



Calibration recommendation for the market risks in the  
Solvency II standard formula

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**CRO FORUM**



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# 1. Executive summary

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The CRO Forum welcomes the opportunity to contribute to the calibration of the standard formula through this paper on market risks. This document is a follow-up to our position papers published respectively last May: 'Calibration Principles for the Solvency II Standard Formula'; and last December: 'Calibration recommendation for the correlations in the Solvency II standard formula'.

While the CRO Forum had expected an increase in capital requirements for market risks (in comparison to QIS4 capital requirements), the increases proposed in the Consultation Papers were at the extreme end. The Final Advices, recently issued by CEIOPS on market risks, show a marked decrease from the consultation paper proposals – yet these calibrations are still generally higher than those of our Internal Models<sup>1</sup>. This paper proposes an alternative calibration of the 1-in-200 market stresses, compared to those suggested by CEIOPS in its Final Advices (former CP 69/ 70/ 74). The counter-proposal provided below are supported by the members of the CRO Forum,

The CRO Forum argues that calibration parameters should be set in accordance with the envisioned risk tolerance of a 1-in-200 year loss (individual shocks x correlation), not higher and not lower. The calibration approach should not result in accounting for the worst shocks observed ever with the simultaneous worst possible correlations between all pair-wise risks, as observed for very short periods of time during the financial crises. If parameters are calibrated to account for these 'extreme events', the aggregate 1-200 year calibrations across all risks will be far too conservative and together, not be supported by history or what is plausible in the future.

More generally, the combined overall impact of all CEIOPS suggested calibrations could be devastating for an insurer's asset mix with potential large scale asset sales and longer term diverting capital from the European industry.

We strongly believe that CEIOPS' proposed calibrations and correlations factors for Market risks need to be revised. The following points substantiate this recommendation:

- The lack of liquidity experienced during the crisis had dramatically widened spreads relative to where they used to trade. However, the calibration factors for Spread Risk suggested by CEIOPS reflect the worst shock observed, and are presumably above the 99.5 percentile. There are two distinct ways to calibrate SCR shocks for spread/ bonds: (i) calibrated on CDS (called option 1 in the study), or (ii) calibrated on corporate bonds but allowing for a Liquidity Premium offset on the liabilities depending on their predictability (called option 2 in the study). At present, discussions around liquidity premium are not closed and we therefore present both options in this paper. For both options, the CRO Forum proposes reduced calibrations factors.
- While the CRO Forum would have preferred the inclusion on an Equity dampener in Pillar II, we welcome its introduction (albeit in Pillar 1) as it will reduce pro-cyclicality of capital requirements under Solvency II. The CRO Forum also encourages the use of such a mechanism for other asset classes as well.
- Indeed, the dependence structure of market risk can change in stressed situations. However, we strongly disagree with the correlations factors that are at the extreme end and factors included in the final advice show that little CRO forum input has been taken into account by CEIOPS (cf. CRO Forum study *Calibration recommendation for the correlations in the SII standard formula* December 2009). In particular, given the predominance of spread risk within market risk, this leads to very low diversification benefit. The prudence in CEIOPS final advice on market risks calibrations combined with extreme correlations leads to an over-estimation of what had been observed during the recent financial crisis.
- The crisis can be no justification for the massive increases suggested by CEIOPS for pure insurance risks (especially on P&C) – this topic will not be addressed further in this paper but the CRO Forum intends to perform shortly a survey among its members to provide a calibration benchmark.

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<sup>1</sup> The CRO Forum is also to evidence this in an internal model calibration survey to be conducted amongst its members.

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In conducting this analysis on calibration for market risks, we perform a systematic analysis of all the available statistics rather than focus on one particular metric or observation period. We identify four major points to be highlighted:

- Overall, given the lack of exhaustive data to make evident statistical conclusions, it is necessary that the calibrations reflect an element of subjectivity and expert opinion, especially for new asset classes.
- Most insurers (including small to medium size) hold portfolios diversified across sectors, ratings and/or regions. Hence, shocks observed from only one pair of indices (e.g. Merrill Lynch “A” US corporates) may lead to an overstatement of the calibration. The calibration should in a way reflect portfolio diversification effects.
- The standard formula, by necessity, makes simplifying assumptions and is not granular (e.g. unlike the SST approach, it does not reflect different geographies). Correlations are only one way of specifying interdependency between risks (alternatives include copulae and structural dependency and, again, correlations are a pragmatic simplification). As a result correlations will require approximate adjustments to partially allow reflection of such subtleties in the dependency structure.
- Additionally, we would like to point out that the market calibrations proposed for the standard formula do not necessarily represent the “benchmark” of what our member firms are using in their internal models, nor do they constitute a recommendation for the assumptions that any individual company should adopt for their own internal model purposes. As expressed above, estimating tail distributions is a difficult, and in a way subjective, task at each individual company level and thus the industry has a range of different viewpoints on this.

The following table presents the CRO Forum’s proposals for market calibrations under the standard formula to change from CEIOPS final advice:

Table 1: Summary of CRO Forum Proposal to change CEIOPS Final Advice

Risk	CRO Forum Proposal
Spread – Corporate Bonds	<p>The CRO Forum has explored 2 different options:</p> <ul style="list-style-type: none"> <li>• Option 1 - Reduce spread stress test by 30 b.p.-40 b.p. for high grade credit from CEIOPS final advice, based on more representative indices, but still calibrated on CDS (for A: 140 b.p vs 180 b.p in the final advice)</li> <li>• Option 2 (consistent with the recommendations of the CEIOPS liquidity premium taskforce) - Calibrate the stress based on corporate bonds rather than CDS, and also apply a Liquidity Premium offset to the Technical Provision calculation depending on the predictability of the cash flows (for A: 190 b.p plus a liability offset vs 180 b.p in the final advice).</li> </ul> <p>The CRO Forum's proposal for option 2 is dependent on introduction under Solvency II of a liquidity premium mechanism which is applied to all liabilities dependent on the predictability of their cash flows and their ability to withstand losses caused by forced sales. In addition, we recognize it's more difficult to implement option 2 in the standard formula than option 1.</p>
Spread – Structure Credit / Credit Derivatives	<p>CEIOPS proposal are punitive for Structured Products (with 10% floor, independent of rating and layer, up to 100% maximum charge) and especially for Credit Derivatives (+600% in spread widening). The CRO Forum recommends:</p> <ul style="list-style-type: none"> <li>• For structured Products, use the corporate bond stress tests multiplied by a scaling factor of 1 for Investment grades structured products and a scaling factor of 1.5 for other ratings</li> <li>• For Credit Derivatives, should be treated the same way as corporate bonds and the same underlying should apply</li> <li>• For Correlations, there is no argument to arbitrarily set 100% correlations within the spread risk module (bonds, structured products, credit derivatives, mortgages loans). We recommend a correlation factor at 75%</li> </ul>
Interest Rate – Level	<ul style="list-style-type: none"> <li>• Retain the CEIOPS proposal (but note anomaly in long-term down stress)</li> </ul>
Interest Rate – Volatility	<ul style="list-style-type: none"> <li>• Retain the CEIOPS proposal of +12%/ -3% absolute stress test noting that the +12% is on the high side</li> </ul>
Equity – Global Central Index	<ul style="list-style-type: none"> <li>• Reduce to stress no higher than 42%, instead of 45% in the CEIOPS Final advice</li> <li>• Expand the definition of global equities to include non-OECD countries, such as Singapore and Hong-Kong; and the definition of global equities will also need to be reviewed regularly as other markets (e.g. Brazil) become stable enough to be considered global equities</li> </ul>
Equity – Dampener	<ul style="list-style-type: none"> <li>• Increase the averaging period from 1 year to at least 3 years.</li> <li>• Include an adjustment term to ensure a symmetric adjustment (ie. average shock over a long period set at 42% and not higher)</li> </ul>
Equity – Volatility	<ul style="list-style-type: none"> <li>• Absolute stresses should be used rather than relative stresses consistent with interest rate volatility</li> <li>• Absolute stresses should be set at +10% and -3%</li> </ul>
Equity – Hedge Funds / Private Equity	<ul style="list-style-type: none"> <li>• Reduce the stress to 30% for a well-diversified hedge fund portfolio</li> <li>• Reduce the stress to 42% for a diversified private equity portfolio</li> </ul>
Property (Real-Estate)	<ul style="list-style-type: none"> <li>• Retain the CEIOPS proposal of a 25% stress test (vs 20% in QIS4)</li> </ul>

