Comments and resolutions template for consultation on QIS5 Catastrophe scenarios	
Name company: CRO Forum – comments provided to CEIOPS and EC (30/04/2010)	
Please insert your comments in the table below, and send it to secretariat@ceiops.eu in word format.	
Reference	**Comment**
General comment	We appreciate CEIOPS effort to define standardized scenarios for catastrophe risk. We also welcome the work of the Cat Task Forced documented in the draft specification. The approaches for the different cat scenarios are in general in line with good risk management practice. In general, the formulae provide the right balance between complexity in order to cover the exposure and simplicity in terms of their requirements on data. We also believe there is still room for considerable improvement. Our major concerns are 1. **Consistency of cat risk and basis risk module:** According to the description provided by CEIOPS for the calibration of the premium and reserve risk module, catastrophe losses could be excluded from the data on a qualitative base (outliers), only. The overall SCR per line of business from premium, reserve and cat risk module should be consistent with historical observations. For some lines of business, e.g. Credit / Surety and Marine, we doubt this is the case. 2. **Provided detail of information:** The work of the task force is preliminary. We are also aware that the calibration of the cat scenarios is challenging and requires expert judgement. Nevertheless we would appreciate more information on the reasoning of a particular calibration. For natural catastrophes the task force should provide details on how and why vendor model results (RMS, AIR, EQECAT, etc.) have been considered or not for setting the PML factors and the correlations. We are not sure whether the new calibrations will or not lead to a significant increase in capital requirements compared to QIS4. So we would like that CEIOPS provides a rough assessment of the new impact prior to the real QIS5 exercise.
Para 13	We believe the cat force should consider double-counting issues with other risk modules. It needs an early decision about which module will be finally adjusted to prevent potential double-counting.

Comments and resolutions template for consultation on QIS5 Catastrophe scenarios	
Name company: CRO Forum – comments provided to CEIOPS and EC (30/04/2010)	
Para 15	We agree with the task force view that finally the individual company must assess whether and why the standardized scenarios reflect its individual exposure in an appropriate way. We propose to include this requirement in the QIS5 technical specifications. Alternative approaches for companies for which the scenarios are not appropriate should be specified. Apart from using internal models is should be specified which adjustments to the standardized scenarios are feasible.
Paras 19-24	We appreciate the approach of the task force not to describe the risk mitigation by a closed formula but to leave flexibility for the broad range of different instruments. We support the arguments provided by the task force. We also agree with the inclusion of inward and outward reinstatement premium and cost.
Para 31	We remark that it is not necessary to assign the cat SCR to individual lines of business when diversification between the lines of business it taken into account in the calculation of the risk margin (QIS5 draft technical specification, TP 2.4).
Para 38	We agree that multiple losses should be taken into account for windstorm. E.g. in 1999 we have experienced two major windstorms (Lothar, Martin). We ask the task force to provide their reasoning for setting the factors for the two event sets ((0.8,0.4);(1.0,0.2)).
Para 40	We agree that multiple losses should be taken into account for flood. We ask the task force to provide their reasoning for setting the factors for the two event sets ((0.65,0.45);(1.0,0.1)).
Para 49	The calibration should be reviewed in conjunction with the high volatility charges of the premium risk module. We doubt that the overall SCR for the lob MAT is plausible.

Comments and resolutions template for consultation on QIS5 Catastrophe scenarios	
Name company: CRO Forum – comments provided to CEIOPS and EC (30/04/2010)	
Para 54	The performance of Credit / Surety business has a high correlation to the general economic conditions where GDP is a common indicator. In particular, high correlation to previous year's economic conditions can be observed. It is questionable whether the shocks should be applied irrespective of the economic cycle.
Para 58	The calculation must be linked to the credit standing of the exposure. If the three largest exposures have a Standard&Poor's rating of AAA it is very prudent to assign their common default to a 1 in 200 event.
Para 59	We understand this scenario to cover a frequency event. The calibration must be considered in conjunction with the calibration of the premium and reserve risk module. We believe the calibration results in an implausible high 99,5% percentile overall loss ratios for the lob credit / surety.

Mr Karel Van Hulle
Head of Unit
European Commission
Directorate General Internal Market and Services
Financial Institutions
Insurance and pensions
Spa Staat, 2, BE-1000 Brussels
Belgium

20 May 2010

Dear Karel,

Application of the illiquidity premium to liabilities

We would like to thank you for the opportunity to provide input into the drafting process of the implementing measures for the Solvency II framework and the Fifth Quantitative Impact Study (QIS 5).

We welcome the European Commission's suggestion in the draft QIS 5 technical specification to include a more granular approach to the application of the illiquidity premium. In this paper, we set out our proposals for the purposes of QIS 5. In addition, we include three separate Appendices which provide the results of quantitative analysis for a range of products. The results highlight a significantly level of predictability or resilience to forced sale for these products.

It has been challenging to develop a set of criteria which are transparent and easy to apply in practice. We recommend that the proposals in this paper serve as a framework to be tested in QIS 5. We recognise that the proposals may need refinement following feedback and an assessment of the impact through the QIS 5. We remain firmly committed to work further on the application of the illiquidity premium to liabilities.

Yours sincerely,

Proposed application of illiquidity premium to liabilities for QIS 5 purposes

For the purposes of QIS 5, we set out the following text on the application of illiquidity premium to liabilities based on the concept of defined categories. For each paragraph we provide associated reasons with reference to the quantitative analysis, where relevant.

Definition

P0. The percentage of the illiquidity premium observed in the financial markets corresponding to insurance or reinsurance obligations shall reflect the predictability of the cash flows of the insurance or reinsurance obligations and the extent to which the cost of forced liquidations of assets can be passed on to policyholders.

For insurance or reinsurance obligations which have discretionary benefits, the assessment of the percentage of the illiquidity premium as defined in P1 to P4 is performed at a level of aggregation at which the liabilities and associated assets are managed.

In order to evaluate the predictability of cash flows and the resilience to forced sale of illiquid assets, we propose that liability cash flows relating to contracts with discretionary benefits are considered at an aggregate level. The aggregation is proposed to be the level at which the undertaking performs the asset and liability management for the business. The objective is to reflect the nature of the discretionary benefit which is a key feature in determining the predictability of such contracts. For the avoidance of doubt, the assessment of the illiquidity premium for contracts which have discretionary benefits in the following paragraphs P1 to P4 is proposed at an aggregated level.

Classification: 100%

P1. For the purposes of QIS5, participants shall identify the liabilities that may be discounted with the risk-free interest rate term structure that includes a 100% illiquidity premium by assessing that they meet all of the following criteria:

- ***There is no option for any form of surrender or the benefits to policyholders in case of any form of surrender are less than or equal to the technical provisions determined with the portion of the illiquidity premium set at 100%.***
- ***The only significant underwriting risk connected to the contract is longevity risk and expenses.***

The percentage of the observed illiquidity premium to be applied to insurance or reinsurance obligations should depend on the nature of the liabilities, specifically on the predictability of the cash flows and the extent to which the cost of forced liquidation of assets can be passed on to policyholders. The proposed application of the illiquidity premium in the draft QIS 5 technical specification to only single premium retirement benefits in the form of annuities clearly does not reflect these principles, as many other liabilities would meet the criteria. Specifically, liabilities where there is no risk on any form of surrender and the only significant underwriting risk is longevity and expense.

The draft QIS 5 technical specification included all contracts less then 1 year in the 0% category. In the context of Property & Casualty contracts, this would be the period for a claim to be fully paid, rather than the period for which the contract had been underwritten. As detailed in our letter of 24 February 2010, there is clear economic rationale to show that for short terms the illiquidity premium vanishes since at maturity an illiquid bond is redeemed in

the same manner as a liquid bond. However, through developing our proposed criteria, it has been clear that this would be hard to implement from a practical perspective. Further, as it relates to discounting over a period of 1 year the financial impact is unlikely to be significant. Consequently, we have proposed to remove this potentially onerous requirement.

We would expect the following products to be in the 100% category; however, this is not an exhaustive list:

- Fixed products, for example, term certain annuities or other guaranteed investment contracts.
- Contracts where the benefit is in the form of an annuity.
- Products where surrender terms are at the full discretion of the company (or no surrender is possible) and there is only longevity and expense risk.

Classification: 0%

P2. For the purposes of QIS5, participants shall identify the liabilities that shall be discounted with the risk-free interest rate term structure that does not includes any illiquidity premium, subject to P1 as the following ones:

- ***Life insurance contracts where all investment risk is borne by the policyholder and there are no discretionary benefits.***

We proposed 0% liquidity premium for products where all the investment risk is borne by the policyholder and there are no discretionary benefits. This represents a pragmatic solution given the varying levels of predictability in such contracts. By definition, this category would include all pure unit linked products.

Classification: 75%

P3. For the purposes of QIS 5, participants shall identify the liabilities that may be discounted with the risk-free interest rate term structure that includes a 75% illiquidity premium, subject to P1 and P2, by assessing that they meet either of the following criteria:

- ***The benefits to policyholders in case of any form of surrender are less than or equal to the technical provisions determined with the portion of the illiquidity premium set at 75%.***
- ***There are features in the liability which significantly limit the rational policyholder's behaviour in the case of any form of surrender. Examples of such features would include significant guaranteed rates or discretionary benefits, significant penalties in case of any form of surrender or fiscal disincentives, significant accrued benefits or final bonus, and the existence of significant in-the-money options and guarantees.***

We have introduced a 75% category for specific contracts compared to the draft QIS 5 technical specification. In Appendix B and C, we have prepared quantitative analysis to support a 75% category for certain products.

Appendix B is a quantitative study prepared by the Fédération Française des Sociétés d'Assurances (FFSA) which demonstrates that for a number of representative French participating products a high portion of the liquidity premium can be applied. The study applies equivalently to other Continental European participating contracts. The existence of discretionary benefits provides resilience to the forced sale of assets as the benefits by definition can be removed, subject to some constraints. Further, Appendix C is a quantitative study prepared jointly by the CFO Forum and CRO Forum which illustrates the high predictability for US fixed annuity style products. In our proposed text (P3), we aim to capture the key descriptive features of these products. However, we would expect that further refinement would be required following the QIS 5 exercise. We would expect that certain

participating and US fixed annuity style products would be in the 75% category. This is not an exhaustive list of products.

Classification: 50%

P4 All liabilities not falling under one of the five previous paragraphs shall be discounted with the risk-free interest rate term structure with a 50% illiquidity premium.

As in the draft QIS 5 technical specification, we have maintained a 50% category for all other contracts. This represents a pragmatic solution given the wide range of contract types and varying degrees of cash flow predictability and resilience to forced liquidation. In Appendix A, we have included the quantitative study prepared jointly by the CFO Forum and CRO Forum in our letter of 24 February 2010. The study shows four contract types – a single premium endowment, individual profit sharing, group pensions and regular premium whole of life – each with an implied level of predictability in excess of 50%.

There are a wide variety of products which would be captured in this category include Property & Casualty contracts. For such contracts, the liability held for the period of risk exposure is generally short (for example, one year) so the inclusion of an illiquidity premium would not be significant. However, the related claims reserves are relatively stable, long term and can even be compared to an annuity in payment which would be highly predictable. The selection of a 50% category for Property & Casualty business presents a pragmatic solution to reduce complexity.

Appendix A – Quantitative assessment of the application of the illiquidity premium to liabilities

The following analysis was prepared jointly by the European Insurance CFO Forum and CRO Forum and submitted to the European Commission in our letter dated 24 February 2010. The analysis highlights that for a range of products there is high predictability.

Predictability of cash flows

Methodology
In this Method, the progression of the technical provisions over time under severe scenarios is examined. In line with other aspects of Solvency II the severe scenario would be the 99.5% percentile. The illiquidity premium can only be applied for the period that the progression of the technical provisions under the severe scenario is positive.

By using this method, a Predictability Ratio can be calculated by comparing the sum of progression of the technical provisions under the 99.5% scenario with the sum of progression of the technical provisions on a best estimate scenario. The comparison is limited to the period where an illiquidity premium can be earned in each currency.

The Predictability Ratio calculated in this manner is conservative as in many cases the company can restrict the loss of the illiquidity premium on surrender through the application of charges – that is the concept of resilience to forced sale. In these circumstances, the true Predictability Ratio would be higher than this analysis would suggest and should be adjusted upwards accordingly to reflect the restricted loss.

The Predictability Ratio is then applied to the observed illiquidity premium in the best estimate scenario to determine the technical provisions.

Application of method to liabilities
We illustrate the application of Method 2 for a sample of four products.

Product 1 - Single premium endowment

The following assumptions are used for this illustrative example:

- Fixed interest rate at 3%.
- Best estimate cash flows based on best estimate surrenders.
- Policy term is 30 years.
- Number of scenarios used is 1000.
- No liquidity premium is available in the market after 20 years

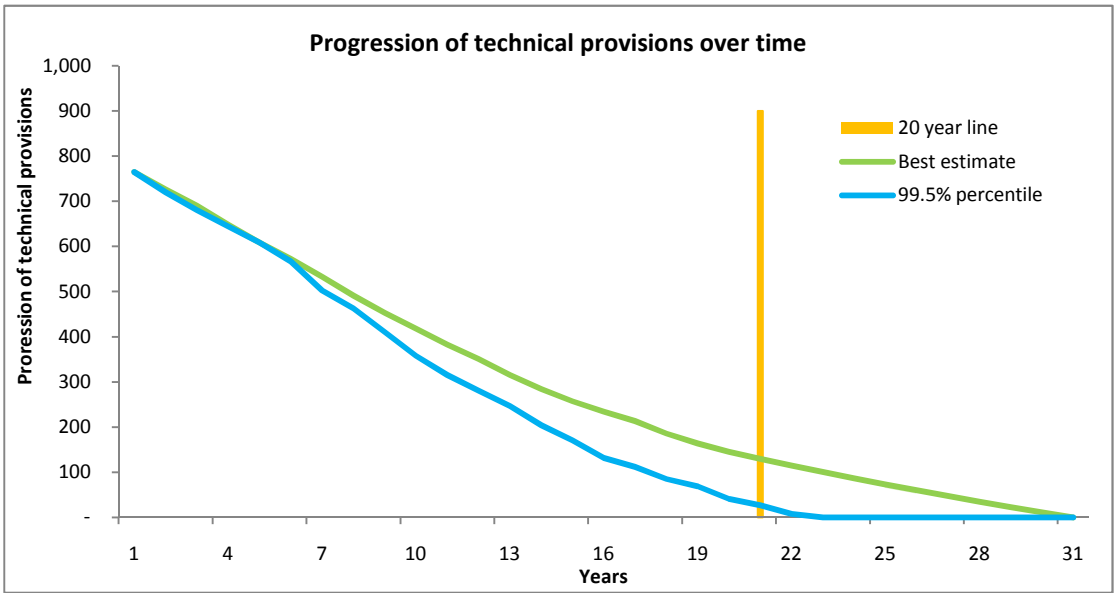
To illustrate the impact of predictability on the liquidity premium in each scenario, we assess the stability of cash flows in a stress scenario relative to the best estimate cash flows.

The following table shows the projected present value of the technical provisions over time:

Year	Best estimate	99.5% scenario	Predictability Ratio	Average Predictability Ratio
0	764.84	764.84	100%	
1	726.00	719.78	99%	
2	689.81	680.32	99%	
3	647.64	644.03	99%	
4	608.74	608.74	100%	

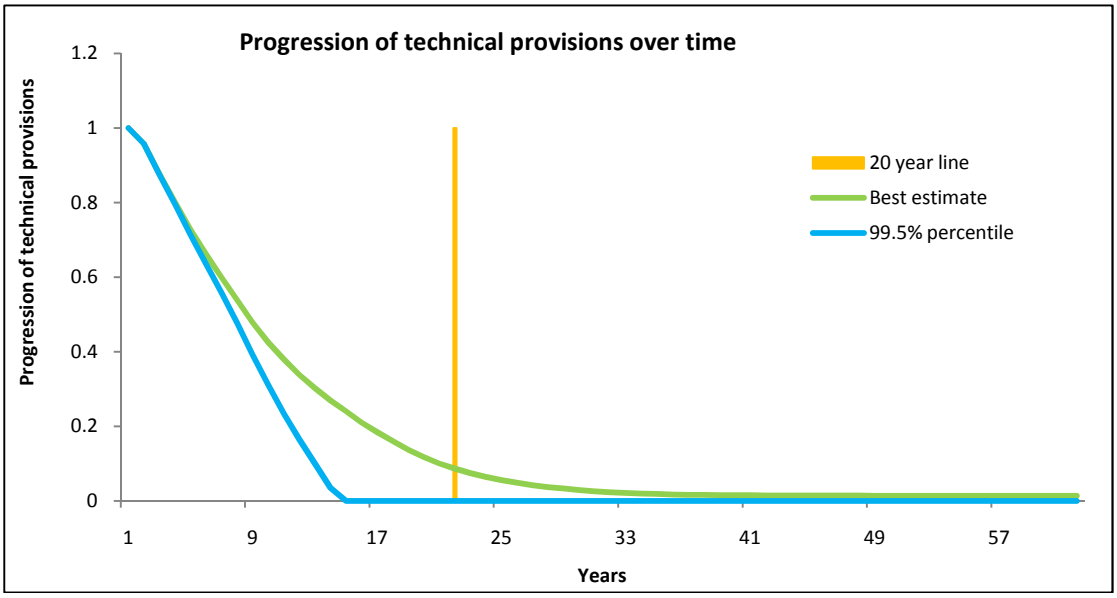
5	572.87	566.89	99%	
6	533.16	502.29	94%	
7	490.89	462.56	94%	
8	452.72	410.21	91%	
9	418.25	357.90	86%	
10	382.69	315.52	82%	
11	350.93	280.55	80%	
12	315.46	246.53	78%	
13	284.47	203.85	72%	
14	257.39	171.18	67%	
15	233.73	131.94	56%	
16	213.05	111.73	52%	
17	185.96	85.03	46%	
18	163.59	69.07	42%	
19	145.14	41.17	28%	
20	129.91	27.39	21%	**85% over 20 years**
21	115.12	8.27	7%	
22	100.77	-	0%	
23	86.83	-	0%	
24	73.30	-	0%	
25	60.16	-	0%	
26	47.41	-	0%	
27	35.03	-	0%	
28	23.00	-	0%	
29	11.33	-	0%	
30	-	-		**80% over 30 years**

In the 99.5% percentile scenario, 719 units of the technical provision can be held for 1 year, 680 units can be held for 2 years, 644 units can be held for 3 years. The following chart shows the results of the table above:



Product 2 - Individual profit sharing product

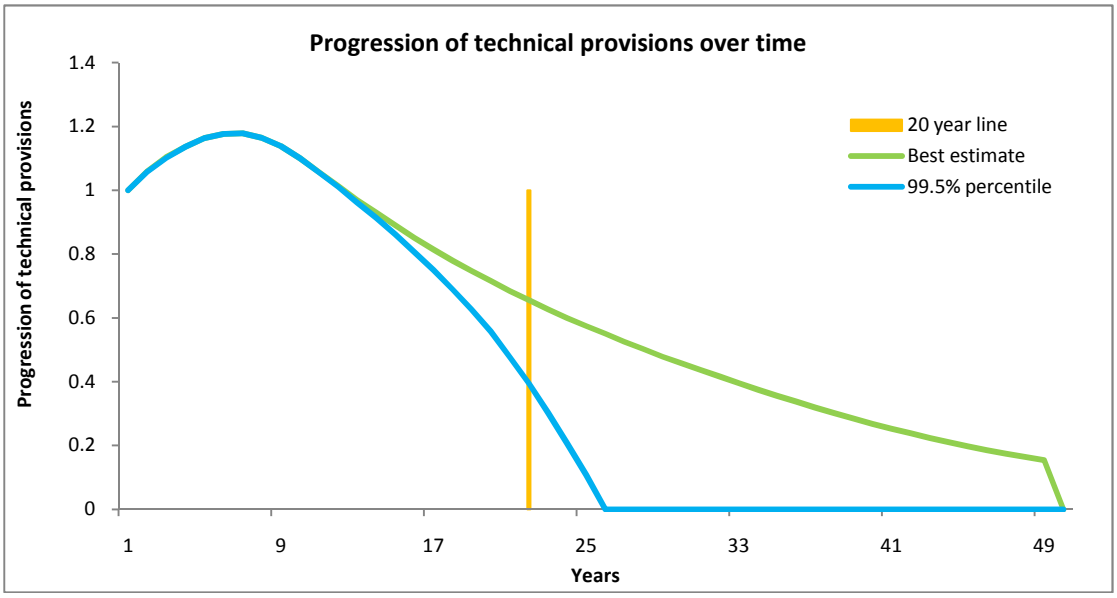
This example is based on an individual profit-sharing product with smoothed bonus linked to the performance of the underlying assets. Other underlying assumptions are the same as the previous example. The following chart shows the present value of the projected technical provisions under the different percentiles:



In the first few years, the bonus is fixed regardless of the performance of the assets, which explains the shape of the chart. In this example, the average predictability ratio based on the 99.5% scenario, is 76% at the 20 year point and 72% at the 30 year point.

Product 3 – Group pensions product

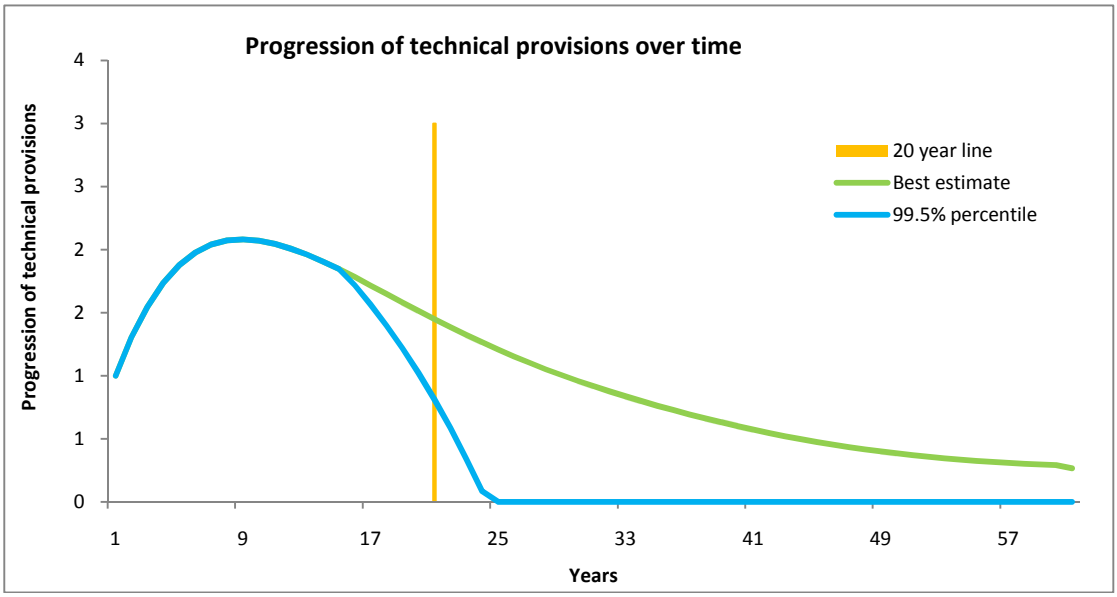
This example is based on a Group pension product with the bonus linked to swap rates. The following chart shows the present value of the projected technical provisions.



