EIOPA/12/307

25 January 2013

Technical Specifications part II on the Long-Term Guarantee Assessment

Final version

Purpose of this document

This document contains part II of the technical specifications for the long-term guarantees assessment which is carried out by the European Insurance and Occupational Pensions Authority (EIOPA) on behalf of the European Commission, the European Parliament and the European Council. It needs to be applied in combination with part I of the technical specifications.

The assessment tests various hypotheses and scenarios. The inclusion of an approach in the test should not be understood as pre-empting or in any way restricting the final agreement on the long-term guarantee measures in the trilogue for the Omnibus II Directive. The purpose of testing several approaches is to collect data and provide a reliable basis for an informed decision on the long-term guarantee measures.

Furthermore, a number of technical assumptions contained in this document have been made for pragmatic reasons and for the purpose of the assessment only. These should therefore not to be seen as guidance for the delegated acts and technical standards for Solvency II. The majority of areas where pragmatic short-cuts have been taken are marked with a disclaimer, but potentially not all of them.

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1 Introduction

The trilogue parties – the European Parliament, the Council and the European Commission – have considered that Solvency II should include regulatory measures to deal with the issues associated with insurance products with long-term guarantees that may be affected by what the trilogue parties call "artificial volatility".

The trilogue parties agreed in July 2012 that the impact of the package of long-term guarantees measures (the LTG package) should be evaluated to assess the effects that implementation of the package will have, in particular

- to assess, first and foremost, the impact of the proposed LTG package on policy holder protection
- to assess whether the proposed LTG package will allow supervisory authorities to supervise insurance and reinsurance undertakings and insurance and reinsurance groups efficiently and effectively
- to assess whether the proposed system can be implemented efficiently and effectively by all insurance and reinsurance undertakings and the cost of implementation
- to assess whether the proposed system provides the right incentives for good risk management and wide risk diversification and contributes to the correct risk reflection of the undertakings
- to assess, in cooperation with ESRB, the impact on financial stability and whether the proposed system has the potential to create systemic risks
- to assess the impact of the proposed LTG package on the single market, including on cross-border business
- to assess the impact of the proposed LTG package on insurance and reinsurance undertakings' solvency position and also possible competition distortions in national markets and the single market
- to assess the impact of the proposed LTG package on long-term investments by insurance and reinsurance undertakings.

EIOPA has been requested to run this technical assessment (referred to as the LTGA in the remainder of this document) that collects both qualitative and quantitative information from insurance and reinsurance undertakings and supervisory authorities on the effects of the LTG package.

The LTGA is designed to evaluate the impact of the following measures individually and in combination:

- Adapted relevant risk-free interest rate term structure ("Counter-cyclical Premium")
- Extrapolation
- Matching adjustment for certain life insurance obligations ("Classic Matching Adjustment")
- Matching adjustment for certain insurance obligations not covered by the above ("Extended Matching Adjustment")
- Transitional measures
- Extension of recovery period

The LTGA will be based on different sets of input, namely

- Quantitative industry input
- Qualitative industry input
- Qualitative NSA input
- Additional EIOPA analysis

The focus of this document is lining out the specifications linking to the LTG Package and additional technical details for the quantitative industry input. It might also provide details on the qualitative questionnaire where it links to providing data input required for further analysis or validation of the quantitative results. It should be noted that the specifications provided are understood to supplement the full set of specifications (so called "part I") already published by EIOPA.

2 Overview to the quantitative assessment

2.1 The scenarios

For the purpose of the quantitative industry assessment, participating undertakings are asked to test combinations of the first five measures[1] that are set out in the introduction in 13 scenarios (labelled "0" through "12") as shown in Table 1.

Scenario 0 ("Scenario without LTG Package"):

Participating undertakings should calculate the complete SI and SII balance sheet and solvency positions at the reference date of 31 December 2011. The LTG technical specifications as provided by EIOPA for this assessment should be used to perform the SII calculations. No application of the adapted relevant risk-free interest rate term structure (formerly known as CCP), no matching adjustment and no transitional measures to the discount curve are to be assumed. For the extrapolation of the discount curves, the same general methodology (Smith Wilson technique) was used as in QIS5. In applying this methodology, the same entry points into extrapolation (last liquid points) were chosen as in QIS5, whereas for the speed of convergence 40 years were fixed for all currencies.

The data to be provided for the scenario include the following: Assets, Technical Provisions, Own Funds (by Tiers and including Ancillary Own Funds where applicable), SCR[2] (including results of all sub-modules), SCR Capital Surplus, SCR Ratio, MCR, MCR Capital Surplus and MCR Ratio. Additionally, corresponding SI items need to be reported for the reference date. Similarly, the balance sheet items and capital requirement under SI should be provided as reported at the 31 December 2011.

Scenario 1 ("BASE scenario with LTG Package"):

Participating undertakings should recalculate the SII balance sheet and solvency position at the reference date of 31 December 2011 assuming the standard adaptation to the risk-free rate (i.e. 100 bps) as provided by EIOPA, the "classic" matching adjustment

[1] The extension of the recovery period is not a measure that will be tested as part of the scenarios within the quantitative industry assessment.

[2] SCR calculations should be done based on the Standard Formula in the default option. However, the results can be accompanied by Internal Model results where relevant.

based on the standardised approach and the "extended" matching adjustment based on the standardised approach as described later in this document. No transitional measures to the discount curve are to be assumed. Extrapolation of the EUR discount curves is done based a last liquid point of 20 years and a convergence speed of 10 years (see Appendix DC5 for the exact discount curves).

The SII balance sheet and solvency position includes the following items: Assets (though unchanged from Scenario 0), Technical Provisions, Own Funds (by Tiers and including Ancillary Own Funds where applicable), SCR[3] (including results of all sub-modules, also including the changes to the CCP and Spread Risk Module), SCR Capital Surplus, SCR Ratio, MCR, MCR Capital Surplus and MCR Ratio.