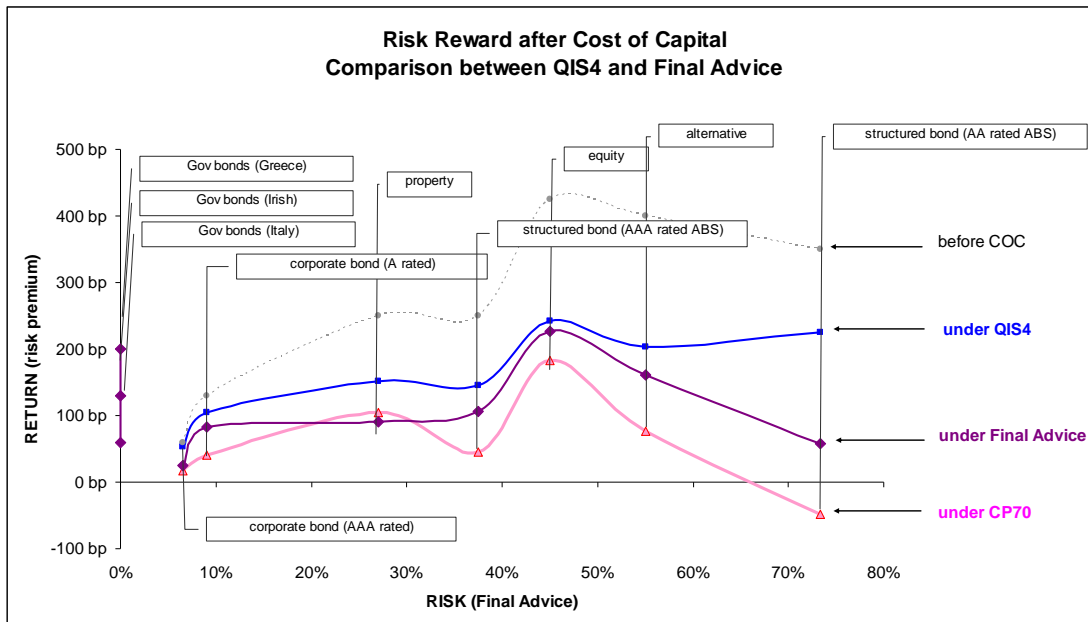
Risk	CRO Forum Proposal
Foreign Exchange	<ul style="list-style-type: none"> <li>• Retain the CEIOPS proposal of a 25% stress test (vs 20% in QIS4)</li> <li>• Refine Group Aggregation by recalculating the up and down components of the solo entities assuming the local currency is the group currency</li> <li>• Reduce the stress test for linked or pegged currency pairs (such as USD/HKD)</li> </ul>
Correlation	<p>Final factors are still at the extreme end and show little CRO Forum input retained by CEIOPS (CRO FORUM study published in December):</p> <ul style="list-style-type: none"> <li>• Disagree on all factors for Property that should be lower at [0.25;0.5]</li> <li>• Disagree on all factors for FX that should be lower at [0;0.25]</li> <li>• Disagree on all factors for Concentration that should be lower at 0</li> </ul> <p>In addition, given the predominance of spread risks in the market risks, it leads to very low diversification benefit</p>

## 2. Implications of current CEIOPS' proposals

### 2.1 Implications of CEIOPS final advice on Asset Allocation

Before considering the proposed calibration of the stresses we compare the risk vs. reward trade-off implied by the three most recent CEIOPS calibrations of market based stress factors. In Graph 1 below we have calculated the expected return in excess of the risk-free rate and of the cost of capital. We have plotted the expected return against the downside stress proposed by CEIOPS.

Graph 1: Illustration of Risk vs. Reward for selected assets classes using recent SCR calibrations.<sup>2</sup>



Graph 1 illustrates that structured credit and mortgages both have a significantly poorer risk vs. return trade-off under the two most recent calibrations (CP70 and Final Advice). In the above illustration we haven't taken into account the volatility shocks for equity as it's highly dependent of the characteristics of the liabilities (option & guarantees), so the equity asset class could be even less attractive, especially for Life insurers.

Overall, the changes in the SCR calibration for market risk suggest a tendency to see higher concentrations of investment in high-yield Government debt.

### 2.2 Back-testing over the last 10 years

Calibrations and correlations in the standard formula are by nature hardly observable, and thus it is quite difficult to visualise the extent to which a calibration can be compared to what was empirically experienced in past years. The following section compares the shocks and diversification benefit actually experienced in financial markets over the last 10 years (particularly during the financial crisis in 2008) with the shocks and diversification benefit implied by the CEIOPS Final Advice.

The back-testing analysis is based on a hypothetical market portfolio example for an insurer:

<sup>2</sup> The assumed risk-free interest rate is low-yield Euro-zone Government debt. The assumed cost of capital is 6%; no consideration of volatility shocks



## 2-2-a) Portfolio Assumptions

Table 1: Back-testing – standard portfolio assumptions

In EUR bn		Assets		Liabilities		
	Equity	5		Reserves	100	
	Property	5				
	Gov Bonds	45				
	CredAAA	5				
	CredAA	15				
	CredA	20				
	CredBBB	5				
	<b>Total</b>	<b>100</b>		<b>Total</b>	<b>100</b>	
<b>Duration</b>	7 years for bonds			9 years for liabilities		