For this example, the calculated predictability ratio based on the 99.5% scenario, is 95% at the 20 year point and 77% at the 30 year point.

Product 4 – Regular premium whole of life contract

This example covers a tradional regular premium whole of life product. The following chart shows the present value of the projected technical provisions.



For this example, the calculated predictability ratio based on the 99.5% scenario, is 95% at the 20 year point and 75% at the 30 year point.

Appendix B – Quantitative assessment of the application of the illiquidity premium to French participating business

The following analysis was prepared by the Fédération Française des Sociétés d'Assurances (FFSA). The primary conclusion of the analysis is that the predictability of cash-flows for the French participating contracts in the study is significantly higher than 50%. It is noted that the conclusions equally apply to other forms of Continental European participating products.

The methods applied are similar to those in Appendix A.

Objectives of the study

- The FFSA carried out a study to assess the level of predictability of insurance cash-flows, in order to estimate the magnitude of illiquidity premium to use. Two different approaches have been followed to assess this predictability.

- The study was carried out on typical French products, representing a large portion of the French insurance business, specifically:

  - An immediate annuity with a low guaranteed rate of 2%.
  - A classical retirement product (namely Article 83), consisting in an accumulation phase before the retirement date where policyholders pay regular premium and a servicing phase where the insurer pay annuities. This contract has no surrender option.
    - The product has been modelled with three different guaranteed rates: 2%, 2.5% and 3%.
  - A classical saving contract, where the policyholders could surrender without penalties on the amount saved. However, due to fiscal benefits the policyholder should stay at least 8 years.
    - The product has been modelled with three different guaranteed rates: 0%, 2%, 2.5% and 3%.

Characteristics of products

The characteristics of the product are as follows:

<u>Savings product</u>:
- Average age of policyholders: 45 years
- Structural total surrenders : 1% before 8 years 2% after
- Structural partial surrenders : 1.5% per year
- Insurers loadings : 0.7%
- Profit sharing on financial results : 100%
- Mortality table : TGH05/TGF05 (French table split by sex and updated in 2005)

<u>Retirement product</u>
- Average age of policyholders: 45 years
- Retirement age : 60 years
- Insurers loadings : 0.7%
- Profit sharing on financial results : 100%
- Mortality table : TGH05/TGF05 (French table split by sex and updated in 2005)

Modelling approach

From a modelling perspective the following is noted:

- Two types of uncertainty have been modelled:
  - Financial uncertainty: interest rate, property and equities values.
  - Longevity uncertainty on retirement products.

- On the asset mix, the rationale used to justify the illiquidity premium is that, if insurance cash-flows were fully predictable, then the insurers could buy assets earning the illiquidity premium and perfectly matching the insurance cash-flows. Thus, we consider for the asset-mix only bonds matching the best-estimated insurance cash-flows (average cash-flows).

- To take into account commercial expectations and ability to surrender, we consider:

  - A prudent profit-sharing rule, where the policyholder expects to receive each year the 10 year risk-free rate net of insurer loadings for savings products. Specifically:
    - The 10 year rate of the year for savings products.
    - The average on three years for retirement products.
    - Potential reserves and unrealised capital gains are used to give the policyholder the expected revalorisation rate.

  - If the policyholder receives less that their expectation, a conservative surrender rule as suggested by the French supervisor for the QIS 4 exercise is applied. By way of further conservatism, no decrease in the surrender rate is modelled if the rate given is greater than that expected.

- 5,000 stochastic scenarios were used. The calibration of the scenarios was either real world or market consistent depending on the approach to assess the cash flow predictability, see subsequent details.

- For simplicity, the business is considered from inception with no initial unrealised gain or initial reserves.

Predictability of cash flows

To assess the predictability of cash flows two methods have been adopted.

Method 1 – "Forced sales" ratio

In summary:

- With assets "earning" the illiquidity premium, the risk which could emerge for the undertaking is to misestimate the cash flows so that the assets are required to be sold.

- The first method aims to assess the forced sales which would result from misestimating the insurance cash-flows:

$$Force\ Sales\ Ratio = \frac{MAX\ (0, Claims(n,i) - \ Average\ Claims\ (n)}{Average\ Claims\ (n)}$$

  Where:
  - "n" = Maturity
  - "I" = Scenario
  - "Average Claims" = Mean of claims across the scenarios. It is assumed that this would be the cash flows used to determinate the matching with illiquid bonds.

- Then for each scenario a mean ratio is calculated as the average of ratios of each maturity weighting by the average claims per maturity.

- The average is prepared over 50 years or 30 years, as it could depend on the longest maturity for bonds earning the illiquidity premium.

- The predictability ratio is estimated as 100% minus the 99.5% percentile of the "forced-sales" ratios calculated.

Method 2 – "Guaranteed Best Estimate" ratio

Method 2 is designed to be a simplified approach to address the two main features impacting predictability on these products, notably surrenders and profit-sharing. The purpose is to show that a large part of the best estimate liability is independent of the profit-sharing allocated to policyholders and insensitive to large surrender shocks.

To achieve this, for each product, we calculate a "guaranteed" ratio as:

- The best estimate liability guaranteed, calculated without profit-sharing.

  [This corresponds to the best estimate liability which should be calculated when assessing the Future Discretionary Benefits]

- Divided by a lapse-shocked best estimate liability.

  [A lapse shock of +50% was applied. The results were similar using the mass-lapse shock as specified in the CEIOPS final advice on Level 2]

Results of analysis

The results of the analysis for the identified products are as follows:

Ref	Product	Method 1		Method 2
		50 year **	30 year **	
1	Savings - 0%	59%	60%	52%
2	Savings - 2%	66%	66%	70%
3	Savings - 2.5%	70%	70%	75%
4	Savings – 3%	73%	71%	82%
5	Retirement – 2%	91%	94%	67%
6	Retirement – 2.5%	94%	95%	76%
7	Retirement – 3%	-	-	85%
8	Immediate Annuities – 2%	94%	96%	84%

** Note, period used to calculate the average "forced-sales" ratio depends on the longest maturity of illiquid instrument.

The results are intuitive:

- Predictability increases when there is no surrender option.
- A significant guaranteed rate increases the level of predictability (less discretionary profit-sharing).

Further, the predictability of cash-flows for these contracts is always significantly higher than 50%.

The analysis could additionally be developed to provide a quantitative criterion as to what a significant guaranteed rate would be at different points in time.

Appendix C – Quantitative assessment of the application of the illiquidity premium to US fixed annuity style products

The following analysis was prepared jointly by the European Insurance CFO Forum and CRO Forum. The analysis highlights that for US fixed annuity style products the predictability of cash flows is significantly higher than 50%.

Background to US fixed annuity style products

There are four primary types of US fixed annuity style products:

Book Value Annuity – [50% of the total US fixed annuity sales in 2009]
A book value annuity is a deferred annuity with a surrender charge and no market value adjustment. An interest rate is declared and guaranteed for a period of at least 1 year. Interest rate guarantee periods vary by product, but do not extend beyond the surrender charge period.

Indexed Annuity – [28% of the total US fixed annuity sales in 2009]
An indexed annuity is a deferred annuity with a surrender charge period, and may or may not have a market value adjustment. Interest credits are based on performance of a stock index, bond index, or fixed interest rate. Rates are generally declared annually.

Market Value Adjusted (MVA) Annuity – [14% of the total US fixed annuity sales in 2009]
An MVA annuity is a deferred annuity with a surrender charge and market value adjustment. An interest rate is declared and guaranteed for a period of at least 1 year. Interest rate guarantee periods vary by product, but do not extend beyond the surrender charge period.

Immediate/Income Annuity – [8% of the total US fixed annuity sales in 2009]
An immediate/income annuity offers guaranteed payments for life or for a fixed period of time. Single premium immediate annuities are most common, but deferred income annuities are also sold. Some products offer increasing payments.

Scope of study
The following example products were considered:

- Fixed-Rate Multi-Year Guaranteed Annuity (MYGA) with surrender charge, market value adjustment (MVA), and 2.5% guaranteed rate.
- Fixed and Fixed Indexed Annuities with surrender charge (no MVA).
- Fixed and Fixed Indexed Annuities with surrender charge and income rider.

Single premium immediate annuities (period certain and life contingent annuities) have not been considered, as these would fall under the classification of 100%

Methodology
The framework proposed is based on the predictability ratios as defined in Appendix A. In addition, the results have been checked against the “Forced Sales” ratio method illustrated in Appendix B.

The overall methodology is summarised as follows:

- Investment strategy is a cash flow matched portfolio of fixed income securities.

- 30 year projection period.

- Interest rates scenarios for the lower bounds predictability ratios presented are developed using the American Academy of Actuaries scenario generator. Scenarios calibrated to markets as of 31.03.2010.

- Dynamic lapse formula is the same formula used for the annual cash flow testing analysis required by regulator. The increase in lapse rate in the dynamic formula is a function of the difference between the rate in the existing contract and the competitor rate on a new contract (net of any remaining surrender charge and MVA on the existing contract).

- Scenarios and dynamic lapse assumptions are also used for solvency demonstrations in the US, including conservatism inherent in the solvency requirement. Due to this, the results represent a lower bound to what would result from a more market consistent and best estimate calibration of assumptions.

Conclusion

The predictability ratios ranged from 64% to 92% for this group of products based on method set out in Appendix A. The results shown below are based on this method. Using the method detailed in Appendix B, we see similar results with predictability ratios in the range of 60% to 93%.

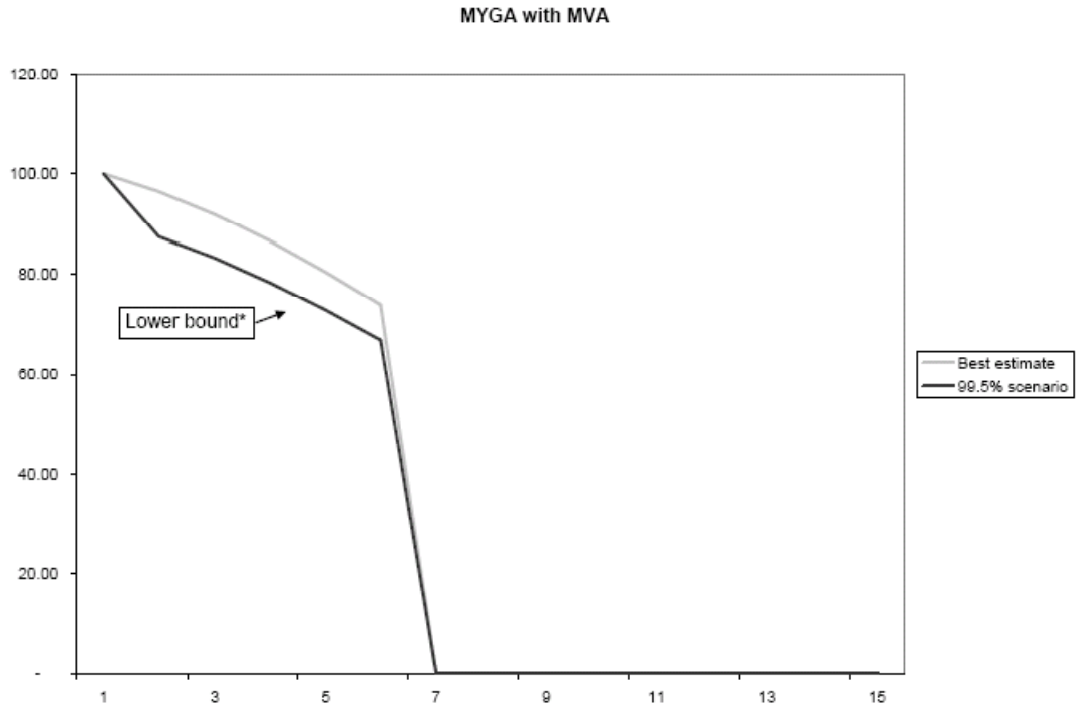
Since this represents lower bounds which are all above the 50% level, it would not be appropriate to classify the US fixed annuity products in the 50% category. Furthermore, a more market consistent and best estimate approach would increase the predictability factors. Therefore, the 75% classification would be appropriate for US fixed annuity products.

Results for product examples

The following graphs illustrate the results of the analysis. The y-axis represents the predictability ratio and the x-axis the year.

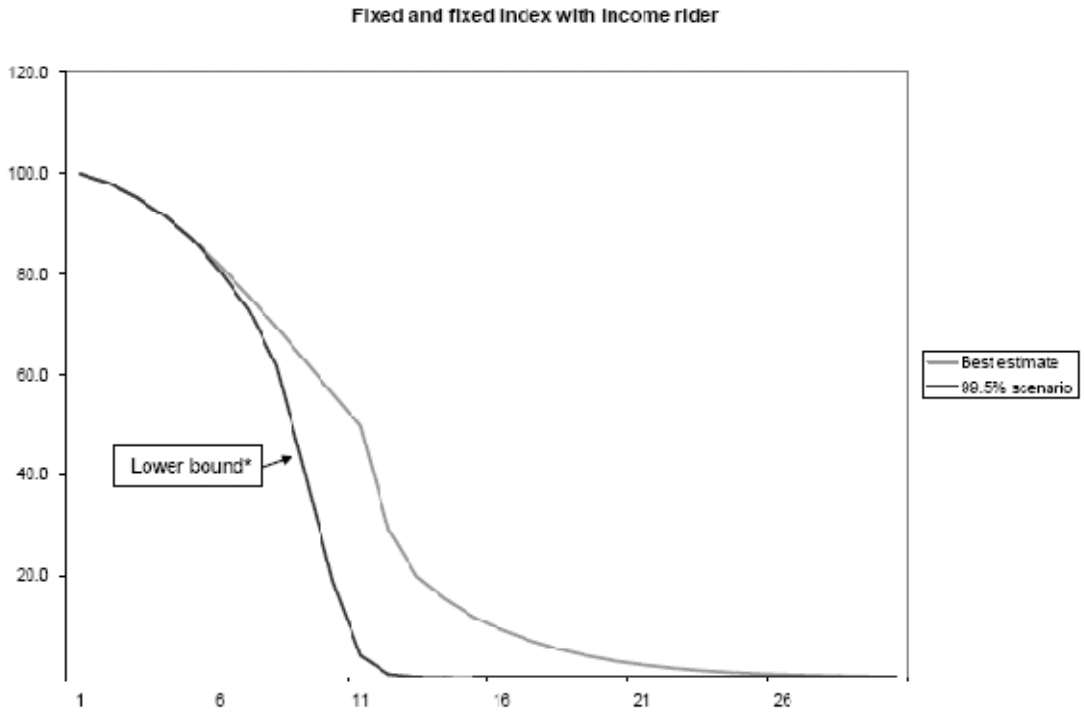
Multi year guaranteed annuity (MYGA) with MVA

Lower bound of the average predictability ratio is 92%



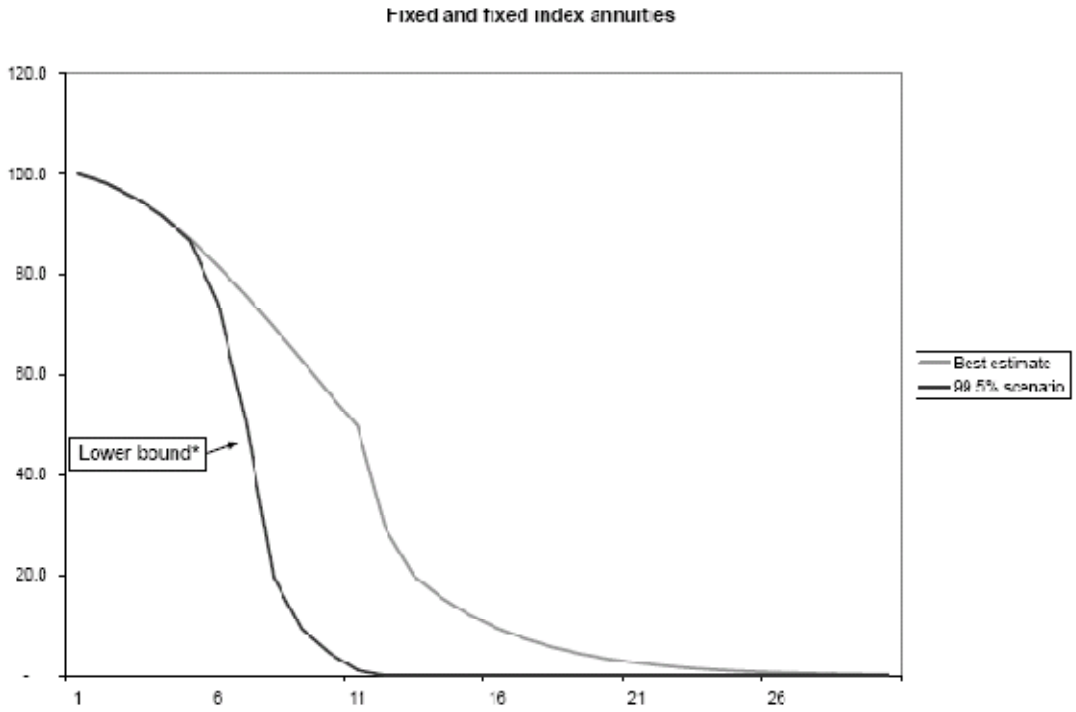
* Projections were run with scenarios and dynamic lapse assumptions that are used for solvency demonstrations in the US, so the results are a lower bound to what would result from a more market consistent calibration of assumptions.

Fixed and fixed index annuities with income rider
Lower bound of the average predictability ratio is 77%.



* Projections were run with scenarios and dynamic lapse assumptions that are used for solvency demonstrations here in the US, so the results are a lower bound to what would result from a more market consistent calibration of assumptions.

Fixed and fixed index annuities
Lower bound of the average predictability ratio is 64%



* Projections were run with scenarios and dynamic lapse assumptions that are used for solvency demonstrations here in the US, so the results are a lower bound to what would result from a more market consistent calibration of assumptions.

QIS 5 Technical Specification
Risk-free interest rates

Secondary currency list

14 May 2010

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Executive summary

We would like to thank you again for the opportunity to specify certain aspects of the risk-free interest rate term structure for Quantitative Impact Study 5 (QIS 5). Further to our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"), we have the pleasure of providing you with the calibration of 13 additional currencies from across the world. This has been prepared on a best endeavours basis. A summary of our proposal is contained on the next page.

In addition to the paper, there is a support spreadsheet containing the basic risk-free interest rate curves adjusted for credit risk ("CFOF_CROF_QIS 5 RFR Curves_Secondary Currencies.xls").

The paper should be read in conjunction with our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"). The recommendations, analysis and simplifying assumptions remain relevant and are not repeated in this paper.

Given the timescales for QIS 5 and the challenges in sourcing reliable data for the smaller markets, we have had to make a number of simplifying assumptions. In particular, we note:

- **For the majority of the Asian currencies, it was not possible to prepare a consistent liquidity premium calibration. However, there is clear evidence of the existence of significant corporate bond markets in many of these currencies. It is proposed for QIS 5 purposes, that insurers are permitted to use their own bespoke calibrations of the liquidity premium in these currencies**

- **For those currencies where there did not exist a sufficiently liquid and reliable swap curve the local government curve without adjustment for credit risk is proposed. If time had permitted further analysis, a credit adjustment may have been proposed. We recommend that insurers are permitted to use their own bespoke credit adjustments, if required, for the purposes of QIS 5. However, we do question whether such an adjustment is required.**

These matters will need to be reconsidered for full Solvency II implementation. We remain firmly committed to work further on the identified matters in this paper.

We are happy to discuss any of the matters set out in this paper with you. In the meantime we will continue to support the European Commission in its development of the Level 2 implementing measures and QIS 5.

Summary of QIS5 proposals for secondary currency list

		(1)	(2)	(3)	(4)	(4)	(5)
Currency	**Abbreviation**	**Basic yield curve (Bloomberg ticker)**	**Adjustment for credit risk (bps)**	**Entry point to extrapolation**	**Liquidity premium 31/12/2008**	**Liquidity premium 31/12/2009**	**Liquidity premium cut-off point**
Canadian Dollar	CAD	CDSWTT	10	30	200	48	25
South Africa Rand	ZAR	SASWTT	10	30	85	70	20
Australian Dollar	AUD	ADSWTT	10	15	139	75	8
Singapore Dollar	SGD	SDSWTT	10	30	Not specified	Not specified	Not specified
Mexican Peso	MXN	MPSWTT (Extended by MBONO)	10	29	0	0	Not applicable
Malaysian Ringgit	MYR	MRSWQOTT (Extended by MGS)	10	18	Not specified	Not specified	Not specified
South Korean Won	KRW	NDFB (Government)	0	18	Not specified	Not specified	Not specified
Thai Baht	THB	TBSWOTT (Extended by THAIGB)	10	30	Not specified	Not specified	Not specified
Hong Kong Dollar	HKD	HDSWTT	10	15	170	54	30
Taiwan Dollar	TWD	NTSWTT (Extended by TGB)	10	24	Not specified	Not specified	Not specified
Chinese Yuan	CNY	CGB (Government)	0	30	Not specified	Not specified	Not specified
Indian Rupee	INR	IGB (Government)	0	29	Not specified	Not specified	Not specified
Brazilian Real	BRL	BLTN, BNTNF (Government)	0	7	0	0	Not applicable

Notes:
(1) There are a variety of approaches taken to set the basic risk-free interest rate term structure. Primarily, inter-bank swap curves are proposed for most currency. For, MXN, MYR, THB and TWD, the inter-bank swap curve raw data is extended using the local government curve. For KRW, CHY, INR and BRL, the local government curve is proposed without adjustment. See section (1) for details.

