undertaking to disability risk (as the whole policy is surrendered). As lapse risk is a two-sided risk, maintaining the correlation to 0 between lapse and disability seems appropriate as in QIS4.</p> <p><input type="checkbox"/> Correlation between lapse and mortality: FFSA does not understand on which basis the correlation factor increased from 0 (in QIS4) to 0.25.</p> <p><input type="checkbox"/> Correlation between revision and lapse: As lapse risk is a two-sided risk, maintaining the correlation to 0 between lapse and disability seems appropriate as in QIS4. In addition, generally insured cannot surrender annuities.</p>	<p>Noted. Cf. to resolution on comment 300.</p>

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			Correlation between revision and mortality: FFSA does not understand on which basis the correlation factor increased from 0 (in QIS4) to 0.25.	
305.	GROUPAMA	3.76.	<p>Life underwriting correlation factors</p> <p>QIS4 correlation factors were set using expert judgment. Hence, we would like to understand the basis on which this expert judgment changed. Expert judgment should not introduce high volatility (about 11% as stated in 3.46) in life underwriting capital requirements otherwise it cannot be considered as such. CEIOPS should clearly justify any change from QIS4 calibration.</p> <p>Moreover correlation between lapse and disability: in life insurance products, disability is often a rider which cannot be surrendered on a stand-alone basis. Hence an increase in lapse rates would lead to lower exposure of the undertaking to disability risk (as the whole policy is surrendered). As lapse risk is a two-sided risk, maintaining the correlation to 0 between lapse and disability seems appropriate as in QIS4.</p> <p>Correlation between revision and lapse: As lapse risk is a two-sided risk, maintaining the correlation to 0 between lapse and disability seems appropriate as in QIS4. In addition, generally policyholders cannot surrender annuities.</p>	Noted. Cf. to resolution comment 297. on
306.	Groupe Consultatif	3.76.	<p>We believe that the negative correlation (-0,25) between mortality and longevity may be too low (ie the correlation should be even more negative). As it's not uncommon that policies with mortality risk and policies with longevity risk is situated in roughly the same age span we believe that a more correct estimation of correlation parameter should at least be -0,50. We also believe that it would not be wrong to assume that changes (shocks) in respectively mortality and longevity would in relative high degree incur in all ages simultaneously and thus offsetting the impact of the increased risk.</p> <p>CEIOPS should provide more detail on the assumptions used for setting correlation.</p>	Not agreed. Cf. revised section 3.1.6.
307.	Just Retirement	3.76.	See comment under 3.45.	Noted.

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	Limited			
308.	KPMG ELLP	3.76.	<p>While it is possible to see how the crisis of 2008 has led CEIOPS to conclude that higher correlations are merited for market risk, it is less clear what has happened between QIS 4 and CP 74 to justify a broad increase in the life insurance correlations.</p> <p>Much of the justification for the increase is based on a couple of examples showing how two risks can be independent yet require a positive correlation to correctly aggregate the risks. This does not preclude examples where the opposite effect is true and where lower correlations may be required in the standard formula. In particular the arguments put forward for the increase were known during earlier QIS exercises which weakens the justification for revising these figures now.</p> <p>We agree that there should be a low and negative correlation between mortality and longevity.</p>	<p>Noted. Correlation parameters were partly revised after reconsidering the approach for independent risks.</p> <p>Noted. Cf. revised section 3.1.4.</p> <p>Noted.</p>
309.	Legal & General Group	3.76.	<p>We are concerned that these factors, when taken with the stresses proposed in other draft CEIOPS advice, represent a situation significantly in excess of a 1 in 200 year event.</p>	<p>Noted. CEIOPS agrees that the correlation parameters specified in the formula should be consistent with the 1:200 VaR standard.</p>
310.	Munich Re	3.76.	<p>The CRO forum recognizes the shortcomings of the aggregation technique for particular distributions in the case of independence. However, we think it is not valid to use this argument to increase all zero correlations (to at least 25%) without giving evidence on the shape or class of the probability distributions. In</p>	<p>Noted. Cf. to resolution on comment 308.</p>