Where insurance liabilities qualify for the application of more than one LTG measure, the prioritisation order described in section 2.2 should be followed.

In addition, selected outputs (impact on SCR, TP and OF) for the following list of sensitivities should be provided:

a) If there was no CCP

b) If the CCP application would be restricted to liabilities with a duration > 7 years

c) If the "classic" MA was subject to alternative conditions

d) If assets under the "extended" MA are invested in a hypothetical portfolio

e) Netting shortfalls and surpluses for the "extended" MA application ratio calculation

Details on the individual conditions of each of these sensitivities are given in section 5. It should be noted that these sensitivities are to be seen as lower priority compared to the scenario calculations and simple estimation approaches to determine the outputs for those sensitivities are acceptable.

[3] SCR calculations should be done based on the Standard Formula in the default option. However, the results can be accompanied by Internal Model results where relevant.

Scenarios 2-3 ("CCP scenarios"):

Participating undertakings should recalculate affected SII items (versus LTG Base Scenario 1) at the reference date of 31 December 2011 assuming the CCP being at 50 bps respectively 250 bps. (see Appendix DC5 for the exact discount curves)

Affected SII items include all of the ones listed above for Scenario 1.

Scenario 4 ("Classic MA scenario"):

Participating undertakings should recalculate affected SII items (versus LTG Base Scenario 1) at the reference date of 31 December 2011 assuming the "classic" Matching Adjustment being applied in an alternative version.

Affected SII items include all of the ones listed above for Scenario 1.

Scenario 5 ("Extrapolation scenario"):

Participating undertakings should recalculate affected SII items (versus Scenario 1) at the reference date of 31 December 2011 assuming the applied interest rates reflect the extrapolation method using 40 years rather than 10 year convergence speed (see Appendix DC5 for the exact discount curves).

Affected SII items include all of the ones listed above for Scenario 1.

Scenarios 6-7 ("Extended MA scenarios"):

Participating undertakings should recalculate affected SII items (versus Base Scenario 1) at the reference date of 31 December 2011 assuming the versions Standard II and Alternative of the extended MA application ratio. Further instructions on the application of MA are provided in section 3.6.

Affected SII items include all of the ones listed above for Scenario 1.

In addition, selected outputs (impact on SCR, TP and OF) for scenario 6 for the following list of sensitivities should be provided:

a) If there was no CCP

b) If the CCP application would be restricted to liabilities with a duration > 7 years

c) If the "classic" MA was subject to alternative conditions

d) If assets under the "extended" MA are invested in a hypothetical portfolio

e) Netting shortfalls and surpluses for the "extended" MA application ratio calculation

f) If a strict cash-flow matching requirement was to be applied to the "extended" alternative MA

g) If a fixed asset cash-flow requirement was to be applied to the "extended" alternative MA

h) If a credit quality limit was to be applied to the "extended" alternative MA

i) If the "extended" alternative MA was done with the extended MA conditions for MA level

Details on the individual conditions of each of these sensitivities are given in section 5. It should be noted that these sensitivities are to be seen as lower priority compared to the scenario calculations and simple estimation approaches to determine the outputs for those sensitivities are acceptable.

Scenarios 8-9 ("Transitional scenarios"):

Participating undertakings should recalculate the affected SII items at the reference date of 31 December 2011 assuming the transitional measure applies to all existing business respectively to paid-in premiums only (i.e. future premiums of existing business are excluded). For this technical assessment it is assumed that the transitional measure is at 0 years into the process, i.e. the full Solvency I curve is applied.

Affected SII balance sheet items include all of the ones listed above for Scenario 1.

Where insurance liabilities qualify for the application of more than one LTG measure, the prioritisation order described in section 2.2 should be followed.

Scenarios 10 ("YE09 scenario"):

Participating undertakings should recalculate the complete SII items at the reference date of 31 December 2009 in line with Base Scenario 1. Undertakings should thereby use the YE11 liability and asset portfolios, only applying the relevant adjustments to yield curves/ market prices as provided by EIOPA. A separate supporting paper describes a proposed simplification on how to value assets and future discretionary benefits at historic reference dates.

The complete SII items include the ones listed for Scenario 1.

In addition, participating undertakings are asked to provide the actual Solvency I position as reported for YE09.[4]

Scenarios 11-12 ("YE04 scenarios"):

Regarding scenario 12, participating undertakings should recalculate the complete SII items at the reference date of 31 December 2004 in line with Base Scenario 1 – however, CCP does not apply given the relatively "normal" financial market conditions in 2004. Scenario 11 varies from scenario 12 to the extent that instead of the extended Matching Adjustment, the transitional measure is applied assuming to be 0 years into the transition process. Undertakings should thereby for both scenarios use the YE11 liability and asset portfolios, only applying the relevant adjustments to yield curves/ market prices as provided by EIOPA. A separate supporting paper describes a proposed simplification on how to value assets and future discretionary benefits at historic reference dates.

The complete SII items include the ones listed for Scenario 1.

In addition, participating undertakings are asked to provide the actual Solvency I position as reported for YE04.[5]

In providing quantitative data for all scenarios, insurance and reinsurance should follow the technical specifications for the LTGA laid out in this document.

[4] It is acknowledged that the balance sheet in the scenarios is not in line with the actual balance sheet at year end 2009.

[5] It is acknowledged that the balance sheet in the scenarios is not in line with the actual balance sheet at year end 2004.

