CEIOPS-DOC-34-09

CEIOPS' Advice for Level 2 Implementing Measures on Solvency II:

Technical Provisions - Article 86 b - Risk-free interest rate term structure

(former CP 40)

October 2009

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1. Introduction

1.1. In its letter of 19 July 2007, the European Commission requested CEIOPS to provide final, fully consulted advice on Level 2 implementing measures by October 2009 and recommended CEIOPS to develop Level 3 guidance on certain areas to foster supervisory convergence. On 12 June 2009 the European Commission sent a letter with further guidance regarding the Solvency II project, including the list of implementing measures and timetable until implementation.[1]

1.2. This Paper aims at providing advice with regard to the relevant risk-free interest rate term structure to be used in the assessment of technical provisions as requested in Article 86(b) of the Solvency II Level 1 text.[2]

2. Extract from Level 1 text

2.1. According to the guiding principles referred to in the Commission's letters, the legal basis for the advice presented in this paper is primarily found in Article 86 of the Level 1 text which states:

"The Commission shall adopt implementing measures laying down the following: […]

b. The relevant risk-free interest rate term structure to be used to calculate the best estimate referred to in Article 77(2); […];

2.2. Article 77(2) requires that:

"[…] The best estimate shall correspond to the probability-weighted average of future cash-flows, taking account of the time value of money (expected present value of future cash-flows) using the relevant risk-free interest rate term structure.

The calculation of the best estimate shall be based upon up-to-date and credible information and realistic assumptions and be performed using adequate, applicable and relevant actuarial and statistical methods. […]"

2.3. Article 76 states the objective for the valuation of insurance and reinsurance obligations:

1. Member States shall ensure that insurance and reinsurance undertakings establish technical provisions with respect to all of their insurance and reinsurance obligations towards policyholders and beneficiaries of insurance or reinsurance contracts.

[1] See http://www.ceiops.eu/content/view/5/5/
[2] Latest version from 19 October 2009 available at http://register.consilium.europa.eu/pdf/en/09/st03/st03643-re01.en09.pdf

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2. *The value of technical provisions shall correspond to the current amount insurance and reinsurance undertakings would have to pay if they were to transfer their insurance and reinsurance obligations immediately to another insurance or reinsurance undertaking.*

3. *The calculation of technical provisions shall make use of and be consistent with information provided by the financial markets and generally available data on underwriting risks (market consistency).*

4. *Technical provisions shall be calculated in a prudent, reliable and objective manner. […]"*

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3. Advice

3.1 Explanatory text

3.1.1 QIS4 feedback

3.1 For QIS4, CEIOPS built the risk-free curve on the government bond rates. However, CEIOPS made an allowance for using swap rates for markets where it would be more appropriate taking due account of possible illiquidity or insufficient credit quality.

3.2 In its letter of 26 March 2008 the European Commission invited CEIOPS to use the swap rate rather than the government bond rates for QIS4.[3]

3.1.2 Desired characteristics

3.3 Ideally, the instrument on which the relevant risk-free interest rate term structure is based should have the following qualities:

a) No credit risk

b) Realism

c) Reliability

d) Highly liquid for all maturities

e) No technical biases

f) Available for all relevant currencies

g) Proportionate

a) No credit risk

3.4 This criterion follows directly from the Level 1 text and is considered by most CEIOPS members to be the most important. Bonds issued by governments with AAA ratings can be considered to have no relevant credit risk, while it is accepted that other instruments, for example swaps, do involve relevant credit risk.

3.5 CEIOPS notes that there is substantial academic discussion on the measurement of credit risk in the return on financial instruments. Several approaches for the quantification of credit spreads are under consideration. It appears that a best practice which would ensure comparable quantification outcomes has not emerged yet.

3.6 The credit risk also differs from currency to currency. For instance, the euro zone has several AAA-rated governments, and a risk-free government bond

[3] See http://www.ceiops.eu/media/docman/public_files/consultations/QIS/Letter%20J.%20Holmquist%20to%20T.%20Steffen%2031%20March%202008.pdf

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curve can be based on the euro curve derived by the European Central Bank. For currencies linked to only one government, however, the government bond rate can still carry credit risk.

3.7 During the current financial crisis the issuers of swaps, mainly investment banks, showed high default vulnerability. For example, Lehman Brothers Inc. became insolvent and many banks were bailed out by governments to avoid their failure. Although swaps are collateralised transactions, there is still significant credit risk connected to these instruments, mainly for two reasons:

- The market value of the collateral may be affected by the default event.
- The collateral covers only the current value of the swap. If interest rates change, a significant exposure may not be covered, in particular for swaps of long maturities.

Moreover, in order to earn the swap rate in practice one has not only to take on the credit risk of the swap counterparty, but also the credit risk which comes along with the earning of the variable rate that is exchanged in the swap arrangement (for example by investing in a bank deposit yielding the floating leg rate). This credit risk is also reflected in the swap rates.

b) Realism

3.8 It should be possible for all insurers to earn the specified risk-free rate in a risk-free manner. If that was not the case, technical provisions discounted by such rates would include hidden losses which would materialise during the run-off period of the liabilities. A balance sheet that includes hidden losses would not be an appropriate basis for solvency assessments.

c) Reliability

3.9 The data basis and the method chosen to determine the term structure should be robust. It should result in a reliable and accurate estimate. This criterion should in particular apply in times of market crisis or turbulence.

d) High liquidity

3.10 The rates should be based on financial instruments for which a reliable market value is observable. A reliable market value is observable from deep, liquid and transparent markets. A term structure based on a deep and liquid market would have fewer distortions than a less liquid market. For most term structures, there is sufficient liquidity up to a certain maturity. Beyond this point the term structure needs to be extrapolated when necessary.

3.11 As stated in the CEIOPS—DOC-35/09 advice on the calculation of technical provisions as a whole (Article 86c of the Level 1 text)[4], *'deep, liquid and transparent markets*', requires to meet all the following requirements:

[4] Former CP 41. See http://www.ceiops.eu/index.php?option=content&task=view&id=592.

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- market participants can rapidly execute large-volume transactions with little impact on the prices of the financial instruments used in the replications;
- current trade and quote information of those prices is readily available to the public;
- the properties specified above are expected to be permanent.

e) No technical biases

3.12 The IAA Risk Margin Working Group provides an example of a technical bias for government bonds: "Government bond prices can be distorted due to an artificially high demand from financial institutions and pension funds that may be subject to regulatory constraints that favour Government bond holdings or were the basis at the time issued of a benchmark (e.g., a ten-year bond whose yield might be 50 basis points lower than either a nine- or eleven-year bond). These supply and demand distortions may not be considered to be relevant for the cash flows expected to occur at that duration."[5]

3.13 Supply and demand distortions can also lead to a technical bias for swap rates. While under normal conditions swaps have higher yields than government bonds, during the financial crisis a reversal occurred in the pound sterling and euro markets: the swap yields became lower than the government bonds rates for durations around 20 years. The high demand for the fixed swap leg of this maturity came mostly from investors with fixed liabilities, such as insurers and pensions funds, and could not be matched by the limited supply of swaps from banks. The result was a negative spread for swaps, which was larger and persisted for longer than was previously the case. Establishing swap yield curves as basis for regulatory liability valuation in smaller currencies could make this kind of distortion become more common also under normal economic conditions.

f) Availability for all relevant currencies

3.14 Ideally, the instrument chosen as a basis for the risk-free rate would be available for all relevant currencies. However this may be difficult to achieve in practice because the specified instrument may not be available for all currencies or may not meet the above criteria for all currencies.

3.15 There are two possible consequences of allowing significant differences across currencies in the choice of the instrument the term structure is derived from. In the first place, there is a possible impact on the level playing field. Significant differences could potentially lead to arbitrage opportunities and a distortion of competition across markets.

3.16 Secondly, the calculation of the Solvency Capital Requirement (and hence the cost of an insurer's capital) depends on the technical provisions. The price of a long term insurance policy could diverge between currencies as a result of the choice of a different interest rate term structure. However,

[5] International Actuarial Assosciation, *Measurement of Liabilities for Insurance Contracts: Current Estimate and Risk Margins*; 15 April 2009; page 46.

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since the prices of long term insurance contracts are also affected by factors other than the cost of regulatory capital, primarily supply and demand issues, it is likely that this would have a secondary impact.

3.17 On the other hand, there could be an impact on the level playing field if an instrument was chosen which was suitable for one market but not for others as a result of liquidity or technical bias considerations.

3.18 Overall, CEIOPS believes that where deviations from a specified instrument are unavoidable because the instrument is not available or not appropriate for a certain currency, utmost importance should be attached to achieving the same degree of risk-freeness in deriving the term structure.

g) Proportionality

3.19 In view of the importance of the risk-free rate for the calculation of technical provisions the principle of proportionality may not allow for simplified or approximate derivations of the risk-free rate term structure. However, as all undertakings should be able to discount their liabilities, consideration needs to be given to how the risk-free interest rate term structure should be made available, particularly for small and medium sized undertakings which might not be in a position to derive the term structure themselves. CEIOPS believes that it is necessary to provide both the term structure and the methodology used to derive the term structure for all major currencies.

3.20 The risk-free interest rate term structure of the EEA currencies should be provided at least on a quarterly basis. Where market conditions are volatile, the term structures may be provided more frequently.

3.21 If no term structure is provided, the published methodology will allow undertakings who might calculate technical provisions on a more regular basis than quarterly to derive the term structure themselves. Moreover, for non-EEA currencies the methodology should be used to derive the relevant risk-free interest rate term structure. The published methodology should be sufficiently detailed to ensure consistency across undertakings and Member States.

3.1.3 Three-stage approach for the derivation of risk-free interest rates

3.22 In principle, the main options available for the derivation of the risk-free interest rates are:

- government bond rates,
- government bond rates plus an adjustment for technical bias,
- swap rates,
- swap rates minus an adjustment for credit risk.

3.23 CEIOPS believes that the main objective for the derivation of the risk-free term structure is to ensure that it includes as little credit spread as possible.

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The credit standing of an AAA rated government should serve as a benchmark. This does not imply that government bonds with a lower rating cannot be used to derive the risk-free rates. However, depending on the materiality of the credit risk included in the rates compared to the AAA benchmark, an adjustment for credit risk needs to be made to derive the risk-free rates.

3.24 Therefore, only in cases where government bonds are inappropriate, for example because of technical bias or liquidity considerations, an adjustment for the deficiencies should be made. Where this is not possible (e.g. because government bonds are not liquid or a technical bias in government bond rates cannot be removed), the risk-free term structure should be approximated by means of instruments which are most similar to them.

3.25 Swap rates are not risk-free and for this reason unadjusted swap rates should not be used to discount technical provisions. Adjusted swap rates should only be used if government bond rates cannot be adjusted to meet the requirements stated above.

3.26 For each currency, CEIOPS proposes to follow a three stage approach to determine the relevant risk-free interest rate term structure:

First stage:

If government bonds are available that meet the criteria (a) to (e) defined in section 3.1.2 ("risk-free rate criteria"), then government bonds should be used to determine the relevant risk-free rate.

Second stage:

If government bonds are available, but they do not meet the risk-free rate criteria, then they should be adjusted for their deficiencies relating to these criteria. The adjusted rates should approximate government bond rates which meet the risk-free criteria. The adjusted rates should be used to determine the relevant risk-free rates.

Third stage:

If government bonds are not available or if government bond rates cannot be adjusted to meet the risk-free rate criteria for practical or theoretical reasons, other financial instruments should be used to derive the risk-free interest rates. These instruments should be as similar to government bonds as possible. Their rates should be adjusted for credit risk and any other deviations from the criteria with the objective to approximate government bond rates which meet the risk-free criteria.

3.27 Where government bonds do meet the risk-free rate criteria (or can be adjusted to meet them) for some maturities but not for all maturities, they should be used to derive the relevant risk-free rate for these maturities. At stage 3, different financial instruments may be used to derive the relevant risk-free rates for different maturities.