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			<p>particular, the CRO forum believes the argument is not valid for the sub risks of life underwriting risk where is has been used extensively.</p> <p>For life underwriting risk, the CRO forum proposes to maintain the correlation factors used for QIS4.</p>	
311.	PricewaterhouseCoopers LLP	3.76.	Refer to comment at para 3.45.	Noted.
312.	CEA	3.77.	Please see comments to Para 3.47.	Noted.
313.	CRO Forum	3.77.	<p>We believe that CEIOPS' arguments do not justify the increase of the correlation factor between cat and basis non-life underwriting risk. More evidence is needed. The correlation factor depends on the particular distribution assumptions and whether the basis risk module should cover expected cat claims.</p> <p>Also the reference to practicability (3.49) is not evident. What portion of "side effect" is to be covered by the cat risk module?</p>	Noted. See revised text, which provides further reasoning.
314.	Groupe Consultatif	3.77.	CEIOPS should provide more detail on the assumptions used for setting correlation between non-life cat risk and non-life basis underwriting risk to 0.25	Noted. See revised text, which provides further reasoning.
315.	Just Retirement Limited	3.77.	See comment under 3.51.	Noted.
316.	Lloyd's	3.77.	<p>We strongly oppose the proposed increase in the correlation parameter to 0.25. It should remain at 0.</p> <p>The justification is extremely weak for this change and subjective. The proposal</p>	Noted. See revised text, which provides further reasoning.

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			would magnify the failing (and overstatements) in the calibration of the premium and reserve risk due to double counting of catastrophe risk. The justification is based on para. 3.20 which we have shown to be inconsistent and thus an unreliable support for the proposal.	
317.	Munich Re	3.77.	The CRO forum believes that CEIOPS' arguments do not justify the increase of the correlation factor between cat and basis non-life underwriting risk. More evidence is needed. The correlation factor depends on the particular distribution assumptions and whether the basis risk module should cover expected cat claims. Also the reference to practicability (3.49) is not evident. What portion of "side effect" is to be covered by the cat risk module?	Noted. See revised text, which provides further reasoning.
318.	PricewaterhouseCoopers LLP	3.77.	Refer to comment at para 3.51.	Noted.
319.	RSA Insurance Group	3.77.	There is little scientific justification for the parameters chosen.	Noted. See revised text, which provides further reasoning.
320.			Confidential comments deleted.	
321.	CEA	3.78.	There is no justification as to why Ceiops has undertaken changes to the correlations set out in Annex IV of the Framework Directive. As discussed in Para 3.58 and 3.60.	Noted. Sub-section has been deleted.
322.	CRO Forum	3.78.	We disagree with the increase of the correlation factor between life underwriting risk and health underwriting risk from 0.25 to 0.75. Different products within these two modules are exposed to different risks (e.g. mortality or longevity). CEIOPS proposal imply a high correlation of a life product exposed to mortality risk and a health product exposed to longevity risk which is implausible. The	Noted. Sub-section has been deleted.

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			argument provided by CEIOPS can be best capture by a different aggregation technique as proposed in Calibration Principles for the Solvency II Standard Formula (CROF, May 2009), namely aggregating risk types in the health and life sub module rather than directly aggregating health and life risk.	
323.	FFSA	3.78.	Basic SCR correlation factors FFSA would like to understand on which basis the correlation matrix, published in level 1 text, for the BSCR calculation is updated. CEIOPS should disclose the expert judgment which enabled setting such correlations.	Noted. Sub-section has been deleted.
324.	GDV e.V.	3.78.	There is no justification, no empirical data and no method as to why CEIOPS has undertaken changes to the correlations set out in Annex IV of the Framework Directive. We are concerned about the lack of the LoB "accident" in the nonlife-modul. We once more reiterate our request to shift "accident" from the "health"-modul into the nonlife-modul. We refer to our comments in CP 48, 50, 71 and CP 72. CEIOPS seems to use this mixture of accident, sickness and disability in its argumentation in para. 3.53 ff to „justify“ the increased correlations between life-, non-life- and health underwriting risk.	Noted. Sub-section has been deleted. Noted.
325.	Just Retirement Limited	3.78.	See comment under 3.64.	Noted.
326.	Lloyd's	3.78.	It is inappropriate and potentially reputationally damaging to Solvency II to change the Level 1 text based on weak and limited analysis.	Noted. Sub-section has been deleted.
327.	Munich Re	3.78.	The CRO forum disagrees with the increase of the correlation factor between life underwriting risk and health underwriting risk from 0.25 to 0.75. Different products within these two modules are exposed to different risks (e.g. mortality	Noted. Sub-section has been deleted.