			Scenarios at the reference date YE11									Scenarios at historic reference dates		
		0	1 BASE	2	3	4	5	6	7	8	9	10	11	12
I	**Adapted relevant risk-free interest rate term structure (CCP)**													
A	*No CCP*	x											x	x
B	*CCP of 100bps*		x			x	x	x	x	x	x	x		
C	*CCP of 50bps*			x										
D	*CCP of 250 bps*				x									
II	**Extrapolation**													
A	*LLP 30yrs for EUR, 40 yr convergence*	x												
B	*LLP 20yrs for EUR, 40 yr convergence*						x							
C	*LLP 20yrs for EUR, 10 yr convergence*		x	x	x	x		x	x	x	x	x	x	x
III	**"Classic" Matching adjustment**													
A	*No Matching Adjustment*	x												
B	*Classic Standard version*		x	x	x		x	x	x	x	x	x	x	x
C	*Classic Alternative version*					x								
IV	**"Extended" Matching adjustment**													
A	*No Matching Adjustment*	x								x	x		x	
B	*"Extended" Standard I version*		x	x	x	x	x					x		x
C	*"Extended" Standard II version*								x					
D	*"Extended" Alternative version*							x						
V	**Transitional Measures**													
A	*No transitional measure*	x	x	x	x	x	x	x	x			x		x
B	*Transitional measure applied to all existing business*									x			x	
C	*Transitional measure applied to paid in premiums only*										x			
VI	**Reference date**													
A	*31 December 2011 (YE11)*	x	x	x	x	x	x	x	x	x	x			
B	*31 December 2009 (YE09)*											x		
C	*31 December 2004 (YE04)*												x	x

Table 1: Overview of scenarios tested in the qualitative assessment (deviations from BASE marked in grey)

2.2 Application of long-term guarantee measures

When considering the application of the different long-term guarantee measures listed in section 1 to different parts of the portfolio of obligations, this should always be done in the following order:

- Identify the obligations that meet the criteria to apply the "classic" matching adjustment (only applicable to life business), and apply the discount curve including "classic" matching adjustment to those obligations;
- Out of the remaining obligations, identify the obligations that meet the criteria to apply the "extended" matching adjustment (applicable to life business and non-life annuities) respectively the transitional measure (only applicable to life business), and apply the discount curve including the "extended" matching adjustment respectively the transitional discount curve to those obligations;
- Depending on respective scenarios, the remaining obligations are then either discounted with the adapted discount curve including the CCP (applicable to life and non-life obligations) if a CCP is applicable, or by the non-adjusted discount curve.

The described approach is to be followed for all scenarios, i.e. if certain obligations (and related assets) meet the criteria of several measures there is no choice of what measure to apply.

3 Determination of the risk-free interest rate term structure

3.1 Introduction

For the different scenarios 0-12 described before, the risk-free interest rate term structures or discount curves applied to different parts of the liabilities (or subportfolios) vary. For the purpose of this assessment, EIOPA provides all major discount curves for the different reference dates and scenarios in appendix DC5, apart from the ones using a matching adjustment or a transitional measure as both of these are company specific.

This section provides insights on

- how the basic risk-free term structures have been derived by EIOPA (subsections 3.2 and 3.3)

- how the CCP adjusted basic risk-free term structures as provided by EIOPA have been derived and are to be applied (subsection 3.4)
- how the transitional term structures are to be derived and applied (subsection 3.5)
- how the matching adjustment is to be applied (subsection 3.6, details on the determination of the matching adjustment are provided in section 4).

Regarding the application of the discount curves (including the ones provided in appendix DC5 as well as the ones taking into account the transitional measure or the matching adjustment), the same curve should be used for discounting as well as projecting liabilities (relevant for profit sharing business).

3.2 Methodology for determining the basic risk-free interest rate term structures provided by EIOPA

The assumptions taken in this section (e.g. Ultimate Forward Rate, Last Liquid Point, Credit Risk Adjustment) often reflect the fact that the respective Technical Standards are currently under development. Therefore none of those assumptions should be seen as an indication for the final implementation, but rather as a pragmatic approach chosen for this assessment only.

3.2.1 Selection of data and determination of entry point to extrapolation

To determine the basic risk-free term structure, considerations have to be made in respect of the availability and the relevance of data. In addition, those data have to be adjusted for the inherent credit risk or take into account the peg to another lead currency, if applicable.

3.2.1.1 Choice of reference instruments

For the purpose of the LTG assessment, as regards the availability of swaps and government bonds for each currency we refer to the analysis performed by EIOPA. The exact choice of instrument by currency is documented in appendix DC1 (Bloomberg codes).

As regards quotes for swap data, the swap mid rate will be used in the determination of the basic risk-free interest rate term structure.

3.2.1.2 Assessment of ADLT criteria and determination of the LLP

For the purpose of the LTG assessment the reference instruments and values for the Last Liquid Points (LLPs) shown in Appendix DC1 were selected. These instruments and values are the same ones that were used in QIS5 except for the following cases:

- The Euro, where a LLP of 20 years was selected (apart from scenario 0).
- The Polish Zloty, where government bond rates were used for maturities 1-10 years, and a LLP of 10 years was selected.

The choice of the last liquid point (LLP), for each currency, is based on the principles laid out in Appendix DC2.

3.2.2 Treatment of data and adjustment for credit risk

The reference instruments used to derive the basic risk-free interest rate term structure need to be adjusted for credit risk, and in the case of interest rate swaps also for basis risk.

3.2.2.1 Adjustment of credit and basis risk for interest rate swaps

For the purpose of the LTG assessment, the adjustment for credit and basis risk is applied as a fixed deduction across all maturities of the observed swap term structure. Acknowledging that the methodology for the determination of this adjustment is still under development as regards the final Solvency II formulation, for the purpose of the Impact Assessment the same adjustment is applied to all currencies.[6]

In particular, the adjustment takes into account the risk that is embedded in the determination of the floating rate leg of the swap deal, i.e. the risk pertaining to uncollateralised interbank market. Thus, the credit risk adjustment depends on the credit quality of the banks that, via interbank transactions, determine the basis for the floating leg in swap contracts. See Appendix DC3 for further details.

[6] The adjustment mainly depends on the credit quality of the banks that, via interbank transactions, determine the basis for the floating leg in swap contracts. For this reason, it is possible that the credit risk adjustment will vary by currency area/country, and it will certainly depend on the state of the business cycle, and the general risk perception in the economy and banking industry. However, for the purpose of the LTGA the same adjustment will be applied to all currencies. See further Appendix DC3 for background material on the credit risk adjustment.