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3.28 A process at Level 3 should ensure that the relevant risk-free interest rate term structures for the different currencies meet in the best possible way the benchmark of risk-free government rates. In case unadjusted government rates were not used to derive the risk-free rate, this should be explained and justified by Member States.

3.29 As financial markets are not stagnant but evolve, it is possible that financial instruments will change with respect to the characteristics mentioned in this paper. For example, the market size of an instrument may increase over time so that a previously illiquid market could become liquid. Similarly, technical bias could appear for particular market instruments, or instruments of a particular duration, if an imbalance develops in the relative supply and demand for these instruments. To account for this, the approach chosen to the determination of a relevant risk-free interest term structure should be revised regularly.

3.1.4 Investment expenses

3.30 In earning investment interest undertakings incur investment expenses like transaction fees, execution fees or unallocated investment management expenses. In principle there are two ways how these expenses can be allowed for in the calculation of technical provisions:

- The discount rate can be lowered by a spread that corresponds to the average level of investment expenses. Thus, technical provisions are discounted with a rate net of expenses.

- The expense payment can be taken into account in the cash-flows underlying the calculation of the technical provisions. For discounting a rate unadjusted for expenses is used.

3.31 CEIOPS suggests that the investment expenses should be allowed for in the cash-flows and not in the discount rate (see CEIOPS-DOC-33/09 L2 Advice on Actuarial and statistical methodologies to calculate the best estimate). This approach is more risk-based as the risk relating to the volatility of management expenses should rather be addressed as part of expense risk than interest rate risk. Moreover, this approach allows undertakings to take undertaking-specific investment expenses into account.

3.1.5 Illiquidity premium

3.32 Industry suggests that the risk-free rate could be increased to reflect cases where the obligation is not redeemable at all, or is not redeemable at short notice without penalty. The addition to the rate is referred to as the "illiquidity premium".

3.33 The vast majority of CEIOPS' Members believes that the relevant risk-free interest rate term structure should not include the referred addition to discount the cash-flows of certain insurance obligations. A minority of CEIOPS' Members[6] does not share this view.

[6] 2 Members.

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3.34 The inclusion of the illiquidity premium would lead to a significant decrease of technical provisions and would lower inappropriately the level of protection of policyholders. Among other reasons (see Annex A), there are concerns that the decreased value of technical provisions would not be sufficient to meet the insurance obligations because undertakings may not be able to earn the illiquidity premium in a risk-free manner in practice.

3.1.6 Additional considerations

3.35 CEIOPS is aware that the application of the new framework derived from Solvency II may have a significant impact in some types of business and certain segments of some concrete national insurance markets.

3.36 The vast majority of CEIOPS' Members considers that the solution to this situation should not be based on a disruption of the coherent framework contained in this advice. Therefore CEIOPS advises that, should this be the case, the adoption of measures to solve the above mentioned situation should be specifically tailored and have a scope exclusively limited to the affected business in force. Annex B contains the current state of the analysis of this issue by CEIOPS' Members.

3.37 CEIOPS considers that further work on this issue requires a precise concept and mandate in light of the framework contained in this advice. CEIOPS is prepared to take the lead in this area and continue to involve all relevant stakeholders in a transparent manner.

3.1.7 Relevant risk-free interest rate term structure for the euro

3.38 The European Central Bank (ECB) regularly determines a risk-free interest rate term structure for the euro. The term structure is derived from AAA rated bonds issued in euro by a euro area central government subject to the following criteria:

- Only bonds with an outstanding amount of at least € 5 billion are included.
- Bonds with special features, including ones with specific institutional arrangements, are excluded.
- Only fixed coupon bonds with a finite maturity and zero coupon bonds are selected, including STRIPS[7]. Variable coupon bonds, including inflation-linked bonds, and perpetual bonds, are not included.
- Only actively traded central government bonds with a maximum bid-ask spread per quote of three basis points are selected. The prices/yields are those at close of market on the reference day.
- In order to reflect a sufficient market depth, the residual maturity brackets have been fixed as ranging from three months up to and including 30 years of residual maturity.

[7] Separate Trading of Registered Interest and Principal Securities.

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3.39 The term structure is derived from the observed rates by application of the Svensson model.[8] The term structure covers maturities from three month up to and including 30 years. The ECB publishes the term structure on a daily basis according to the TARGET[9] calendar.[10]

3.40 The ECB term structure is risk-free because it is derived from AAA rated government bonds. The rates of the term structure can be earned in practice as available government bonds and other financial instruments provide at least the corresponding yields. The term structure is determined in a reliable manner; during the current financial crises the methodology proved to be practicable and robust. There are no indications of a technical bias in the term structure.

3.41 CEIOPS believes that the government bond term structure constructed by the ECB satisfies all of the risk-free rate criteria and therefore is the most appropriate risk-free term structure for the euro. This may also be considered a benchmark for other currencies.

3.1.8 Relevant risk-free interest rate term structure for other currencies

3.42 A vast majority of CEIOPS' Members considers that all risk-free interest rate curves should be based for all currencies on the 3-stage process described in this advice.

3.43 The UK supervisory authority provides the Annex C, concluding:

> *Therefore, for pounds sterling, the risk-free term structure which best satisfies the criteria set out in this paper is the swap curve less an adjustment for credit risk* (see C.32 in Annex C).

3.44 The vast majority of CEIOPS' Members considers that the rationale provide in Annex C does not justify the aforementioned proposal for pounds sterling, and that liabilities expressed in such currency should be discounted according the government curve described in the first stage of paragraph 3.62.

3.1.9 Considerations regarding long maturities

3.45 The appropriate risk-free interest rate term structure is necessarily constructed from a finite number of data points of sufficient liquidity. Therefore, both interpolation between these data points and extrapolation beyond the last available data point of sufficient liquidity is required.

3.46 As the discount factor increases with time to maturity, the extrapolation of the risk-free curve significantly impacts the present value of long term insurance liabilities. Therefore, the technique of extrapolation needs to

[8] Svensson, L. E., 1994, "Estimating and Interpreting Forward Interest Rates: Sweden 1992-1994", Centre for Economic Policy Research, Discussion Paper No 1051.
[9] Trans-European Automated Real-time Gross settlement Express Transfer.
[10] Further information on the risk-free curve of the ECB can be found at the ECB website (http://www.ecb.int/stats/money/yc/html/index.en.html#data).

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adhere to the desired risk-free criteria set out in this advice (in particular the criterion of realism), with the exception of liquidity.

3.47 CEIOPS is aware that high volatility of long-term discount rates can cause substantial changes in the value of liabilities and thereby lead to procyclical effects. Therefore, next to meeting the above criteria, the choice of the extrapolation technique should take into account the effect on financial stability.

3.48 There are many techniques available for extrapolating the interest rate curve, and there is no consensus about which of them is the best in all circumstances and for all currencies. CEIOPS has analyzed the main families of methods and has concluded:

a) There is an unanimous agreement that the same high-level principles should be applied to the extrapolated part of the curve as to the non-extrapolated curve, in particular its calculation by an EU institution (unbiased guarantee) and the use of the same extrapolated rates by all undertakings covering compromises in the same currency and the same long terms.

b) There is also wide support to allow for some mechanism in the method that may provide stability to the outcomes of the extrapolation, avoiding spurious movements in the long part of the curve. This is particularly important for currencies where liquid reference rates are only available for short term maturities and simple extrapolation of these short term interest rates may cause excessive volatility.

c) There is wide support for the view that it is not possible to identify a single method performing the best extrapolation for all currencies.

For example, some currencies are poorly traded and subject to significant changes in macroeconomic expectations. In this case the macroeconomic approach may produce volatile results. Other currencies may be nearby the integration in the euro zone. Again other currencies may be actively traded and have stable macro-economic expectations.

d) There is wide support for the view that it is not possible to guarantee that a certain method will perform appropriately for a given currency at all times.

3.49 Having in mind all these features, CEIOPS recognises the importance of the choice of the extrapolation technique and thus will not prescribe the method for extrapolating the interest rate curve at this stage. Instead, during the Level 3 process, CEIOPS will develop a set of principles for the choice of an appropriate extrapolation method and will, based on these principles choose for each currency the method deemed to be most appropriate. In the following paragraphs four alternative approaches are briefly sketched: simple extrapolation techniques, macroeconomic techniques, parameterisation techniques and a constant spread technique for non-Euro

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currencies. None of them are considered appropriate or robust by all of CEIOPS' Members.

3.50 **Simple extrapolation techniques** require no deeper analysis of the fundamentals or shape of the curve. In its purest form, the simple extrapolation technique assumes that the final liquid data point is also the long term interest rate level. From the final liquid point onwards, the curve is therefore a horizontal line.

3.51 **Macroeconomic extrapolation techniques** involve identifying a long term equilibrium interest rate, usually but not necessarily through economic analysis, and interpolating between the available data points and this additional long term equilibrium point. An example of this technique is the approach outlined in Annexes D and E based on a long-term unconditional forward interest rate.

3.52 **Parameterisation techniques** emphasise smoothing and provide an objective construction of the term structure if the parameterisation technique is fixed. They can be (but it is not necessarily the case) based on economic assumptions. This category of extrapolation techniques is the one currently most used in market practice. There are many types of parameterisation techniques: for example, constant forward rates,[11] the Svensson method,[12] the one-factor or Vasicek class of models, to mention only a few.

3.53 **Constant or variable spread** methods are alternative methods for non-Euro currencies: first an appropriate extrapolation technique for the Euro is defined, then the rates for the other currencies are extrapolated by using the Euro curve plus

> In the case of a constant spread method, the constant spread between the Euro and the relevant currency for the last available liquid data point of the relevant currency.
>
> In the case of a variable spread, the spreads might be derived by fitting a curve to the spreads observed in the non-extrapolated part of the curve.

This technique is based on one unique extrapolation technique for all non-Euro currencies. Annex F includes a short example of this method.

[11] This method was applied for the interpolation and extrapolation of the QIS4 term structures.
[12] This method is used to fit the ECB AAA government bond curve.

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3.2 CEIOPS' advice

3.54 For each currency, a relevant risk-free interest rate term structure should be defined following a uniform methodology. This interest rate term structure should be used to measure the time value of cash-flows payable in the currency.

3.55 For each valuation date, the relevant risk-free interest rate term structure should be determined on the basis of market data relevant for the valuation date.

3.56 For a given currency and valuation date, each insurance and reinsurance undertaking should use the same relevant risk-free interest rate term structure.

3.57 The relevant risk-free interest rate term structure should consist of rates for all relevant maturities.

3.58 CEIOPS suggests that the investment expenses shall be allowed for in the cash-flows underlying the calculation of technical provisions and not in the risk-free interest rates (see CEIOPS-DOC-33/09 L2 advice on actuarial and statistical methodologies to calculate the best estimate).

3.59 CEIOPS believes that it is necessary to provide both the relevant risk-free interest rate term structure and the uniform methodology used to derive the term structure for all major currencies. The relevant risk-free interest rate term structure of the EEA currencies should be provided at least on a quarterly basis. Where market conditions are volatile, the term structures may be provided more frequently. Where for a certain currency and valuation date no relevant risk-free interest rate term structure is provided, insurance and reinsurance undertakings should determine the relevant term structure following the provided methodology. The methodology shall be sufficiently detailed to ensure consistency between undertakings.

3.60 The relevant risk-free interest rate term structure should ideally meet the following criteria ("risk-free rate criteria"):

(a) No credit risk: the rates should be free of credit risk.

(b) Realism: it should be possible to earn the rates in practice.

(c) Reliability: the determination of the rates should be reliable and robust.

(d) High liquidity: the rates should be based on financial instruments from deep, liquid and transparent markets.

(e) No technical bias: the rates should have no technical bias.

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3.61 Government bonds rates of AAA rated governments should be considered as the benchmark for credit risk-free rates. Swap rates are not credit risk-free and for this reason unadjusted swap rates should not be used to discount technical provisions.