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			or longevity). CEIOPS proposal imply a high correlation of a life product exposed to mortality risk and a health product exposed to longevity risk which is implausible. The argument provided by CEIOPS can be best capture by a different aggregation technique as proposed in Calibration Principles for the Solvency II Standard Formula (CROF, May 2009), namely aggregating risk types in the health and life sub module rather than directly aggregating health and life risk.	
328.	AFS	3.79.	It is not clear how the data collected will be used to update the correlations, as in many cases the correlation assumption is set by qualitative reasoning rather than data analysis.	Noted. See revised text, which provides further reasoning.
329.	CEA	3.79.	It is not clear how the data collected will be used to update the correlations, as in many cases, the correlation assumption is set by qualitative reasoning rather than data analysis. The collection of data appropriate methods should be developed and applied to determine correlation factors reflecting the underlying risk profile suitably. Before collecting data from the industry Ceiops should clarify the model (random variables, kind of analysis, methods to calculate dependencies e.g. linear correlations or rank correlations or copulas or ...?) and the necessary data for such a survey.	Noted. See revised text, which provides further reasoning. Noted. CEIOPS agrees that the calibration of correlation parameters should be based on appropriate and reliable methodologies using adequate data and assumptions.
330.	CRO Forum	3.79.	We support this suggestion.	Noted.
331.	GDV e.V.	3.79.	It is not clear how the data collected will be used to update the correlations, as in many cases, the correlation assumption is set by qualitative reasoning rather	Noted. Cf. to resolution on

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			<p>than data analysis.</p> <p>The collection of data appropriate methods should be developed and applied to determine correlation factors reflecting the underlying risk profile suitably. Before collecting data from the industry CEIOPS should clarify the model (random variables, kind of analysis, methods to calculate dependencies e.g. linear correlations or rank correlations or copulas or ...?) and the necessary data for such a survey.</p>	comment 329.
332.	Groupe Consultatif	3.79.	In addition to the collection of data appropriate methods should be developed and applied to determine correlation factors reflecting the underlying risk profile suitably.	Noted. Cf. to resolution on comment 329.
333.	IUA	3.79.	We are supportive of CEIOPS proposing that consideration being given to collect appropriate data to support the revision of the correlation factors. Any such data collection however should not be disproportionately onerous.	Noted. Cf. to resolution on comment 329.
334.	Munich Re	3.79.	The CRO forum supports this suggestion.	Noted.
335.	CEA	A.1.	The impact is calculated with the new correlation factors compared to QIS4. Unfortunately it is not clear what the impact would have been, given the proposed re-calibration of all risks under Ceioms' proposals for implementing measures.	Noted.
336.	AMICE	A.6.	Based on our estimations the effect of changes in the correlation matrix is of 30% of the SCR. The main driver is the increase in the correlation factor between the concentration risk and the other risks included in the market risk module.	Noted. Correlation parameters for concentration risk have been revised.

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337.	IUA	A.10.	We are concerned by the significance of these increases in the Basic SCR over and above increases in capital requirements elsewhere.	Noted.
338.	XL Capital Ltd	A.10.	We are concerned by the significance of these increases in the Basic SCR over and above increases in capital requirements elsewhere.	Noted.
339.	Just Retirement Limited	Annex	See comment under 3.37.	Noted.
340.	CEA	Annex	<p>In the absence of sufficient relevant data to carry out a detailed analysis of non-life correlations, we see no reason to change the correlations used for QIS4. We would appreciate clarification from Ceiops on the preferred correlations and the approach to update these correlations going forward.</p> <p>The whole approach in annex B seems misleading: instead of three options, Ceiops should give a definition of the random variables which are underlying the premium and reserve risk (proposal: ultimate loss ratios resp. the 1-yr change in the best estimate of claims provisions). For each LoB and separately for the loss ratios resp. the 1-yr change in the best estimate of claims provisions one can estimate a dependency (linear correlations or rank-correlations or copulas) between each pair of these random variables. Therefore one should, and one can, use identical data for calibrating the premium and reserve risk (estimation of the coefficient of variation) and for estimating dependencies.</p>	<p>Noted. See revised text, which provides further reasoning.</p> <p>Noted. CEIOPS agrees that further technical work is necessary to determine how correlation parameters in the non-life underwriting risk module can be reliably derived.</p>
341.	GDV e.V.	Annex	In the absence of sufficient relevant data to carry out a detailed analysis of non-life correlations, we see no reason to change the correlations used for QIS4. We would appreciate clarification from CEIOPS on the preferred correlations and the approach to update these correlations going forward.	Noted. Cf. to resolution on comment 340.