The adjustment that mainly reflects the credit risk inherited in swap rates changes over time and is therefore estimated separately for each reference date of the LTG impact assessment. See Appendix DC1 for further details on the adjustments applied for the different reference dates.

3.2.2.2 Adjustment of credit risk for government bonds

The vast majority of risk free term structures to be derived for the LTGA are based on swap rates. And, being conscious of the fact that a framework for the credit risk adjustment for government bonds currently is under development, it is proposed for the current assessment not to implement a credit risk adjustment for government bonds that deviate from the one applied to swaps.

3.2.2.3 Treatment of currencies pegged to the euro

For currencies pegged to the Euro, the basic risk-free interest rate term structure for the Euro, subject to an adjustment, may be used to calculate the best estimate with respect to insurance and reinsurance obligations denoted in that currency, provided that certain conditions are met.

The exact approach to calculation of the adjustment is however not yet fully decided and the adjustment was set to zero in the context of this assessment for practical reasons. For the purpose of this assessment, DKK is assumed to meet the pegging criteria.

3.3 Methodology for extrapolation and interpolation of the basic risk-free interest rate term structures provided by EIOPA

The appropriate risk-free interest rate term structure will in practice be constructed from a finite number of liquid market data points. Therefore, both interpolation between these data points and extrapolation beyond the last liquid point (LLP) are required.

3.3.1 Methodology

The interpolation between data points and extrapolation beyond the LLP will be done using the Smith-Wilson method. See Appendix DC6 for further details.

3.3.2 Parameterisation

3.3.2.1 The ultimate forward rate (UFR)

The ultimate forward rate (UFR) is the percentage rate that the forward curve converges to at the pre-specified maturity. The UFR is a function of long-term expectations to the inflation rate, and to the long-term average of the short-term real rate. As this value is

assessed in line with long-term economic expectations it is expected to be stable over time and only change due to changes in long-term expectations.

For the purpose of the LTGA it is assumed that the UFR for each currency is based only on the estimate of the expected inflation and the estimate of the long-term average of the short-term real rate.

For pragmatic reasons, since it is very difficult to differentiate between long-term economic expectations of different currency areas in a globalized economy, for the purpose of the LTGA it is assumed that the UFR for each currency is equal to 4.2% (i.e. 2.2% long term growth rate and 2% inflation rate assumption). Details regarding the methodology to determine the UFR are provided in Appendix DC4.

The choice of the last liquid point (LLP) for each currency is based on the principles laid out in Appendix DC2.

3.3.2.2 The speed of convergence to the UFR

The alpha parameter in the Smith-Wilson method determines both the speed of convergence to the UFR in the extrapolated part, and the smoothness of the curve in the interpolated part. Larger values of alpha give greater weight to the UFR, while smaller values of alpha give more weight to the liquid market data.

For the purpose of the LTGA, the alpha parameter is calibrated so that the extrapolated part of the forward curve converges to within 3 bps from the UFR at a specified number of years from the LLP. Two different assumptions are tested:

- Convergence in 10 years from the LLP, and
- Convergence in 40 years from the LLP.

3.4 Determination of adjustments to the basic risk-free interest rate term structure provided by EIOPA (CCP)

3.4.1 CCP testing approach for the LTGA

Given the currently insufficient data situation to determine the "real" yield curve adjustments (also known as Countercyclical Premium or CCP), the approach chosen for the impact assessment is to test three default levels of CCP in the scenarios (50 bps, 100 bps, 250 bps). The impact of actual CCP values linking to the respective reference date, currency or country is then determined in an add-on analysis by EIOPA in a later stage of the assessment.

Besides the non-adjusted risk free rates, EIOPA also provides the CCP adjusted risk free rates for all scenarios in Appendix DC5 (tabs named "X_ccp").

3.4.2 Determination of the adjusted risk-free interest rate term structure

For the purpose of this assessment, EIOPA has provided the CCP-adjusted curves for major currencies. Respective curves where determined as follows:

- Swap rates (used as basis for calculation of the risk-free rate until the Last Liquid Point) are corrected for credit and basis risk as described earlier
- The CPP adjustment is added to the observed swap rates (spot, coupon bearing), i.e. only until the LLP
- The resulting rates are the input to the Smith-Wilson model outputting the full zero curves

Because CCP is applied to swap rates, final CCP-adjusted discount curves provided by EIOPA do not show a parallel shift until the LLP. There is also no parallel shift after the LLP since all curves ultimately converge to the same UFR, irrespective of the CCP.

The approach described above on the CCP adjustment of the risk-free interest rate term structure is under further technical consideration and might be changed on the future.

3.4.3 Interaction with the standard formula

Following the draft implementing measures, the capital requirement for counter-cyclical premium risk shall be equal to the loss in the basic own funds that would result from an instantaneous decrease of 100% of the counter-cyclical premiums in the standard formula.

Companies using internal models should also reflect CCP risk.

3.5 Transitional measure

A transitional measure on the discount curve is proposed with the aim to introduce the full effect of Solvency II only gradually over a sufficiently long time-period. In practice this means that undertakings would value according to Solvency II principles, however assuming that an average of Solvency II and Solvency I interest rates is used for valuing existing liabilities, where the Solvency I interest rate is fixed at the date of implementation of the LTG package. In effect, the transitional measure applies to recognized insurance obligations at the date of application.