(2) The 10bps deduction to remove credit risk in the inter-bank swap curve is applied as a parallel shift to the simply compounded forward rates. For government curves, no adjustment has been specified. See section (1) for details.

(3) The same entry point into the yield curve extrapolation is proposed for 31 December 2008 and 2009.

(4) & (5) The liquidity premium is applied additively to the basic forward swap curve up to the cut-off point where the addition applied to the forward rate is reduced linearly to zero over the next 5 years. For the majority of the Asian currencies, it was not possible to prepare a consistent liquidity premium calibration given the timescales for QIS 5. However, there is clear evidence of the existence of significant corporate bond markets in these currencies. It is proposed for QIS 5 purposes, that insurers are permitted to use their own bespoke calibrations of the liquidity premium in these currencies.

1. Basic risk-free interest rate

Principles for the selection of the basic risk-free interest rate

In selecting the basic risk-free interest rate for the secondary list of currencies for QIS 5 purposes we have used, as our guiding framework, the principles provided in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"). In summary:

1. ***For each currency where swaps exist and are sufficiently liquid and reliable, the basic risk-free interest rate applicable to the valuation of a liability should be based on the swap curve appropriately adjusted to remove credit risk.***

2. ***When using swaps where the deposit period on the floating rate leg is not overnight an adjustment for long-term through-the-cycle credit risk appropriate to the deposit period should be made.***

3. ***Where swaps do not exist or are not sufficiently liquid and reliable from a certain point, the basic risk-free interest rate applicable to the valuation of a liability should have reference to the government curve in that currency.***

4. ***For government curves where the government is of credit quality lower than AAA an adjustment for long-term through-the-cycle credit risk should be made.***

5. ***In all cases, the basic risk-free interest rates should follow a smooth progression.***

Proposed basic risk-free interest rate for QIS 5

The selection of the basic risk-free interest rate is challenging for smaller or developing markets. In particular, there may be different swap curves for onshore rates (that is transactions in the local market) and non-deliverable interest rate swaps (NDIRS) where the net payments are cash settled in a major currency, for example, US dollars.

The inter-bank swap curves are based on rates collected from Bloomberg. We have used what we believe to be the most commonly used convention in terms of compounding and term of the underlying deposit. As described in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"), we have used the Bloomberg ticker convention XXSWTT.

Associated to this paper is a spreadsheet ("CFOF_CROF_QIS 5 RFR Curves_Secondary Currencies.xls") which contains fitted curves (adjusted for credit risk where required) for each currency based on the Bloomberg data using the Barrie & Hibbert standard yield curve fitting methodology. The method uses a regression spline with smoothing constraints. This method produces rates that are very close to but not exactly equal to market rates. The average absolute error is generally less than 1 basis point[1]. It is also noted that the fits presented use all available data and do not apply the proposed cut-off points for entry into extrapolation for QIS 5.

For a number of the secondary currencies, we proposed a government curve where the swap curve does not exist or is not sufficiently liquidity and reliable. In summary:

- **South Korean Won (KRW) –** The basic risk free interest rate for QIS 5 purposes is set as the government curve due to systematic distortions in the swap market compared to the local government bond market. Foreign investors in South Korea had to pay special taxes on the interest income from government bond holdings which did not apply to local investors. Consequently, local investors had a significant competitive advantage in the local government bond market. As the same tax did not apply for the swap market, external investors concentrate their investments on the swap market while local investors concentrate on the government bond market. Although the legal basis for this different treatment had been abolished during 2009, there is still a significant disconnect between the swap and government bond market with the government bond curve representing the only reliable risk-free interest rate for the local insurer. However, this will need to be monitored in future.

- **Chinese Yuan (CNY) and Indian Rupee (INR)** – For these two currencies, local insurers are either prohibited from entering into swap transactions or there are onerous regulatory approval requirements. Given the constraints in these two currencies and the relative immaturity of the swap markets, it is proposed to use the government curve as the basic risk free interest rate for QIS 5 purposes.

- **Brazilian Real (BRL)** – There are no swap rates available so government rates are used.

It is also noted that the Hong Kong Dollar (HKD) is pegged, based on a narrow range, to the US Dollar (USD1 = HKD 7.75 – 7.85). We propose to use the local HKD swap curve for QIS 5 as this is sufficiently liquid and reliable in its own right.

[1] See: http://www.barrhibb.com/documents/downloads/A_Framework_for_Estimating_and_Extrapolating_the_Term_Structure.pdf

The Government curves are derived by fitting splines to forward rates such that the forward curve minimises the least squared error to market bond prices (accounting for accrued interest where appropriate) subject to certain smoothing constraints. The bond universe includes all central government and treasury securities available using the listed Bloomberg Ticker series. Sub-sovereign securities are not included. We note that we use only bonds that have reliable prices, for example, vendor derived 'fair prices', such as Bloomberg BFV, are excluded. This represents the standard methodology used by Barrie & Hibbert.

Method for adjusting inter-bank swaps for credit risk

Currencies using inter-banks swaps as the basic risk-free interest rate
For those currencies where the basic risk-free interest rate is the inter-bank swap curve, we propose to reduce the rates by 10bps for QIS 5 purposes to reflect the impact of credit risk. The 10bps deduction for credit risk is applied as a parallel shift to the simply compounded forward rates. The rationale for the adjustment is detailed in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL").

Currencies using government bonds as the basis risk-free interest rate
For those currencies where the basic risk-free interest rate is the local government curve, we have applied the following methodology to adjust for credit risk.

- **For currencies where the local government is AAA rated, we have applied no adjustment for credit risk.**

- **For currencies where the local government is rated less than AAA, we have not adjusted for credit risk due to the time constraints in preparing this analysis.** We acknowledge that for consistency with the SCR Standard Formula market risk calibration no adjustment is required for EEA or OECD countries. Of the currencies where a local government curve is proposed is proposed for QIS 5, notably, KRW, CNY, INR and BRL, only South Korea is a member of the OECD. **For CNY (AA rated), INR (BBB rated) and BRL (BBB rated), we recommend that insurers are permitted to use their own bespoke credit adjustments for the purposes of QIS 5. Further analysis would then be required for full Solvency II implementation. However, we do question whether this adjustment is required, especially for China.**

Assessing the entry point into the yield curve extrapolation

Methodology

While it may be possible to see quotes and access data for very long swap contacts, often the markets in these rates will not be deep or liquid. It is a requirement to assess the last observed liquid market data point which will serve as an entry point into the extrapolated part of the curve. Establishing which point on the curve is the last liquid point is not an easy task as data on volume of trades is not directly available by duration and the liquidity of long term swap rates may vary under different market conditions. This is especially challenging for smaller and developing markets.

Where possible for the secondary list of currencies, we have used the range of methods as detailed in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"). However, due to the time constraints in preparing the analysis and the reduced availability of data for the secondary currencies a pragmatic approach has been taken to select the entry points for extrapolation based on the sources available. As for the primary currencies, given the importance of the selection and the key interaction with the extrapolation method and assumptions, further analysis is required for full Solvency II implementation.

Proposed swap curve entry point into the yield curve extrapolation for QIS5

Appendix 1 displays the results of the analysis, including a brief explanation for each currency. **For simplicity, as for the primary currencies, we propose a single set of entry points for both 2008 and 2009. The entry points are based on the level of liquidity observed at end 2008, where it was possible to separately assess this.**

For a number of secondary currencies where the basic risk-free rate is the inter-bank swap curve, the government curve is available for longer tenors, specifically, the Mexican Peso (MXN), Malaysian Ringgit (MYR), Thai Baht (THB) and Taiwan Dollar (TWD). We have used the additional market data to extend the inter-bank swap curve before entry into the extrapolation. This has been achieved by adding raw data points before the fitting methodology is applied. We have used a relatively simple method to develop the additional raw data points by assuming that the spread between the swap curve and the government curve at the last observed swap point is maintained. For example: TWD 20 year Swap = TWD 20 year Government Bond + 15 year Swap to Government Spread. This extension is performed on the simply compounded forward rates. It is important in this method to avoid the introduction of arbitrage opportunities, however, as the curves will be re-fitted as part of the extrapolation to long horizons this should not be an issue. **A more refined method could be developed in which the extrapolated spread increases or decreases with tenor. However, often there is not sufficient market data to support a more refined method. Further analysis is required for full Solvency II implementation, including the assessment of the last liquid and reliable government bond tenor.**

2. Liquidity premium

Principles over the derivation of the liquidity premium

In setting the liquidity premium for the secondary list of currencies for QIS 5 purposes, we apply the relevant principles from the CEIOPS working party report ("Task Force on the Illiquidity Premium – Report" – 1 March 2010). In summary:

- ***The risk-free reference rate applicable to the valuation of a liability should be the sum of a basic risk-free reference rate and a liquidity premium depending on the nature of the liability.***

- ***The liquidity premium should be independent of the investment strategy adopted by the company.***

- ***The liquidity premium applicable to a liability should not exceed the extra return which can be earned by the insurer by holding illiquid assets free of credit risk, available in the financial markets and matching the cash flows of the liability.***

- ***The liquidity premium should be calculated and published by a central EU institution with the same frequency and according to the same procedures as the basic risk-free interest rate.***

- ***The liquidity premium should be assessed and quantified by reliable methods based on objective market data from the relevant financial markets and consistent with solvency valuation methods.***

- ***No liquidity premium should be applied to liabilities in the absence of a corresponding liquidity premium evidenced in the valuation of assets.***

Proposed liquidity premium term structure for QIS 5

The proposed liquidity premium term structure for QIS 5 purposes for the secondary list of currencies relative to the basic risk-free interest are detailed in Appendices 2 and 3. The liquidity premium is applied additively to the basic forward swap curve up to the cut-off point where the addition applied to the forward rate is reduced linearly to zero over the next 5 years. It is also note that the liquidity premium cut-off point could be at a longer tenor than the entry point for the basic risk-free interest rate extrapolation. This would reflect the relative depth and liquidity of the corporate bond market to the swap market.

As detailed in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"), in determining the liquidity premium for QIS 5 purposes a number of simplifications have been made due to data limitations and time constraints in preparing the calibration which will require further investigation for full Solvency II implementation. These simplifications apply equally to the secondary currency list.

For the majority of the Asian currencies, it was not possible to prepare a consistent liquidity premium calibration in the timeframe for QIS 5. However, there is clear evidence of the existence of significant corporate bond markets in these currencies. It is proposed for QIS 5 purposes, that insurers are permitted to use their own bespoke calibrations of the liquidity premium in these currencies.

For full Solvency II implementation, further analysis is required. We will continue to refine our analysis in these areas.

Appendix 1:

Currency by currency basic risk-free rate curve and proposed cut-off points for entry into extrapolation for QIS 5

Notes on presented data

- The fits presented use all available data and do not apply the proposed cut-off points for entry into extrapolation for QIS 5. We show spot and forward rates at end December 2008 and 2009 for the following curves:
  - Inter-bank swaps
  - Local government bonds
  - Inter-banks swaps adjusted for through-the-cycle credit risk (“Swap + Adj”)
  - Inter-banks swaps adjusted for through-the-cycle credit risk and extended using government data where longer tenors exist (“Swap + Adj (Ext)”)

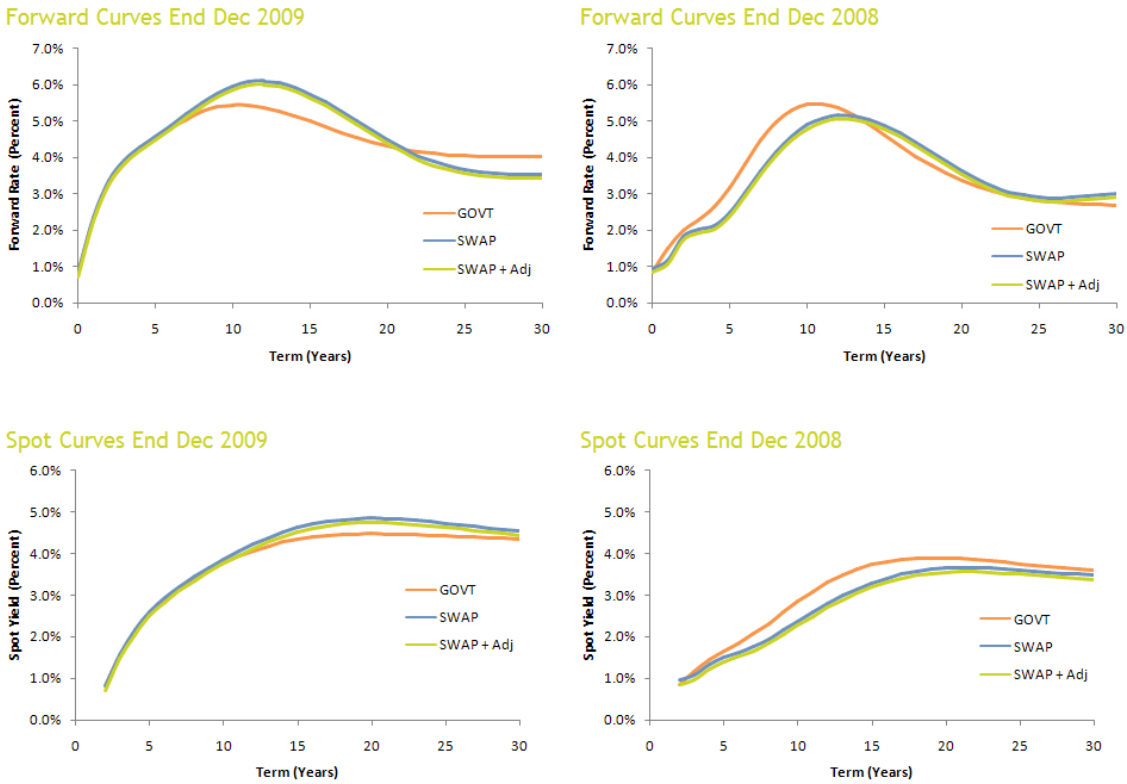
Canadian Dollar – CAD

Swap Tickers: CDSWTT = Semi Annual Fixed vs. 3 month Canada Bankers Acceptances

Basic risk-free interest rate curve liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum[2])
30	30	30

Fitted Curves:



Conclusion:

- Due to the limited data available in the timeframe to prepare the QIS 5 specification, no formal analysis could be prepared. **It is proposed to use all the market data and therefore an entry point of 30 years.** This is consistent with the availability of government bonds in the market and local experience of the market as evidence by the CRO Forum survey.

[2] CRO Forum member's views survey on the last liquidity point used internally by those firms at end December 2009

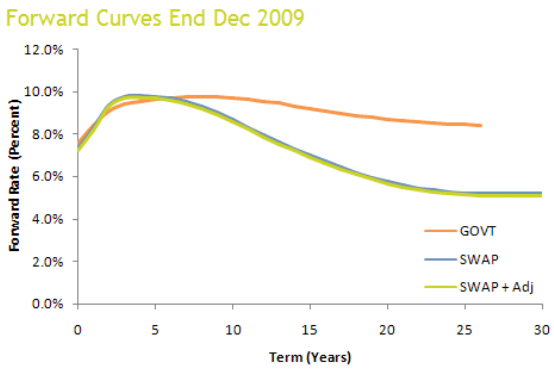
South African Rand – ZAR

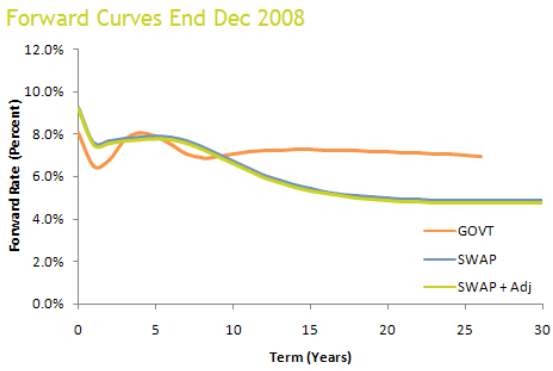
Swap Tickers: SASWTT = Quarterly Fixed vs. 3 month JIBOR

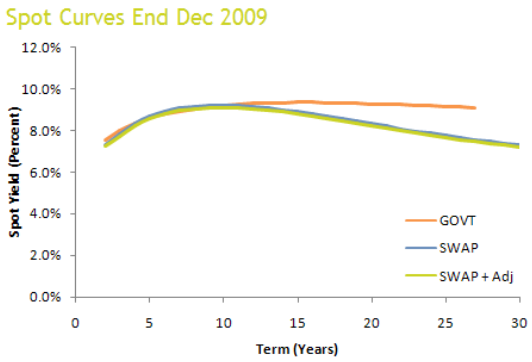
Basic risk-free interest rate curve liquidity:

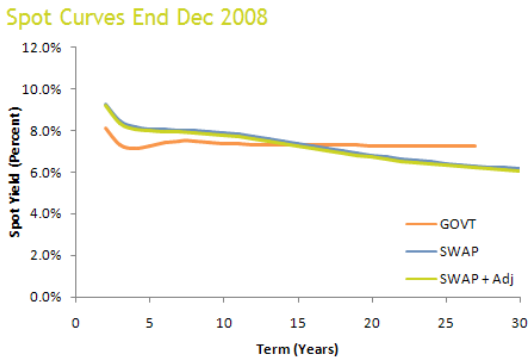
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
25-30	30	Not applicable

Fitted Curves:









Conclusion:

- Due to the limited data available in the timeframe to prepare the QIS 5 specification, no formal analysis could be prepared. **It is proposed to use all the market data and therefore an entry point of 30 years.** This is consistent with the availability of government bonds in the market.

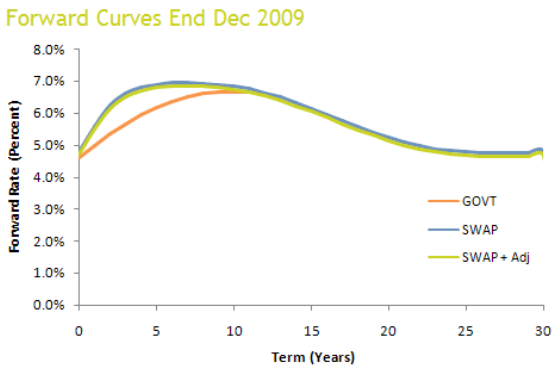
Australian Dollar – AUD

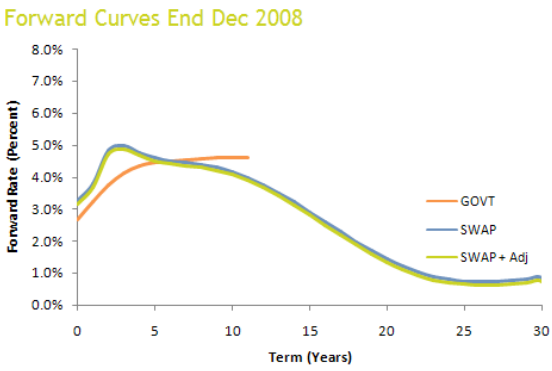
Swap Tickers: ADSWTT = Semi Annual Fixed vs. 6 month Australia Bank Bill

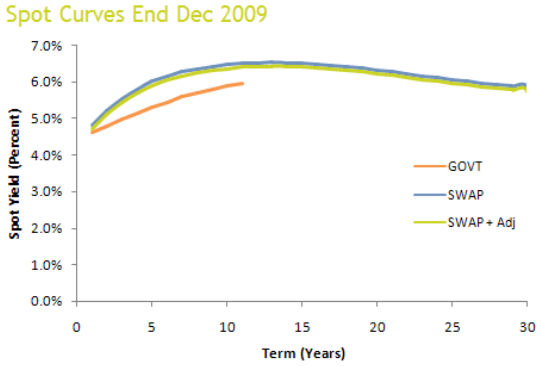
Basic risk-free interest rate curve liquidity:

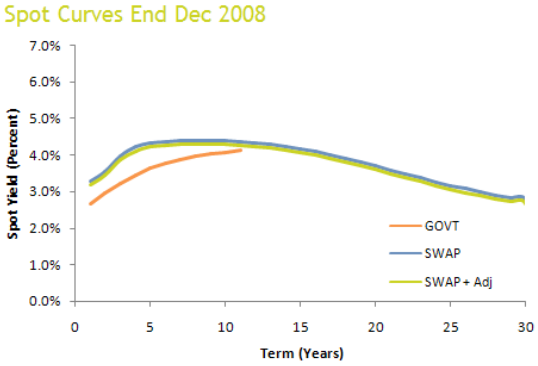
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
10-15	30	30

Fitted Curves:

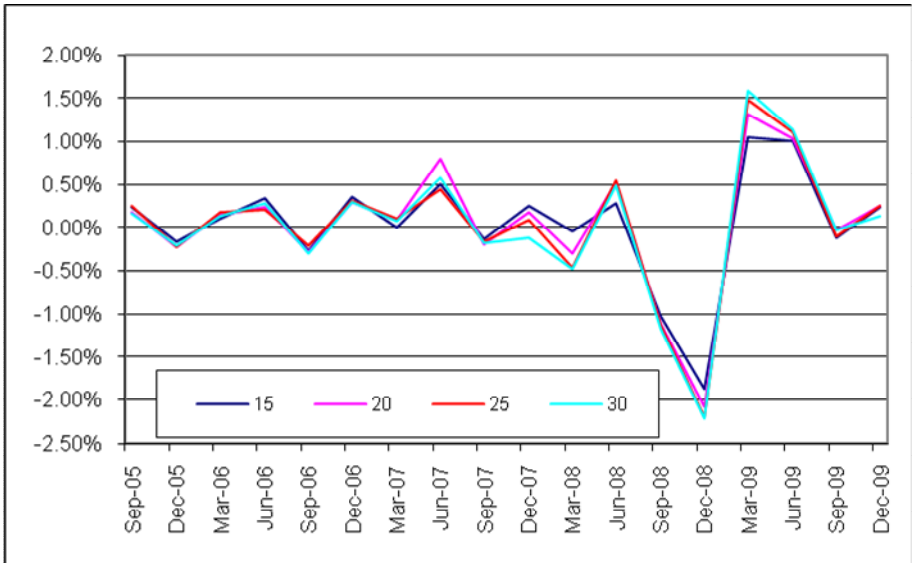




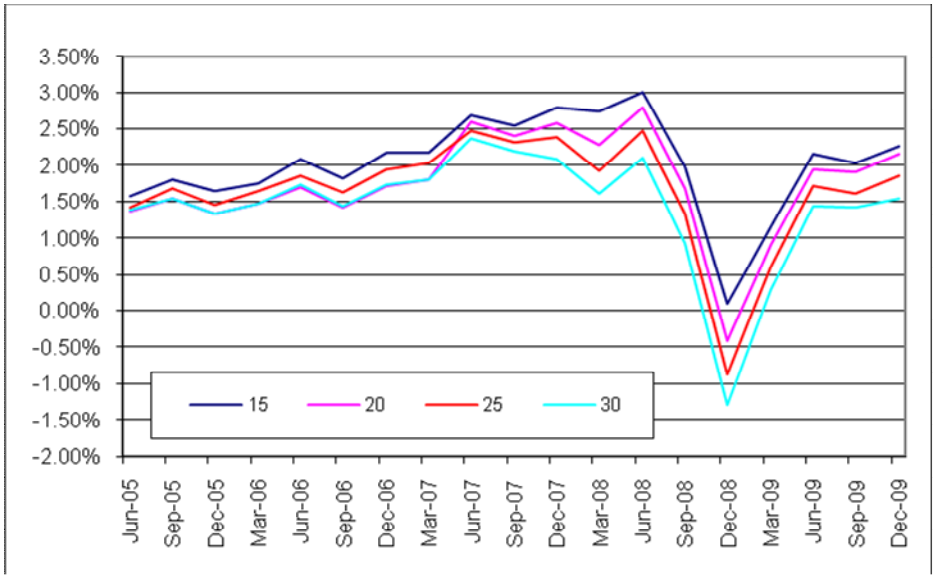




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Volatility in long-term forward rates increase in Q4 2008 (up to 2% quarterly movement).
- Long-term forward rates dropped significantly below the ultimate rate (up to 1% for 25-30 year forwards).
- **Propose 15 years entry point. There appears some liquidity up to 30 years in 2009.**

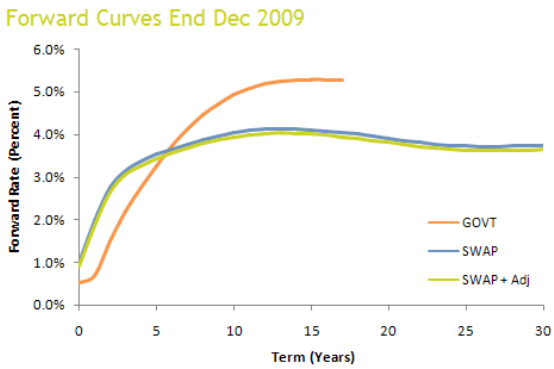
Singapore Dollar – SGD

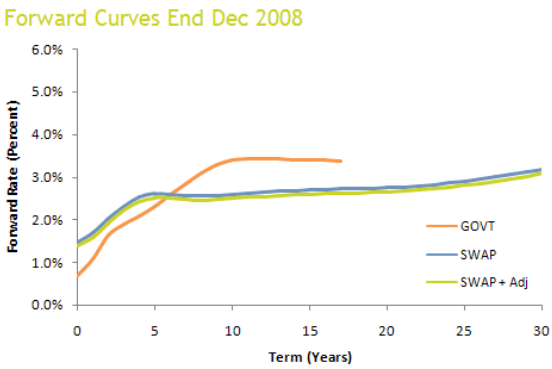
Swap Tickers: SDSWTT = Semi Annual Fixed vs. 6 month Association of Banks in Singapore Swap Offer Rate

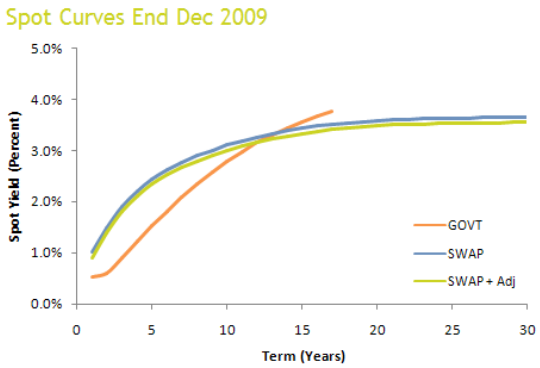
Basic risk-free interest rate curve liquidity:

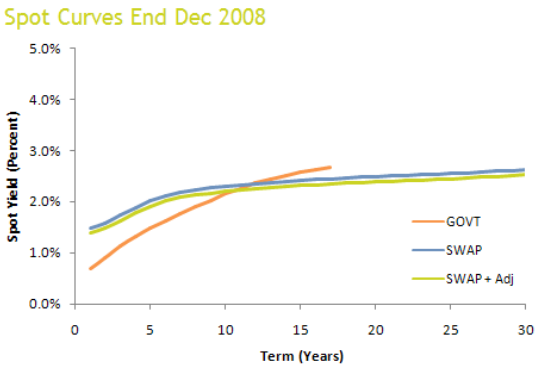
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
15-20	30	30

Fitted Curves:

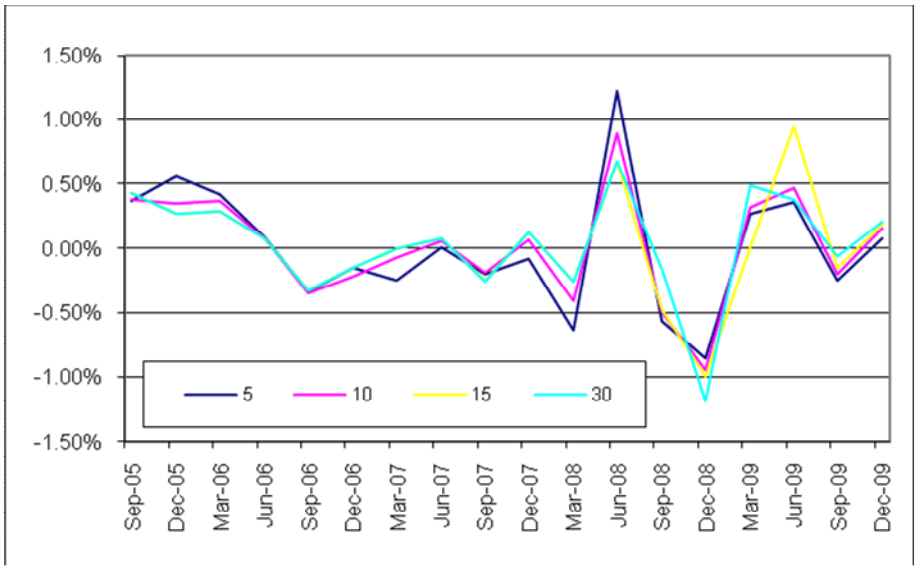








Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:

Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Volatility in long-term forward rates increase in Q4 2008 (up to 1.0% quarterly movement).
- Long-term forward rates dropped to extreme levels, but the decrease was consistent across the whole term structure.
- **Propose 30 years entry point consistent for 2008 and 2009.**

Mexican Peso – MXN

Swap Tickers: MPSWTT = Monthly Fixed vs. 28 day Mexico Interbank

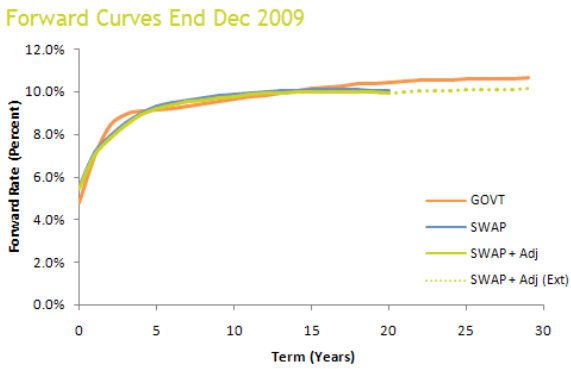
Government Tickers: MBONO = Mexican Bonos

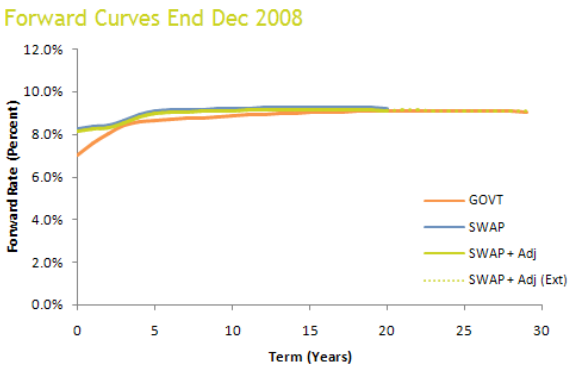
Basic risk-free interest rate curve liquidity:

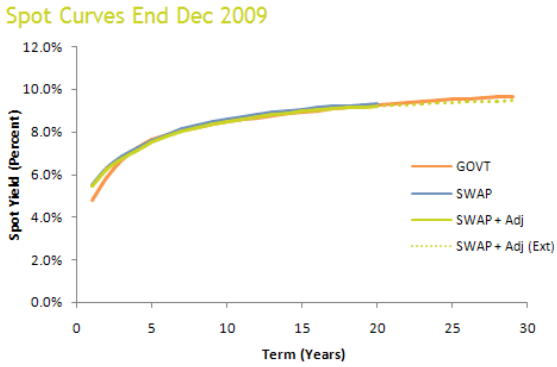
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
29	30	30

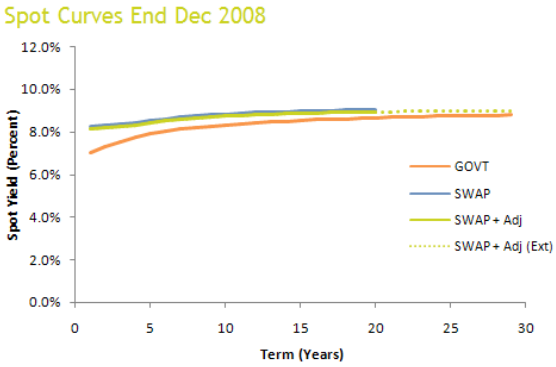
The 30 year swap raw data point has been removed as it was found to be not liquid and reliable. For example, the price updates circa every 2 weeks compared to the daily updates on the earlier terms.

Fitted Curves:









Conclusion:

- In line with the methodology detailed previously **the entry point to extrapolation is 29 years** reflecting the extension of the swap raw data using the government curve.

Malaysian Ringgit – MYR

Swap Tickers: MRSWQOTT = Quarterly Fixed vs. 3 month Malaysia Inter-bank Offer Rate

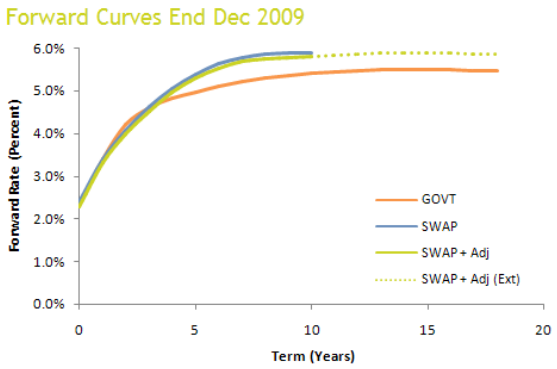
Government Tickers: MGS = Malaysia Government Bonds

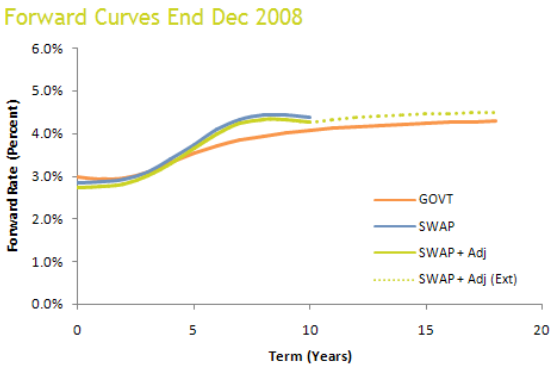
Basic risk-free interest rate curve liquidity:

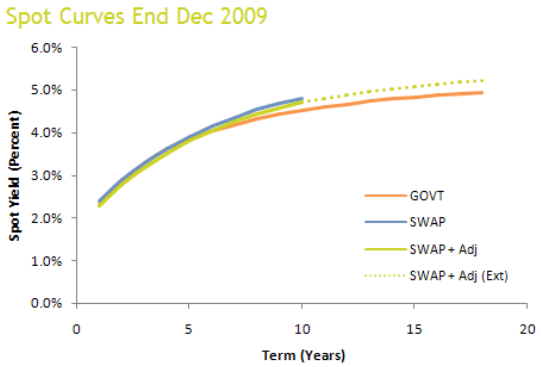
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
18	10	20 **

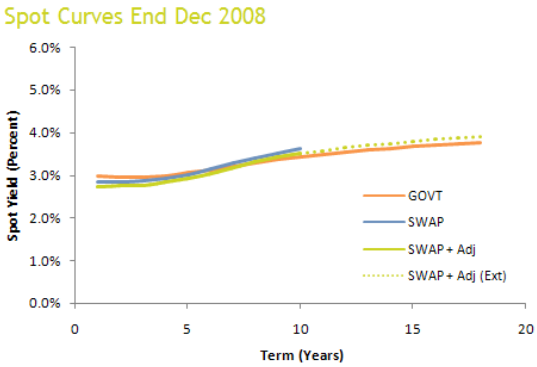
** The swap market data is extended based on the spread between government bonds and swaps

Fitted Curves:









Conclusion:

- In line with the methodology detailed previously **the entry point to extrapolation is 18 years** reflecting the extension of the swap raw data using the government curve.

South Korean Won – KRW

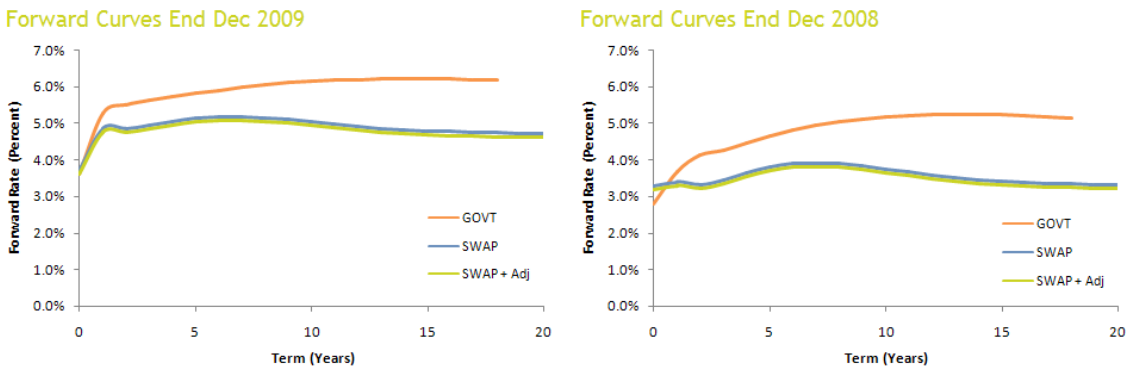
Swap Tickers: KWSWOTT = Quarterly Fixed vs. 3 month KRW Certificate of Deposit

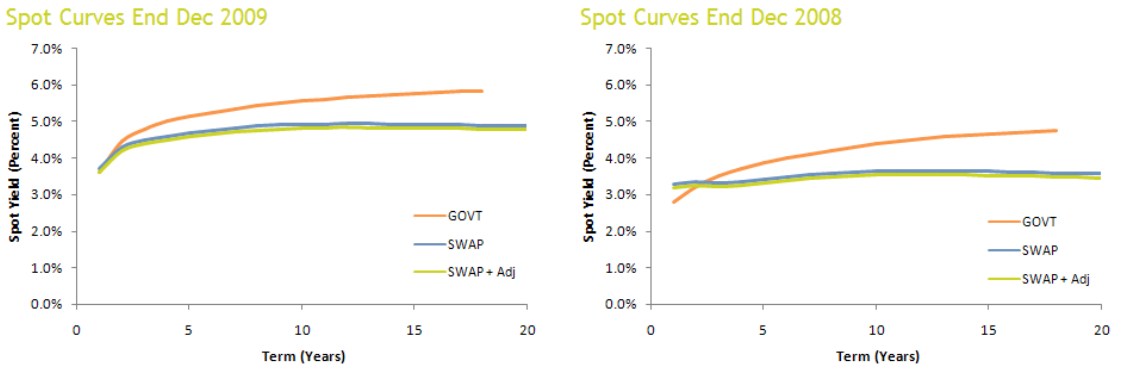
Government Tickers: NDFB = Korean Treasury Bonds

Basic risk-free interest rate curve liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
18	20	20

Fitted Curves:





Conclusion:

- The government curve is proposed for KRW as detailed previously. **The entry point to extrapolation is 18 years** reflecting the last market data point. This point was selected in the absence of formal analysis due to limited data being available in the timeframe to prepare the QIS 5 specification.

Thai Baht – THB

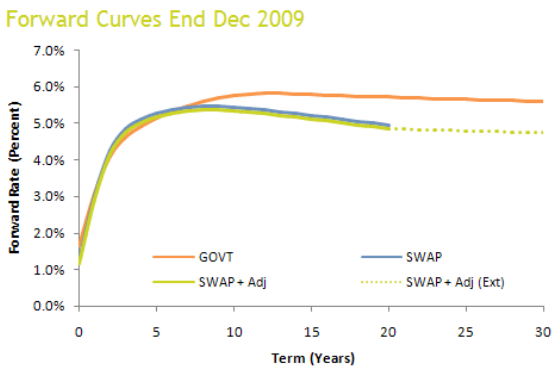
Swap Tickers: TBSWOTT = Semi Annual Fixed vs. 6 month BIBOR

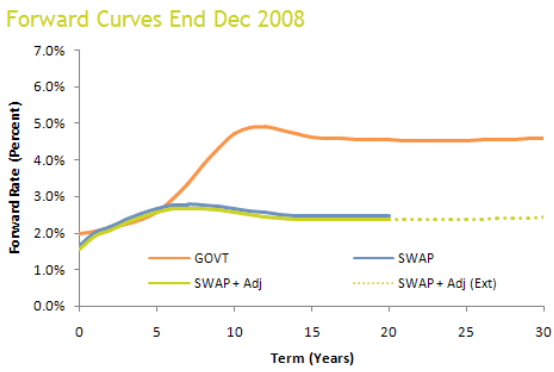
Government Tickers: THAIGB = Thailand Government Bonds

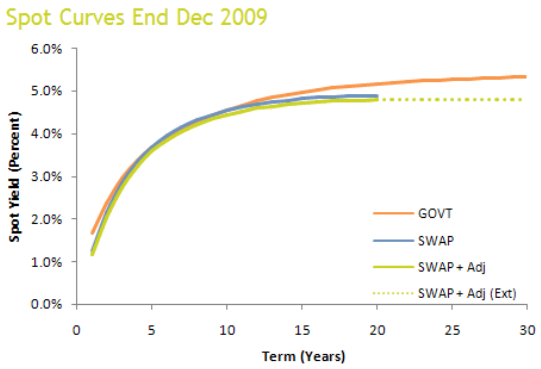
Basic risk-free interest rate curve liquidity:

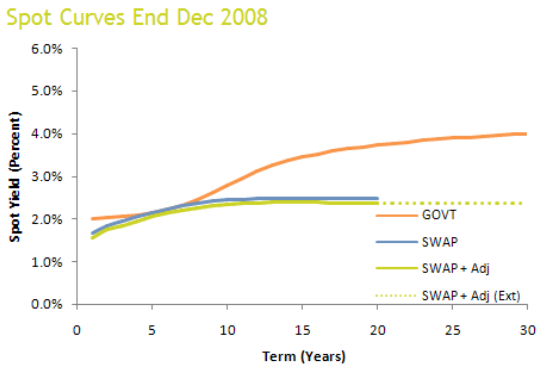
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
30	20	20

Fitted Curves:









Conclusion:

- In line with the methodology detailed previously **the entry point to extrapolation is 30 years** reflecting the extension of the swap raw data using the government curve.

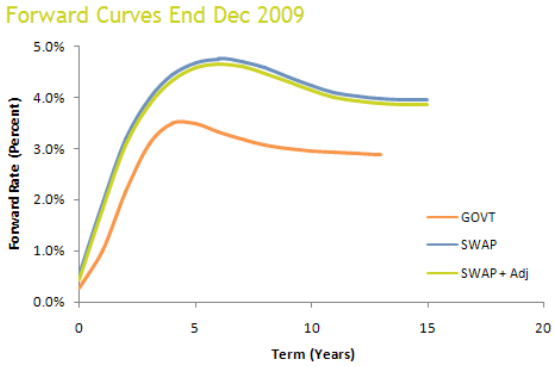
Hong Kong Dollar – HKD

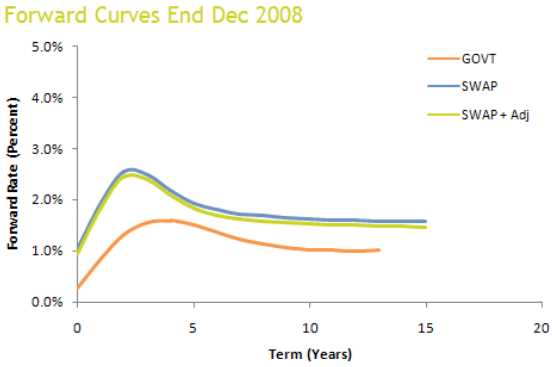
Swap Tickers: HDSWTT = Quarterly Fixed vs. 3 month HIBOR

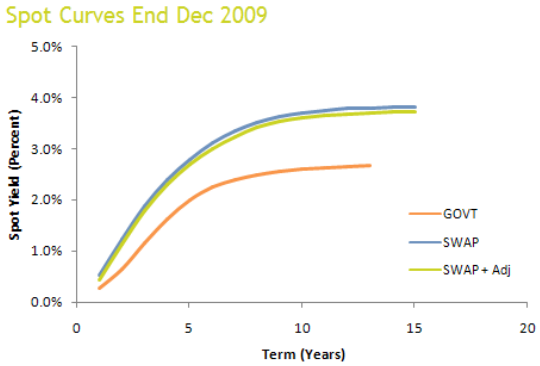
Basic risk-free interest rate curve liquidity:

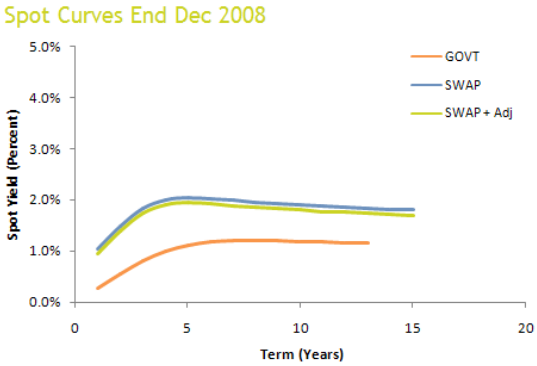
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
10-15	15	15

Fitted Curves:









Conclusion:

- **The proposed entry point to extrapolation is 15 years** which represents the last market data point. This point was selected in the absence of formal analysis due to limited data being available in the timeframe to prepare the QIS 5 specification. However, as the rates for the HKD are low the selection of the entry point is unlikely to be too significant.