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			<p>The whole approach in annex B seems misleading: instead of three options, CEIOPS should give a definition of the random variables which are underlying the premium and reserve risk (proposal: ultimate loss ratios resp. the 1-yr change in the best estimate of claims provisions). For each LoB and separately for the loss ratios resp. the 1-yr change in the best estimate of claims provisions one can estimate a dependency (linear correlations or rank-correlations or copulas) between each pair of these random variables. Therefore one should, and one can, use identical data for calibrating the premium and reserve risk (estimation of the coefficient of variation) and for estimating dependencies.</p> <p>We are concerned about the lack of the LoB "accident" in the nonlife-modul. We once more reiterate our request to shift "accident" from the "health"-modul into the nonlife-modul. We refer to our comments in CP 48, 50, 71 and CP 72.</p>	Noted.
342.	Lloyd's	Annex	<p>The standard formula significantly understates the true diversification effects by selecting too broad segmentation (such as MAT) where is it known diversification exists at lower levels.</p> <p>This would suggest that the class correlation parameters should be reduced to reflect this phenomenon.</p> <p>However, for the general reasons stated above, there should only be changes to the assumed correlation parameters following more complete and detailed analysis with input from industry experts.</p> <p>Given that the evidence for option 2 is circumstantial rather than empirical, there does not appear to be enough evidence to reduce the factors. There is absolutely no evidence (empirical or circumstantial) to increase the factors.</p>	Noted. Cf. to resolution comment 340. on
343.	RSA Insurance Group	Annex	<p>The function of this part of the paper is not clear. There is no reference to Annex B in the rest of the paper. It is not at all clear what CEIOPS is recommending here. B28 just states a broad consensus exists.</p>	Noted. Cf. to resolution comment 340. on

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			There is no scientific justification for any of the numbers provided. Just higher and lower.	
344.			Confidential comments deleted.	
345.	CEA	B.7.	<p>The QIS4 correlation parameters across non-life lines of business do not always appear to be in line with the results of our own study</p> <p>Below, are the results of an analysis of German development data, looking at paid triangles of 101 undertakings (gross data, different size, on average about 18 years) and earned premium by accident year. Some of the results are quite different from the QIS4 parameters. As discussed in our comments to Para 3.47, we have seen significant evidence that the correlations relating to premium risk are quite different to those from reserve risk.</p> <p>Premium Risk</p> <p>Method (for random variable loss ratio):</p> <ol style="list-style-type: none"> 1) Chain ladder estimation of ultimate losses including tail estimation up to 25 development years for each triangle 2) Calculate the ultimate loss ratios (ultimate losses divided by earned premiums) for each undertaking and accident year 3) Estimate the correlation in the loss ratios between 2 lines of business with two methods (linear estimation/ robust estimation based on Kendalls tau): <ol style="list-style-type: none"> 3a) Calculate the linear correlation coefficient per undertaking, calculate the average correlation as weighted average of the undertakings correlation coefficients. 3b) Calculate Kendalls tau for the loss-ratio residuals (with variance inverse proportional to the earned premium), calculate the correlation parameter via $\sin(\tau \cdot \pi/2)$. See Lindskog, McNeil, Schmock: Kendalls tau for elliptical Distributions, ETH Zürich 2001). <p>Result:</p> <p>There is a wide spread between the undertakings correlation. The average correlation, rounded in "CeIops' manner" is:</p> <p align="center">1 2 4 5 7</p>	Noted.

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			<p>1. M 3rd party 1</p> <p>2. M other 0.50 1</p> <p>4. Fire and property 0.25 0.50 1</p> <p>5. 3rd party liab 0.50 0.25 0.00 1</p> <p>7. legal exp. 0.00 0.00 0.00 0.50 1</p> <p>The highlighted numbers show changes with respect to the QIS4 parameters.</p> <p>Reserve Risk Method (for random variable claims development result): 1) For each triangle (without the actual diagonal) calculate the mean squared error of prediction MSEP of the claims development result for the time-horizon of one year (see Merz/Wüthrich). The root of MSEP serves as theoretical standard deviation of the claims development result. 2) For each triangle calculate the last observed claims development result using the payments on the actual diagonal and using two times chain ladder projection (re-reserving). 3) The quotient of the last observed claims development result and the theoretical standard deviation serves as undertaking-residual. For two lines of business calculate Kendalls tau for the undertaking-residuals and estimate the correlation parameter via $\sin(\tau \cdot \pi/2)$.</p> <p>Result (example): The average correlation, between Motor 3rd party/ 3rd party liab/accident is 0.00.</p>	
346.	GDV e.V.	B.7.	<p>The QIS4 correlation parameters across non-life lines of business do not always appear to be in line with the results of our GDV.study</p> <p>Below, are the results of an analysis of German development data, looking at paid triangles of 101 undertakings (gross data, different size, on average about 18 years) and earned premium by accident year. Some of the results are quite different from the QIS4 parameters. As discussed in our comments to Para</p>	

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3.47, we have seen significant evidence that the correlations relating to premium risk are quite different to those from reserve risk.