3.5.1 Scope of transitional measure

The rates of the relevant risk-free interest rate term structure to calculate the best estimate with respect to insurance or reinsurance obligations for contracts, excluding renewals,

(a) for which, according to the laws, regulations and administrative provisions adopted pursuant to Directive 2002/83/EC, technical provisions were determined using the interest rate referred to in the laws, regulations and administrative provisions adopted pursuant to Article 20.B.a of that Directive; and,

(b) where the insurance or reinsurance undertaking complies with the laws, regulations and administrative provisions for the establishment of technical provisions which are adopted pursuant to Article 20 of Directive 2002/83/EC, Article 15 of Directive 73/239/EEC and Article 32 of Directive 2005/68/EC,

shall be calculated as set out in the following paragraph.

3.5.2 Construction of the transitional discount curve

This subsection describes the construction of the transitional curve over the transitional period of 7 years. However, it should be noted that for the purpose of the LTGA it is assumed that undertakings are zero years into the transitional process, i.e. simply the Solvency I curve is applied to discount the respective obligations in scenarios 8, 9 and 11. Undertakings need to provide the Solvency I discount curves themselves as they (would) have been used for the respective obligations at YE 2011 or YE2004 (depending on the scenario in question) according to the current national regulatory framework.

In general, for each currency and in respect of each maturity the transitional discount rate is to be calculated as the weighted average of the following two elements:

- Solvency II rate as provided by EIOPA: The rate for that maturity of the relevant risk-free interest rate term structure as measured in accordance with Article 76 (2), Article 76 (3) and Article 76 (5). In case of a countercyclical adjustment being applied to that relevant risk-free interest rate term structure (in accordance with Article 77a) this should be taken into account
- Solvency I rate: The interest rate referred to in the laws, regulations and administrative provisions adopted pursuant to Article 20.B.a of Directive 2002/83/EC

Where member states have adopted laws, regulations and administrative provisions pursuant to Article 20.B.a.ii of Directive 2002/83/EC, the interest rate referred to in the second bullet point shall be determined using the methods used by the insurance or reinsurance undertaking taking into account information that is current each time that determination is made.

The transitional measure on the discount curve has the aim to introduce the full effect of Solvency II only gradually over a time-period of 7 years.

General conditions to be met if the transitional measure is applied:

- The transitional measure can only be applied to obligations resulting from activities within the member state where the insurance or reinsurance undertaking is authorised
- The transitional measure only applies to existing contracts at date of application
- The transitional measure applies to all eligible insurance obligations of the undertaking unless the "Classic" matching adjustment applies or the obligations are non-life obligations, i.e. there is no free choice to apply the measure only to a subset of those obligations
- Neither the "Classic" Matching Adjustment nor the "Extended" Matching Adjustment can be applied to the same obligations

If the Solvency I rate varies for different obligations, the transitional measure is to be determined separately for each bucket of obligations. To facilitate the calculations, appropriate simplifications to the calculations can be considered. Where there is different interest rate guarantees offered by an insurance undertaking it may not be practical to apply different interest rate curves for the determination of technical provisions. It could therefore be considered to apply an average interest rate where the average takes into account the share of liabilities with different guarantee levels on the whole insurance portfolio. The calculation of the average should however consider that the shares of liabilities with different guarantee levels can vary over time. Any simplification will require the participating undertaking to provide information needed to validate the appropriateness of the calculation.

The respective weights for all maturity points are to be determined according to the following table:

Years into the process	Weight of SII rate	Weight of SI rate
0 (applied during LTGA)	0 %	100%
1	14 %	86 %
2	29 %	71 %
3	43 %	57 %
4	57 %	43 %
5	71 %	29 %
6	86 %	14 %
7	100%	0 %

3.5.3 Application of the transitional measure

- The transitional measure is to be used to calculate technical provisions for the Solvency II balance sheet.
- For the purpose of determining the SCR (e.g. 1-in-200 stress on the interest rates), the stresses of the interest rate risk sub-module are applied to the whole relevant risk free interest rate term structure including the part of the Solvency I rate which represents 100% of the term structure for the purpose of this assessment. As a consequence, the basic risk-free rate interest rate to be used for the purpose of calculating the interest rate capital charge is the Solvency I rate as indicated above. The interest rate stress should be consistently applied for liabilities and corresponding assets. The Solvency I rate, used as the basic risk-free interest rate, should be stressed at different maturities, as prescribed in the interest rate risk sub-module. As a simplification, the undertaking may apply to the Solvency I rate the shock provided for maturity 1Y only (i.e. upward shock of 70% and downward shock of 75%).
- In case of a CCP application in conjunction with the transitional yield curve, the CCP is only to be applied to the Solvency II part of the curve, i.e. in the context of this assessment (assuming year 0 into the transition meaning 0% weight for the Solvency II curve) the transitional curve will not contain any CCP adjustment.

3.5.4 Related topic: Equity transitional

It should be noted that in the context of this assessment, a transitional measure to determine the SCR equity stress is applied. The equity transitional aims at introducing the full effect of the equity sub-module only gradually over a sufficiently long time-

period. The equity transitional is applied assuming to be zero years into the transition. This means that as part of this assessment:

- the equity stress to be applied is a shock of 22% for each type of equities; and
- no symmetric adjustment (also known as "equity dampener") is applied throughout the assessment.

3.6 Application of the matching-adjustment to the risk-free interest rate term structure

The assumption taken in this section have been made for practicality reasons only and should not be seen as an indication for the final approach to be implemented under Solvency II.

In the context of this assessment, the Matching Adjustment is to be applied as a parallel shift to the entire basic risk-free term structure as provided by EIOPA in Appendix DC5 (tabs named "X_zero"). I.e. it is not varying by maturity. Details regarding the determination of the Matching Adjustment level, according to the types of Matching Adjustment being applied, are provided in the next section.

It should be noted that different Matching Adjustment level might apply to different sets of liabilities (or sub-portfolios) within one scenario.

In the context of the SCR submodule for interest rate risk, it should be noted that the shocks should be applied not taking into account the Matching Adjustment.

For the purpose of this assessment, it is assumed that the Risk Margin remains unchanged when applying a Matching Adjustment.

4 Matching adjustments to the basic risk-free rate

4.1 Introduction

What do the matching adjustments intend to achieve?