Taiwan Dollar – TWD

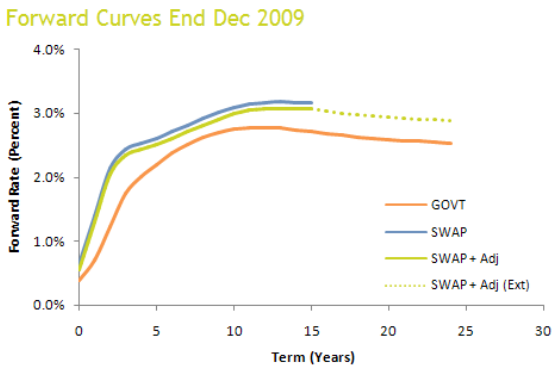
Swap Tickers: NTSWTT = Quarterly Fixed vs. 3 month Taiwan Secondary Commercial Fixings

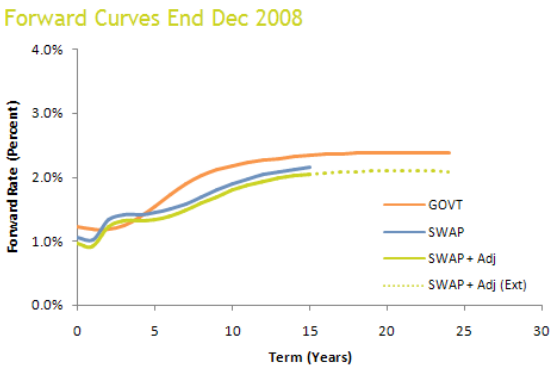
Government Tickers: TGB = Taiwan Government Bonds

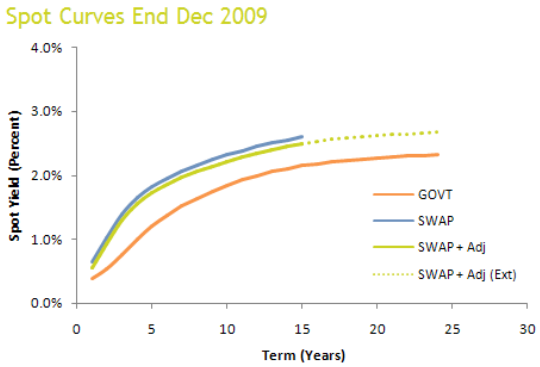
Basic risk-free interest rate curve liquidity:

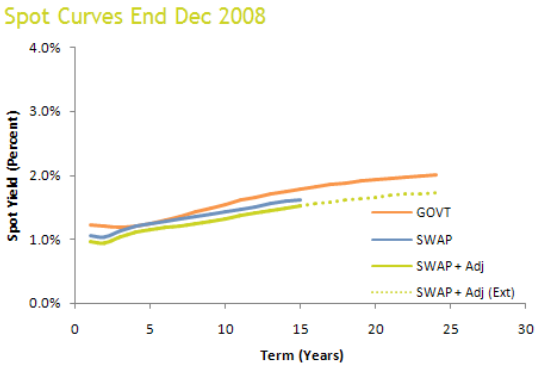
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
24	15	15

Fitted Curves:









Conclusion

- In line with the methodology detailed previously **the entry point to extrapolation is 24 years** reflecting the extension of the swap raw data using the government curve.

Chinese Yuan – CNY

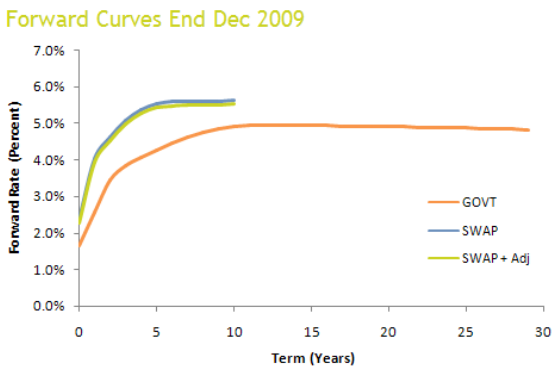
Swap Tickers: CCSHOTT = Quarterly Fixed vs. 3 month SHIBOR

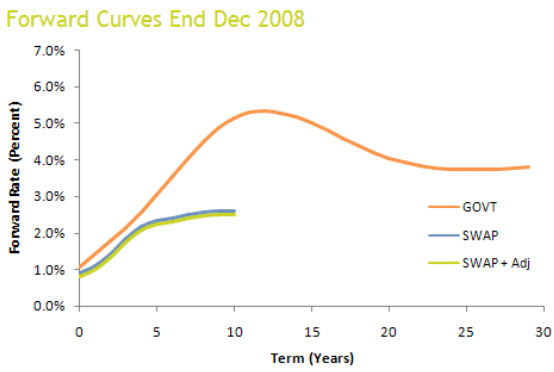
Government Tickers: CGB = China Government Bonds

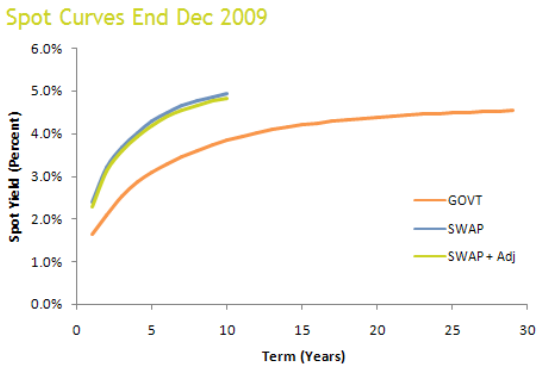
Basic risk-free interest rate curve liquidity:

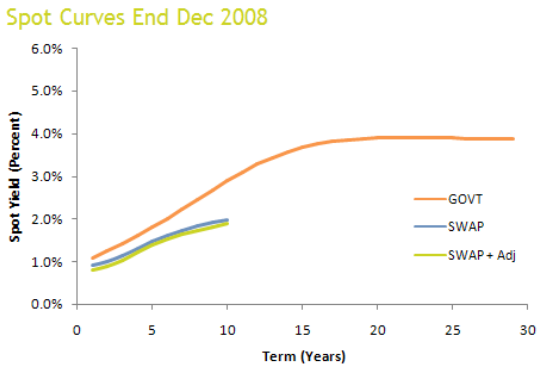
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
30	10	10

Fitted Curves:









Conclusion:

- The government curve is proposed for CNY as detailed previously. **The proposed entry point to extrapolation is 30 years** which represents the last market data point. This point was selected in the absence of formal analysis due to limited data being available in the timeframe to prepare the QIS 5 specification. However, as the rates for the CNY are low the selection of the entry point is unlikely to be too significant.

Indian Rupee – INR

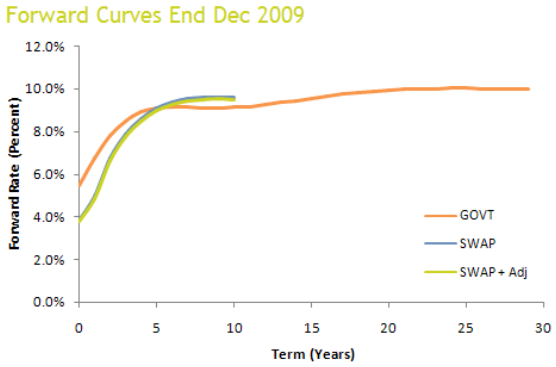
Swap Tickers: IRSWMTT = Semi Annual Fixed vs. 6 month MIFOR

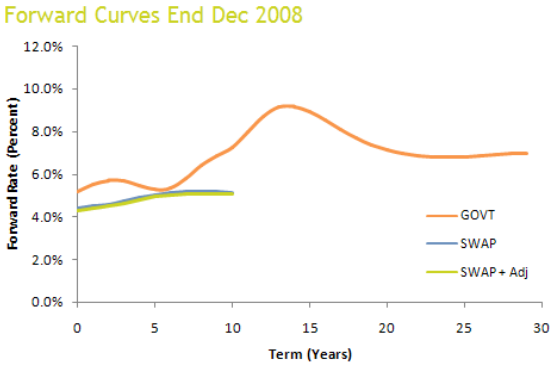
Government Tickers: IGB = India Government Bonds

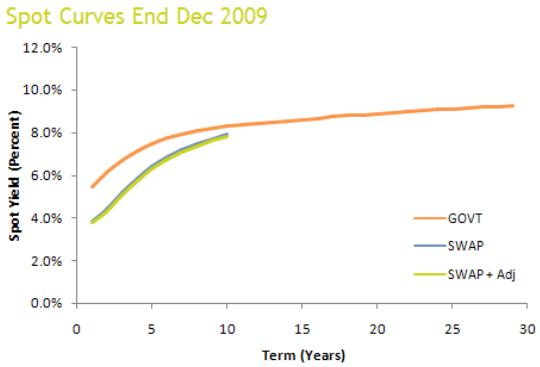
Basic risk-free interest rate curve liquidity:

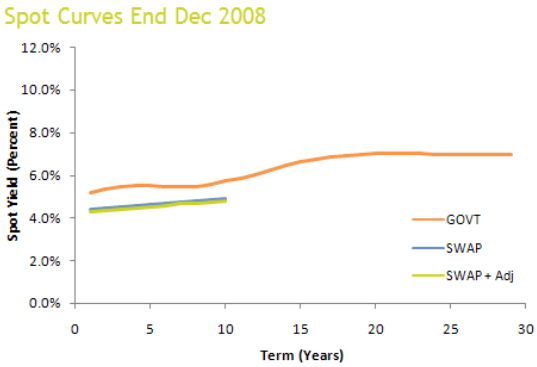
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)
29	10	10

Fitted Curves:









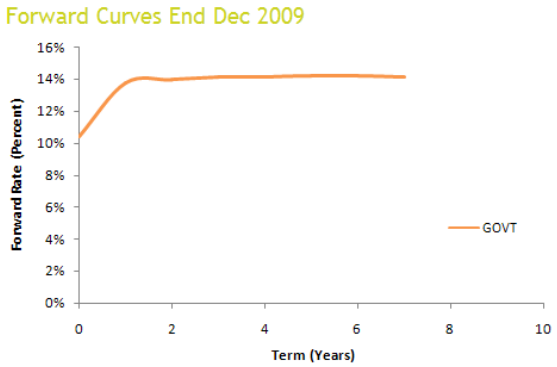
Conclusion:

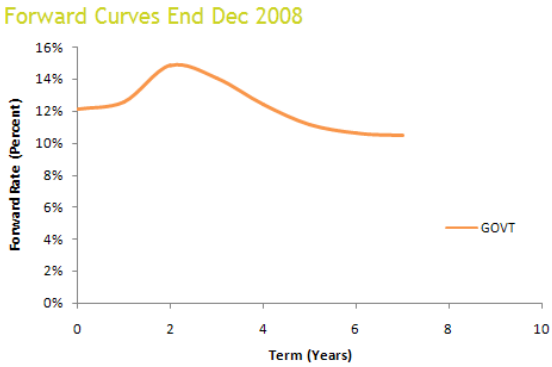
- The government curve is proposed for INR as detailed previously. **The proposed entry point to extrapolation is 29 years** which represents the last market data point. This point was selected in the absence of formal analysis due to limited data being available in the timeframe to prepare the QIS 5 specification.

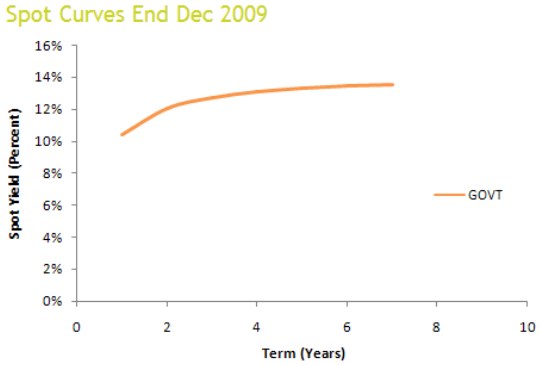
Brazilian Real - BRL

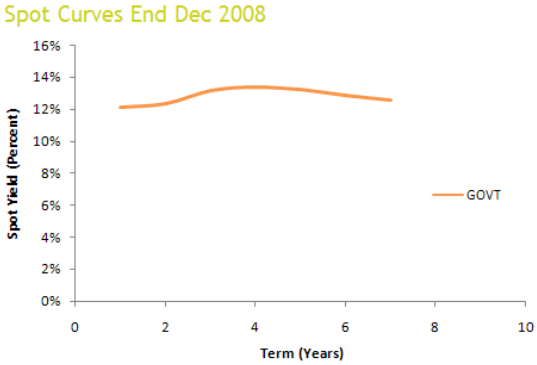
Government Tickers: BLTN & BNTNF = Brazil Letras do Tesouro Nacional & Brazil Notas do Tesouro Nacional

Fitted Curves:









Conclusion:

- The government curve is proposed for BRL as detailed previously. **The proposed entry point to extrapolation is 7 years** which represents the last market data point. This point was selected in the absence of formal analysis due to limited data being available in the timeframe to prepare the QIS 5 specification.

Appendix 2: Liquidity premium for CAD, ZAR, AUD and HKD currencies

In this Appendix, we propose liquidity premium for CAD, ZAR and AUD.

Canadian Dollar – CAD

Methodology

In order to derive a liquidity premium estimate for CAD we have applied the proxy method for EUR, GBP and USD to the DEX Corporate Bond indices. We similarly tested a Merrill Lynch CAD Corporate Bond index which provided comparable results.

The corporate bond spread over swaps is based on the weighted average of the long, medium and short DEX indices and equivalent swaps (by duration). The weighting applied is the market value of each sub-index. This represents a simplified approach compared to our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL").

Results

Date	Liquidity Premium (bps)
31 December 2007	22
31 December 2008	190
30 June 2009	98
30 September 2009	48
31 December 2009	38

It is noted that the results presented are relative to the swap curve. Consequently, 10bps is required to be added to derive the QIS 5 liquidity premium as detailed in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"). The liquidity premium is 200bps and 48bps at end December 2008 and 2009.

Supporting analysis of direct measures

There are no significant volumes of CDS quotes to apply this method and the structural model could not be calibrated in the time required for QIS 5. However, there does exist some issuances of covered bonds, notably, Canada Housing Trust bonds (guaranteed by Federal Government) and Provincial Bonds (treated in local Canada statutory valuation rules as "risk free" the same as Federal Government Bonds). The Provisional Bond market is of similar size to the local corporate bond market and further, the implied spread over swaps is similar to that derived from the simplified formula. Where available the direct measures broadly support the use of the proxy method calibrated as for EUR, GBP and USD.

Term structure of the liquidity premium

The long sub-index of the DEX Corporate bond index has an average term to maturity of 23 years. The average term to maturity of the long Provincial Bond market is also circa 23 years. This therefore suggests that there are substantial bonds available at the long end, so a cut-off point of 25-30 years could be supportable. For QIS 5 purposes, we propose a cut-off of 25 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point, as in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL").

South African Rand – ZAR

Methodology

In order to derive a liquidity estimate for ZAR, we have used the direct covered bond method as there are no reliable CDS quotes or reliable corporate bond indices in this market. The quantum of liquidity premium is determined by comparing the yields of similar durations on South African government bonds and bonds issued by state-owned enterprises (such as ESKOM) which is effectively government guaranteed, and therefore has similar default risk to government bonds. This represents a conservative approach as state-owned enterprises represent the more liquid end of the market due to the volumes in issue.

Results

Based on the actual asset holdings in state-owned enterprises for one large insurer in South Africa, the implied liquidity premium is:

Date	Liquidity Premium (bps)
31 December 2008	85
30 June 2009	70
31 December 2009	70

We assuming that the actual asset holding in bonds issued by state-owned enterprises for one large insurer in South Africa is representative of the whole market of such covered bonds. In particular, to address the requirement of the liquidity premium principle: *"The liquidity premium should be independent of the investment strategy adopted by the company."*

It is clear that assets exist in South Africa to earn a liquidity premium. However, due to time and data constraints, it has not been possible to perform a full analysis for QIS 5 purposes. We propose to use the liquidity premium derived from the asset holdings for one large insurer in South Africa as a benchmark to provide consistency for QIS 5. **For full Solvency II implementation, further analysis into the covered bond method independent of the actual asset holdings by insurers is required.**

Term structure of the liquidity premium

It is understood that there are currently no bonds issued by state-owned enterprises with an outstanding term to maturity beyond 24 years. We therefore propose a cut-off of 20 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point, as in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL").

Australian Dollar – AUD

Methodology

In order to derive a liquidity estimate for AUD we have applied the proxy method for EUR, GBP and USD to the Merrill Lynch Australian Corporate Bond Index (AUC0). This is believed to be a representative index for AUD.

We have not been able to calculate direct measures of the liquidity premium due to a lack of reliable data and time constraints for QIS 5. However, it is clear that there is an AUD corporate bond market to access the liquidity premium.

The liquidity premium estimate is calculated as follows: MAX (0, 50% * (BondIndexYield – InterpolatedSwapRate) – 40bps))

We use linear interpolation to derive a swap spread of the same term as the duration of the index. The calculation is: InterpolatedSwapRate = SRB + (SRA – SRB) * (IndDur – TenorB) / (TenorA – TenorB)

Where:

- IndDur – Duration of the index
- TenorA – Smallest tenor above IndDur at which a swap rate is quoted
- TenorB – Largest tenor below IndDur at which a swap rate is quoted
- SRA – SwapRate at tenor TenorA
- SRB – SwapRate at tenor TenorB

The approach is similar to that for EUR, GBP and USD although there are some key differences. For the EUR, GBP and USD, we used Iboxx indices as one of the outputs available is the average spread to government bond yields. This is calculated at an individual security level then averaged. We then adjusted this credit spread by the government to swap spread to get a spread relative to swaps. For AUD, we take the average yield and subtract a swap rate to give the spread over swaps directly. The major difference between the two approached is for AUD we calculate the spread relative to the average yield as opposed to the average of the individual spreads. The credit spread measure applied for AUD is the same as for CHF and JPY in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"). **For full Solvency II implementation, we would seek to align the definition of the credit spread measure.**

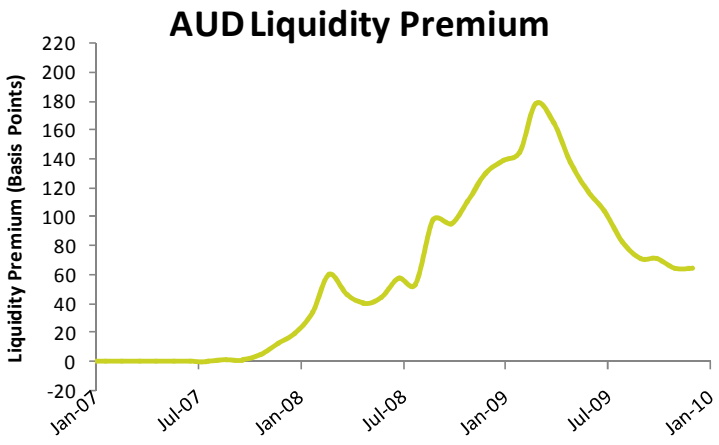
Data

For the end December 2008 and 2009 liquidity premium estimates, we have use Bloomberg swap rates ADSW2 (2 year) & ADSW3 (3 year); and redemption yield and duration from the Merrill Lynch index AUC0.

Results

Date	31/12/08	31/12/09
Index yield %	6.77	7.03
Index duration	2.81	2.70
Swap 2 year %	3.51	5.14
Swap 3 year %	3.85	5.41
Interpolated swap rate %	3.78	5.33
Liquidity premium (bps)	129	65

It is noted that the results presented are relative to the swap curve. Consequently, 10bps is required to be added to derive the QIS 5 liquidity premium. The liquidity premium is 139bps and 75bps at end December 2008 and 2009.



Term structure of the liquidity premium

We examine a maturity analysis of the Merrill Lynch Australian Corporate Bond Index:

Maturity Band	Number of bonds
01/01/10 – 31/12/11	47
01/01/12 – 31/12/13	57
01/01/14 – 31/12/15	28
01/01/16 – 31/12/17	15
01/01/18 – 31/12/19	1
01/01/20 – 31/12/24	2

Given that there are relatively few bonds beyond 8 years, we propose a cut-off of 8 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point, as in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL").

Appendix 3: Liquidity premium for all other currencies

In this Appendix, we propose liquidity premium for all other currencies on the secondary list.

Hong Kong Dollar – HKD

The HKD has been pegged to the US Dollar (USD) within the range USD1 = HKD 7.75 – 7.85 since 1983. For QIS 5 purposes, it is proposed to use the USD liquidity premium term structure translated to HKD through the use of currency swaps. The currency swap adjustment is based on a 10 year tenor referenced from Bloomberg (Ticker: HDBS10). This approach has been taken for HKD as it known that local insurers have significant investments in USD denominated assets. The currency swap serves to hedge any risk of the peg between HKD and USD breaking and is used by insurers for this purpose in HKD.