3.62 For each currency, CEIOPS proposes to follow a three stage approach to determine the relevant risk-free interest rate term structure:

First stage:

If government bonds are available that meet the risk-free criteria as defined in section 3.1.2 and the above paragraph 3.60 then government bonds should be used to determine the relevant risk-free rates.

Second stage:

If government bonds are available, but they do not meet the risk-free rate criteria, then they should be adjusted for their deficiencies relating to these criteria. The adjusted rates should approximate government bond rates which meet the risk-free criteria. The adjusted rates should be used to determine the relevant risk-free rates.

Third stage:

If government bonds are not available or if government bond rates cannot be adjusted to meet the risk-free rate criteria for practical or theoretical reasons, other financial instruments can be used to derive the risk-free interest rates. These instruments should be as similar to government bonds as possible. Their rates should be adjusted for credit risk and any other deviations from the criteria with the objective to approximate government bond rates which meet the risk-free criteria.

3.63 Where government bonds do meet the risk-free rate criteria (or can be adjusted to meet them) for some maturities but not for all maturities, they should be used to derive the relevant risk-free rate for these maturities only. At stage three, different financial instruments may be used to derive the relevant risk-free rates for different maturities.

3.64 A process should ensure at Level 3 that the relevant risk-free interest rate term structures for the different currencies meet in the best possible way the benchmark of risk-free government rates. In case unadjusted government rates were not used to derive the risk-free rate, this should be explained and justified by the Member States and revised regularly.

3.65 The government yield curve based on AAA rated government bonds and published daily by the European Central Bank should be used as the relevant risk-free interest rate term structure for the euro.

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Illiquidity premium

3.66 The vast majority of CEIOPS believes that the relevant risk-free interest rate term structure should not include any illiquidity premium to discount certain insurance obligations. The inclusion of the illiquidity premium would lead to a significant decrease of technical provisions and would lower inappropriately the level of protection of policyholders (see Annex A).

Additional considerations

3.67 CEIOPS is aware that the application of the new framework derived from Solvency II may have a significant impact in some types of business and certain segments of some concrete national insurance markets.

3.68 The vast majority of CEIOPS' Members considers that the solution to this situation should not be based on a disruption of the coherent framework contained in this advice. Therefore CEIOPS advises that, should this be the case, the adoption of measures to solve the above mentioned situation, should be specifically tailored and have a scope exclusively limited to the affected business in force. Annex B contains the current state of the analysis of this issue by CEIOPS' Members.

3.69 If the liquidity premium is considered as a measure to solve the concrete situation of the business in force described in annex B, CEIOPS is willing to analyze and develop, through a due fully-consulted procedure, the points still pending and necessary to put into practice the methodology proposed in annex, aiming to ensure objectivity and reliability for the purpose of solving the aforementioned situation.

3.70 CEIOPS is prepared to lead further work on this issue based on a clear concept and mandate in light of the framework contained in this advice.

Extrapolation beyond the last available point of sufficient liquidity,

3.71 The appropriate risk-free interest rate term structure is necessarily constructed from a finite number of data points of sufficient liquidity. Therefore, both interpolation between these data points and extrapolation beyond the last available data point of sufficient liquidity is required.

3.72 As the discount factor increases with time to maturity, the extrapolation of the risk-free curve significantly impacts the present value of long term insurance liabilities. Therefore, the technique of extrapolation needs to adhere to the desired risk-free criteria set out in this advice (in particular the criterion of realism), with the exception of liquidity.

3.73 CEIOPS has analyzed the main families of methods and has concluded:

a) There is a unanimous agreement on applying to the extrapolated part of the curve the same high-level principles as for the non-extrapolated curve, in particular its calculation by an EU institution (unbiased guarantee) and the use of the same extrapolated rates by all undertakings covering compromises in the same currency and the

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same long terms.

b) There is also a wide support to allow for some mechanism in the method that may provide stability to the outcomes of the extrapolation, avoiding spurious movements in the long part of the curve. This is particularly important for currencies where liquid reference rates are only available for short term maturities and simple extrapolation of these short term interest rates may cause excessive volatility.

c) There is wide support for the view that it is not possible to identify a single method performing the best extrapolation for all currencies.

d) There is wide support for the view that it is not possible to guarantee that a certain method will perform appropriately for a given currency at all times.

3.74 CEIOPS recognises the importance of the choice of the extrapolation technique and thus does not prescribe the method for extrapolating the interest rate curve at this stage. Instead, during the Level 3 process, CEIOPS will develop a set of principles for the choice of an appropriate extrapolation method and will, based on these principles, choose for each currency the method deemed to be most appropriate

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ANNEX A Impact assessment on the risk-free rate

In its Call for Advice of 1 April 2009, the Commission has asked CEIOPS to contribute to the Commission's impact assessment of the Level 2 implementing measures.[13] To this end, a list of issues has been set up by the Commission and CEIOPS, identifying the Level 2 implementing measures that should be accompanied by an impact assessment. The objectives of the issues have been selected among the list of objectives used by the Commission in its Level 1 impact assessment.[14] On 12 June 2009, the Commission has issued an updated list of policy issues and options, to which reference is being made.[15] This impact assessment covers issue 1 of the list of policy issues and options.
Two summary tables accompany the impact assessment, published in a separate excel document.[16]

1. Description of the policy issue

A.1. Under Solvency I, life liability cash-flows are discounted using a single valuation rate of interest. Generally speaking, in Member States where assets are valued at the purchase price, where contracts contain an interest rate guarantee, this valuation interest rate is subject to a maximum of 60% of the rate on bond issues by the State in whose currency the contract is denominated. In Member States where assets are not valued at purchase price, the valuation interest rate is based on the risk adjusted yield on the assets backing the liabilities and, where reinvestment is required, taking into account the anticipated yield on future assets. Non-life liability cash-flows are generally not discounted under Solvency I.

A.2. The Level 1 text states that the technical provisions correspond to the current amount (re)insurance undertakings would have to pay if they were to transfer their (re)insurance obligations immediately to another undertaking. They are calculated in a "prudent, reliable and objective manner". Their value is equal to the sum of a best estimate and a risk margin where the best estimate corresponds to the probability-weighted average of future cash-flows discounted using the relevant risk-free interest rate term structure. The Level 1 text further states that the Commission shall adopt implementing measures laying down the relevant risk-free interest rate term structure.

A.3. CEIOPS should therefore provide advice to the Commission on:

[13] http://www.ceiops.eu/media/files/requestsforadvice/EC-april-09-CfA/EC-call-for-advice-Solvency-II-Level-2.pdf
[14] http://ec.europa.eu/internal_market/insurance/docs/solvency/impactassess/final-report_en.pdf
[15] http://www.ceiops.eu/media/files/requestsforadvice/EC-June-09-CfA/Updated-List-of-policy-issues-and-options-for-IA.pdf.
[16] http://www.ceiops.eu/media/files/consultations/consultationpapers/CP40/CEIOPS-CP-40-09-Appendix-IA-Risk-free-rate.xls

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- The financial instruments which should be taken as a basis to determine the relevant risk-free interest term structure; and
- The methodology for deriving the curve based on that financial instrument. The methodology should cover any adjustments required as well as the method for interpolating between different data points and extrapolating beyond the final liquid data point.

This impact assessment focuses on the first of the above bullet points.

A.4. CEIOPS has identified a number of criteria which the financial instruments used as a basis to determine the relevant risk-free tem structure should respect:

a) free of all credit risks
b) realistic
c) reliable
d) liquid
e) unbiased
f) available

A.5. According to these criteria, the financial instrument should not include a credit spread in order to compensate for the default risk of its issuer (free of all credit risks) and undertakings should be able to earn the specified rate in a risk-free manner in both normal and stressed conditions (realistic). The calculation methodology and the data should result in a reliable and accurate estimate of risk-free interest term structure (reliable). The selected financial instrument should be liquid for all maturities (liquid) and available for all currencies (availability). The price of selected financial instruments should not be distorted by technical considerations (unbiased). However, it might be that for some of the main currencies no curve exists which meets all of the above criteria. Therefore, the availability criterion needs to be complemented with additional harmonized methodology for those cases not meeting the aforementioned criteria.

A.6. The methods for determining the risk-free interest rate term structure should also be independent from the assets held by the undertaking. This characteristic applies equally to all financial instruments that could be used to derive the risk-free interest rate term structure (i.e. government bonds and swaps).

A.7. Finally, the process of deriving, or at least accessing, the risk-free interest rate term structure should not be unduly onerous for undertakings (proportionality). In practice, regardless of the instrument chosen as the basis for the term structure, as the derivation of the interest rate term structure is not a trivial exercise, the most workable way forward is to have publicly available curves derived according to the prescribed methodology made accessible to undertakings. Therefore, the risk-free interest rate term structure for different currencies would be calculated and made available by a central institution.

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A.8. In some Member States, interest rate term structures are published by the central banks. For example, in the Eurozone, a government bond curve is published daily by the European Central Bank (ECB) and in the UK market, both government bond and commercial bank liability (swap) curves are published daily by the Bank of England (BoE). However there may be differences between the interest rate models used by banks. For example, the interest rate model used by the ECB differs from that used by the BoE.

2. Detailed description of policy options and assessment of the relative impacts on the different affected parties

Detailed description of policy options

A.9. Option 1 - Use the swap curve

Under this option, the market price of swaps is used to determine the risk-free interest rate term structure.

A.10. Option 2 – Use the government bond curve

Under this option, the market price of government bonds is used to determine the risk-free interest rate term structure.

A.11. Option 3 – Use the swap curve with an adjustment

Under this option, the risk-free interest rate term structure determined with the use of swaps is adjusted downwards.

The downward adjustment is required to reflect the fact that investors are normally unable to earn the swap rate without incurring additional credit risk.

A.12. Option 4 - Use the government bonds curve with an adjustment

Under this option, the risk-free interest rate term structure determined with the use of government bonds is adjusted upwards.

Yields on government bonds may be subject to market distortions and as a result investors may be able to earn a higher return without incurring additional risk in practice. Where this is the case, an adjustment upwards could be required to reflect this.

A.13. Option 5 – Combination of the previous options

Under this option, the risk-free interest rate term structure could be determined differently for different currencies.

For example, if government bonds are the preferred financial instruments on which to base the risk-free interest rate term structure but these instruments are not available or appropriate for certain currencies, the

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risk-free interest rate term could be determined by means of an adjustment to the government bond or swap curves.

A.14. Specific questions that were addressed in the discussion of the policy options include:

Should the relevant risk-free interest rate be determined by starting from swaps or government bonds?

A.15. CEIOPS believes that the main objective for the derivation of the risk-free term structure is to ensure that it includes as little credit spread as possible. Government bonds are generally accepted as risk-free because the likelihood of government failing to honour their commitments is extremely low in most cases. The credit standing of a AAA rated government should serve therefore as a benchmark.

Should this starting point be adjusted? If so, how should the upwards/downwards adjustment be quantified?

A.16. An adjustment should be made only in cases where government bonds are inappropriate, for example because of technical bias or liquidity considerations. This adjustment should be made following a clear, reliable and well-established methodology. Where government bonds are not liquid or a technical bias in government bond rates cannot be removed, the risk-free term structure should be approximated by means of instruments which are most similar to government bonds.

Should the discount rate include an illiquidity premium? If so, which (re)insurance liabilities should be considered sufficiently illiquid and how should the illiquidity premium be quantified?

A.17. Currently there is a suggestion from some undertakings that liabilities which cannot be surrendered should be considered as sufficiently illiquid and therefore the cash-flows of these liabilities could be discounted using a risk-free rate increased to allow for a "illiquidity premium". However, to date there is no generally acknowledged method which will derive the illiquidity premium in a prudent, reliable and objective way.

A.18. As it stands, the industry has divergent views on whether the risk-free rate could be increased for this "liquidity premium". The great majority of CEIOPS believes the relevant risk-free interest rate term structure should not include an illiquidity premium. Some CEIOPS Members do not fully share this view and believe that this issue requires further investigation.