- Historical data suggests that market values of bonds are more volatile than implied by their chances of defaulting alone.
- Where insurers may need to sell bonds to meet their unpredictable liabilities, they are exposed to these short-term bond value fluctuations; but not where they hold bonds to maturity.
- Insurers holding bonds for predictable portfolios can be more certain that they will be able to hold their bonds to maturity, and are therefore less exposed to short-term fluctuations in bond values. They are still exposed to default and to the cost associated with maintaining the credit quality of the portfolio should downgrades occur.
- The matching adjustment is an adjustment to the discount rate used to value such predictable liabilities, whereby the market value of the liability mirrors the market changes evident in the asset values which are not related to default or downgrade costs. It is equal to the spread over the risk-free rate on admissible backing assets, less an estimate of the costs of default and downgrade (the fundamental spread).

What is the intention of the application ratio?

- The application ratio restricts the matching adjustment to allow for possible mismatch stemming from discontinuances or earlier than expected payments on eligible business.
- It is based on a measure of these costs under given stress scenarios.

4.2 Requirements for applying matching adjustments

1. Insurance undertakings shall use the rates of the relevant risk-free interest rate term structure to calculate the best estimate with respect to life insurance obligations or, if applicable, annuity obligations arising from non-life contracts with a matching adjustment as set out in Section 4.7, provided that the following conditions are met:

(a) the conditions relating to the insurance obligations as set out in Section 4.4;

(b) the conditions relating to the admissibility of assets in the matching asset portfolio as set out in Section 4.5;

(c) the conditions relating to the matching of asset and liability cash-flows as set out in Sections 4.6.

2. The form of the matching adjustment to the risk-free curve will depend on the type of insurance obligation. Five forms of matching adjustments apply:

Two forms linking to the "classic" Matching Adjustment:

a. "Classic" standard: the matching adjustment for certain life insurance obligations with no policyholder options (or only a surrender option where the surrender value cannot exceed the value of assets) and where limits apply to both the proportion of assets held in credit quality step 3 and the level of matching adjustment applicable to these assets;

b. "Classic" alternative: the matching adjustment for certain life insurance obligations with no policyholder options (or only a surrender option where the surrender value cannot exceed the value of assets) and ignoring the two limits in term of both the proportion of assets held in credit quality step 3 and the level of matching adjustment applicable to these assets;

Three forms linking to the "extended" Matching Adjustment:

c. "Extended" standard I: the extended matching adjustment for life insurance obligations or annuity obligations arising from non-life contracts including policyholder options;

d. "Extended" standard II: this version differs from "extended" standard I only in the calculation of the application ratio; which in this case applies a 99.9% confidence level rather than the 99.5% underlying the stresses used to determine the application ratio;

e. "Extended" alternative: the alternative adjustment for life insurance obligations or annuity obligations arising from non-life contracts differing from the standardised version in four ways: no cash-flow matching is required instead the adjustment reflects the material risk of mismatch and forced sale of assets; eligible assets do not need to provide fixed cash-flows; credit quality limits do not apply for asset admissibility or level of the matching adjustment; and the fundamental spread includes only the credit spread corresponding to the probability of default.

3. The conditions set out in paragraph 1 may differ depending on the relevant form of the matching adjustment being applied. The adjustment in paragraph 2(c), 2(d) or 2(e) shall not apply for insurance obligations for which the adjustment referred to in paragraph 2(a) or 2(b) apply. The application of the adjustment in paragraph 2(a) - 2(e) depends on the scenario being applied:

- The "Classic" standard matching adjustment referred to in paragraph 2(a) shall apply from scenario 1 to 3 and 5 to 12 (i.e. this adjustment shall not apply in scenario 0 and scenario 4);
- The "Classic" alternative adjustment referred to in paragraph 2(b) shall apply for scenario 4;
- The "Extended" standard I extended matching adjustment referred to in paragraph 2(c) shall apply from scenario 1 to 5 and in scenarios 10 and 12;
- The "Extended" standard II extended matching adjustment referred to in paragraph 2(e) shall only apply in scenario 7;
- The "Extended" alternative extended matching adjustment referred to in paragraph 2(e) shall only apply in scenario 6.

In applying the matching adjustment under the relevant scenarios the 4 steps set out in the next section should be followed.

For the purpose of this impact assessment, it is assumed that the introduction of a matching adjustment does not change the risk margin calculation. However, this may not be the case in the final Solvency II requirements.

4.3 Summary of the steps to follow in applying the different versions of the matching adjustment

	Classic Standard	Classic Alternative	Extended Standard I	Extended Standard II	Extended Alternative
Step 1: identify the eligible liabilities	· Life longevity exposures with no further premiums or policyholder options (except a surrender option where the surrender value cannot exceed the value of the assets)) · Insurance obligations of an insurance contract cannot be split		· All life insurance obligations and non-life annuities; policyholder options are permitted · Insurance obligations of insurance contracts may be split		