## 2-2-b) Historical Market Returns (monetary losses in EUR bn)

Table 2: Back-testing – Historical market returns

Year	Equity	Property	Int rate			Credit					FX			Total
				Assets	Liabilities (*)		AAA	AA	A	BBB		USD/EUR	GBP/EUR	
1999	2.0	0.5	2.3	-3.7	6.0	0.2	0.0	0.0	0.1	0.1	4.9	5.5	4.3	10.0
2000	-0.3	0.5	-2.1	7.6	-9.7	-0.5	0.0	0.0	-0.2	-0.3	0.9	2.2	-0.4	-1.4
2001	-1.0	0.4	-0.7	5.3	-6.0	0.4	0.1	0.1	0.2	0.0	1.5	2.0	1.0	0.6
2002	-1.7	0.4	-2.0	10.3	-12.3	-0.2	0.0	0.1	0.0	-0.3	-3.6	-5.1	-2.1	-7.2
2003	0.9	0.4	-0.5	3.9	-4.3	1.2	0.0	0.1	0.6	0.5	-4.1	-5.6	-2.6	-2.0
2004	0.5	0.5	-2.6	8.3	-10.9	0.4	0.0	0.1	0.2	0.1	-1.2	-2.4	0.0	-2.4
2005	1.2	0.6	-2.7	5.4	-8.1	0.0	0.0	0.0	0.0	-0.1	2.9	4.8	0.9	1.9
2006	1.0	0.7	0.8	-0.8	1.6	0.2	0.0	0.0	0.1	0.1	-1.4	-3.4	0.7	1.3
2007	0.2	0.3	1.2	1.5	-0.3	-1.1	-0.1	-0.3	-0.6	-0.2	-3.0	-3.2	-2.8	-2.4
2008	-2.3	-0.3	-1.2	9.2	-10.4	-5.9	-0.3	-0.9	-3.2	-1.5	-3.1	1.5	-7.7	-12.9
2009	1.1	-0.3	0.4	3.6	-3.3	4.9	0.1	0.7	2.0	2.0	-0.2	-2.1	1.6	5.8
<b>MaxMax</b>	<b>-2.3</b>	<b>-0.3</b>	<b>-2.7</b>			<b>-5.9</b>					<b>-4.1</b>			<b>-15.3</b>

(\*) the liability interest rate calculations are based on government bond return indices

$$\text{Realised Diversification} = 1 - (12.9/15.3)$$

As a first step, we measure the market return from our standard market portfolio back tested over the last 10 years. For each asset class we calculate the highest loss over the past 10 years (e.g. a loss of EUR 2.3bn for equities in 2008, which is the combination of 5% exposure and a -46% return on the equity market).

We then define the “realised diversification benefit” over this period by comparing the worst annual market return experienced from the asset portfolio over the 10 year period (12.9 in 2008) with the sum of the worst individual return per asset class observed (15.3). Thus we compare the worst shocks over the last 10 years versus the shocks experienced

in 2008. This leads to a “realised diversification benefit” of 16% ( $=1-12.9/15.3$ ). This statistic illustrates that some diversification was in fact observed in the year of the crisis in 2008 (in contradiction to CEIOPS’ claims in its Final Advice).

In the second step, we measure the solo SCR for each asset class and the diversification benefit implied, derived from the Final Advices. The implied Market SCR is at 13.1 and related diversification on SCR is at the low level of 16%. If we apply the same methodology to the QIS4 correlation matrix we obtain Market SCR at 7.1 and related diversification of 32%.

The CRO Forum proposed shocks and correlation matrix leads to a Market SCR at 11.0 and related diversification of 20%.

### 2-2-c) Solvency II Methodology

Table 3: Comparison of Implied Market SCR and related diversification benefit

	Final Advice <sup>3</sup>		QIS4		CRO Forum proposal	
	CPs shocks	Solo SCR	CPs shocks	Solo SCR	CPs shocks	Solo SCR
Interest rate risk	-39% for 7Y	3.9	-37% for 7Y	3.7	-39% for 7Y	3.9
Equity	-45%	2.25	-32%	1.6	-42%	2.1
Property	-25%	1.5	-20%	1.0	-25%	1.5
Spread	F(rating) x Maturity	7.4	F(rating) x Maturity	3.5	F(rating) x Maturity	6.3
FX		0.8		0.6		0.8
<b>Sum of solo SCR</b>		<b>15.9</b>		<b>10.5</b>		<b>14.1</b>

Market SCR	Final Advice <sup>4</sup>	QIS4	CRO Forum proposal <sup>5</sup>	Real World
Sum of solo SCR	15.9	10.5	14.1	15.3
Market SCR	13.1	7.1	11.0	2008 crisis: 12.9
Implied Diversification	16%	32%	20% $=1-(11.0/13.9)$	16% $=1-(12.9/15.3)$

3,4 Note that we haven’t taken into account in this simulation the volatility shocks on Equity and Interest Rate.

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The analysis above highlights, in a simple way, that taking the worst possible individual shocks and correlations between all risks (observed for a very short time during the crisis at its peak) leads to a significant underestimation of the diversification benefit between all asset classes that exists naturally in financial markets, even in an extreme stressed scenario.

Note that we haven't taken into account in these simulations the volatility shocks on Equity and Interest Rate as it's highly dependent of the characteristics of the liabilities (option & guarantees for Life insurers). If included, the results with the Final Advices would have been even worst.

Indeed, the diversification benefit implied by the CEIOPS proposal on market risk correlation matrix (16%) is equivalent to the diversification benefit effectively experienced in 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.

## 3. Spread on Corporate Bonds

The CRO Forum has explored two different options for calibrating the corporate bond spread stress tests:

- **Option 1** is a recalibration of the same stress test framework proposed by CEIOPS, based on CDS. It involves an alternative calibration to the Credit Default Swap (CDS) market removing some of the biases in the original CEIOPS calibration, based on more representative indices.
- **Option 2** is a more theoretically sound approach. This method involves calibrating to Corporate Bonds but allows for a liquidity spread widening offset on the liabilities. The degree of liquidity allowed for in the liabilities depends on the predictability of their cash-flows. It follows the work of the CEIOPS Liquidity Premium Task Force. Level 2 text should explicitly allow for this option for companies that use internal models such that a fully consistent and an integrated approach to liquidity premiums should always be feasible.

**The CRO Forum's proposal for option 2 is dependent on introduction under Solvency II of a liquidity premium mechanism which is applied to all liabilities dependent on the predictability of their cash flows and their ability to withstand losses caused by forced sales. In addition, we recognize it's more difficult to implement option 2 in the standard formula than option 1.**

### 3.1 Option 1 - Spread calibrated on CDS

After reading the CEIOPS Final Advice the CRO Forum had concerns over the underlying data used by CEIOPS to calibrate the stress tests. A significant number of the CDSs used were issued for US companies that have since been downgraded (e.g. AIG, Citigroup, Bank of America, etc...). The CRO Forum proposes that the emphasis of the calibration is on European companies (e.g. Credit Suisse, BNPP, etc) and that we should ensure that the impact of rating migration is excluded from the analysis. The CRO Forum also believes that the impact of AIG should be carefully checked, as it causes a significant increase in the shock.

In order to calibrate the stress, the CRO Forum analysed data for the ITRAXX index from 2003 (which is when the data are available from). We believe that despite the length of historical data available it is still representative as the highest increase in spread was between 2007 and 2009.

- We believe that the stress test for AAA (130bps) is too high, especially compared to the other ratings. Once we take account of the small number of AAA rated CDS issuers and the AAA exposure derived from covered bonds (e.g. Pfandbriefe) and/or government related issuers we believe that the AAA stress test should be lowered. For AAA exposures we calibrated to more representative bond indices, such as Merrill Lynch Euro Quasi Government AA-AAA 1-5 Year Index and Merrill Lynch Euro Corporate and Pfandbriefe AAA Index.
- For AA and A exposures we calculate the stress test using the ITRAXX index to be lower than the figure used in CEIOPS Final Advice.

Table 4: Corporate Bond Credit Spread – representatives index

	AAA (representative AAA exposure)	AA (Itraxx)	A (Itraxx)
Max	90	122	142
99,5%	83	103	133
99%	80	89	128
95%	64	68	92
90%	46	56	75
75%	24	31	38

### Proposal

The CRO Forum concludes that the corporate bond spread stress tests in the Final Advice from CEIOPS are too onerous. An alternative calibration based on a more detailed analysis of the underlying data is proposed. A comparison is shown in the table below.