How can the method used to calculate the risk discount rate be extended to derive a figure consistent across different currencies, including those without government bond and swap markets?

A.19. CEIOPS believes that the application of the three-stage process set out in the consultation paper will result in a consistent figure by ensuring that the most appropriate risk-free term structure is used for all currencies.

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Impact on industry, policyholders and beneficiaries and supervisory authorities

Likely industry response

A.20. Option 1 (unadjusted swap rates) results in the highest discount rates. Therefore this option will generate lower technical provisions relative to other options. This may contribute to an industry preference for this option.

A.21. In those Member States where undertakings currently use swap rates as a basis for determining the risk-free interest rate term structure, option 2, and to some extent options 3, 4 and 5 may increase technical provisions and decrease the eligible own funds of the undertakings. It may create difficulties for competitive markets where it may reduce the incentive to provide insurance products for which profit margins are already low.

Cost and Benefits

- Policyholders and beneficiaries

A.22. Option 1 and to some extent options 3, 4 and 5 will have an indirect negative effect on policyholders and beneficiaries in the case where these options will lead to discount rates that cannot be earned in a risk-free manner. Lower mathematical provisions compared to current value of technical provisions will probably not result in lower premiums.

A.23. In those Member States where undertakings currently use swap rates as a basis for determining the risk-free term structure, Option 2 and to some extent the options 3, 4 and 5 may have a direct negative effect on policyholders and beneficiaries in the cases where these options will lead to increased premium to compensate for additional cost of capital or reduce the incentive to provide insurance products. On the other hand, the increase of the technical provisions will force the undertakings to hold more technical provisions and thereby reduce the default probability of the undertakings and foster financial stability.

- Insurance and reinsurance undertakings

A.24. The decrease of the technical provisions upon introduction of Solvency II will be the highest under option 1. The decrease will be the smallest for option 2. This effect will be permanent. In any case, the quantitative assessment of the different options needs to include both the impact on the value of the technical provisions as well as the impact on the own funds through the net asset value (assets minus liabilities), which may differ.

A.25. For those Member States where mathematical provisions were discounted with a prescribed interest rate not higher than 60 % of the rate on bond

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issues by the State, all options will lead to a decrease of mathematical provisions, all things being equal.

A.26. For those Member States where mathematical provisions were discounted with the use of risk-free interest rate term structure derived with the use of swaps, the use of Option 2 and to some extent options 3, 4 and 5 will increase mathematical provisions.

- Supervisory authorities

A.27. Options 3, 4 and 5 could have a direct negative impact on supervisory authorities because they need to assess whether the adjustment to the rates is objective, fair and reliable. There is as of yet no best practice which ensures the comparability and reliability of these adjustments. CEIOPS believes that this could be a negative effect on a permanent basis.

A.28. Option 1 and to some extent options 3, 4 and 5 limit the possibility to transfer the technical provisions to another undertaking because the value of the provisions would be lower. This negative indirect effect would be low but permanent.

A.29. The analysis in this paper is based on the assumption that in most of cases Option 1 (unadjusted swap rates) leads to the highest discount rate and Option 2 (unadjusted government bond rates) leads to the lowest discount rate. Options 3 and 4 would therefore result in a discount rate somewhere in-between the two. Table 3 below demonstrates that this is not always the case. However, CEIOPS believes that this is a reasonable assumption to make for the purpose of the impact assessment as it is generally expected to be the case that swap rates are higher than government bond rates as swaps are not free of all credit risk. The fact that the swap curve is lower than the government bond curve in the long end is thought to be a product of the unusual market conditions at the end of 2008 and is not expected to continue into the future.

A.30. All proposed options are likely to result in higher discount rates than those currently allowed under Solvency I in those Member States where the maximum valuation interest rate is 60% of the rate on bond issues by the State in whose currency the contract is denominated. This will lead to a decrease of the technical provisions and thereby increase the default probability of the undertakings. For those Member States where the discount rate is determined on a Solvency I basis, it is most probable that the eligible own funds will increase regardless of the option selected.

A.31. Although the risk-free curve used to discount technical provisions should be independent from the assets covering the technical provisions, the quantitative assessment of the different options needs to include both the impact on the value of the technical provisions as well as the impact on the own funds through the net asset value (assets minus liabilities), which may differ.

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A.32. Choosing higher discount rates than the government bond rate could reinforce the behaviour not to invest in low-risk assets as it is unlikely that (re)insurance undertakings will invest in government bonds which in general yield lower interest rates than those used to determine the risk-free interest rate term structure. Nevertheless, swap rates adjusted for credit risk would in theory deliver the same yield as government bonds in well-functioning financial markets.

3. Relevant objectives

A.33. The determination of the relevant risk-free interest term structure falls under the scope of the following general, specific and operational objectives.

A.34. Firstly, an important general objective is to "enhance the protection of policyholders and beneficiaries".

A.35. Secondly, a specific objective relevant for this policy options is to "improve risk management of EU insurers".

A.36. Finally, the relevant operational objectives are "harmonised calculation of technical provisions", "introduce risk-sensitive harmonised solvency standard", "introduce proportionate requirements for small undertakings" and "promote comparability of valuation and reporting rules with the international accounting standards elaborated by the IASB".

A.37. Many CEIOPS Members consider the importance of the harmonization objective, since the interest rate risk-free curve has in most of cases a major impact on the valuation of technical provisions (see below). Therefore any lack of harmonization on this topic impacts directly on the level playing field.

4. Comparison between the different options based on the efficiency and effectiveness in reaching the relevant operational objectives

A.38. The comparison and ranking of the policy options is based on the effectiveness and efficiency of each option in reaching the relevant operational objectives. Effectiveness is defined as the extent to which options achieve the objectives of the proposal. Efficiency is defined as the extent to which objectives can be achieved at the lowest cost (cost-effectiveness).

A.39. The source of evidence of the impact assessment is the risk-free interest rate term structure for Euros determined based on market prices of swaps and government bonds at the end of the years 2006, 2007 and 2008. The methodology to derive the risk-free interest rate determined for swaps was similar to the method used for QIS4 and the risk-free interest rate term structure for government bonds was derived by the European Central Bank and published on its website.

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A.40. Although the Euro is the most important currency in the sense that 16 Member States are currently within the Eurozone, and that other Member states plan to move to the Euro by the entry into force of Solvency II, or are pegged to the Euro, there are nevertheless other Member States which use a different currency. The impact on these Member States has not been considered to any great extent in this assessment due to time constraints.

Table 1: Comparison of the risk-free interest rate term structure for Euro calculated with swap and government bonds at the end of 2006

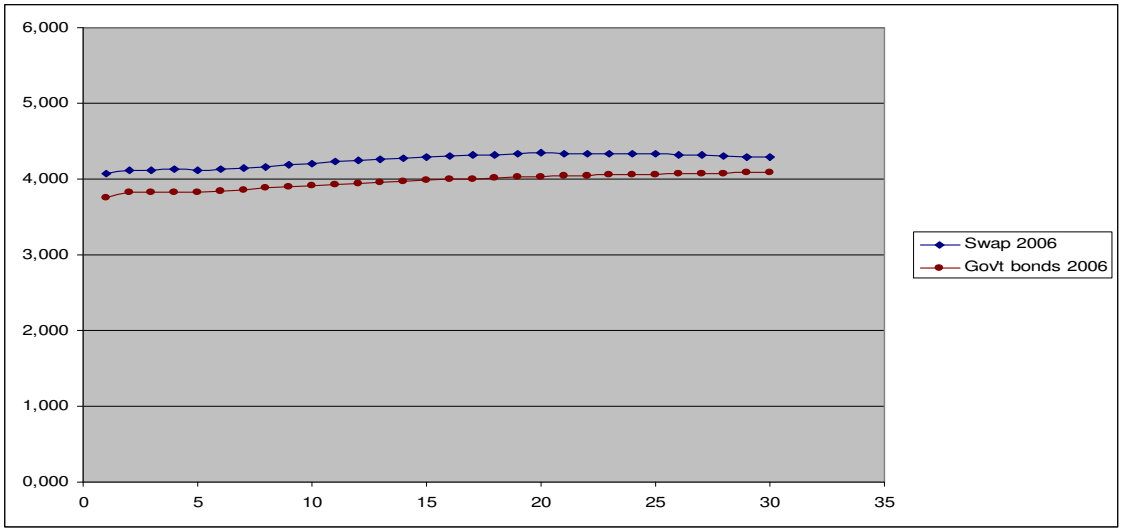

Table 2: Comparison of the risk-free interest rate term structure for Euro calculated with swap and government bonds at the end of 2007

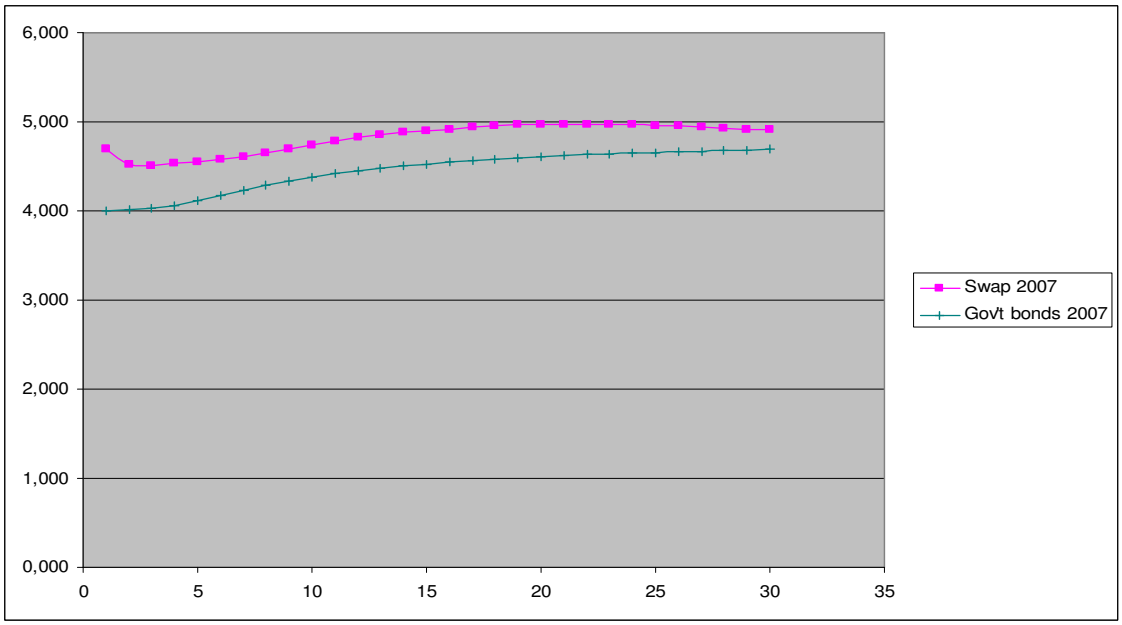

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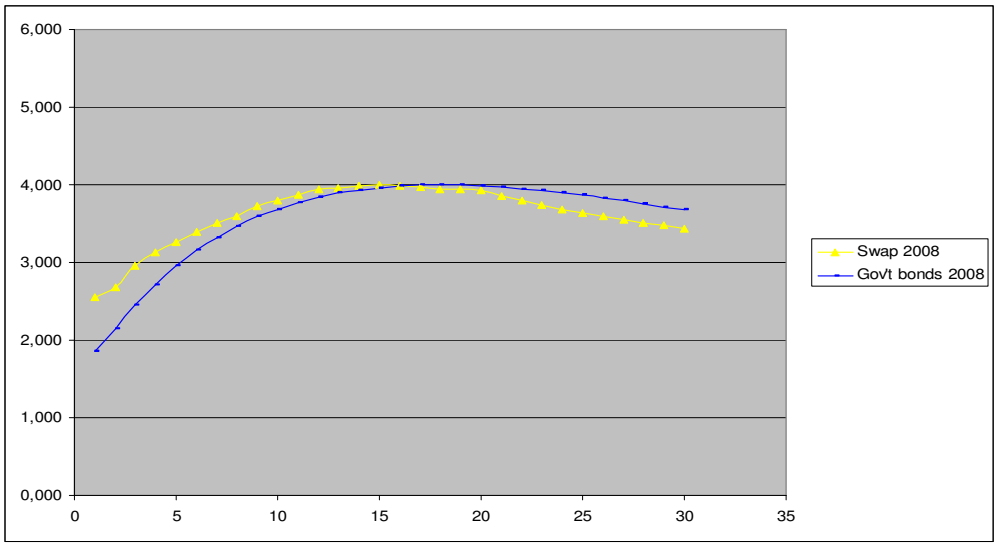
Table 3: Comparison of the risk-free interest rate term structure for Euro calculated with swap and government bonds at the end of 2008



A.41. The mathematical provisions were calculated for three example portfolios using the risk-free interest rate term structure determined based on swaps and government bonds. The comparison shows that the mathematical provisions determined using the risk-free interest term structure for government bonds were greater than the mathematical provisions determined using the risk-free interest term structure based on swaps. The biggest difference over the years 2006, 2007 and 2008 (Table 4) was for the year 2007 and was between 3.6% for 20-years endowment assurance and 2.2% for 10-years endowment assurance and whole life annuities.

$$Diff.\% = (1 - \frac{Math.prov.Govern.Bonds}{Math.prov.Swaps}) * 100$$

Table 4: Mathematical provisions and the difference between mathematical provisions calculated with risk-free interest term structure determined with government bonds and swaps.