	USD	**Currency swap adjustment**	**HKD**
31/12/08 Liquidity Premium	231	-61	170
31/12/09 Liquidity Premium	71	-17	54
Liquidity Premium cut-off point	30	-	30

For full solvency II implementation, further analysis will be required to ensure the appropriateness of this method, however, for QIS 5 purposes, it will provide consistency across insurers. We note that a method based on currency translation could equally be valid for other markets, for example, in Japan where significant USD assets are held by insurers. The method could also be applied for other currencies, for example, in countries with there is significant investments in EUR denominated assets. This was not proposed in our calibration of the primary currencies dated 1 April 2010 ("CFOF_CROF_QIS 5 RFR calibration_FINAL"), but it is worthy of further analysis.

Mexican Peso (MXN), Brazil Real (BRL)

For MXN and BRL, we were not able to find corporate bond markets on Bloomberg or other readily available sources for QIS 5. Further, in MXN, there is a positive swap spread over government bonds, at most durations, at end 2008 and 2009. **We propose zero liquidity premium for QIS 5.**

Other Asian currencies

This includes the following currencies: Singapore Dollar (SGD), Malaysia Ringgit (MYR), Thai Baht (THB), South Korean Won (KRW), Taiwan Dollar (TWD), Chinese Yuan (CHY) and Indian Rupee (INR).

In the course of our analysis, we identified a range of corporate bonds indices for many of these currencies. The indices are prepared by the local governments, quasi-government organisations or self regulated industry bodies and are either denominated in local currencies or USD. Further, there are pan Asian (excluding Japan) indices for corporate bonds and credit default swaps which can provide direct or indirect measures of the liquidity premium.

Given the timeframe for QIS 5 purposes, it was not possible to prepare a consistent liquidity premium calibration. However, our initial analysis indicated clear evidence of the existence of significant markets in illiquid assets (e.g. corporate bonds) in many of these currencies. It is proposed for QIS 5 purposes, that insurers are permitted to use their own bespoke calibrations of the liquidity premium in these currencies.

17 May 2010

Memo on Base Risk Free curve, Liquidity Premium and Extrapolation

This paper includes our analysis of current proposals on the Base Risk Free curve, Liquidity Premium and Extrapolation:

- It is of the CRO Forum's opinion that CEIOPS may have misinterpreted the conclusions set out in the Taskforce Report, which is now evidenced in IM20 as well. We reiterate that the liquidity premium extrapolation should apply on the forward curve and not the spot curve.
- For QIS5, the unconditional long-term forward rate has been set to 4.2% for most currencies (with exception of JPY, CHF and TRY). This long-term rate is reached after 90 years based on a Smith-Wilson extrapolation. There are a number of issues related to the extrapolation towards this long-term forward rate. As short term mediations for QIS5 we propose:
    - the allowance of country specific inflation where appropriate; and
    - excluding the separate risk margin for non-hedgeable market risk, to keep consistency with the current suggested 4.2% level of the long-term rate (with a term premium set arbitrarily at 0).

  But beyond QIS5, we advocate that the estimation of the long-term rate needs to include assumptions on the term premium and convexity adjustment; and we recommend also that there should be mechanisms in place to update this long-term rate over time.

- For practical reasons, we consider it appropriate that the base risk free rate (as determined by swaps) can be below government rates. We note that longer tenor swap rates in some instances are below corresponding government rates. This has similarly been observed in the Euro-zone where longer tenors swap rates have been trading below AAA European government bonds. It establishes that government rates are not necessarily below the risk free curve.
    - Equity implied volatility is highly relevant in determining the market value of the options and guarantees embedded in liabilities; and the CRO Forum believes that further work is required to develop guidance in this area for Solvency II. (please refer to our separate paper on this topic)

1. Liquidity premium extrapolation

The discussion between the industry and CEIOPS on the liquidity premium (LP) is based on work done by the combined illiquidity Taskforce. The taskforce final report is therefore an important basis for the work in this area.

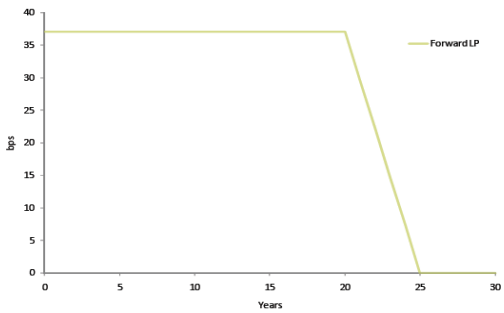
The CEIOPS paper on the extrapolation of the risk free rates states that two alternative interpretations can be given to the Liquidity Premium (LP) as adjustment to the risk free curve: Firstly as a spot adjustment or secondly as a forward adjustment. The main impact is currently the selection of method in which LP is phased out (extrapolated) to zero: Either based on (a) spot or on (b) forward rates. CEIOPS supports phasing out the liquidity premium based on spot rates which follows their interpretation of the illiquidity taskforce report. Furthermore CEIOPS refer to the implementing measures IM20 section IR6(3)

that states: “No illiquidity premium shall be applied to the extrapolated part of the relevant basic risk-free interest rate term structure”. In response, the CRO Forum advised that IM20 should read: “No **forward** illiquidity premium shall be applied …”.

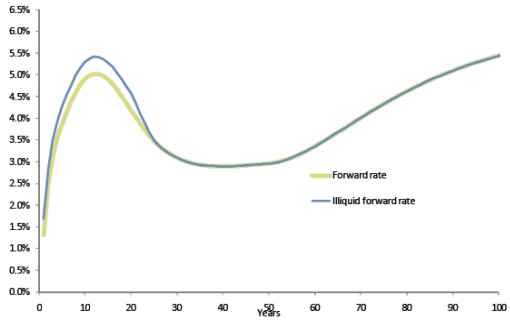
It is the CRO Forum’s opinion that CEIOPS may have misinterpreted the conclusions set out in the Taskforce Report, which is now evidenced in IM20 as well. We reiterate that the liquidity premium extrapolation should apply on the forward curve and not the spot curve.

Section I-6 of the report explicitly sets out the formula to apply the liquidity premium to the base risk free curve, with graphic illustration. Furthermore, the two graphs from the report, displayed below, offer a very clear interpretation of the report’s conclusions. The formulae and the graphs are completely ignored in IM20. Nor are they mentioned in CEIOPS’ interpretation.

EUR - Forward liquidity premium



EUR - Forward yield curve



Our conclusion is that the method proposed by CEIOPS is not consistent with the method proposed in the Taskforce report. To illustrate, the graph below shows the EUR forward yield curves, based on the QIS5 proposal, with and without liquidity premium applied. These are clearly different to the same curve constructed as per that from the Taskforce report.

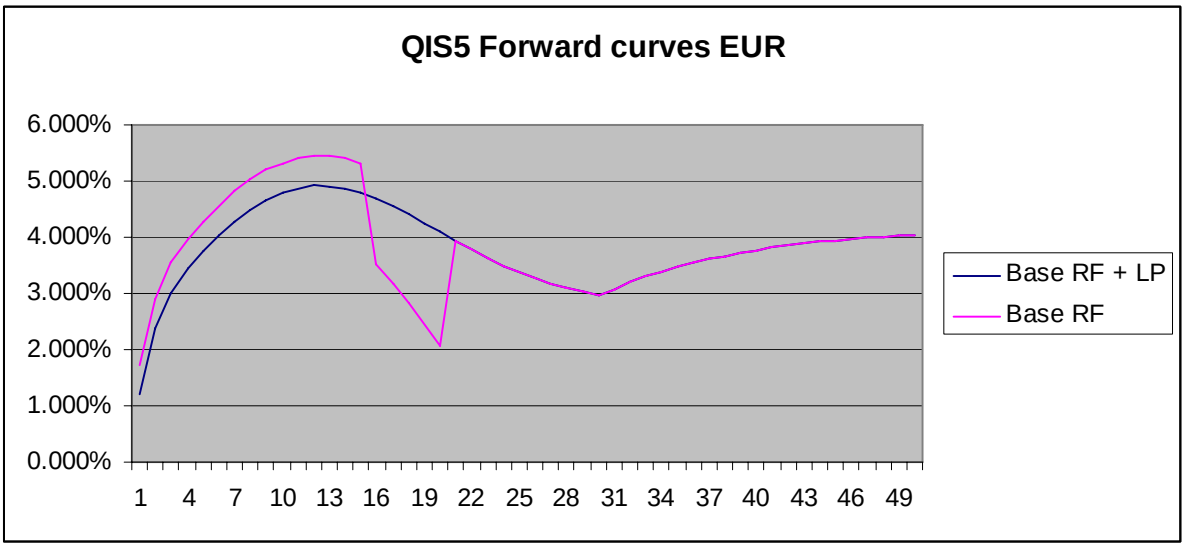
The CRO Forum further notes that not only is the method inconsistent with the methodology agreed in the Taskforce, but it is also not consistent with agreed Taskforce principles on extrapolation with which all CEIOPS members were in agreement. In particular, principles such as:

- “Extrapolated Market Data should be arbitrage-free”; and
- “Extrapolation should be based on forward rates …” are contravened.

We illustrate the inconsistency by way of example.

Consider a 15yr liability: its valuation qualifies for the full LP, because this premium can be earned by investing in a 15yr asset. CEIOPS’ interpretation of the report implies that no LP applies to longer liabilities e.g. 30yr. This, unfortunately, does not take into account the insurer’s ability to invest in the 15yr asset to earn 15yrs of LP and simultaneously cover the remaining interest rate exposure by investing in an interest rate swap, which effectively swaps the 15yr asset into a 30yr asset.

Moreover, the insurer could arbitrage the current extrapolation of the LP to earn the 15yr LP-spread by repackaging the 30yr liability into a 15yr liability via a swap. The picture below also shows clearly that the forward curve is not smooth as set out by the principles. Moreover, an economic interpretation of negative forward LPs up to -200bp is also missing.



2. <u>Unconditional long term forward rate & risk margin for non-hedgeable market risk</u>

The unconditional long-term forward rate has been set to 4.2% for most currencies (with exception of JPY, CHF and TRY). This long-term rate is reached after 90 years based on a Smith-Wilson extrapolation. There are a number of issues related to the extrapolation towards this long-term forward rate:

1) The basis for the 4.2% is a 2.0% inflation assumption and a 2.2% real rate. The underlying assumption behind the 2.0% inflation assumption is that all currencies to which this applies target 2.0% as their long-term inflation level. While this is specifically appropriate for the ECB, other countries either have no specific target or a higher inflation target. E.g. The Norway central bank targets a 2.5% inflation level. Other currencies in different stages of development and lower inflation reputation might also quantify for a higher inflation target. One possible remedy for this would be to also (partially) incorporating projected inflation levels as part of the long-term target, and to consider different inflation target levels for different central banks.

2) In general we do not specifically object to the real rate level (2.2%), which is supported by our analysis as well.

3) Furthermore, the 4.2% explicitly ignores two further components of the long-term rate, namely the term premium and the convexity adjustment. Although CEIOPS specifically mentions them, both the term premium and the convexity adjustment are assumed to be zero. While the convexity component is always negative (by definition), there are various studies arguing that the term premium should be (significantly) positive. The resultant contribution to the long-term rate based on the result that the combination of term premium and convexity adjustment could be positive. However, much more work needs to be done in determining the right level. We also note consistency with the risk margin as stated below.

4) Grading of Smith-Wilson. The extrapolation method with the parameterisation applied produces results for some currencies in a shape of the forward curve that does not make sense, for some currencies. In fact the grading towards the long-term rate seems to go too fast. This is particularly clear for the EUR - the graph in the previous section shows that the forward EUR curve does not smoothly revert to its long-term level, but in a rather sporadically turns ad-hoc manner goes from decline to quickly rising at the 30 year rate. This is not consistent with observed market information. We point out that the linear method seems to result in a more logical shape of the forward curve.

5) Based on current work of the CRO Forum workgroup on extrapolation, we think that the risk margin for non-hedgeable market risk and the extrapolation of the risk free curve should be done in a consistent manner to avoid that twice is charged for the same risk. The risk margin takes into account capital required to offset the interest rate risk that cannot be hedged in the market. We believe that observed market data that is the starting point for extrapolation already prices in the risk that for longer tenors there is already a mismatch in supply and demand (forward curve is consistently downward slooping beyond 20yrs for all major currencies). Furthermore, the long-term rate assumes no term premium. A lower term premium results in lower extrapolated rates and therefore also less risk in the un-hedgeable part of the curve. We believe that the current extrapolation and risk margin are therefore not set consistently. We strongly prefer not to have a separate risk margin. Another clear example of un-hedgeable market risk is implied volatility risk. There we can also clearly see that implied volatility (at all tenors) incorporates an add-on for non-hegeable market risk and therefore market prices aready “price” in the capital required by market participants for risks they cannot effectively hedge in the market.

6) So where liabilities rely on extrapolated interest rates, this implies that a significant capital charge is required. We argue that CEIOPS is in fact double counting the risk by firstly not taking into account a term premium and then

requiring a risk margin to be held. We state that the long-term rate should be set in a consistent manner with the risk margin. Our strong preference is to capture the risk that interest rate cannot be hedged in the market in the extrapolation and therefore not require a separate risk margin. One can clearly observe that the market already captures such a mismatch in supply and demand already in the observed part of the risk free curve (30yr forward rates have been almost always below 20yr forward rates in all major currencies over the last 5yrs (even for currencies with upwards sloping interest rate curves such as JPY).

As short term remediation for QIS5 we propose:

- the allowance of country specific inflation where appropriate; and
- excluding the separate risk margin for non-hedgeable market risk, to keep consistency with the current suggested 4.2% level of the long-term rate (with a term premium set arbitrarily at 0).

Beyond QIS5, we advocate that the estimation of the long-term rate needs to include assumptions on the term premium and convexity adjustment; and we recommend that there should be mechanisms in place to update this long-term rate over time. This should be done in combination with work on the grading towards this ultimate rate as those two elements cannot be viewed in isolation. We recognise that given the timelines such work cannot be done before the QIS5 exercise.

3. Risk free rates for currencies without an appropriate, liquid swap curve

For some currencies the swap curve is not liquid or, is inappropriate for regulatory purposes (e.g. insurers are unable to access the China CNY swap market). It is therefore perceived as practical to regard the government curve as the next best alternative valuation rate. This then raises the question of whether the local government curve is risk-free, and thus whether it should be used directly as risk-free without the application of credit risk adjustments. CRO-F regards local government bonds as risk-free from a local perspective, and thus suitable for use without any credit risk adjustments. Furthermore, there are no known local regulatory requirements around credit risk adjustment to the government curve. Applying such an adjustment for Europe-based players would then result in an uneven playing field. CEIOPS has suggested to only apply an adjustment for credit risk for non-EEA and non-OECD countries. This criteria is somewhat arbitrary as countries as China and India are no-OECD members while similar countries or countries with a lower credit standing are part of the OECD or EEA.

4. Can the base risk free rate (as determined by swaps) be below government rates?

In certain market conditions, the base risk free rate (as determined by swaps) may be lower than the government bond curve. For example, in stressed markets it is more likely that the demand for interest rates swaps becomes one way focussed (as the other side becomes harder to source from long dated issuers that will not be attracted to long date issuance in these markets and banks will be less able to manufacture the other side) pushing down the yield and its liquidity. There is some evidence that this occurred to EUR in the recent crisis. This could result in insurers having to discount their liabilities at a higher rate than paid on government rates (in particular if that government is AAA).

There are in fact two ways to address this issue. Firstly, it could be resolved by extrapolating from an earlier point in the curve than is applied in normal markets. Although this might be the preferred solution, this might be problematic in practice unless the institution setting the risk free curve and its extrapolation has clear rules on how to adjust the entry point of the extrapolation. Otherwise this would result in material uncertainty for companies. Secondly, some of our members suggest an absolute floor of government bond on the long-end of the swap curve could be applied to provide an automatic mechanism and clarity for industry on what would occur if liquidity in longer tenor swap rates would become insufficient in times of a crisis.

Overall, we could like to avoid a situation where companies have to discount their liabilities at a lower rate than the yield on their government bonds due to technical rather than fundamental reasons and as this requires insurers to value these contracts as if they are giving a safer guarantee than can be achieved in our actual investments. So beyond QIS5, CEIOPS should consider on how best to address this issue.

5. Equity Implied Volatility Extrapolation

Equity implied volatility is highly relevant in determining the market value of the options and guarantees embedded in liabilities; and the CRO Forum believes that further work is required to develop guidance in this area for Solvency II.
It is noted that while extensive guidance is given in QIS5 on risk free rates, there is none as yet for equity implied volatilities. Such guidance is critical for the consistent treatment of implied volatility within Solvency II. The CRO Forum has prepared input in this area for QIS5 but understands that the commission does not want to include this input,given the insufficient guidance in this area thus far. As such, the CRO Forum believes that developing further guidance in this area is necessary.

6. Guidance needed on how to calibrate our liabilities to risk free curve

Typically, scenario calibration tools use implied volatilities to calibrate the parameters of the interest rate and equity models. When we change the term structure (swap credit adjustment and liquidity premium), we also (inadvertently) change the price of options. This raises the practical issue on how to calibrate our scenarios required for valuing our liabilities to observed option prices.

What guidance is QIS5 given us?

- "TP.1.263. a) The asset model shall try to reproduce asset prices for the most significant liabilities by nature and term that can be directly verified by the market". This can be interpreted to mean that we need to calibrate all models (i.e.base, partial LP or full LP) to observed option prices (rather than volatilities). Option prices are quoted on the basis of implied volatilities based on an underlying swap curve as the risk free rate.
- "TP 1.320. Reproduce calibration parameters – market data such as equity and swaption implied volatility used to calibrate the ESG is compared to the equity and swaption implied volatility estimated from the ESG scenarios"; if we calibrate to observed option prices as suggested above, then this test will not work because simulated interest rates are not equal to market observed rates. This statement would therefore imply that we calibrate to market volatilities (rather than prices).

So the guidance given is not consistent. Furthermore, no company has yet calibrated scenarios to another curve than to swap curves, which would require CEIOPS to provide us guidance on how to achieve this. Therefore our suggestion is to give clearer guidance to calibrate to implied volatilities rather than option prices. This allows business units to calibrate as they do now based on implied volatilities and swap curves. Adjustments for credit risk and liquidity premium can then be applied as adjustments to the discount rate curve when applying the scenarios.

7. Consistency of Interest Rate SCR Shock with Extrapolation

In the current technical specifications (SCR.5.29) the relative changes on the interest rate shock are defined up to 30 years. It is noted that for maturities greater than 30 years a stress of +25%/-30% should be maintained. In a footnote CEIOPS notes that the continuation of the stress of +25%/-30% for all maturities beyond 30 years may need to be reviewed in order to ensure that the calibration of the shock to the risk free interest rate term structure is compatible with the relative invariance of the ultimate long-term forward rate which is set as part of the macro-economic extrapolation of the risk-free curve as proposed by CEIOPS.

We believe that the interest rate stress should indeed be adjusted to reflect the fact that interest rate volatility declines beyond the cut-off point as the ultimate long-term forward rate should be very stable over time. Based on this, the shock should decline beyond the 30 year point. Although more work needs to be done in this area beyond QIS5, it would be good to reflect a preliminary reduction in the shock beyond 30 years for the purpose of QIS5.

Furthermore, we note that the QIS5 assumption of a fixed charge beyond 30 years in fact results in an inconsistency with the MVM for non-hedgeable risk as well as this risk is double counted (and we argue in fact triple counter in the long-term rate as well).

CRO FORUM

14 May 2010

CRO Forum position on the Spread risk in the standard formula

On the 15th April the European Commission published the draft QIS5 specifications – in which the Spread module had been somewhat amended (compared to the Final Advice from CEIOPS). Despite the progress evidenced by the amendments, the treatment of the spread risk module remains punitive.

While the CRO Forum had expected an increase in the capital requirement for Spread compared to QIS4, the current proposals for the whole module (bonds, non-OECD sovereign, structured products, credit derivatives, and covered bonds) are still at the extreme end. The level of credit shocks proposed will severely discourage investment in Corporate bonds potentially causing severe dislocation in the capital markets across the European Union.

This paper reiterates the conclusions from our CRO Forum paper on 'Market risk calibration' published in March 2010 (including a separate excel file with time series used). Overall, the suggested calibrations in the draft QIS5 specifications are roughly 30% higher than the proposal from the CRO Forum on Corporate bonds.

We welcome the introduction of the illiquidity premium stress in the spread risk module. However, careful consideration will need to be given to the application of the liquidity premium to the liabilities (eg. allocation to the "predictability buckets") in order to ensure appropriate results under the spread risk module. The current drafting of this module leaves room for ambiguity; we therefore request clarification on the way the 'liability adjustment' should be applied in the formula (SCR.5.115.) and we suggest a formula.

1. Calibration of the spread risk for bonds

4.1. Our numeric counter-proposal

The draft QIS5 Technical specification published on the 15th April proposed a significant increase in the corporate bond stresses compared with the CEIOPS Final Advice. CEIOPS has finally opted for the theoretically sounder approach that partially explains this increase in the calibration factor:

- This method involves calibrating to Corporate Bonds instead of CDS in the Final Advice 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. This is in line with the work of the CEIOPS Liquidity Premium Task Force.

The calibration paper prepared by CEIOPS shows that the calibration has been based on Merrill Lynch EMU Corporate Bond Indices:

- These indices are available only from February 1999 and, as a result, only 11 years of data have been taken into account.
- The short length of the dataset has the impact of skewing the results of the analysis, in particular given the recent extreme events.

As already presented in our study last March, the CRO Forum has recalibrated the stresses based on the longest available corporate bond data sets:

- For investment grade credit, the longest available credit data comes from Moody's analysis of long dated US corporate bond spreads (since 1919). There are benefits of using a longer data set, and so the 1919 figures could be the most appropriate to use. However we have added in extra prudence by using the data set that gives the higher figures as our numeric counter-proposal is based on the period [1970; 2009].
- For sub-investment grade, the most relevant data are the Merrill Lynch Corporate Bond indices which are available on Bloomberg since December 1996. For consistency with the calibration for investment grade credit, we have used the USD indices.
- For un-rated corporate bonds, the calibration proposed in the QIS5 TS is approximately equivalent to BBB. The CRO Forum agrees that this assumption is reasonable and therefore proposes that the credit spread stress for unrated bonds should be set at 300 bps.