Premium Risk

Method (for random variable loss ratio):

- 1) Chain ladder estimation of ultimate losses including tail estimation up to 25 development years for each triangle
- 2) Calculate the ultimate loss ratios (ultimate losses divided by earned premiums) for each undertaking and accident year
- 3) Estimate the correlation in the loss ratios between 2 lines of business with two methods (linear estimation/ robust estimation based on Kendalls tau):
 - 3a) Calculate the linear correlation coefficient per undertaking, calculate the average correlation as weighted average of the undertakings correlation coefficients.
 - 3b) Calculate Kendalls tau for the loss-ratio residuals (with variance inverse proportional to the earned premium), calculate the correlation parameter via $\sin(\tau \cdot \pi/2)$. See Lindskog, McNeil, Schmock: Kendalls tau for elliptical Distributions, ETH Zürich 2001).

Result:

There is a wide spread between the undertakings correlation. The average correlation, rounded in "CEIOPS' manner" is:

	1	2	4	5	7
1. M 3rd party	1				
2. M other	0.50	1			
4. Fire and property	0.25	0.50	1		
5. 3rd party liab	0.50	0.25	0.00	1	

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			<p>7. legal exp. 0.00 0.00 0.00 0.50 1</p> <p>The highlighted numbers show changes with respect to the QIS4 parameters.</p> <p>Reserve Risk</p> <p>Method (for random variable claims development result):</p> <p>1) For each triangle (without the actual diagonal) calculate the mean squared error of prediction MSEP of the claims development result for the time-horizon of one year (see Merz/ Wüthrich). The root of MSEP serves as theoretical standard deviation of the claims development result.</p> <p>2) For each triangle calculate the last observed claims development result using the payments on the actual diagonal and using two times chain ladder projection (re-reserving).</p> <p>3) The quotient of the last observed claims development result and the theoretical standard deviation serves as undertaking-residual. For two lines of business calculate Kendalls tau for the undertaking-residuals and estimate the correlation parameter via $\sin(\tau \cdot \pi/2)$.</p> <p>Result (example):</p> <p>The average correlation, between Motor 3rd party/ 3rd party liab/ accident is 0.00.</p>	
347.	ACA	B.20.	Does the CEIOPS' strategy consist in convincing small undertakings to invest in an internal model? Indeed, even if we agree that we should not understate the SCR, on the other hand we should not overstate it either because of a too prudent standard formula.	Noted. CEIOPS has aimed to setting correlation parameters consistent with the

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				99.5% VaR standard.
348.	RSA Insurance Group	B.26.	Lower correlations would be fine if they were correct.	Noted.
349.	AMICE	B.27.	The only reason higher parameters can lead to better risk management would be if the undertakings are going to use internal models, which again should be an open question and not a hidden agenda from the CEIOPS or the supervisory authorities. Besides higher premiums, higher parameters will definitely also lead to a deterioration of the insurance policy terms and in turn will not be for the customers' best.	Noted. See revised text.
350.	CEA	B.27.	The only reason higher parameters can lead to better risk management would be if undertakings are going to use internal models, which again should be an open question and not a hidden agenda from Ceiops or the supervisory authorities. Besides higher premiums, higher parameters will definitely also lead to a deterioration of the insurance policy terms and in turn will not be in the customers' best interests.	Noted. Cf. to resolution on comment 349.
351.	GDV e.V.	B.27.	The only reason higher parameters can lead to better risk management would be if undertakings are going to use internal models, which again should be an open question and not a hidden agenda from CEIOPS or the supervisory authorities. Besides higher premiums, higher parameters will definitely also lead to a deterioration of the insurance policy terms and in turn will not be in the customers' best interests.	Noted. Cf. to resolution on comment 349.
352.	RSA Insurance Group	B.27.	High correlations do not necessarily lead to better risk management. A correlation of 1 may discourage a company maintaining a diversified portfolio of insurance risks. This may be poor risk management.	Noted.
353.			Confidential comments deleted.	
354.	Pricewaterho	B.28.	We agree with the consensus to maintain the correlation factors at their QIS4	Noted.

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	useCoopers LLP		level on the basis that these selections meet the operational objectives in B.24 better than if the correlations were systematically increased or decreased.	
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