	Mathematical provisions 2006			Mathematical provisions 2007			Mathematical provisions 2008		
	Govern. bonds	Swaps	Diff. %	Govern. bonds	Swaps	Diff. %	Govern. bonds	Swaps	Diff. %
10 years endowment assurance	5160036	5074529	1,66	5048753	4935918	2,23	5328464	5265455	1,18
20 years endowment assurance	8949627	8683652	2,97	8519889	8212352	3,61	9122650	9065490	0,63
Whole life annuities	1487303	1461804	1,71	1450198	1418177	2,21	1525657	1513231	0,81

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A.42. CEIOPS also noticed that the year-on-year volatility was higher where mathematical provisions were calculated using the risk-free interest rate term structure based on swaps than the mathematical provisions calculated using the risk-free interest rate term structure based on government bonds (Table 5).

$$Volatility = \frac{Math.prov_{t+1} - Math.prov_{t}}{Math.prov_{t}} * 100$$

Table 5: Year to year volatility of the mathematical provisions

	Mathematical provisions determined with swaps		Mathematical provisions determined with government bonds	
	2007/2006	2008/2007	2007/2006	2008/2007
10 years endowment assurance	-2,7%	6,7%	-2,2%	5,5%
20 years endowment assurance	-5,4%	10,4%	-4,8%	7,1%
Whole life annuities	-3,0%	6,7%	-2,5%	5,2%

A.43. The choice of the risk-free term structure does not impact to any great extent on the following operational objectives:

- The operational objective to introduce **risk-sensitive harmonised solvency standard**: Provided the risk-free term structure is based on market data, the choice of risk-free term structure does not impact to any great extent on the risk-sensitivity of the solvency standard.

- The operational objective to **promote comparability of valuation and reporting rules with the international accounting standards elaborated by the IASB**. It is difficult to evaluate the options against this objective as the accounting standards are still evolving and have not yet settled on a risk-free term structure.

A.44. With regard to the objective of i**ntroducing proportionate requirements for small undertakings**, the ease of determination of the reference rate is important. The use of unadjusted rates as reference rates would fulfil this objective effectively and in an efficient manner. Option 1 and Option 2 are preferable in this respect since, compared to Option 3, Option 4 and Option 5, less financial information would be needed to determine the risk-free term structure. Option 5 would add another layer of complexity.

A.45. CEIOPS places great importance on the operational objective to **harmonise the calculation of technical provisions** because of its impact on the level playing field. Therefore, where appropriate, the same instrument should be used to derive the risk-free interest rate term structure for different currencies. However, where deviations from a specified instrument are unavoidable because the instrument is not

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available or not appropriate, harmonisation is achieved by ensuring the same degree of risk-freeness in deriving the term structure. Therefore this objective may be achieved by all options provided that, for each currency, the option is applied consistently by all undertakings. The harmonisation recommended by CEIOPS refers to the methodology used to derive the yield curve as well as the actual yield curve for each currency and should be such that the same cash flow in the same currency is discounted by all undertakings with the same discount rate. The prescription of a particular observable rate, without adjustments would lead most effectively and efficiently to the harmonisation of the calculation of the technical provisions (option 1 or 2). Any adjustments would have to be further harmonised.

A.46. Furthermore, CEIOPS would like to point out that Option 2 enhances the protection of policyholders and beneficiaries compared to Option 1, Option 3 and Option 4 and to some extent to Option 5 because the risk-free interest rate term structure would in most cases be lower than the risk-free term structures calculated based on other financial instruments or with methods that take adjustments into account. Option 3 enhances to some extent the protection of policyholders and beneficiaries relative to Option 1 as the risk-free interest rate term structure is determined based on swaps with a downward adjustment to allow for credit risk. Option 4 to some extent decreases the protection of policyholders and beneficiaries compared to Option 2 due to the fact that the risk-free interest rate term structure determined with the use of government bonds will be upwards adjusted.

A.47. Finally, CEIOPS notes that the choice of risk-free interest rate term structure will also have consequences on the calibration of the interest rate risk sub-module, which must be calibrated at a 99.5 per cent of confidence level. Since different curves have different volatilities, it is likely that different options will lead to shocks of different magnitude. In other words, the choice of a curve apparently deriving higher/lower values of technical provisions may be offset at least partially by the calibration of lower/ higher shocks in the interest rate risk sub-module and therefore lower/higher capital requirements.

A.48. In conclusion, taking into account the potential cost and benefits for policyholders and beneficiaries, insurance and reinsurance undertakings and supervisory authorities, the effectiveness and efficiency level to meet the relevant objectives, and its sustainability and comparability levels, CEIOPS recommends Option 2 in its advice.

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ANNEX B CEIOPS' considerations on the inclusion of an illiquidity premium in the risk free rate

Preliminary remarks

B.1. The following paragraphs reflect on the existence of an illiquidity premium and puts forward views on whether or not such premium might provide an appropriate solution for the situation mentioned in section 3.1.5 in the explanatory text of this Advice.

B.2. From a financial perspective, the illiquidity premium is being defined as the additional compensation that investors require for bearing the risk from an illiquid asset, compared with the return on a liquid asset. This premium should compensate for the risk that investors might not be able to find a buyer at the theoretical market price.

B.3. It needs to be pointed out that in most markets the investment in such illiquid products, which share common features with savings products, have substantially different features than regular insurance products, including the existence of tax benefits which in particular aim at compensating the lack of liquidity of these products.

B.4. The existence of an illiquidity premium is controversial. In any case, even assuming its existence, the question remains whether this illiquidity premium provides a suitable solution to the specific business analyzed in section 3.1.5.

Discussion on the allowance for an illiquidity premium to solve the situation

B.5. When discussing the inclusion of an illiquidity premium in the rate that will be used for discounting the best estimate in the context of section 3.1.5 and 3.1.6, the following considerations need to be taken into account:

B.6. The Level 1 text requires the discount rate to be risk free (Article 77(2)). The illiquidity premium would represent an additional non-risk free element, which would be based on corporate credit spreads. This does not seem to be in line with the risk-freeness requested by the Level 1 text.

B.7. Some studies assuming the existence of an illiquidity premium, conclude that it tends to be larger in times of crisis. So does the need to ensure the protection of policyholders. In times of crisis, when risks for the (re)insurance undertaking increase, the inclusion of an illiquidity premium would lower the amount of technical provisions. The resulting amount of own funds (through the net-asset-value, i.e. the resulting increase of available own funds due to the decrease of the technical provisions) would be very much under stress and would need to loss-absorbent in order to cover losses. The increase in solvency capital requirements would very likely not compensate for the decrease in technical provisions. In this

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respect, it remains to be seen how the use of the own funds in times of crisis, which could eventually lead the undertaking to breach its SCR, would impact the undertaking. How long would it take for the undertaking, once the illiquidity premium has been reduced, to recover its technical provisions? How long can the undertaking remain in breach of the SCR?

B.8. There is debate on whether the inclusion of the illiquidity premium could also increase financial instability by introducing more volatility in the balance sheets and by lowering the protection of policyholders, or whether it may serve or not as a counter-cyclical measure which aims at allowing technical provisions to move in line with the market, and which would hence prevent fire-sales of assets for covering the liabilities. It can be noted that article 76 of the Level 1 text sets out market consistent principles for the valuation of technical provisions, in such a manner that anti-cyclical criteria of valuation of assets or liabilities may not be aligned with the Level 1 text.

Scope for the inclusion of an illiquidity

B.9. As reflected above, a vast majority of CEIOPS' Members considers that the scope of this solution should be limited, by its own nature, to the affected business in force.

B.10. According the information received and in general terms, the nature of these liabilities is such that:

i. The timing and size of the liability cash flows is known with enough certainty that the expected cash flows can be matched by the income and redemptions from illiquid assets.[17]

ii. Deviations from expected cash-flows do not generate significant additional liquidity requirements.

B.11. According to the current legal and commercial practices applied to such existing insurance contracts (ie. contracts sold before the entering into force of Solvency II), one may wonder whether policyholders expect some return due the illiquid nature of the contract (or the fact that the insurance undertaking is not bearing any surrender risk if the contract is cancelled by a decision of the policyholder). It is unclear to what extent such return or compensation is already satisfied with the significant tax benefits granted for retirement benefits. Commercial prospectuses are sufficiently illustrative on how this tax benefits are accounted as return, and then the consumer does not expect necessarily an additional illiquidity premium.

B.12. According the described rationale, the information received and the necessity of avoiding distortions in competition, a vast majority of CEIOPS' Members considers that the business mentioned in section 3.1.5, is appropriately defined with, at least, the following requirements:

[17] It is important to clarify that this matching is conceptually different from the replication mentioned in article 75.5, as explained in CP 41_09, on calculation of technical provisions as a whole.

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a) Existing contracts that at the moment Solvency II comes into force, are discounted using a discount rate based on the return of the assets used to back the liabilities to policyholders under such contracts (article 17.B.a.ii Directive 92/96/CEE);

b) The benefits of the contracts take the form of retirement annuities, and the only underwriting risks connected to the contracts are longevity risk and expense risk;

c) The contracts do not pay discretionary benefits;

d) The policyholder has no right to fully or partly cash back the mathematical provision of the contract or there is any other option that leads to earlier payments with similar economic effects. Furthermore the insurance undertaking does not bear any risk in case of any form of surrender;

e) The contracts are single premium policies and the premium has already been paid; no incoming cash-flows are allowed for in the technical provisions of the contracts;

f) The insurance undertaking invest the highest part of the technical provisions of this business, in corporate bonds and applies adequate matching of the cash flows derived from its assets and liabilities;

g) Financial markets provide a sufficient amount of illiquid bonds to cover the liabilities; these bonds denote in the currency of the contract's benefits and investment in these bonds is in line with the prudent person principle; the bonds can be used to match the cash-flows of the contracts.

Calculation of a theoretical illiquidity premium

B.13. In order to minimize the negative effects that the application of an illiquidity premium may have, most of CEIOPS members agree that the allowance for an illiquidity premium should respect the following requirements, which should be understood consistently with the requirements set out in respect of the risk-free interest rate curve of reference, as described in the previous sections of this advice:

a) The calculation method should be objective, reliable for the purposes described in this sub-item, and easy to apply.

b) For each currency, the illiquidity premium should be the same for all undertakings assuming obligations under such currency.

c) The method and parameters to calculate the liquidity premium should be set out in Level 2 implementing measures. The concrete values of the illiquidity premium should be calculated, at least quarterly, by a European institution.