Table: Corporate Bond Credit Spread – draft QIS5 specifications vs. CRO Forum Proposal (called option2 in our previous submission published in March 2010)

Spread UP

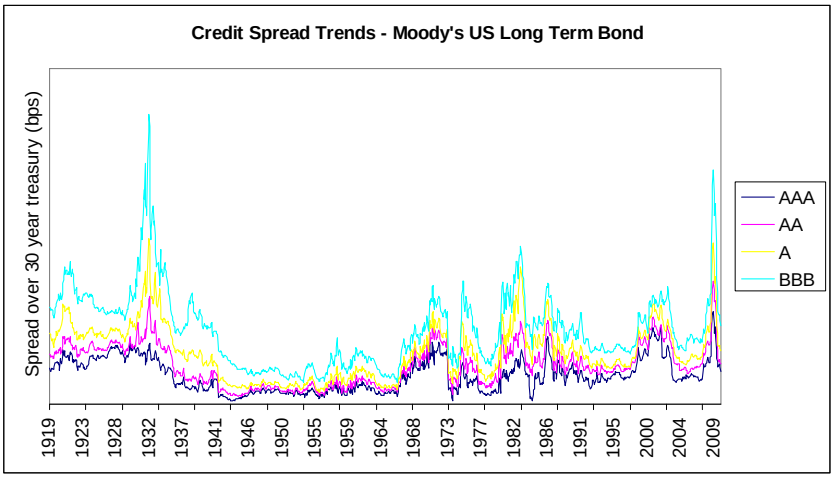
	AAA	AA	A	BBB	BB	B	Unrated
Draft QIS5 TS	100 b.p.	150 b.p.	260 b.p.	450 b.p	840 b.p	1620 b.p	500 b.p
CRO Forum Proposal – option 2	*(120 b.p.) (*)*	140 b.p.	190 b.p.	300 b.p	875 b.p.	1205b.p.	300 b.p.

(*) we note the lower shock for AAA rating in CEIOPS proposal. This can be explained by: (i) the cap of 33% applied for the financial index, and (ii) change in the populated index for AAA.

4.2. Choice of dataset & key features

The Moody's data provides monthly spreads of US corporate bonds over treasuries since 1919 for investment grade credit ratings (AAA, AA, A and BBB).
A licence agreement with Moody's is required to obtain the full data set which includes monthly data available back to January 1919. However the corporate bond yield curves (available from Bloomberg1) and the 30 year Treasury curve (available from the Federal Reserve website2) may be used to derive the data set from 1977 onwards.

The data is graphically depicted below:



[1] MOODCAAA, MOODCAA, MOODCA, MOODCBAA

[2] http://federalreserve.gov/releases/h15/data.htm

The occurrence of two extreme events stands out in the dataset; the Great Depression of 1929, and the more recent 'Credit Crunch' of 2008.

The table below shows the empirical 99.5th percentile of 12 month rolling spread changes based on different data periods. Other selected percentiles and statistical features are shown in the Appendix.

Percentile 99,5	USD Moody's				USD Merrill Lynch	
	AAA	AA	A	BBB	BB	B
1919+	91	107	146	262		
1958+	113	125	157	275		
1970+	118	139	188	293		
1979+ (Bloomberg)	122	147	208	306		
1997+ (bloomberg)					877	1205

We have further analysed the worst 12 month spread changes. The table below shows both the worst, and the average of the five worst, empirical annual changes in spread. It is worth noting that the worst annual change in spread from more than 1000 observations is less than the 1-in-200 year stress proposed in the QIS5 TS for A and BBB rated bonds.

Period 1970+	AAA	AA	A	BBB
Worst	124	156	224	346
Average of the 5 worst	118	138	193	307

2. Design of the spread risk module

We welcome the introduction of the illiquidity premium stress in the spread risk module. However, careful consideration will need to be given to the application of the liquidity premium to the liabilities (eg. allocation to the "predictability buckets") in order to ensure appropriate results under the spread risk module. Please refer to our separate contribution on the application of Liquidity Premium to products and our proposal to allocate products to 4 "predictability buckets" (0% / 50% / 75% / 100%) [separate contribution to be circulated on the 20th May].

In particular, we reiterate 2 concerns already expressed in previous contributions:

- We recognize that this method (shock on the assets calibrated on bonds with a liability adjustment) is more advanced compared to the approach developed in QIS4 (shock on the assets only calibrated on CDS) for the spread risk SCR in standard formula. But definitely this approach is theoretically sounder.

- In case where the allocation to the "predictability buckets" would not be appropriately applied, there might be an incentive to sell government bonds and invest into corporate bonds to minimize the SRC. Such counterintuitive rebalancing activities might have an enormous impact on the European government bond market. This highlights the need for the appropriate application of the liquidity buckets to the liabilities.

The current drafting of this module leaves room for ambiguity. We note two weaknesses in the current design of the spread risk:

- The draft QIS5 TS (article SCR.5.115) does not take the liquidity of the liabilities into account.

- The treatment of assets and liabilities is not consistent in the draft QIS5 TS. The specification proposes a relatively simple calculation on the asset side (MV * duration * stress) but suggests that the liabilities should be fully re-valued based on a new risk free curve which takes the implied liquidity premium into account. As a result, the convexity of the liabilities is taken into account but the convexity of the assets is not. This effect may be very significant.

    - The alternative solution would be to increase the sophistication of the asset shock but we recognize this may lead to over-sophistication in a standard formula. Therefore we recommend that, where companies are able to accurately reflect convexity in the calculation of the impact on both assets and liabilities, they should do so. Otherwise the simple calculation applied on the asset side (MV * duration * stress) should also be applied to the liability side.

We therefore suggest 2 approaches for the design on the spread risk module:

Total Spread SCR = shock applied on the Asset Side - Liability adjustment (ie. MV(Liabilities before shock) - MV(Liabilities after shock))

Advanced approach:
Mkt_{sp}^{bonds} = Change in the market value of bonds for the movement in spreads given by $F^{up\ or\ down}$ (adjusted as appropriate for the duration caps and floor) less the change in the implied value of the illiquid liabilities (where this implied value incorporates the movement in the underlying index implied by the formula and the % of the liquidity premium that applies to this business)

Simplified approach:

Shock applied on the asset side = Market Value (Corporate Bonds effectively invested) * duration of the assets * (shock corresponding to the Corporate Bonds effectively invested)

CRO Forum Liability adjustment = Market Value (Liabilities) * duration of the liabilities * Predictability Ratio * (equivalent shock for the Iboxx portfolio) * 50% (ie, shock to apply on implied Liquidity Premium)

Please refer to the separate excel example that illustrates how the module should work in our understanding if the simplified approach or the more advanced are implemented..

3. Treatment of sovereign credit risk

We believe that it is not appropriate to apply these overly prudent market risk charges to holdings of all non-OECD sovereign debt (China, Singapore, HK, South Africa vs Malawi or Yemen).

- A possible interpretation of SCR.5.94 in the draft QI5 TS is that holdings of government debt in non-OECD governments would not be exempt from the spread risk SCR module, and thus would be subject to the credit spread risk charges shown in SCR.5.109.

- We oppose the application of the excessive credit spread risk charges to non-OECD government debt on the following grounds: (i) there is no evidence that the credit risk on these governments is anywhere near as high as the spread charges shown in SCR.5.109, (ii) for insurance undertakings in many territories it is often part of the core business model to invest heavily in domestic government debt (due to the absence of other suitable investments).

- Similarly, SCR.5.139 also implies that holdings of government debt in non-OECD governments would not be exempt from the concentration risk SCR module, and thus would be subject to the concentration charges

- To apply the QIS5 spread and concentration risk charges to government bond holdings will severely damage the ability of EEA based insurance groups to compete in non-EEA markets.

We therefore recommend that home-governments (ie. invested in the same countries where insurance contracts are underwritten) are not stressed for the fundamental reason that home-governments are what local insurers have to invest in to back their liabilities. The stress is zero for OECD home-governments and should also be zero for non-OECD home governments.

4. Spread risk other than bonds

Next parts are an extract from our CRO Forum paper published in March 2010

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. We also note that S&P has default table(s) for non AAA ratings, which are not applied.

- 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. Moreover, the impact of the minimum capital charge is that AAA structures are mostly bound by the 10% minimum charge. This implies that the table is in fact only applied to below AAA ratings while S&P only published this table for application to AAA CDO ratings.

- 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.

4.1.1. 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.

- To simply just apply the CDO model to ABS, CMBS and RMBS will result in capital requirements that can bear no relation to the actual risks being born. For instance:

    - It would result in prime mortgages (secured on low LTVs) giving much higher capital requirements than the same exposure to unsecured credit cards. This is due to the underlying asset pool in both cases being unrated but the tenure on the credit card exposures being much lower than the prime mortgage loans.

    - These types of structured credit often involve the use of master trusts, where a series of individual issuances, each with their own tranchings, occur out of the same pool and there is often a relationship to the strength and structure of the issuer. In these cases the interaction between one set of issuance and the others plus the position within the overall structure is vital to the risk of the investment and will not be reflected within the particular issuances attachment and detachment points.

The only practical way to recognize all these specificities is to look to the overall rating of the investment in the standard formula.

4.1.2. 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: 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 (ie. applying directly the corporate bond stress) and a scaling factor of 1.5 for other ratings (ie. applying 1.5 x corporate bond stress for BB and ratings below)

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.
Credit Default Swaps should be treated in the same way as corporate bonds (i.e. based on the rating of the underlying name).. For the calibration of CDS in the spread module, CEIOPS should use the same data used in the calibration of bonds in the final advice (ie. CDS data and not real bonds index).

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).

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.
Only for covered bonds (eg. German Pfandbriefe, Spanish Cedulas), we would defend far lower shock both under the spread risk and concentration risk sub-modules. These bonds should have a specific treatment that appropriately reflects their risks. As an example, German Pfandbriefe could benefit from a AAA shock set at 1%, and not 8% as currently written.

14 May 2010

'Pedagogic Memo' on the volatility risk in the standard formula

As evidenced in recent meetings, there seems to be a lot of discussion and debate around 'volatility stresses' under the standard formula:

- The Level 1 Text mentions this explicitly (*The market risk module shall reflect the risk arising from the level or volatility of market prices, Art 105 (4)*). (Implied) volatility is a risk for a life insurer:
  - liabilities are sensitive to an increase in implied volatility due to embedded options such as profit sharing, surrender options, or the guaranteed annuity options
  - as on the asset side companies are short volatility, leading to a non negligible volatility risk

- Companies managing volatility risk (by reducing the liability risk in life business with volatility hedging program on the asset side) should benefit from this risk reduction, in comparison with companies without hedging.

- It's necessary to highlight that the volatility shock is quite difficult to assess/ evaluate for the following reasons:
  - To calculate the volatility SCR a stochastic modeling of assets and liabilities (EEV/MCEV) is required. The easiest way is to use the EEV/MCEV volatility sensitivities for determining the volatility SCR. The use of deterministic cash-flow is not possible.
  - For small companies, EEV/MCEV calculations are very costly and time-consuming. In addition, in order to achieve robust volatility sensitivities, companies may require years of experience.

- Finally, there are debates related to:
  - the calibration/ horizon of the shock - that should be decreasing for longer tenor (see a numeric proposal below)
  - the scope of these volatility stresses (equity, interest rate) and why this should not be extended to other asset classes (given their non-materiality), even if it may be theoretically justified.

This CRO Forum 'pedagogic paper' intends to remain neutral and addresses all the issues listed above.

1. Volatility risk in insurance products

Volatility risk measures the impact of a decrease or increase in equity and/or interest rate implied volatility on the economic value of the Group.

- On the asset side the change of implied volatilities only has an impact on options, whose market value is sensitive to implied volatility (e.g. equity calls/puts, swaptions, FX options, etc).
- However, the main driver for the volatility risk is from the liability side. Volatility risk is mainly present in Life insurance business.

Life insurance products may contain a variety of different options such as profit sharing, surrender option or guaranteed annuity option.

- Typically those options are managed with standard instruments, such as equity or bonds. The use of derivative products (equity options, swaptions, caps/floors) to hedge the optionalities inherent in these products is becoming more common.
- However, for life business insurers are usually short volatility (i.e. more options on the liability side than on the asset side).

For non-life business the volatility risk is usually very small/ negligible. Non-life liabilities have no optionality and the use of options is typically limited on the asset side.

	Asset Side	Liability Side	If asset side is hedged	General comment
Life	+	++	Exposed to an increase in implied volatility risk	
P&C	~0	No options	Exposed to a decrease in implied volatility risk	Volatility risk is very small

It could be argued that implied volatilities are not a true risk factor, in that they do not impact a firm's ability to pay policyholders, i.e. they do not (ceteris paribus) impact the asset and liability cash flows that will occur. However this interpretation may contradict the Solvency II framework:

- Implied volatility can be interpreted (in part) as the market view on future volatility which will then impact option and guarantee costs.
- The SCR framework is based on a one-year mark-to-market approach, and in this context implied volatilities are true risk factors.

Illustration/ functioning of the volatility shock for Participating products

In a life insurance product, in exchange of a premium the company commits to return a higher sum to the insured at the end of the contract (i.e. redemption, death of the policyholder, horizon of the contract).
For participating products, the commitment of the company to its policyholders will depend on (i) the yearly financial profit to the policyholders (eg. Fixed percentage of 85% in France) as well as (ii) a guarantee of a minimum rate of realisation.

To illustrate the impact of an increase in volatility asset return on the value of the liabilities, let's consider the following example:

- an insurance entity has only one single group of policyholders,
- all of them having signed the contract on 1st January for a insurance sum of 100 and for a horizon of 1 year,
- with a minimum guaranteed rate of 0% (at least the paid in premiums at the end of a year) and 85% of the yearly financial profit will be returned to policyholder (risk free rate = 0%)

1st case – 'low equity volatility environment': *let's assume that assume that the asset return is +5% with a probability of ¼, 0% with a probability of ½, and -5% with a probability of ¼.*

Scenario	Probability	Asset value at t=0	Asset value at t=1	Liability value at t=1	Comment
Assets +5%	¼	100	105	104.25	=100 + 5*85% + 0(no market movement)=104,25
Assets 0%	½	100	100	100	=100 + 0*85% + 0=100
Assets -5%	¼	100	95	100	=100 - 5*85% + 0=95,75 rebalanced to 100 due to the minimum revalorisation of 0%
			Expectation : 100	Expectation : 101.62	E[A]= ¼*105+½*100+¼*95=100 E[P]=¼*104.25+½*100+¼*100=101.62

2nd case – 'high equity volatility environment': *let's assume that asset return is +10% with a probability of ¼, 0% with a probability of ½, and -10% with a probability of ¼.*

Scenario	*Probability*	Asset value at t=0	*Asset value at t=1*	*Liability value at t=1*	Comment
Assets +10%	*¼*	100	*110*	*108.5*	P=100 + 10*85% + 0=108,5
Assets 0%	½	100	100	100	P=100 + 0*85% + 0=100
Assets -10%	¼	100	90	100	=100 - 10*85% + 0=91, 5, rebalanced to 100 due to the minimum revalorisation of 0%
			Expectation: 100	Expectation: 102.125	E[A]= ¼*110+½*100+¼*90=100 E[P]=¼*108.5+½*100+¼*100=102.125

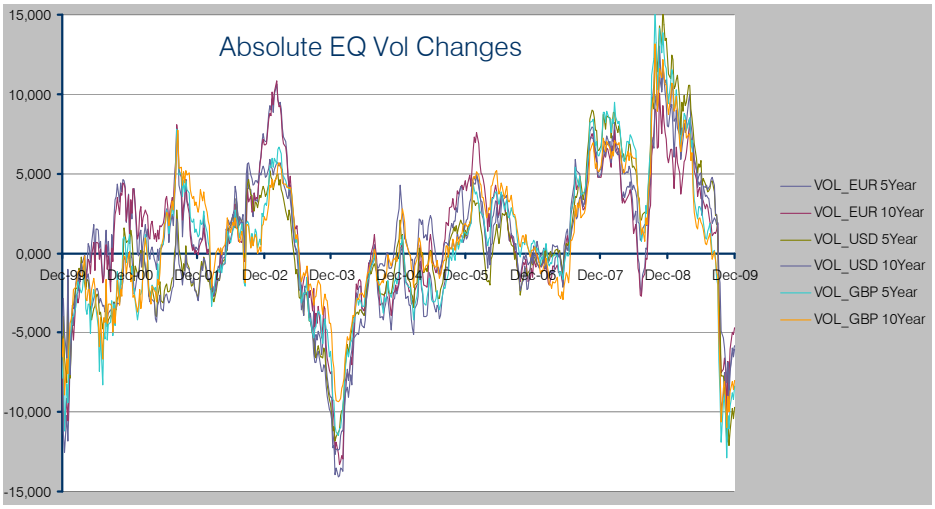
Conclusion: With this simple case we demonstrate that the link between assets and liabilities exists for a life insurance company and that the expected value of the liabilities increases with higher asset volatility.

A volatility stress therefore has two effects: on the one hand the cost of option and guarantees (and hence the best estimate) increases, reducing the AFR, while at the same time the SCR increases. The combination of the two effects may have a significant impact to the coverage ratio.

2. Calibration of the volatility shock, particularly for longer tenor

In the draft QIS5 specification, the European Commission defines the equity volatility risk as the more onerous of a equity global shock, combined with an absolute volatility stress of +10% in the upward direction or a volatility stress of -3% in the downward direction. The equity SCR is calculated by assuming correlation between equity level and equity volatility of 75%

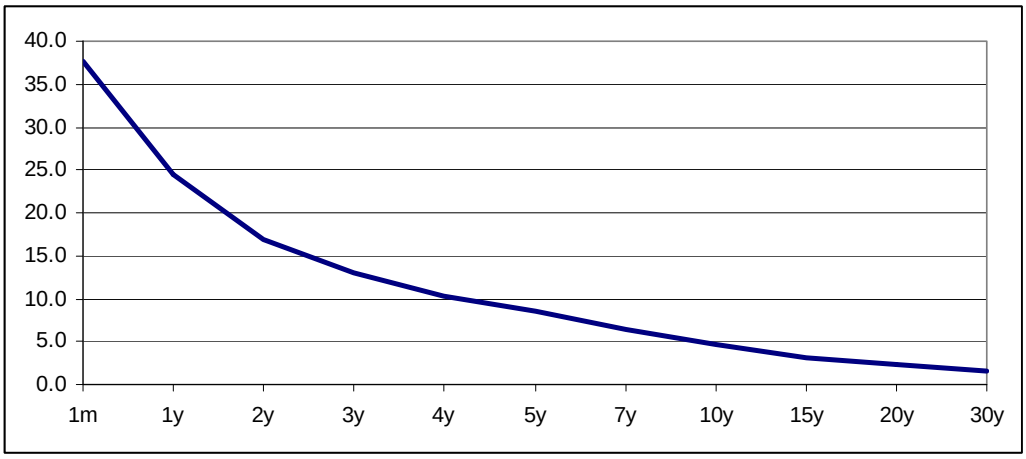
This is aligned with the CRO Forum proposed calibrations published in March highlighting that CEIOPS final advice on design and calibration of the volatility stress was overly onerous and highly pro-cyclical (the relative amount and their calibration was equivalent to having a +16% absolute stress as at 31 December 2009).



An important feature of volatility is that it is mean reverting over time:

- Market volatility can increase substantially, but typically only for short periods of time after which it reverts to long-term levels (or even below). This can be observed in the term structure of implied volatility (short-term implied volatilities – as depicted in graph above - increased drastically compared to longer tenor volatilities during the crisis)
- Secondly, one has to be careful in taking into account the observed volatility of longer tenor options. During a crisis market liquidity typically drops e.g. 10yr implied volatilities might not have been representative for long term market expectations of volatility (implied volatility is in fact a proxy of the expected volatility for a certain future period).
- So while an absolute volatility shock of 10% as proposed for the SCR makes sense for 5yr options, we believe it should lower for longer tenors. The speed of decline depends on how quickly it is assumed that volatility dampens over time.
- Below graph shows the shock assuming an initial shock of 38% for 1m options based on the worst observed 12 month shock for the DJ EuroStoxx50 during the crisis (end-of-month data from Markit) and consistent with a 10% increase for 5yr options. The spread of mean reversion is estimated based on observed market movements during the crisis,
- One additional element to consider for shorter tenor options is that volatility shocks within the 1yr horizon of the SCR calculation are in fact realised which limits the actual impact for shorter options (e.g. holding a 1yr option you are only sensitive to equity shock that have been observed during the year at the end of the year and not to implied volatility shocks as there is no time value in the option anymore). We would therefore recommend to stick to a 10% shock for shorter tenor.
-

[please refer to the excel named – 'Equity volatility data.xls'



Applying a full term-structure might be complex for companies to apply in a standard model. Therefore, a suggestion could be to apply different shock buckets for tenors. Of course further granularity of the buckets is feasible, but this will make the shock more complex. A further potential simplification is that

companies could still apply a single shock taking into account the profile and horizon of their equity linked options and guarantees.

Based on above graph a simple manner in which to bucket could be as follows:

Tenor	Equity volatility up stress (absolute amount)
0-7yrs	10%
7-15yrs	5%
>15yrs	3%
Further simplification taking into account the profile of their equity linked options and guarantees *(eg. 20% of their options are 0-3yrs, 60% of their options are 0-7yrs and 30% 7-15yrs and 10% >15yrs)*	*Single equivalent shock would be equal:* *60%x10% + 30%x5% + 10%x3% = 8%*

Focus on Interest Rate implied volatility shock

The interest rate shock is defined as the more onerous between an up and down term structure stress, combined with an absolute volatility stress of 12% in the upward direction, respectively an absolute volatility stress of -3% in the downward direction. The total interest rate SCR is calculated by aggregating the term structure stress and the volatility stress using a correlation factor of 0%.

We performed the same type of analysis on the volatility shock for Interest Rate for longer term - but given the complexity of this asset class (2 sided), we recommend to directly use the unique shock set at 12% in the upward direction and -3% in the downward direction, applied on the horizon of the Interest rate linked options and guarantees.

3. Why there is no need to extend the volatility shocks to other asset classes

In theory, there should be a volatility shock on all asset classes; but its appropriate to apply it only to Equity and Interest rate because of:

- Materiality: It is relevant only for these 2 asset classes – insurers have options predominantly on Equity and Interest Rate in their replicating portfolios. So the risk is non-material for other asset classes.
- Calibration/ Practicability: there are no implied volatility indices on other asset classes to calibrate any implied volatility stress, except for FX.