Table 5: Corporate Bond Credit Spread – CEIOPS Final Advice vs. CRO Forum Proposal option1

	AAA	AA	A
CEIOPS Final Advice (CDS based)	130 b.p.	150 b.p.	180 b.p.
CRO Forum Proposal – option 1 (CDS based)	90 b.p.	110 b.p.	140 b.p.

- The level 2 text should also allow for equivalence of internal credit ratings (allowed under Basel II for banks).
- For very long dated bonds, we suggest imposing a cap on duration (20 years) to ensure the stresses are not unduly onerous.

### 3.2 Option 2 - Spread calibrated on Corporate bonds with liability adjustment

In order to calibrate the stress test, the CRO Forum analysed the spread of US Investment Grade corporate bonds over US Treasuries using monthly Moody’s data from 1919. This data set makes it statistically easier to calibrate a 1-in-200 stress test than using a European Index for which data history is typically only 12 years.

We also need to consider whether data is relevant to a prospective stress test. CEIOPS’ calibration of the equity stress considered data from 1970 onwards so we have included this time frame in our analysis.

Table 6: Selected percentiles and statistical features for data from 1970 onwards

1970 +				
	AAA	AA	A	BBB
100.00%	124	156	224	346
99.95%	124	154	222	343
99.50%	118	139	188	293
99.00%	95	109	136	221
97.50%	67	88	118	154
50.00%	4	1	0	1

We note however that this is a somewhat conservative approach as considering longer time periods would result in a reduced calibration:

Table 7: 95<sup>th</sup> percentile for data over different time periods

	AAA	AA	A	BBB
1919-2009	91 b.p.	107 b.p.	146 b.p.	262 b.p.
1958-2009	113 b.p.	125 b.p.	157 b.p.	275 b.p.
1970-2009	118 b.p.	139 b.p.	188 b.p.	293 b.p.

#### Proposal

Taking the analysis of Moody's data into account together with the empirical 99.5th percentile considering data from 1970 onwards, we propose the following calibration of the spread risk module.

Table 8: Corporate Bond Credit Spread – CEIOPS Final Advice vs. CRO Forum Proposal option2

	AAA	AA	A	BBB
CEIOPS Final Advice (CDS based)	130 b.p.	150 b.p.	180 b.p.	250 b.p.
CRO Forum Proposal – option 2 (Corporate Bond Based)	120 b.p.	140 b.p.	190 b.p.	300 b.p.
	<p><b>(-) a Liquidity Premium offset on the liabilities depending on their predictability and regardless of the rating of the assets invested</b></p> <p>Liability adjustment = (Liabilities * Predictability Ratio) * X% * (equivalent shock for the lboxx portfolio * duration of the liabilities)</p> <p>The X% refers to the CRO Forum/ CFO Forum simplified formula to assess liquidity premium <math>X\% * (\text{Credit Spread} - Y)</math>. In practice, based on the work performed so far; using <math>X=50\%</math> for all markets seems reasonable. The average rating for the lboxx is A in Europe, and BBB in the US.</p>			

- As already expressed above, the CRO Forum’s proposal for option 2 is dependent on introduction under Solvency II of a liquidity premium mechanism which is applied to all liabilities dependent on the predictability of their cash flows and their ability to withstand losses caused by forced sales.
- The calibration here suggests slightly higher stress tests to the CEIOPS Final Advice. However under the CRO Forum’s Option 2, the spread widening would be accompanied by a widening in the Liquidity Premium which would be applied to the calculation of the Technical Provisions. The application of the Liquidity Premium to liabilities would depend on the degree of their Liquidity – which could be assessed by the certainty of the liability cash-flows.
- Therefore some liquid policy liabilities could be expected to suffer a credit spread widening stress test close to the CEIOPS final advice. Meanwhile illiquid policy liabilities could be expected to suffer a lower credit spread widening stress test by benefiting from some Liquidity Premium offset
- The Level 2 text should explicitly allow for this option for companies that use internal models such that a fully consistent and an integrated approach to liquidity premiums should always be feasible.
- The level 2 text should also allow for equivalence of internal credit ratings (allowed under Basel II for banks).
- For very long dated bonds, we suggest imposing a cap on duration (20 years) to ensure the stresses are not unduly onerous.

## 4. Spread risk other than bonds

### 4.1 Spread on Structured Products

The CRO Forum considers CEIOPS' proposals on Structured Products to be highly punitive for the following reasons:

- The calibration of structured product stress tests, through a look-through approach, is complex due to the nature of the products and the lack of data (underlying assets quality, attach/detachment points).
- There is inconsistency between the stress tests for structured credit and corporate bonds. Shocks for corporate bonds are calibrated to historical spread movements while structured credit is calibrated to historical defaults.
- The proposed shocks for ABS are those required by S&P to achieve AAA CDO rating. These are too onerous for lower credit ratings and the shocks are too sensitive to attach/ detachment points.
- The minimum capital charge of 10%, independent of rating and layer, is arbitrary and too conservative for high quality short term assets. The CRO Forum also believes that the requirement to check that the originator is in compliance with the 5% retention is onerous and should be removed.
- The CRO Forum believes CEIOPS' calibration has not taken the downgrades of these types of assets and the recent updating of the rating models into account. This makes the comparison of the shocks between the final advice and QIS4 not very informative. The rating methodology for structured products has been questioned in the past and it makes more sense for the regulators to review or criticise the current updated rating models of the recognised rating agencies. This will avoid having different interpretations of the same ratings in the Solvency 2.

#### Types of Structured Credit

There are several different types of structured credit, each of which exhibit different risk characteristics. The CEIOPS Final Advice doesn't distinguish between different structured credit features:

- For example default and recovery rates for non-rated assets do not depend on asset quality. There is a large difference in the default and recovery rates of unrated prime and sub-prime mortgages. Furthermore the Final Advice does not recognize that the type of collateral held can be very different. Over-collateralisation is not recognised either.
- It is also important to distinguish between funded ABS and synthetic CDOs. Funded ABS and CMBS should be treated similarly to corporate bonds as they have exhibited more similar volatility to corporate bonds of the same rating than synthetic CDOs.

However, we recognize that all these specificities are difficult to reflect in a standard formula.

#### Proposal on Structured Products

In their final advice CEIOPS accept that the shocks for structured credit can be based on historical defaults. At the same time RCA states that credit ratings are a forward-looking assessment to withstand particular conditions of economic stress without defaulting (though they might be downgraded significantly as economic stresses increase). Based on this definition, the look-through approach for structured assets is not necessary unless the current rating methodologies continue to be not fully trusted. It should be noted that rating agencies are aware of this issue and have been taking appropriate actions. The focus of the regulator should be in taking the appropriate action to help restore confidence in all ratings from recognized RCA and not re-address this confidence issue within the Solvency 2 framework.

As a matter of principle, the CRO Forum believes that shocks of the structured credit should be based on the actual rating of these instruments.