B.14. The illiquidity premium could, for example, be calculated as a percentage of the spread of a corporate bond basket of references with the highest credit quality on the one hand, and the risk-free reference curve (the highest quality government curve), on the other hand. Further analysis would be necessary at this respect.

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B.15. If the liquidity premium is considered as a measure to solve the concrete situation of the business in force under the scope above proposed, CEIOPS considers necessary to set a cap, for example, as a percentage of the spread government curve versus swap curve, at least during the first years of application of the liquidity premium. This cap would prevent any disruptive bias of financial markets or unexpected deviations of the models used to assess the liquidity premium curve. The calculation method and application of the cap should be further analysed.

B.16. If the liquidity premium is considered as a measure to solve the concrete situation of the business in force under the scope above proposed, CEIOPS will analyze the points necessary to put into practice the aforementioned methodology trying to ensure objectivity, and reliability for the purposes of this sub-item 3.1.4.

Consequences of the inclusion of the illiquidity premium on the SCR standard formula

B.17. CEIOPS considers that, at least, the following changes to the SCR standard formula need to be made to address the risk inherent in the illiquidity premium:

1. According an economic approach and in order to achieve the confidence Level set out in the Level 1 text, the downward stress scenario of the interest rate risk sub-module should be modified as follows: Liabilities which are discounted with the illiquidity premium should incur an additional stress of the size of the illiquidity premium.
2. The underlying idea of the illiquidity premium is that illiquid liabilities can be covered with illiquid bonds and that these assets are not needed to pay other obligations. If the SCR calculation takes diversification between risks relation to illiquid and liquid obligations into account then this contradicts the underlying idea of the illiquidity premium. Because diversification implies that a loss relating to the liquid obligations can be paid with the assets covering the illiquid obligations. Owing to the illiquidity of these assets this is not possible. Therefore, no diversification between the risks relation to illiquid and liquid obligations should be taken into account in the calculation of the SCR standard formula.
3. The allowance for using an illiquidity premium would increase the amount of basic own funds, being necessary to assess the quality of such increase and its relevant tier.

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ANNEX C UK Financial Supervisory Authority's analysis of available options for the risk-free term structure for liabilities denominated in UK pounds sterling

Technical bias

C.1. The government bond curve in the UK is significantly affected by technicalities in the market.

The inverted yield curve

C.2. Longer-dated gilt yields are usually higher than shorter-dated gilt yields because investors tend to demand higher interest to compensate for the perceived risks of holding debt for a long period, including the risk of higher inflation in the future. However, until recently, the reverse has been true in the UK for a number of years.

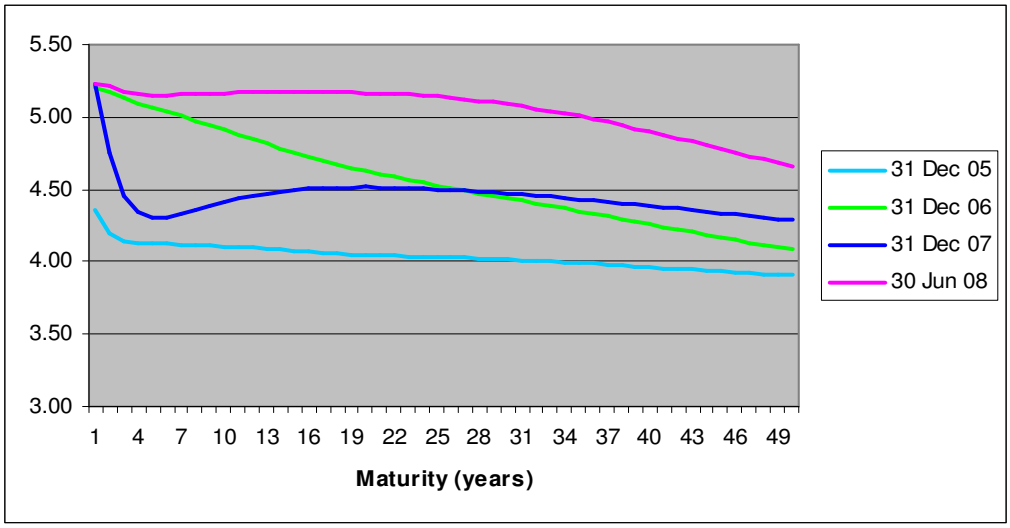

Figure 1: Downward sloping gilt yield curves

C.3. This inversion of the yield curve has resulted from a mismatch of the supply and demand for long dated gilts.

C.4. There is a very high demand from institutional investors for long dated and indexed gilts. This is driven by:

- The introduction of mark to market accounting as a result of which pension scheme deficits are now included on company balance sheets.

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- An industry wide shift towards better matching of long dated liabilities.
- In most markets, supply is linked to demand. However this link is tenuous in the gilt market as gilt issues are based on government borrowing requirements rather than investor demand. As a result the demand from institutional investors for long dated conventional or index linked gilts has not been matched by supply. This has resulted in a downward sloping yield curve.

C.5. This has the potential to create a vicious circle whereby falling yields result in an increase in liabilities which in turn leads to greater investor demand for long dated gilts to match their liabilities which contributes to further falls in yield curves.

C.6. It is our understanding that this supply/demand issue does not occur in other developed markets such as the US and the Euro zone.

C.7. The swap curve also suffers from technical bias - the swap curve was also inverted for a number of years. Furthermore, in current market conditions, the swap curve is lower than the gilt curve at the long end, possibly as a result of supply and demand distortions. However, in markets where there is generally a deep and liquid swap market, the swap curve is less likely to suffer from this distortion than the government bond curve. This is because supply and demand are more strongly linked in the case of swaps – investment banks are have an incentive to increase supply to meet demand.

Impact of benchmark bonds

C.8. Certain issues of gilts are considered to be "benchmark issues" because of the size, liquidity and market depth. Such issues tend to have lower yields than more illiquid issues as a result of which the gilt curve is not smooth.

C.9. There do not tend to be "benchmark issues" of swaps, so the swap curve is smoother than the gilt curve.

Impact of the "repo" market

C.10. Short/medium term gilts are very liquid investments and therefore it is possible to earn an additional return on gilts through the "repo" market. This may result in gilt yields which are slightly depressed.

Impact of monetary policy actions

C.11. In October 2008, as a result of indications that the UK economy was entering a period of recession, the Bank of England began to cut base rates aggressively.

C.12. At the same time, risk aversion on the part of investors in difficult market conditions resulted in a "flight to quality" which also contributed to the fall in short term yields. This "flight to quality" phenomenon may lead to high volatility in the short end of the yield curve since, as the market recovers, investors will unwind these positions.

C.13. Finally, it is worth noting that during this time the possibility of quantitative easing was raised and furthermore it became clear that the Treasury would need to substantially increase net borrowing. It is possible

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that market expectations of these events also contributed to the change in the shape of the yield curve.

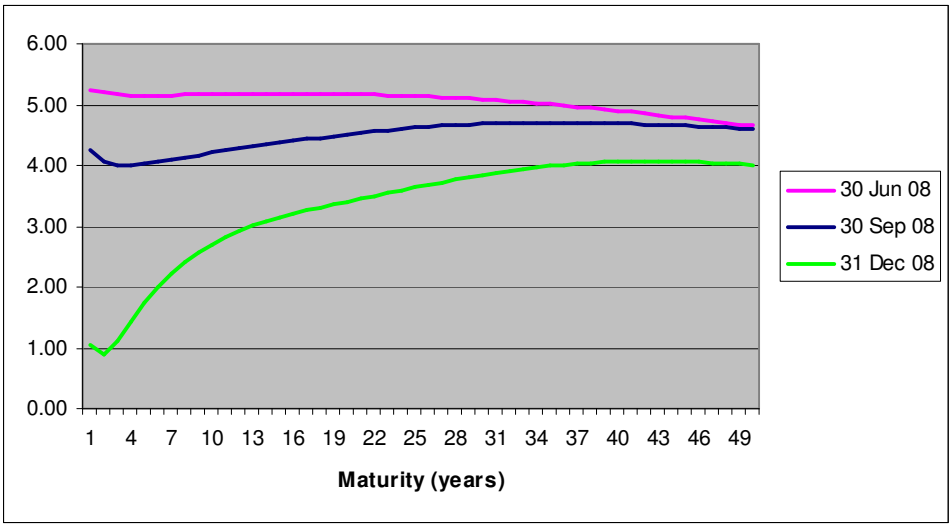

Figure 2: Change in the shape of the yield curve in the last 6 months of 2008

C.14. Quantitative easing (purchase of gilts by the UK government to increase liquidity in the market) began during March 2009. The impact of quantitative easing on the gilt curve is clear from the graph below.

C.15. Finally the extent of the borrowing currently being undertaken by governments has resulted in questions being raised with regard to the credit quality of their debt. Any downgrading of a government would have a significant impact on the government bond curve.

C.16. Swaps are also indirectly affected by monetary policy. However swaps are not used as a tool of monetary policy and are therefore less likely to be affected by monetary policy interventions.

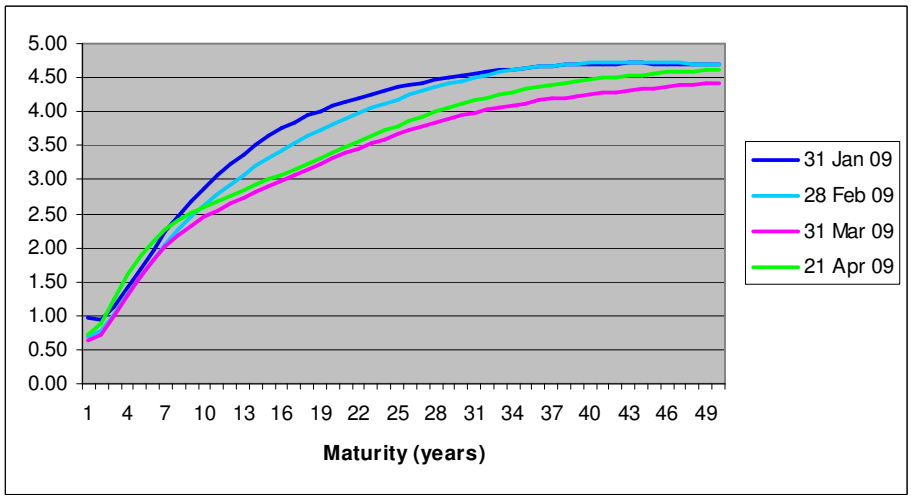

Figure 3: Impact of quantitative easing on UK gilt curve

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Credit risk-free

C.17. It is generally accepted that gilts are risk-free. Nevertheless, swap yields only contain a small margin for credit risk. Swap payments are the difference between fixed and variable rates applied to a notional amount. The present value of future payments is collateralised and the collateral is generally high quality securities. In addition hair cuts to the market value of the instrument used as collateral are often applied. The size of the hair cut depends on factors such as the credit quality, liquidity and term of the collateral. As a result credit risk may be immaterial on swap transactions themselves. (The extent of the credit risk depends on the terms and conditions of the swap agreement which are governed by an ISDA protocol).

C.18. However, consideration must also be given to how an insurer would earn the variable rate (in this case LIBOR). In practice the insurer is likely to use an asset manager who will invest in a money market fund. The asset manager is likely to take some credit risk, as well as some basis risk, in order to generate the variable rate.

C.19. Therefore, although the insurer potentially has negligible credit exposure to the bank with which they have entered into the swap, they will need to take credit risk in order to generate the variable rate. Despite this the credit risk on swaps is still relatively low.

C.20. In general the amount of credit risk is not consistent with the size of the swap spread. Possible other explanations for the spread are:

- Some element of liquidity premium since, although in a liquid market swaps can be unwound with ease, there are costs involved.
- The impact of supply and demand issues on the gilt curve as discussed below

C.21. Finally there is some basis risk in that the variable rate earned will not be the same as the variable rate payable on the swap (since you may not earn exactly LIBOR).