	Classic Standard	Classic Alternative	Extended Standard I	Extended Standard II	Extended Alternative
Step 2: identify the admissible assets	· Bonds and similar assets or cash · Fixed cash-flows · No issuer options · Investment grade apart from exposures to Member States' central governments and central banks denominated and funded in the domestic currency of that central government and central bank (33% maximum exposure in credit quality step 3)	· Bonds and similar assets or cash · Fixed cash-flows · No issuer options · Investment grade apart from exposures to Member States' central governments and central banks denominated and funded in the domestic currency of that central government and central bank (no 33% maximum exposure in credit quality step 3)	· Bonds and similar assets or cash · Fixed cash-flows · No issuer options · Investment grade apart from exposures to Member States' central governments and central banks denominated and funded in the domestic currency of that central government and central bank (33% maximum exposure in credit quality step 3)		· Bonds and similar or cash · No issuer options · No restriction on credit quality
Step 3: consider the impact of matching governance requirements	· Cash-flow matching required: the discounted value of cash-flow shortfalls must be below the 15% limit · It must be possible for the portfolio of eligible obligations and the assigned admissible asset portfolio to be ring-fenced or organised and managed separately from the rest of the business of the undertaking without any possibility of transfer; if this is not possible, then matching adjustment cannot be applied to the portfolio				· Cash-flow matching is not required · It must be possible for the portfolio of eligible obligations and the assigned admissible asset portfolio to be ring-fenced or organised and managed separately from the rest of the business of the undertaking, without any possibility of transfer
Step 4: the matching adjustment calculation	The matching adjustment is equal to the spread over the risk-free rate, understood as the difference between the flat actuarial rate that equals the present values of liabilities with the market value of assets and the flat actuarial rate equivalent to RFR, less the fundamental spread provided. In respect of assets of credit quality step 3 the matching adjustment is capped at the higher of that applicable to credit step 1 and 2. The fundamental spread includes: · Probability of default · the cost of	Same as for "Classic" standard, but excluding the cap applicable to credit quality step 3	· Same as "Classic" standard (including the cap), but with a floor of 80% of the long-term average, reduced by applying the application ratio		· The matching adjustment is equal to the spread over the risk-free rate, understood as the difference between the flat actuarial rate that equals the present values of liabilities with the market value of assets and the flat actuarial rate equivalent to RFR, less the probability of default provided. · No floor and no cost of downgrades applies The result is reduced by applying the application ratio · Where a sub-portfolio of obligations is identified for the purpose of the calculation of the MA but the MA is applied to the whole portfolio

	Classic Standard	Classic Alternative	Extended Standard I	Extended Standard II	Extended Alternative
	downgrades · a floor of 75% of the long-term average spread				of insurance obligations, the effect of introducing the MA on the liability side does not exceed the difference between the present value of the asset cash-flows, discounted with the risk-free interest rate curve, and the present value of the asset cash-flows, discounted with the risk-free interest rate curve including the MA.
Step 4a: calculating the application ratio			Application ratio = max (0 , 1 – *discounted-cash-flow-shortfall* / BE) Where *discounted-cash-flow-shortfall* reflects the mismatch caused by the incidence of lapse risk, mortality risk, disability-morbidity risk and/or life catastrophe risk according to a confidence level of 99.5%.	Same as for "Extended" standard I, but assuming a 99.9% confidence level (rather than the 99.5% confidence level)	Same as for "Extended" standard I

4.4 Step 1: identifying the liability types eligible for matching adjustments

Liability eligibility criteria applicable to <u>all versions</u> of the matching adjustment

1. Liabilities for insurance contracts where market risk is borne by policyholder (i.e. unit-linked products) are not eligible for a matching adjustment.

2. Policyholder participation in the distributable profits of a product shall not of itself render the liability connected to that product eligible or ineligible for a matching adjustment. All the eligibility criteria should be considered in the same manner as for the liabilities relating to guaranteed benefits.

Specific to <u>"Classic" standard and "Classic" alternative</u>

3. The matching adjustment referred to in paragraph 2(a) and 2(b) of Section 4.2 applies to life insurance obligations for which the following two criteria are fulfilled:

a) the only underwriting risks connected to the portfolio of life insurance obligations are longevity risk, expense and revision risk (i.e. mortality risk is explicitly excluded from the scope of the "classic" matching adjustment, even when it is not material) and the contracts underlying the life insurance obligations include no options for the policy holder or only a surrender option where the surrender value does not exceed the value of the assets, valued in accordance with Article 75 of Directive 2009/138/EC, covering the life insurance obligations at the time the surrender option is exercised;
b) the life insurance contracts underlying the portfolio of life insurance obligations do not give rise to future premium payments.

4. The insurance obligations of an insurance contract cannot be split into different parts when composing the portfolio of eligible insurance obligations. All benefits under the contract should be eligible in order to apply the "Classic" standard and alternative matching adjustments.

Specific to <u>"Extended" standard I & II and "Extended" alternative</u>

5. The adjustments referred to in paragraph 2(c), 2(d) and 2(e) of Section 4.2 applies to all life insurance obligations and annuity obligations arising from non-life contracts. Health insurance obligations where the underlying business is pursued on a similar technical basis to that of life insurance shall be considered as life insurance obligations.

6. The insurance obligations may include options for the policy holder, such as surrender options.

7. Where insurance contracts include insurance obligations (or benefits) which fall within the scope of the adjustment as referred to in paragraph 2(c), 2(d) and 2(e) of Section 4.2, and insurance obligations (or benefits) which do not fall within the scope as defined in Section 4.4, undertakings may split the insurance obligations of those contracts. In this case, the adjustment applies to the eligible parts of the contracts only.

8. If an insurance contract includes only one guaranteed insurance obligation (or benefit), this benefit cannot be split into different portions.

4.5 Step 2: identifying the assets admissible to the matching portfolio

Admissibility restrictions applicable to <u>all versions</u> of the matching adjustment

1. Assets shall only be admissible to the assigned portfolio for matching eligible insurance obligations provided the following condition is met:

(a) The assigned portfolio of assets consists of bonds and other assets with similar cash-flow characteristics;

(b) The cash-flows of the assets of the assigned portfolio of assets cannot be changed by the issuers of the assets or any third parties.

2. Overnight assets such as cash are admissible to the matching portfolio to cover cash-flow requirements in the first year. Such liquid assets shall be considered as being risk-free and shall be assumed to have a matching adjustment of zero.

3. In the event that issuers or third parties have the right to change cash-flows flows in such a manner that the necessary cash-flows can be restored at an equivalent level of credit risk (as in the case with "make-whole' clauses), the right to change shall not disqualify the asset for admissibility to the assigned portfolio.

Make-whole clauses are not in line with the requirement sets out in paragraph 1(b), but they should be considered admissible for the purpose of this technical assessment because they are a frequent feature of bonds and loans.