4. PROs/ CONs for the introduction of the volatility shock

Advantages:

- State-of-the-art risk management model should consider the (implied) volatility risk. In life business, liabilities are sensitive to an increase in implied volatility due to embedded options such as profit sharing, surrender options or the guaranteed annuity options. As companies are generally short volatility on the asset side, this leads to a non negligible volatility risk.
- Companies managing the volatility risk (reducing the liability risk in life business with volatility hedging programs on the asset side) should benefit from a reduction of the risks in comparison with companies without hedging.

Disadvantages:

- In order to be able to calculate the volatility SCR a stochastic modeling of assets and liabilities (EEV/MCEV) is required. The easiest way is to use the EEV/MCEV volatility sensitivities for determining the volatility SCR. The use of deterministic cash-flow in not possible.
- For small companies, EEV/MCEV calculations are very costly and time-consuming. In addition, in order to achieve robust volatility sensitivities, companies may require years of experience. At the beginning the value has the priority, later on the sensitivities require management's attention.

- The ongoing discussions on the calibration of the volatility shocks (horizon of the stress, scope, correlation with underlying risks) demonstrate the complexity of this topic.
- The inclusion of the volatility risk increases the solvency capital requirement in the standard formula. The increase depends on the business (strong for Life, limited for non-life) and on the countries involved (lower impact in Mediterranean Region given the features of their products, higher impact in Continental Europe).

14 May 2010

Memo on financial mitigation/ dynamic hedging in the standard formula

HEDGING INSTRUMENTS IN ALL RISKS MODULES

Hedging instruments in all risks modules are only allowed with the average protection level over the next year. We strongly disagree with this treatment since it contradicts to the main aim of Solvency II, namely to have an economic framework.

We understand that the idea is to prevent firms from window dressing, i.e. to avoid that derivatives are only installed shortly before the reference date and only for a very short time.

As a compromise we suggest that hedging instruments with an average protection level of less than one year shall be fully allowed, under the condition that the firm has a well documented hedge policy in place and that the hedges are part of this hedge policy.

DYNAMIC HEDGING

Insurance products are getting more and more complex. The policyholders want to participate in the up moves and at the same time have a guarantee in the case of an down move. Therefore the use of dynamic hedging programs is getting increasingly important.

We thus welcome the current drafting of article SCR12.24, as it allows the recognition of dynamic hedging as an effective risk mitigation, as long as it is well documented and automatic procedures are in place. However, we ask to adapt article SCR.5.38 accordingly.

Our proposal to capture dynamic rebalancing well in the standard model would be to allow for a rebalance after 50% of the shock. The idea behind this is that the full SCR equity shock is not happening overnight. So in reality any dynamic hedging program with an automated rebalancing (either daily rebalancing or based on market triggers), will have the ability to adjust after the initial shock in the market.

Let's assume the following example: The current Delta (Δ) and Gamma (Γ) are known for the variable annuity business and take into account the current hedges. Let's assume that the QIS equity shock amounts to 30%. In a first step an immediate shock of 15% is applied. The loss in this first step amounts to:

$$Loss_I = \Delta \cdot 15 + \frac{1}{2} \cdot \Gamma \cdot (15)^2$$

After the first shock the hedges can be re-adjusted leading to new Greeks (Δ^* and Γ^*). In a second step an additional shock of 15% is applied. The loss in the second step is given by:

$$Loss_{II} = \Delta^* \cdot 15 + \frac{1}{2} \cdot \Gamma^* \cdot (15)^2$$

The total loss for one year is given by the formula:

$$Loss_{Annual} = (\Delta^* + \Delta) \cdot 15 + \frac{1}{2} \cdot (\Gamma^* + \Gamma) \cdot (15)^2$$

Assuming that the Delta was rebalanced to the initial value and that Γ^* equals the initial Gamma the formula becomes:

$$Loss_{Annual} = \Delta \cdot 30 + \frac{1}{2} \cdot (2 \cdot \Gamma) \cdot (15)^2$$

For sake of simplification, we assume that gamma is not changing after the rebalance: this is not an unrealistic assumption considering that option are longer dated such that gamma is not quickly changing.

This can be compared to the annual loss if no dynamic hedging was considered:

$$Loss_{Annual}^{Static} = \Delta \cdot 30 + \frac{1}{2} \cdot \Gamma \cdot (30)^2$$

Comparing these two approaches (static vs dynamic within the standard formula) leads to the following conclusions:

- The risk charge for Delta is the same if dynamic hedging is considered or not.
- For Gamma risk charge is divided by two if dynamic hedging is allowed.
- The SCR is the same as if considering only half of the shock and multiplying the result by 2.

So, to conclude, when dynamic delta hedging is captured in an official hedge policy then the SCR can be calculated by applying 50% of the equity shock and multiplying the result by 2

The same approach can be used to take into account the dynamic hedging on interest rates. Also here half the QIS shock can be applied (defined by time bucket) and the result can then be multiplied by two.

For implied volatility (equity and IR) no dynamic hedging is considered. Therefore the loss can be directly calculated by multiplying the shock with the corresponding Vega.

20 May 2010
Amended version to better cover
the issue of geographical diversification

Joint Paper on the Non-Life Risk Module: Key Messages from the Industry

The CRO Forum and CEA have jointly prepared this paper highlighting our concerns over the treatment of the non-life underwriting risk module. We do however appreciate the significant efforts to revert to more sensible factors, as proposed under the draft QIS5 specification. Even though the Commission's draft is a step in the right direction, the non-life risk module is still an area of concern.

On the basis proposed, non-life insurers will have to fork-out roughly +20% more non-life SCR compared to QIS4 (€ 25bn for the European Market). **We do not agree with such an increase above QIS4: the crisis has not demonstrated any significant deterioration on non-life insurance business.**

The increase is even more exaggerated when considering the calibrations included in the internal models of major European insurers as evidenced in the CRO Forum's non-life calibration benchmark survey (8 respondents accounting for 26% of Europe's Gross Earned Premiums). **This CRO Forum survey reinforces the conclusions of our QIS4 Benchmarking Study (October 2008) that already indicated the conservatism of QIS4 calibration compared to internal models.**

Thus, the CRO Forum and CEA strongly recommend a reduction in Non-life calibrations.

We therefore urge the Commission and CEIOPS to work together in the coming weeks to re-assess the calibration factors on non-life. The factors should be assessed in conjunction with the calibration of the cat risk module for the corresponding lines of business. We provide the following arguments to substantiate this recommendation:

Table 1: Executive Summary Table

Main concerns previously expressed	Status on the draft QIS5 spec	Comment
Premium & Reserve risk		
Scope of the data analysed	Amber	Data sampled by CEIOPS for calibrating the non-life factors accounts for at max ~32% of this market[1]. Furthermore, the used data from countries with emerging market characteristics overstates the volatility assessment (compared to the EU market average).
Methods retained	Amber	While we are aware of the issues around lack of data and that most methods would have some flaws, we would like to point out some major issues with the selected methods.
Calibration	Red	We note the efforts to come back to more sensible factors. However, these factors are still ~20% higher than QIS4 and significantly higher than our results provided in the CRO Forum non-life internal model survey (+80%).
Use of Undertaking specific parameters	Amber	Risks borne by non-life insurance contracts differ significantly within Europe due to different legal frameworks, products offered and the way individual companies manage these. Moreover it is recognized even by CEIOPS and EC that standard parameters are often not relevant at all for large non-life portfolios. We therefore urge that companies are able to apply undertaking-specific parameters under more relaxed terms.
Non-Proportional reinsurance	Amber	We welcome the recognition of Non-Proportional reinsurance in the premium risk to fit the joint AMICE / CRO Forum proposal. We believe minor improvements of the

[1] See Table 2 showing an assessment of data Sampled for non-life

Main concerns previously expressed	Status on the draft QIS5 spec	Comment
		formula are still possible.
Geographical diversification	**Amber**	We welcome the fact that the EC explicitly return to the QIS4 approach with the Herfindahl index. While we recognize some weaknesses to this approach, no strong actuarial and statistic arguments against it. We do have issues with: • the granularity of the geographical segmentation; and • the level of the cap built into the Herfindahl index. In practice, this drastically reduces the intended level of diversification benefit.
Lapse Risk	**Amber**	Clarification is needed on the scope of the lapse risk module. The Non-Life lapse risk should be included, only, where the value of corresponding premiums is recognized in Own Funds.
Cat Risk	**Amber**	We appreciate the approach taken by CEIOPS to define standardised scenarios for the cat risk module (as included in draft QIS5). The current state of the work does not allow for a final judgement as the task force needs to provide more information on the "hows" and "whys" of the calibration. We believe it is important to review the cat risk calibration in conjunction with calibration of the premium and reserve risk module to avoid potential double-counting.

The characteristics of the countries' data analysed in CEIOPS' advice do not share overall characteristics of the wider Europe

We do not believe that the countries sampled are fully representative of the entire EU non-life insurance market, neither by demographics, nor size (see Table 2):

- Most countries sampled are relatively less developed, particularly those located in Eastern Europe - an insurance environment characterised by peculiarities which do not belong to more mature markets. These markets are more likely to experience sudden changes in economic trends that will affect the non-life volatility assessment. We believe there is still room to adjust factors downward to a level more representative of the wider Europe (while still incorporating the evidence from smaller countries).
- Many sources of heterogeneity have been ignored in the analysis including changes in reinsurance programmes, and many differences between countries such as claims environment, accounting basis and regulation. Cat losses have been excluded on a qualitative based, only.

We are aware that data availability is limited to cover all these issues but these qualitative arguments should be considered when setting the parameters.

Setting Solvency II factors on this basis is highly questionable. We recommend a critical review of the scope of data used and consideration of the CRO Forum results (26% of European Market share).

Table 2: Overview of factors and Data Sampled

Market share information per country (EUR, mil)	CEA Non-Life GEP	CEIOPS Final advice		CRO Forum market share %
		In the scope	*Maximum possible market share sampled*	
Germany	84 900	Yes	*80%*	More than 30%
France	60 948		*0%*	More than 30%
United Kingdom	60 810	Yes	*47%*	[10%; 20%]
Netherlands	50 177		*0%*	[0%; 10%]
Italy	37 451	Yes	*49%*	More than 30%
Spain	32 597		*0%*	[20%; 30%]
Switzerland	13 264	Not in scope		More than 30%
Belgium	9 892		*0%*	[10%; 20%]
Austria	8 852		*0%*	[10%; 20%]
Sweden	6 997	Yes	*31%*	
Denmark	6 201	Yes	*80%*	
Poland	5 797	Yes	*80%*	
Portugal	4 320	Yes	*37%*	[10%; 20%]
Ireland	3 333		*0%*	[0%; 10%]
Czech Republic	3 325		*0%*	More than 30%
Finland	3 270	Yes	*50%*	
Hungary	1 706	Yes	*46%*	[20%; 30%]
Slovenia	1 376	Yes	*80%*	
Slovakia	966	Yes	*80%*	
Luxembourg	702	Yes	*79%*	
Latvia	453	Yes	*80%*	
Lithuania	427	Yes	*66%*	
Iceland	258	Yes	*39%*	
Total excl. Switzerland	**401 890**		***33%***	**24%**
Total	**415 154**		***32%***	**26%**

- **Note:** Max possible data - assuming all relevant Gross Premiums of that country/ relevant LOB was used. To determine final advice market share, the total Gross premium for countries/ relevant LOB sampled (capped at 80%) was included. Hence the actual figure is likely to be less than 32%.

The methods used have a significant impact on retained factors

While we are aware of the issues around lack of data and that most methods would have some flaws, we reiterate our serious concerns with the selected methods. The fact that Solvency II factors will be set using these methods is questionable. In particular:

- **Premium risk method 3** involves a mean parameter μ across all undertakings. This bias the volatility estimates, that are very likely to be over-estimated. This is reflected in the results where Methods 3 is consistently much higher than Methods 1 and 2.
- **Reserve risk method 1** involves a strong assumption: especially that expectancy of O/S claims are equal to the reserves volume, which implies that IBNR expectancy is nil. This is likely to result in over-estimated parameters of volatility.
- **Reserves risk methods 1-3** give more weight on the reporting year with the smallest reserve volume (eg. the very first accident year has usually higher standard deviation). Model 1-3 may be amended by removing the 1-3 first reporting/accounting years from the estimation of the standard deviations in order to stabilise the results.

We recommend excluding the use of method 3 for Premium risk and method 1 for Reserve Risk, and advise that an adjustment is made to the reserve risk methods.

Despite the significant reductions from the final advice, we still recommend a reduction in Non-life calibrations

We note the efforts to come back to more sensible factors. However these draft QIS5 factors are still higher[2] than QIS4 (estimated at 20%higher), which was deemed a more acceptable level, but still not to be considered the benchmark. We would like to reiterate the level of calibration provided in the CRO Forum non-life internal model survey.

Some explanations on the results of our CRO Forum internal model survey:

- The standard deviation factors presented below, per LOB for premium and reserve risks, are adjusted to be **gross of geographical diversification** (eg. average of all "country" standard deviations) so that these outcomes are comparable with a "solo" calibration for large portfolios.
- Our observations of prudence included in the proposed calibrations - relative to QIS4 and even more in comparison to our internal model - apply to all lines of business (with the exception of very specific lines such as MAT reserve risk, reflecting the heterogenic nature of this LoB).
- For the portfolio of CRO Forum insurance surveyed, the equivalent weighted average standard deviation is at:
  - 6,5% for the Premium Risk using Internal Model calibrations. The equivalent factor would increase by +83% using calibrations of draft QIS5 (to 11,8% weighted average) and by +54% with QIS4 (to 10,0% weighted average);
  - 6,3% for the Reserve Risk using Internal Model calibrations. The equivalent factor would increase by +88% using calibrations of either draft QIS5 specifications or QIS4 (to 11,9% weighted average);

Even if suggest draft QIS5 parameters may appear sound for smaller size portfolio, these are not appropriate for medium & large portfolios (e.g. CROF members' ones), due to the size impact on volatility.
We propose further consideration of these factors and recommend reverting back to an industry calibration position (between CRO Forum calibrations and QIS4 calibrations).

Under such prudent calibrations, allowance of the use of USPs becomes crucial

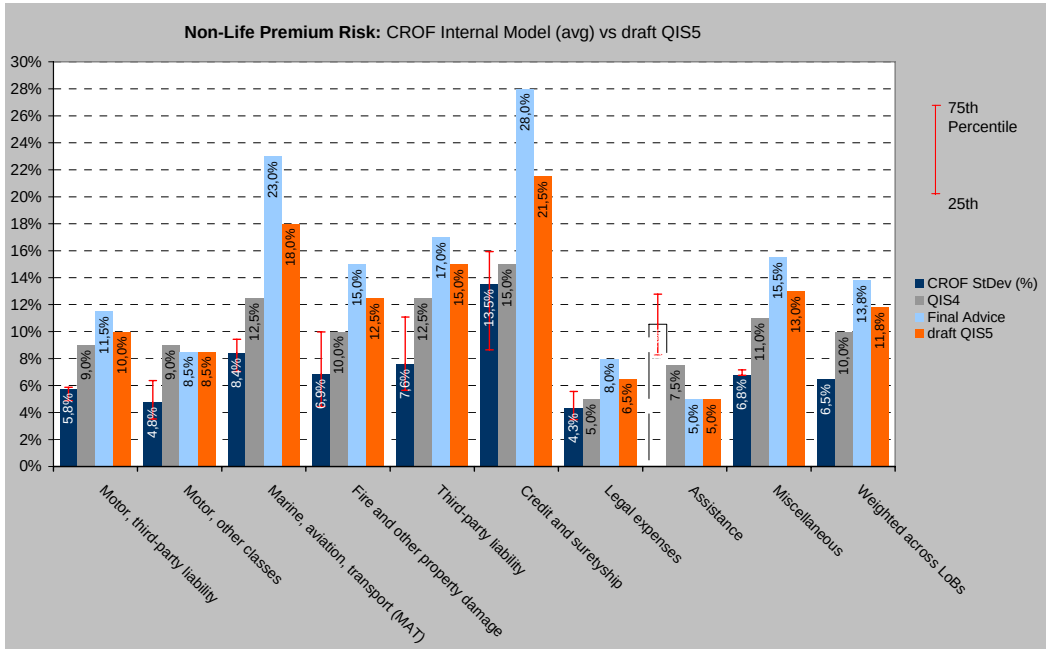
We argue that the use of USPs should be supervised in the most flexible way:

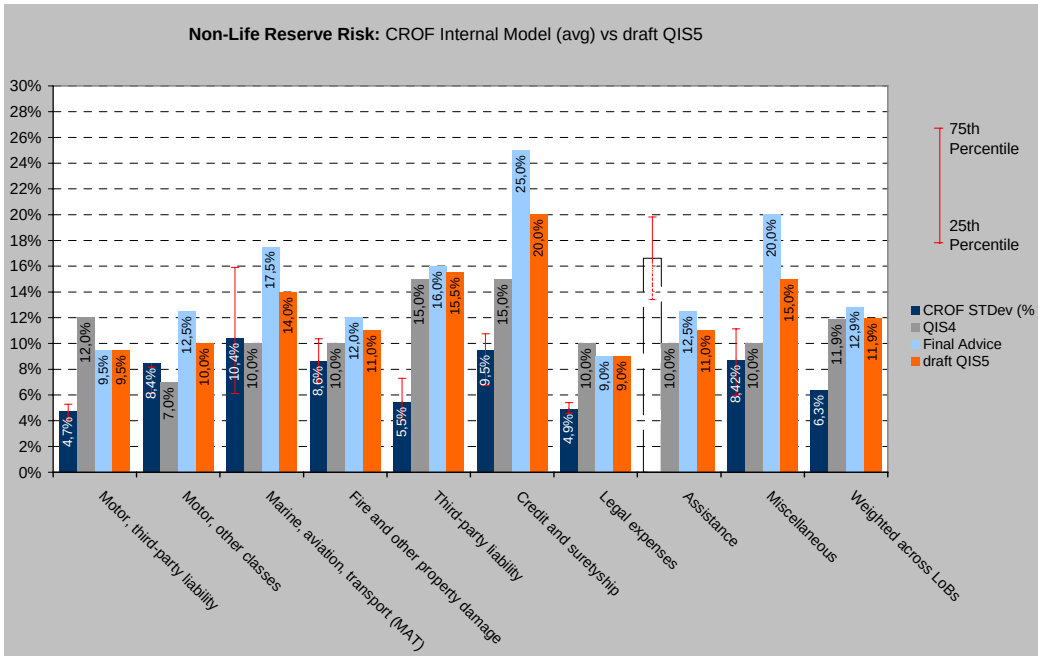
- The use of undertaking specific parameters should not be restricted in terms of the scope of risks which are covered and the methods which can be used. The restriction of methods to the "standard methods" proposed in CP 75 will, in most cases, make it impossible to obtain valid results. We envisage a certain amount of flexibility from CEIOPS in the use of frequency / severity approach proposed for Premium risk (e.g. in calibration methods, and reinsurance per risk treaties modelling).
- A time frame should be settled for approval process; especially USP should be allowed from the early implementation of Solvency II in 2012.
- We agree on the "completeness, accuracy, and appropriateness of data" criteria. We would, however like to ensure that these criteria will not be reviewed by local regulators in too restrictive a manner, possibly inconsistent with CEIOPS data, as well as "robust and reliable estimation" criteria.
- We expect CEIOPS to commit oneself on automatic objective criteria that ensure USP approval e.g. if we use standard methods and standard format of data.
- We expect that USP will be allowed though a more flexible and simplified validation process of the regulator, in comparison to what is required under the full internal model.

In addition 'Fire' LoB gathers a very heterogeneous type of business (from household insurance, to industrial fire & damages). This questions the relevance of calibration parameters - especially for Premium risk in large retail property portfolios. In this case the use of USPs should be widely allowed and facilitated by regulators.

[2] Mainly due to the premium risk as the net/ gross adjustment is neutral for the major business lines

Premium factors presented below for draft QIS5 should be multiplied by (NCRi/GCRi): net combined ratio / gross combined ratio.





We welcome the recognition of Non-Proportional reinsurance and recommend further investigation

The CRO Forum agrees that the AMICE/CROF formula that focuses on impact assessment of non-proportional reinsurance to the average claims cost is the best trade-off between accuracy and complexity.
Nevertheless, there remain issues to be worked on:

- As underlined in the AMICE/CROF proposal, not all reinsurance features are accounted for;
- The formula for calculating these adjustment factors can be applied only when an XoL treaty covers one single LoB and no other reinsurance contracts are applied to this LoB. We propose an adjustment to the method so that XoL treaties covering a part of the lob, only, can be included;
- The QIS5 technical specification should include examples how the formula shall be applied for different reinsurance structures. [3]
- We propose to open the method for company individual adjustments.

We welcome the partial recognition of geographical diversification but refinements are needed to adequately capture this

The full recognition of diversification is a crucial element to promote best risk management practices. We welcome the improvements to partially capture geographical diversification with the Herfindahl index. We recognize some weaknesses to this approach, but that there are no strong actuarial and statistic arguments that can seriously challenge it. However, we have issues with:

- the granularity of the geographical segmentation - the geographical segmentation (based on U.N. geo-scheme) has been drastically amended compared to QIS4 and leads in practice not to recognize any diversification within some EEA countries (eg. for Western Europe: France, vs Germany, vs Switzerland).
- the level of the cap (25%) built into the Herfindahl index, that should not become a benchmark applied to Internal Model

In practice, the above drastically reduces the intended level of diversification benefit.

We ask for clarification of the scope of the lapse risk module

As currently written, the recognition of non-life future premiums in Own Funds is not mentioned in the QIS5 Draft specifications. So, the recognition of this additional value is thus very unclear: will companies be allowed to recognise a full year of P&L or only benefits arising from non-life multi-years contracts with price options?
In order to maintain consistency between the SCR and Own Funds, lapse risk should be included only where the value of corresponding premiums is recognised in Own Funds.

See separate comments on the cat risk proposal (cf. CEIOPS Cat taskforce)

[3] For instance Fire LoB include both retail household insurance, and industrial fire, which are very unlikely to be covered the same way.