For structured credit, the CRO Forum has analysed the maximum default rates of CDOs since 1981 and compared the results of this analysis to the corporate bond stresses proposed by CEIOPS in the final advice. This analysis results in the following scaling factors:

Table 9: Structured Products Credit Spread – corresponding scaling factor of max observed default rates of CDOs with the corporate bond stresses proposed by CEIOPS in the final advice

Term	AAA	AA	A	BBB	BB	B	CCC
1	-	0.1	0.6	0.6	1.6	2.8	-
2	0.3	0.1	0.4	0.7	1.5	1.9	0.3
3	0.4	0.2	0.4	0.7	1.3	1.6	0.4
4	0.3	0.2	0.4	0.7	1.2	1.5	0.3
5	0.3	0.2	0.3	0.6	1.1	1.3	0.3
6	0.3	0.2	0.3	0.6	1.0	1.2	0.3
7	0.2	0.2	0.3	0.6	0.9	1.2	0.2
8	0.3	0.2	0.3	0.6	0.9	1.3	0.3
9	0.2	0.2	0.3	0.5	1.0	1.3	0.2
10	0.2	0.2	0.3	0.5	1.1	1.3	0.2

The CRO Forum proposes that the stress tests based on the rating of the structured products are re-calibrated to be equivalent to the corporate bond stress tests multiplied by a scaling factor of 1 for investment grades and a scaling factor of 1.5 for other ratings

#### 4.2 Proposal on Credit Derivatives

In the CEIOPS final advice, CDS (not qualifying as hedges) subject to 600% spread widening or 75% spread narrowing. We strongly disagree with this arbitrary approach. In the calibration, CEIOPS focused on the CDS sold by institutions that defaulted during the crisis which created inconsistency with the calibration and the treatment of bonds. The issue of the default of the counterparties in CDS transaction is more relevant in the calibration of the counterparty sub-module.

For the calibration of CDS in the spread module, CEIOPS should use the same CDS data used in the calibration of bonds in the final advice.

Credit Default Swaps should be treated in the same way as corporate bonds (i.e. based on the rating of the underlying name) and the same calibration should apply.

A different CDS shock would give the wrong risk management incentives: companies will optimize their SCR by including hedges either in the bonds module or in the CDS module (if there is a large part of CDS where protection is sold, it will be cheaper to treat hedges in the CDS module since they will lead to a netting).

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### 4.3 Proposal on Mortgages

In the CEIOPS final advice, the Mortgage Loans shock is 8% of the risk weighted exposure, knowing that the exposure via structured products such as MBS do not fall within this sub-module.

We acknowledge that the proposed treatment of mortgage loans is imperfect:

- Not risk sensitive by spread
- Makes no allowance for rating (since they are not typically externally rated)
- Makes no allowance for the features of the underlying local loan market
- No link to the duration of the loans
- Applies a haircut to the collateral that is an additional prudence relative to Basel 2
- Unclear treatment for covered bonds

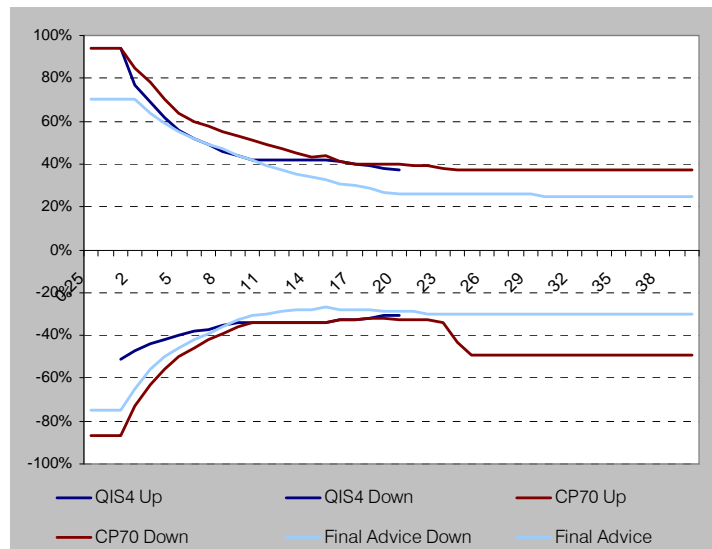
However, for the sake of simplification, we agree with the pragmatic approach of a unique shock of 8% in the standard formula.

## 5. Interest Risk (Nominal)

### 5.1 Absolute level of the Interest Rate shock

The CRO Forum agrees with the yield curve stresses as proposed in CEIOPS Final Advice. However we question the downward stresses having a minimum at Year 15. This seems in contradiction to economic theory. Beyond 30 years we expect to see a gradual decline in line with the extrapolation method principles agreed in the CEIOPS taskforce. For example, the down stress test should continue to decline beyond 15 years.

Graph 2: Interest Rate shock – comparison of the various CEIOPS proposals



#### Proposal

The CRO Forum agrees with the stress tests in the CEIOPS Final Advice, but recommends that the long term down stresses receive more attention in any future review.

### 5.2 Interest Rate volatility shock

The CRO Forum recommended the introduction of an Interest Rate implied volatility shock in order to capture the risk of volatility changes on the price of options.<sup>6</sup>

The CRO Forum has undertaken analysis of weekly swaption implied volatility data observed over the last 10 years. The implied volatility was for a 10 year into 10 year swaption. We calculate an absolute stress on swaption implied volatility of +10% / -3%; lower than the stress tests assumed in the recent CEIOPS advice. CEIOPS proposes an upward absolute stress of 12%.

We note that CEIOPS propose a zero correlation between the yield curve stress test and the swaption implied volatility stress test which may compensate for conservatism in the +12% swaption implied volatility stress test.

#### Proposal

The CRO Forum accepts the CEIOPS proposal of (+12%/-3%) and the correlation of zero with the interest rate shock.

In terms of methodology, a stochastic modeling of assets and liabilities (in which costs of options and guarantees for life insurers are taken into account) is required to calculate the volatility of SCR. The simplest manner to do so is to use the EEV/MCEV volatility sensitivities for determining the volatility SCR. For the small companies, that are less familiar to EEV/ MCEV calculations, we are conscious of the fact that it may require time to model this correctly.

<sup>6</sup> Calibration Principles for the Solvency II Standard Formula, CRO Forum, May 2009

## 6. Global Equity

### 6.1 Central Global Equity Index Stress Test

CEIOPS Consultation Paper 69 (CP69) proposed a calibration of 45% for the central (i.e. before the symmetric dampener is taken into account) standard stress test on global equities. This was a substantial increase from their proposal in QIS4 of 32%.

The proposed calibration of 45% is based on an analysis of the MSCI World Index. However, as shown in CP69, a range of approaches and data which are consistent with the Level 1 text could be used to calibrate the equity stress.

As shown in CP69, the observed 0.5th percentile of the MSCI World Index was between 42% (Total Return) and 44% (Price Return).

Table 10: Extract of CEIOPS Final Advice (previous CP69) justifying the equity stress test

	MSCI World TR	MSCI World PR
100.00%	65.82%	62.62%
99.95%	63.93%	61.39%
99.50%	53.94%	55.94%
<b>0.50%</b>	<b>-42.12%</b>	<b>-43.70%</b>
0.05%	-46.16%	-48.83%
0.00%	-46.21%	-49.88%
<b>Mean</b>	<b>10.04%</b>	<b>7.52%</b>
St Deviation	17.31%	18.11%
Kurtosis	94.54%	76.49%
Skewness	-30.62%	-21.71%
<b>Normal VaR</b>	<b>34.53%</b>	<b>39.14%</b>
<b>Empirical VaR</b>	<b>42.12%</b>	<b>43.70%</b>

#### Proposal

Taking into the data used account; the CRO Forum proposes a stress of no higher than 42% for the central standard stress on global equities. In addition, we believe that the definition of global equities should be expanded to some non-OECD countries, such as Singapore and Hong-Kong.