Realistic

C.22. An insurer can earn the rate of return underlying swap prices by investing in a money market fund to generate the variable rate and entering into a swap contract. This strategy is not entirely risk-free.

C.23. On the other hand, by engaging in repo activity, insurers can earn more than gilts in a risk-free fashion. A common adjustment to the risk-free yield is a 10bps increase for this effect.

Reliable

C.24. Gilt prices are publicly available in the UK from the Debt Management Office website. For terms up to 25 years, nominal and real spot and forward curves are produced by the Bank of England and published on their website.

C.25. Similarly par swap prices are quoted on Bloomberg and the zero coupon rates may be derived based on this data. The situation is comparable to that of long dated gilts as deriving a zero coupon swap curve from par swap rates is also non trivial. However the exercise is less complex for

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swaps than for gilts since the curve is more likely to be smooth (as discussed below).

C.26. Most investment banks will also quote zero coupon swap rates though this information is not publicly available. Therefore in practice an insurer would be able to obtain quotes from only a small number of investment banks (or, in the case of smaller insurers, would not be able to obtain the data at all). A possible solution would be for an external body such as the regulator to obtain zero coupon swap rates from a reasonable number of investment banks. The swap curve could then be derived simply by averaging the rates received with an appropriate allowance for outliers. Interpolation and extrapolation would also be less of an issue since investment banks generally quote rates for long dated maturities and at a reasonably granular level.

C.27. It is clear from the above that the derivation of the interest rate term structure is not a trivial exercise for either gilts or swaps.

Highly liquid for all maturities

C.28. In the past, the swaps market in the UK is has been deeper and more liquid than the government bond market. This is sustained by the fact that:

- Trading volumes are higher
- Dealing costs are typically lower
- Bid offer spreads are much tighter than on government bonds

C.29. However since the financial crisis, the swap market has become very illiquid and it is likely that the situation has been reversed to some extent. This demonstrates that the relative liquidity of different instruments may change over time.

Conclusion

C.30. There is no perfect risk-free curve. The main drawback of swaps is that they are not completely credit risk-free. On the other hand gilts are generally accepted to be risk-free and it is straightforward to earn the gilt rate and possibly more.

C.31. However, for the UK market, swaps may be considered to be superior to gilts in respect of some of the other criteria. The swap market may be deeper and more liquid than the gilt market. Since swaps are synthetic instruments, they are less subject to the same supply and demand issues as gilts. As a result the swap curve is smooth where the gilt curve is not. As explained above the gilt curve may be artificially depressed at certain points, may be downward sloping may be significantly affected by macro-economic measures such as quantitative easing.

C.32. Therefore, for pounds sterling, the risk-free term structure which best satisfies the criteria set out in this paper is the swap curve less an adjustment for credit risk.

C.33. The issue of a clear and simple method to derive this adjustment will be tackled at a later stage. A practical method of deriving this adjustment might be the Swedish model (the average of the swap and gilt rates) as described in the Appendix A to this paper.

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ANNEX D Example of an interpolation method for long maturities and a short description of current Swedish regulation

1. Introduction

D.1. The appropriate method for discounting insurance companies' long-term liabilities has been debated for many years. Recently, more European authorities have moved towards a market-based discount rate, where (current) market rates of government bonds, long-term corporate bonds, covered bonds rates and swap rates are used as the main determinants. However, insurance liabilities extend to very long maturities, up to 70 years into the future, where no corresponding term structure exists. Different countries have used various methods to estimate such long-term yields, or to extrapolate existing yields to longer maturities.

D.2. The financial crisis of 2008 has revealed serious problems with such an extrapolation. An abrupt fall in inflation expectations coupled with a dramatic increase in risk aversion and flight-to-quality have caused long-term rates to reach historical lows. For example, the yield on the 10-year US Treasury bond fell below 3 per cent, the lowest rate in more then 50 years. In some countries, the pressure on long-term interest rates has been further aggravated by different measures of quantitative easing adopted by central banks. At the same time, broad equity indices, such as MSCI Europe, fell by approximately 40% in 2008. The fall in equity values and the sharp increase in calculated provisions have put pressure on many insurance companies' solvency. Furthermore, lower solvency may have induced some firms to decrease their asset-and liability mismatch by investing in long-term instruments, leading to further drops in the market rates ("The downward spiral").

D.3. The high volatility of long-term rates, and their potential to deviate from equilibrium levels for considerable periods of time, put current practices into question. In annex E, an alternative model for determining discount rates for calculation of technical provisions is briefly presented. At this stage, Finansinspektionen (Swedish regulator) must emphasize that we do not have a full view of the model or implications of using it, but we find it interesting enough - particularly concerning long-term commitments - to present it to a wider group. Here, we do not discuss in detail any advantages or disadvantages compared to other models, but we hope that discussions will lead to further insights into the possibilities of developing this model further on a national and/or international level.

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2. Swedish experience of problems relating to the use of market rates in discounting

D.4. In Sweden, since a couple of years, the cash flows of liabilities should be discounted by the interest rate based on the average of government bonds and swaps or government bonds and covered bonds. Changes in technical provisions due to long-term cash flows as a result of changes in market rates will be quite volatile, even in times of relative financial stability. In the Swedish interest rate market, securities with maturities of up to about 10 years are generally considered liquid. For maturities over 10 years, liquidity decreases rapidly, at least for large transactions.

D.5. The financial crisis shows that demand for financial instruments with longer maturities may increase quite abruptly. This was accentuated by the increasing demands for government bonds in the autumn of 2008, which caused market rates to drop considerably. Market rates also depend on the government's policy of issuing long-term bonds, which might shift from time to time due to reasons beyond insurance business control.

D.6. The model described in annex E for determination of the discount rates to be used for calculations of the technical provisions has the explicit aim to try to reduce the problems described above.

3. Extract from current Swedish regulation: Choice of interest rate for occupational pension insurance

D.7. **Section 1** An insurance company shall choose the nominal interest rate for undertakings related to occupational pension insurance which constitutes the average between the market interest rates that are set out in the third and fourth paragraphs.

D.8. These market interest rates shall be chosen based on the maturity of the cash flows that shall be valued, or from the average of such cash flows and from the currency in which the insurance obligations are payable. The financial instruments that the rate is based on shall be the object of regular trading.

D.9. The first interest rate that is referred to in the first paragraph is, where applicable, the market interest rate for treasury bills or government bonds, with a supplement for the value of future coupon income (zero-coupon rate).

D.10. The second interest rate that is referred to in the first paragraph is, where applicable, the market rate for the agreement of exchange of interest payments (swap rates) or covered bonds.

D.11. **Section 2** For the maturities, where it is not possible to determine the interest rate that is referred to in section 1, third paragraph, the insurance company shall instead choose the interest rate based on the interest rate set forth in section 1, fourth paragraph with the same maturity. Deductions shall be applied to this rate in accordance with section 3. The

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interest rate shall be chosen taking into account section 1, second paragraph.

D.12. **Section 3** Pursuant to section 2, deductions shall be made in accordance with the following: The longest zero-rate coupon is derived from each and every one of the three government bonds with the longest remaining maturity. This interest rate is deducted from the swap/covered bond interest rate with the same maturity. The deduction is calculated as half of the average of these differences.

D.13. **Section 4** For the maturities where it is not possible to establish the rate referred to in section 1 or section 2, the insurance company shall determine the interest rate as the rate with the longest maturity which can be calculated in accordance with sections 1, 2 or 3.

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ANNEX E Proposal for a macroeconomic extrapolation method

1. Introduction

E.1. This section provides some background information partly linked to the Norwegian and Swedish market, but we believe it is relevant for insurance undertakings in other markets as well.

E.2. A major part of the liabilities in Norwegian life insurance companies are of long term nature and related to defined benefit schemes. The long end of the interest rate curve is thus of great importance for the solvency position of the Norwegian life insurance industry.

E.3. Since there are no government bonds outstanding beyond 10 years maturity and no reliable information on swap-rates beyond 15 years, an extrapolation of the curve based on constant forward rates may give rise to unintended fluctuations in the long term interest rates.

E.4. Our main problem is how to find practical and pragmatic methods for stipulating the interest rate curve both in the medium to long term (say maturities of 10–30 years) and the long to very long term (maturities beyond 30 years). **A major difference between the euro market and the Norwegian market is that companies in the euro market may hedge their interest rate risk using instruments with long maturity whereas Norwegian companies are not able to do so.**

E.5. Sweden has earlier proposed a macroeconomic model for risk-free rates. There is also some literature from the consultancy firm Barrie & Hibbert[18] arguing for setting unconditional forward rates based on macroeconomic assumptions in the long end in order to produce more "reliable" long term interest rates. We see strong arguments in favour of using a macroeconomic approach, in particular in countries where there is no liquid market beyond 10 years maturity.

E.6. In section 3 we present a macroeconomic model. According to our understanding the most important economic factors explaining long term forward rates are *expected inflation* and *real interest rates*. To avoid spurious volatility in long term rates caused by extrapolation from short term market rates, we propose to use long term forward rates based on macroeconomic estimations of future inflation and expected future real interest rates.

E.7. However, there are several choices to be made:

[18] Barrie & Hibbert: *A framework for estimating and extrapolating the term structure of interest rates, September 2008 (version 1.0).*

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1) At what maturity should the unconditional forward rate be set?
2) Which method should be used to interpolate between the last observable liquid rate and the unconditional forward rate?

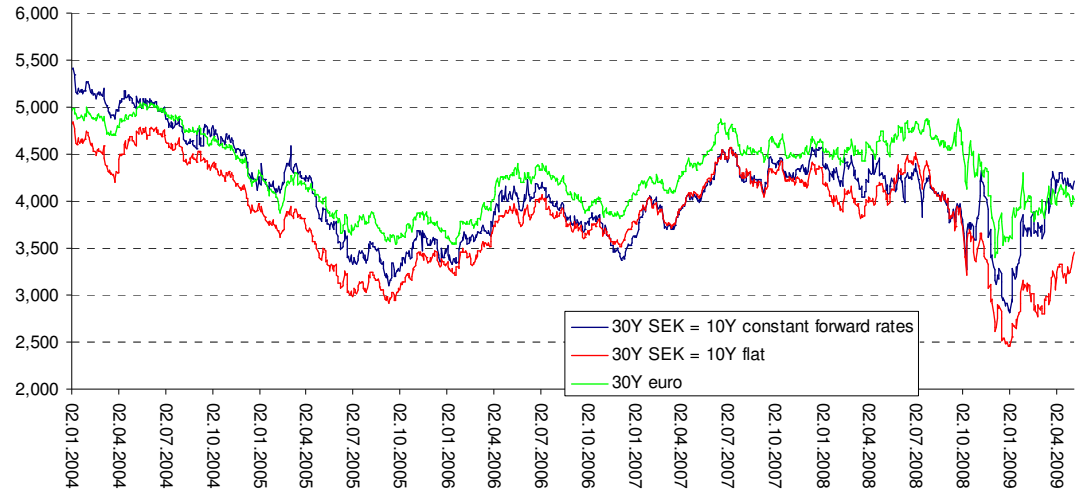
E.8. All choices, including those referred to under 1 and 2, will affect the volatility of long term interest rates in the final model. The aim should be to achieve market consistency. This implies also that such a model must be calibrated and take into account available information from other markets (e.g. from liquid euro rates).

2. Background: Illustration based on different models for extrapolation

E.9. In the following, we have tried to illustrate how different methods for extrapolation may affect the assumed long term risk-free rate.

E.10. Figure 1 illustrates the behaviour of the extrapolated interest rates for 30 years maturity based on (i) simple extrapolation technique (final liquid data point = long term interest rate level) and (ii) constant forward rates (as used in QIS4 and also mentioned under option "Parameterisation techniques" in the main body of the consultation paper on the relevant risk-free interest rate term structure) as compared to the euro-zone rate for 30 years maturity. For illustrative and comparability purposes, we have used Swedish interest rates.