We insist that taken together with the equity dampener of 10% this means that potentially a stress of 52% could be applied, which appears to be larger than the extreme of the historical data set (-46%) and in particular is more extreme than the observed 99.5th percentile stress. So our proposal is already conservative.

Furthermore the CRO Forum propose that the equity index stress in non-OECD (except HK and Singapore) should be set at -52% (proposed standard equity shock plus 10pts).

The definition of global equities will also need to be reviewed regularly as other markets (e.g. Brazil) become stable enough to be considered global equities<sup>7</sup>. This would ensure that there are no disproportionate effects on third countries operations across the different modules of the SCR, such as equity and counterparty modules.

<sup>7</sup> Note that this comment could also be applied to other areas of the framework (e.g. counterparty default module)

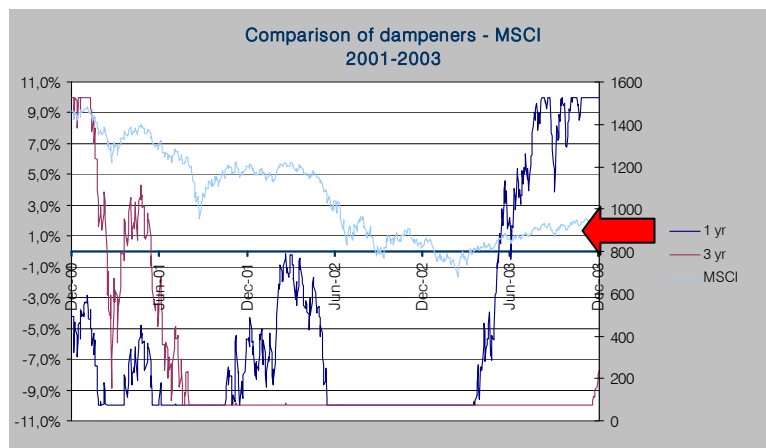
## 6.2 Application of the Equity Dampener

The CRO Forum welcomes the introduction of the equity dampener. The dampener will help to avoid any pro-cyclical effects of the equity stress and reduce the likelihood that (re)insurance undertakings will unnecessarily have to sell equities in a falling market.

We now consider the specific formulation of the dampener in CEIOPS final advice on the calibration of the market risk module.

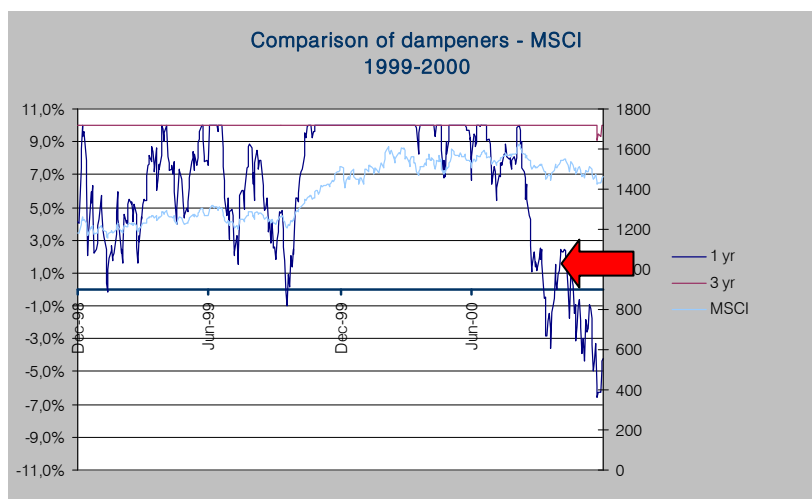
We believe that the dampener with a 1 year averaging period does not have the desired effect and that a 3 year dampener is preferable. For example consider the MSCI Developed Europe index. If the behavior of the 1 and 3 year dampeners is compared during the market falls of 2001 – 2003 as shown in the Graph below, it is clear that the 3 year dampener is more effective. Given the relatively low levels of the market, we would not expect to increase the stress in the second half of 2003.

Graph 3: Comparison of dampeners (2001-2003)



Also consider the period 1999-2000 where the 1 year dampener reduces the shock despite the market being relatively high in the recent economic cycle. The 3 year dampener results in a higher shock which is more reasonable in light of the market conditions as can be seen in the graph below.

Graph 4: Comparison of dampeners (1999-2000)



Furthermore, we note that, as shown in Annex B of CP69, the MSCI index was on average 11% above its 3 year moving average. The CRO Forum supports the proposal in Annex B of CP69 that an adjustment should be made to the dampener to capture this effect and avoids that the dampener on average increases the equity shocks and is therefore no longer the intended symmetric adjustment.

#### Internal Models

The CRO Forum believes that is important to retain flexibility for firms to investigate different parameters and structures of the dampener for their internal model calibration.

#### Proposal

Therefore the CRO Forum proposes that the formulation of the equity dampener could be improved as follows:

- Increasing the averaging period from 1 year (260 days) to at least 3 years
- Including an adjustment term to allow for the fact that, at any point in time, equity indices are on average higher than the historic moving average. Since the MSCI equity index was on average 11% above its 36-month moving average an adjustment term of approximately 11% would be appropriate.

The recalibration of the dampener leads to the respective shocks:

Table 11:

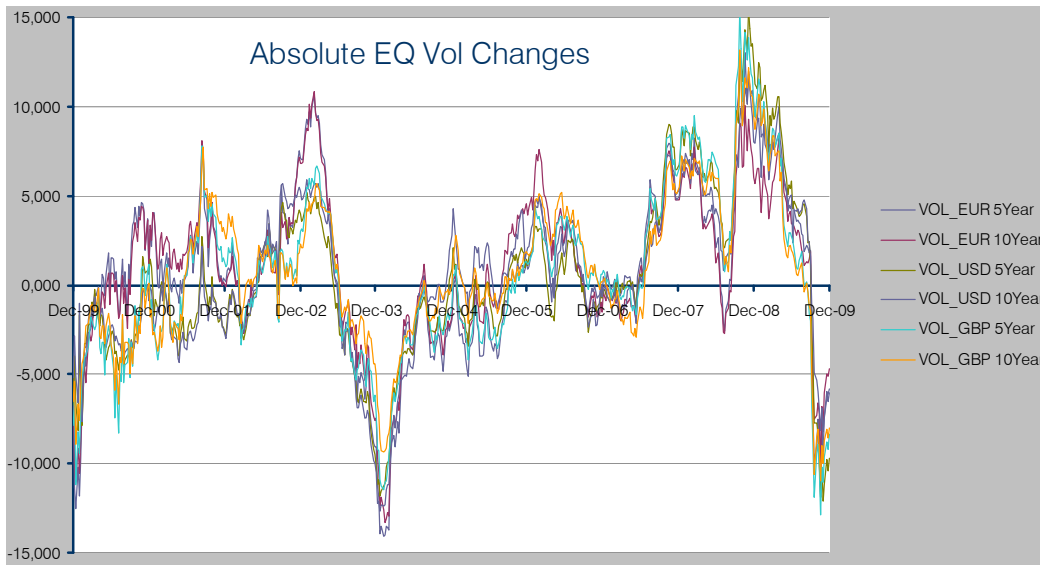
	Q4 07	Q2 08	Q4 08	Q2 09	Q4 09	Average Over 30 Years
Initial Dampener (standard shock at 45%/ 1 year average period/ no adjustment)	44%	34%	35%	39%	55%	49%
Dampener Re-Calibrated (standard shock at 42%/ 3 years average period/ no adjustment)	52%	32%	32%	32%	32.4%	47%
CRO Forum proposal - Dampener Re-Calibrated (standard shock at 42%/ 3 years average period/ adjustment term of 11%)	44.3%		32%	32%	32%	42%

### 6.3 Equity volatility shock

The CRO Forum has previously recommended the introduction of an equity implied volatility stress test<sup>8</sup>. However the CRO Forum believes that CEIOPS design and calibration of the volatility stress is overly onerous and highly pro-cyclical. In particular by proposing a relative stress test the equity volatility stress test becomes very onerous when equity implied volatility rises, as occurs in stressed market conditions.

<sup>8</sup> Calibration Principles for the Solvency II Standard Formula, CRO Forum, May 2009

Graph 5: Absolute Equity Volatility changes (2000-2009)



### Proposal

We believe that absolute stresses should be set at +10%/-3% instead of the relative stresses used in the final advice. We find that a relative stress of +50%/-15% is equivalent to a +16% absolute stress as at 31 December 2009. The CRO Forum agrees with CEIOPS proposal to set the correlation between the index stress test and the volatility stress test at 75%.

In terms of methodology, a stochastic modeling of assets and liabilities (in which costs of options and guarantees for life insurers are taken into account) is required to calculate the volatility of SCR. The simplest manner to do so is to use the EEV/MCEV volatility sensitivities for determining the volatility SCR. For the small companies, that are less familiar to EEV/ MCEV calculations, we are conscious of the fact that it may require time to model this correctly.

## 7. Alternative Assets

### 7.1 Hedge Funds

Under CEIOPS' Final Advice, hedge funds fall under the 'Other Equity' category. The Advice proposes a stress test of -55% for Other Equity whereas this stress test was -45% in QIS4. CEIOPS acknowledges that the fair stress for hedge funds is at a level of 23%, based on the HFRX Global hedge fund index.

2008 was the worst year in the history of hedge funds. The table below shows the falls in the best known hedge fund indices.

Table 12:

Hedge Fund Index	2008 Fall
Eureka	-11%
HFRX	-23%
Barclay Hedge Fund Index	-22%
Credit Suisse Tremont Index	-19%
EDHEC Index	-19%

The Table above suggests that a stress test of between -45% to -65% as proposed by CEIOPS Final Advice is very conservative.

It is commonly accepted that there might be positive return biases in the hedge fund indices. For example of a bias is survivorship bias. Survivorship bias means that only the hedge funds that have survived until today are reported. Failed hedge funds are removed from the index. Another example of bias is self-selection bias. Funds can voluntarily report their performance or decide to stop reporting performance.

Recent research<sup>9</sup> has shown that the biases could lead to an overestimation of the returns by as much as 8% per year.

#### Proposal

The CRO Forum believes that the shock applied to hedge fund portfolio should be set at -30% for a well-diversified portfolio (or -42% for other portfolios).

### 7.2 Private Equity

Currently private equities are treated in the 'Other Equity' category, together with hedge funds, equity listed in emerging markets and non-listed equity. For all those categories a shock of 45% in QIS4, respectively 55% in the final advice is applied for the SCR calculation.

CEIOPS justifies the new charges based on the LPX50 index for private equity, the S&P GSCI index for commodities, the HFRX index for hedge funds and the MSCI Emerging markets BRIC index for equities listed in emerging market.

We have strong reservations about the chosen index to represent the private equity class. This is not a direct private equity index, but a listed private equity index of companies investing in private equities. We would rather use a pure direct private equity index, such as the Thomson index.

<sup>9</sup> Horst/Verbeek in Review of Finance 11(4), 2007



The below table depicts the yearly returns of different private equity life stages, based on quarterly Thomson indices. The weighted portfolio is based on the assumption that 50% of the investments are made each in EUR and USD, while within an economy the assets are equally invested.

Table 13<sup>10</sup>: Yearly Returns on selected Private Equity indices

Quartile 99,5 <sup>th</sup>		Smoothed	Unsmoothed
Europe	Thomson all Buyouts	-47%	-45%
Europe	Thomson Mezzanine	-26%	-27%
Europe	Thomson all Venture	-61%	-61%
US	Thomson all Buyouts	-41%	-44%
US	Thomson Mezzanine	-26%	-27%
US	Thomson all Venture	-70%	-70%

The index is unsmoothed using the Fisher-Geltner-Webb approach in order to remove the effects that reported returns based on valuations are typically 'smoother' than returns from transaction-based indices.

#### Proposal

Based on the above figures, we observe very different shocks depending on the nature of the Private Equity: Venture (-60%), Buyout (-45%) and Mezzanine (-27%). We defend a lower shock at 42% for a diversified portfolio, otherwise 55%.

<sup>10</sup> Data extrapolated through a Monte Carlo simulation (11'000 scenarios), based on the volatility on the unsmoothed Thomson indices.

## 8. Property Risk

Over the last 10 years, we observed major discrepancies among the European Real Estate market with stark geographic differences. Clearly the UK IPD, as currently used in the CEIOPS final advice, is not the good proxy for all European market.

In the analysis below, we have used IPD data for the European major markets. Annual public data interpolated by IPD<sup>11</sup> to give quarterly figures in France, Germany, Netherlands. Monthly figures for the UK are publicly available:

Table 14: Yearly Returns on IPD quarterly data (un-smoothed)

<b>99,5% Shock</b> quarterly return [Q1 99 - Q4 08]	<b>Unsmoothed</b>				
	Retail	Office	Industrial	Residential	All Property
IPD France	19%	19%	16%	17%	16%
IPD Germany	5%	17%	5%	5%	11%
IPD UK	30%	30%	27%	25%	28%
IPD Netherlands	6%	11%	9%	10%	8%
<b>IAZI Switz (up to Q3 09)</b>					12%
<b>NCREIF US (up to Q3 09)</b>					40%

### Proposal

The data above clearly shows that property risk varies significantly by Member State, and we reiterate that property clearly represents a very different risk across Member States and so should be calibrated per country. However, for the sake of simplification, we agree with the pragmatic approach of a unique shock of 25% in the standard formula (vs 20% in QIS4).

In addition, we insist that International insurers have by nature very diversified real estate portfolio among countries (lag effect among countries). This justify why in our internal model, we could use lower shocks for Real estate.

<sup>11</sup> As a reminder, IPD index (Pan European IPD Total Return All Property/ Public data) is based on expert opinions and not transaction prices and covers about 50% of European Institutional Investors in Europe (investment market). Traditional private individual real estate is not covered in IDP data.

## 9. Foreign Exchange Risk

Under QIS4 Foreign Exchange (FX) risk was derived as the more onerous of a 20% rise and fall of all other currencies versus the local currency. The calibration was generally judged to be appropriate, however, the model has been criticised to be too simplistic, in particular, the assumption that all foreign currencies move into the same direction.

The calibration of the new FX module foresees a shock of +/- 25% vs the local currency for all foreign currencies. While the shock itself still appears to be acceptable (although being on the higher side of the range), the model per se should be put into question:

The suggested currency model stipulates that for each foreign currency the worst possible scenario happens and the FX SCR is then the simple sum of all those worst scenarios. The assumption is as incorrect as the assumption that all currencies move into the same direction.