Figure 1. Swedish interest rates, 30 years maturity based on different extrapolation techniques compared to euro-zone 30 year interest rate



E.11. Using the two simple extrapolation techniques referred to above (constant forward rates or flat spot rate), we can see that the volatility of interest rates in Sweden is significantly higher than for the euro-zone.

E.12. In our opinion, there is no economic justification for having significantly more volatile *long term* interest rates in Sweden or Norway than in the euro-zone. In this context it should be stressed that the volatility causes

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particular problems in our markets due to the fact that there are no long dated instruments available to hedge these volatile interest rates.

3. A macroeconomic model for extrapolation - an example

E.13. In this section we present a model for extrapolation which is based on macroeconomic assumptions. The model has a strong link to available market information for shorter maturities, and in our opinion provides a modelled rate which can be deemed as market consistent.

E.14. We find it essential that the extrapolation method gives a reasonable outcome in a market where there is limited liquidity in the long end. As mentioned above, Barrie & Hibbert[19] (B&H) has proposed an interest rate model based on setting an unconditional long-term forward rate[20]. By using such a method, the volatility in the long end will be reduced. As B&H, we believe that the volatility of interest rates should decrease with maturity.

E.15. In B&H's model, the components of forward interest rates are based on long-term macro-economic assumptions regarding the long-term real rate of interest and long-term inflation expectations. In addition B&H include a bond term premia and a technical "convexity" adjustment. However, we find it more debatable whether and how to include the last two factors.

E.16. The main assumptions behind the macroeconomic model we are presenting here are:

- The market consistent risk-free interest rate based on government bonds up to maturity A, A =10 years for the Norwegian market (currently);
- An unconditional macroeconomic target forward rate for all maturities above a given threshold B (B is set to 20 years in our example);
- A linear interpolation between the risk-free forward rate from year A–1 (9) to year A (10) and the target forward rate at B for maturities between A and B; and
- The unconditional rate from B to B+1 and onwards being stipulated as the sum of a long term real interest rate and long term target inflation. Note that no term premium and no additional rate linking the long to the short term rate are taken into account.

E.17. In our opinion this model leads to an approximation of the risk-free term structure which is:

- adequate from a theoretical point of view; almost all academic literature is based on extrapolating forward and not spot rates,
- adequate from a practical point of view, as using forward rates is standard in financial pricing and analysis (moreover Economic Scenario Generators

[19] Barrie & Hibbert: *A framework for estimating and extrapolating the term structure of interest rates, September 2008 (version 1.0).*

[20] This is similar to the earlier proposal from Sweden, the main difference is the maturity for the "equilibrium" interest rate. The Swedish proposal is based on a constant spot rate from 20 Y, whereas B&H argues for a constant *forward* rate in the very long term.

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estimate forward rates and model yield curves from forward rates, Central Banks base their models on forward rates, and so on), and

- at the same time very simple to implement and very transparent (few parameters, all "easy" to understand and to assess, linear interpolation of forward rates).

E.18. In addition:

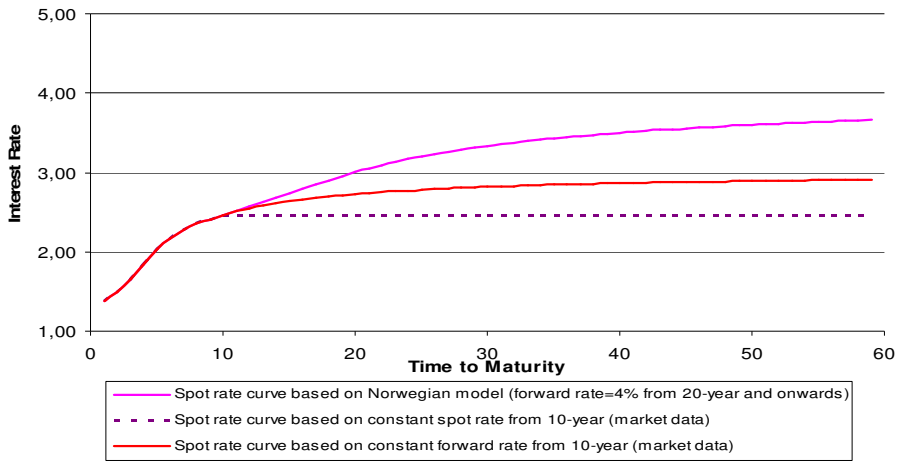
- The resulting term structure will then be based on assumptions which are cautious, fairly undisputed and robust over time.
- The method is forward looking; some of the excessive volatility of the term structure (due to distortions) is taken out at the long end, but a large part of the volatility in the rates is left, because the spot rates for a given maturity are an average over all one-period forward rates up to this maturity. Longer periods with very high or very low short term interest rates (up to 10 years) are thus anticipated, and do not need any frequent adjustments of parameters.

E.19. In our opinion, this method adheres to the basic principles in Solvency II and no credit risk or liquidity premium is reflected in the modelled interest rate.

E.20. The assumed real interest rate in the illustration we present here (2 percent) is based on historical data, while the assumed inflation rate is based on the inflation target in Sweden (2 percent). How to fix these parameters and the criteria for updating them has to be discussed further based on a more detailed analysis.

E.21. In this simple model, we set the unconditional forward rate (4 percent) at 20 years and use linear interpolation to arrive at forward rates between the last liquid interest rate (10 years) and the unconditional forward rate.

Figure 2. The Swedish government bond spot rate curve as of 31.12.2008 based on different assumptions. The data up to 10-year maturity are observed market rates



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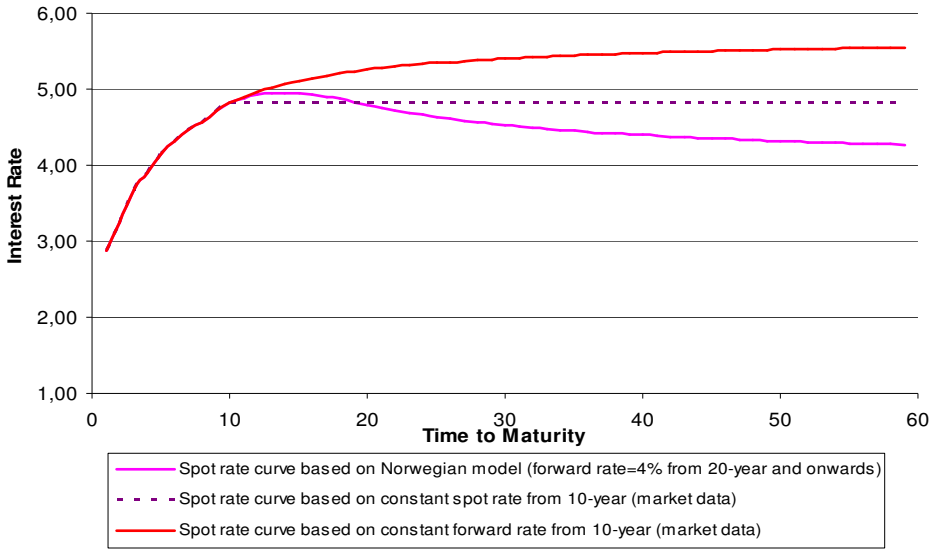
E.22. Figure 2 illustrates the interest rate curve based on this model as of 31 December 2008 compared to curves based on constant forward rates and constant spot rates, respectively. At the end of 2008, the 10 year interest rate in Sweden was historical low at 2.4 percent. Three months before and three months after, the 10 year interest rate was 3.8 – 3.7 percent respectively. Using the macroeconomic approach would help to avoid the most extreme volatility caused by distortions in the market.

E.23. When the 10 year market interest rates is relatively high, as was the case in the beginning of 2004, the macroeconomic model produces a lower long term interest rate than what follows from extrapolating based on constant market forward rates or the 10 year market spot rate.

Figure 3. The Swedish government bond spot rate curve as of 02.01.2004 based on different assumptions. The data up to 10-year maturity are observed market rates



E.24. Figure 4 illustrates the behaviour of the interest rates at maturity 20 years during period 2004 to 2009. The model outlined above is compared to 20 years interest rates based on constant forward rates from year 10 onwards (QIS4-methodology) and a flat spot curve from year 10 onwards (simple extrapolation method). We can see that the interest rate based on our proposed macroeconomic extrapolation follows the pattern of interest rates based on extrapolation of constant forward rates, however the volatility is reduced.

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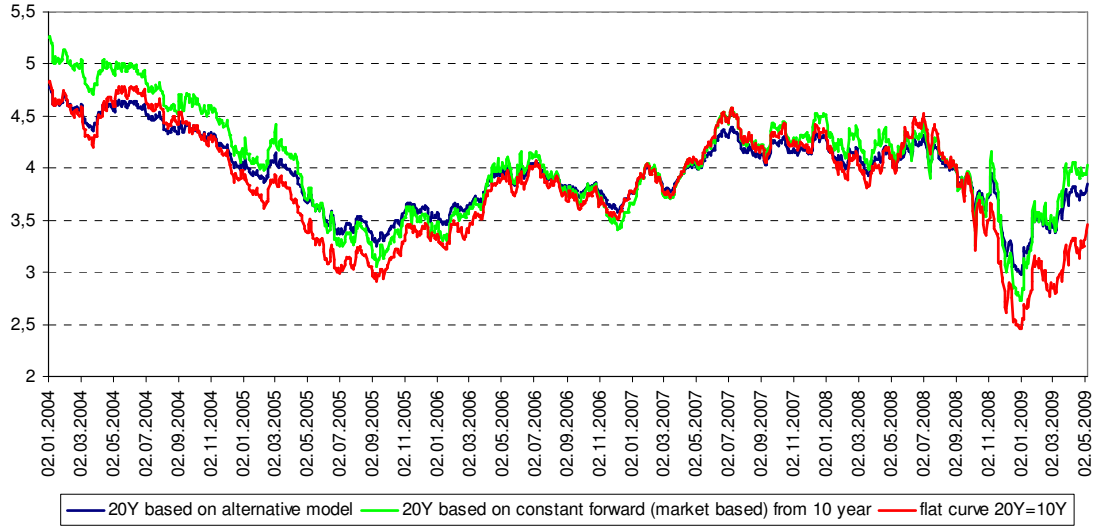
Figure 4. Macroeconomic assumptions vs. constant forward rates: Example Sweden



E.25. Using constant forward rates (market based) in the extrapolation, the interest rate varies between 5.4 percent and 2.8 percent, while using the macroeconomic approach gives a variation in interest rates between 4.8 percent and 3.0 percent in this period.

E.26. For the period 2004 to 2009, the model based on macroeconomic assumptions shows a level of volatility similar to the 20 year euro-zone market based volatility. One may argue (cf. an earlier Spanish proposal) also for the euro-zone that in the long and very long term, *"risk-free observed rates at the date of valuation are not generated in deep and liquid markets, and due other* circumstances *such rates do not represent a necessary reference."* This view may justify a smoothing of the curve in the euro-zone and thus justify a macroeconomic model resulting in less volatility (than what is presented in figure 2) in the long end of the curve.

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ANNEX F Simple example of constant/variable spread method.

In the example given below the constant spread method was used. This method could be refined further, for instance by taking into account the shape of the curve before the last available liquid data point.

Another option is using a variable spread, calculated by fitting the spreads observed in the non-extrapolated part of the curve.

Example	Interest rate 20-years	Interest rate 22-years	Interest rate 24-years…
Currency X	Observed value: 4.25 %	Observed value: not reliable Constant Spread Method value: 4.20 (=3.45+0.75)	Observed value: not reliable Constant Spread Method value: 4.10 (=3.35+0.75)
Euro	3.50 per cent	3.45 per cent	3.35 per cent
Spread (€/X)	+ 75 bp (=4.25-3.50)	+ 75 bp (constant)	+ 75 bp (constant)

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