For the majority of the solo companies the new model does not change their SCR figures compared to the old model (apart from the higher shock). The new model has only an impact for a minor part of the companies, namely if liabilities are held in a currency other than the local currency with a relevant mismatch, or if a currency is over-hedged.

Even though the new model is easy to understand, it might require the implementation of several hundred different shocks, dependent on the number of different currencies considered in the templates.

The new model should allow for a reduction of the risk charge also to other currency pairs with linked or pegged exchange rate systems, such as USD/HKD.

The new FX model has some significant drawbacks for the aggregation:

- Issue 1: The aggregated SCR figure is dependent on the portfolio structure and the chosen granularity.

Let us consider a simple example. Assume an entity is split into two sub-entities, all with local currency EUR:

- Sub-entity1 has local currency EUR and has assets of 100 EURm, invested in GBP.
- Sub-entity2 has local currency EUR and has a liability of 100 EURm, also in GBP.

On entity level we would expect zero FX SCR. However the resulting SCR would amount to 25 EURm:

Table 15:

	Sub-Entity 1	Sub-Entity 2	Total
FX <sub>GBP</sub> up	25	0	25
FX <sub>GBP</sub> down	0	25	25
FX <sub>GBP</sub>	25	25	<b>25</b>

If the sub-entities would not be treated separately, but as one joint entity, the SCR would be zero.

- Issue 2: The aggregation of FX SCR of entities with different currencies fails. The same issue has already been present in the QIS4 methodology.

Let us again consider a simple example:

- o Entity A has local currency GBP and has assets of 100 EURm, invested in EUR
- o Entity B has local currency EUR and has assets of 100 EURm, invested in GBP

Table 16:

	Entity A	Entity B	Total
$FX_{GBP}^{up}$	25	25	50
$FX_{GBP}^{down}$	0	0	0
$FX_{GBP}$	25	25	<b>50</b>

This results in a Group FX SCR of 50 EURm (not including translation risk). However, a rise of EUR vs GBP is the same as a fall of GBP vs. EUR. Therefore it is not correct to blindly aggregate the FXup scenarios. In this example it would be rather appropriate to aggregate the FXup scenario of entity A and the FXdown scenario of entity B.

#### Proposal

In order to solve this issue we suggest that, for the group aggregation, the up and down components of the solo entities shall be recalculated, again assuming that the local currency is the group currency (however neglecting the impact of the local currency vs. the group currency). In this manner, the up scenarios and down scenarios can be aggregated across all entities in scope.

We suggest reverting to the QIS4 model (with stress factors of +/- 25%), however the Group aggregation has to be refined. For the Group aggregation the up and down components of the solo entities shall be recalculated again, assuming that the local currency is the group currency.

In addition, we suggest that the risk charges for linked or pegged currency pairs (such as USD/HKD) will be reduced.

## 10. Correlations for market risks

We note that final factors for market risks in the Correlations Matrix are still at the extreme end and show little CRO Forum input retained by CEIOPS.

We invite readers to refer to the CRO Forum study published in December 2009 that explains in details our counter-proposals for the correlation matrix for market risks, based on a systematic analysis of all the available statistics:

- We disagree on all factors for Property that should be lower at [0.25; 0.5] as evidenced in the previous study.
  - The analysis on correlations between IPD data and relevant indices suggests that the correlations between interest rate / equity/ spread and property are material for France, Netherlands, UK and the US.
  - However the Swiss IAZI or German IPD indices are reversed correlated to interest rate/ Equity/ Spread. We therefore propose that the correlations for property risk are set to a range of [0.25; 0.5], versus 0.75 or 0.5 in the CEIOPS Final advice.
  
- We disagree on all factors for FX that should be lower at [0;0.25], given that FX risk was in fact a major diversifier in the recent financial crisis:
  - FX rates may move up or down depending on the FX positions in a portfolio. FX rate movements may be beneficial or detrimental (two-sided nature of FX risks). Likewise, the correlations between FX and the other market risks also have a high dependency on the FX positions in the portfolio.
  - Various currency rates do not normally rise or fall simultaneously. During 2008 some FX rates fell against the EUR (such as GBP, AUD, CAD, ISK), whilst others increased (such as USD, CHF, JPY, HKD).
  - For a diversified portfolio we can therefore assume a smoothing effect of upward-moving and downward-moving FX rates on the correlations between FX and the other market risks; we therefore suggest a low positive correlation with a range [0; 0.25].
  
- We disagree on all factors for Concentration that should be lower at 0, as in QIS4:
  - The correlations between the concentration risk and the other market risks depend on the underlying portfolio. An internal analysis of QIS4 results for Groups shows that for entities that have a concentration risk, most of the risk stems from government-related bonds (such as provinces or Bundesländer). An increase of the equity exposure would therefore effectively decrease the concentration risk, since it increases the asset base. Thus a negative correlation between concentration and equity risk would seem more appropriate in this case.
  - Concentration correlations have greater dependence on the individual portfolio than on the market movements. Concentration risk is not a stand alone risk, nor is it a risk that needs to be managed. The concentration should be allocated to the underlying risk and let the correlations carry through.
  - So, we propose to keep the correlations between concentration risk and other market risk at 0%, as in QIS4. Where a company has a very concentrated portfolio an add-on could be set as part of the pillar II measures.

Table 17: CRO Forum proposal for the market correlations in the standard formula

<i>CorrMkt</i>	<i>Interest Rate</i>	<i>Equity</i>	<i>Property</i>	<i>Spread</i>	<i>Currency</i>	<i>Concentration</i>
<i>Interest Rate</i>	1					
<i>Equity</i>	CRO Forum: 0.5 / Final Advice: 0.5/ 0 / QIS4: (0; +/-0.25)	1				
<i>Property</i>	CRO Forum: [0.25;0.5] FINAL ADVICE: 0.5/ 0 / QIS4: 0.5	CRO Forum: [0.25;0.5] FINAL ADVICE: 0.75 / QIS4: 0.75	1			
<i>Spread</i>	CRO Forum: 0.5 / 0 FINAL ADVICE: 0.5/ 0 / QIS4: 0.25	CRO Forum: 0.75 FINAL ADVICE: 0.75 / QIS4: 0.25	CRO Forum: [0.25;0.5] FINAL ADVICE: 0.5 / QIS4: 0.25	1		
<i>Currency</i>	CRO Forum: 0.25 FINAL ADVICE: 0.5 / QIS4: 0.25	CRO Forum: FINAL ADVICE: 0.5 / QIS4: 0.25	CRO Forum: [0;0.25] FINAL ADVICE: 0.5 / QIS4: 0.25	CRO Forum: [0;0.25] FINAL ADVICE: 0.5 / QIS4: 0.25	1	
<i>Concentration</i>	CRO Forum: 0 FINAL ADVICE: 0.5 / QIS4: 0	CRO Forum: 0 FINAL ADVICE: 0.5 / QIS4: 0	CRO Forum: 0 FINAL ADVICE: 0.5 / QIS4: 0	CRO Forum: 0 FINAL ADVICE: 0.5 / QIS4: 0	CRO Forum: 0 FINAL ADVICE: 0.5 / QIS4: 0	1

## Recent publications of the CRO Forum

Calibration recommendation for the correlations in the Solvency II standard formula  
December 2009

Calibration Principles  
May 2009

Internal Model Admissibility  
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Insurance Risk Management Response to the Crisis  
April 2009

Internal models benchmark study  
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Addressing the pro-cyclical nature of Solvency II  
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