4. For the purpose of calculating the matching adjustment, the cash-flows stemming from the assigned portfolio of assets are not adjusted for credit risk.

Specific to <u>"Classic" standard and "Classic" alternative and "Extended" standard I & II</u>

5. Assets shall only be admissible to the assigned portfolio for matching eligible insurance obligations provided the following conditions are met:

(a) the cash-flows of the assets of the assigned portfolio of assets are fixed;

(b) no assets of the assigned portfolio of assets have a credit quality below credit quality step 3[7] unless they are exposures to Member States' central governments and central banks denominated and funded in the domestic currency of that central government and central bank;

(c) the value of assigned assets allocated to the credit quality step 3 shall be limited to 33.33% of the total value of assigned assets. For this purpose, assigned assets shall not include exposures to Member States' central governments and central banks denominated and funded in the domestic currency of that central government and central bank.

6. The condition set out in paragraph 3(c) does not apply for "classic alternative".

7. Insurance or reinsurance undertakings shall not consider an asset to have fixed cash-flows where either the asset has no predefined maturity or the date of maturity depends on the issuer or third party decisions or actions.

8. With reference to point 3(a), where cash-flows of the insurance obligations depend on inflation only, the insurance undertaking may consider the cash-flows as fixed provided that those assets match the inflation-linked cash-flows of the portfolio of insurance obligations.

9. The admissibility rules apply to each individual asset of the assigned matching portfolio, except as regards the fixity of cash-flows condition which may apply to a combination of assets.

10. The table below compares various asset classes against the restrictions on changeability and fixity of cash-flows. The "no" indicates where EIOPA would generally expect the asset class to be inadmissible where the restriction applies, in ordinary cases, though there may be exceptions. If undertakings include assets with a "no" in their

[7] Please see the association of credit assessments of an External Credit Assessment Institution (ECAI) to credit quality steps in Appendix MA1.

assigned portfolio, they should demonstrate that the requirements have been met. Note that the restriction that cash-flows be fixed does not apply to "Extended" alternative.

Restrictions:

A. Cash-flows can't be changed by third parties

B. Fixed in timing and amount (in real or nominal terms)

Asset class	**A**	**B** **(not applicable for the "extended alternative")**
Cash (overnight instruments)		
Standard or inflation-linked corporate bonds		
Standard or inflation-linked sovereign bonds		
Swaps, where the combination with other assets leads to fixed cash-flows		
Callable bonds	no	
Commercial mortgages with make-whole clauses		
Convertible bonds		no
Equity release mortgages	no	no
Floating rate notes		no
Asset backed securities with fixed cash-flows		
Subordinated debt	no	
Preference shares	no	no
Bank hybrid debt	no	no
Other derivatives	no	no
Property (long lease)	no	no

4.6 Step 3: considering the impact of cash-flow matching governance requirements

Applying to <u>all versions</u> of the matching adjustment

1. Insurance and reinsurance undertakings shall be able to demonstrate the following conditions relating to the matching of asset and liability cash-flows are met:

(a) the insurance undertaking has assigned a portfolio of assets, consisting of bonds and other assets with similar cash-flow characteristics, to cover the best estimate of the portfolio of insurance obligations and maintains that assignment over the lifetime of the obligations, except for the purpose of maintaining the replication of cash-flows between assets and liabilities where the cash-flows have materially changed such as the default of a bond;

(b) the portfolio of insurance obligations to which the matching adjustment is applied and the assigned portfolio of assets are or can be, ring-fenced or identified, managed and organised separately from the other activities of the insurance undertakings, without any possibility of transfer.

If the portfolio of insurance obligations and the assigned portfolio of assets are not currently ring-fenced or identified, managed and organised separately from the other activities of the insurance undertakings without any possibility of transfer, this situation does not disqualify those portfolios for eligibility to the matching adjustment as long as it is possible for the undertaking to meet this condition. If this is not possible, then the matching adjustment cannot be applied to those portfolios.
It should be noticed that this relaxation of the restriction is set out for the purpose of this impact assessment only.

Specific to <u>"Extended" alternative</u> only

2. If undertakings do not have sufficient admissible assets to cover the best estimate of a whole portfolio of obligations, a sub-portfolio of obligations should be identified which can be covered by admissible assets. The identification of obligations shall be performed such that the whole portfolio of insurance obligations is scaled according to the proportion of the present value of the asset cash-flows on the present value of the liability cash-flows of the whole portfolio of obligations where in both cases the discount rate applied is the basic risk-free rate only.

3. In this case, undertakings may apply a matching adjustment to the whole portfolio of obligations, provided this is reflected in the matching adjustment calculation as specified in section 4.7 as well as in calculating the application ratio as specified in section 4.8.

Specific to "Classic" standard, "Classic" alternative and "Extended" standard

4. The future cash-flows of the assigned portfolio of assets replicate each of the future cash-flows of the portfolio of insurance obligations in the same currency and any mismatch does not give rise to risks which are material in relation to the risks inherent in the insurance business to which the matching adjustment is applied.

5. Undertakings should carry out the following steps to assess the adequacy of cash-flow matching by duration:

a) Step A: partition the cash-flows into intervals to determine the materiality of any timing mismatch. For the purpose of this impact assessment, a 1 year interval should be chosen.

   The expected cash-flows of the liabilities should not materially differ from the cash-flows stemming from the admissible assets.

b) Step B: For the purpose of the Impact Assessment a relaxation of the immateriality requirement shall be made such that the sum of the discounted cash-flow shortfalls for each future year is no greater than 15% of the best estimate of the obligations using the basic risk free rate.

   Discounting of the asset and liability cash-flows for this assessment should be based on the basic risk-free rate only and any cash-flow surpluses for a given interval should be ignored.

   Liquid overnight assets such as cash should be considered available to meet cash-flow matching requirement within the first year only. No cash balances should be taken into account in the calculation of the discounted cash-flow shortfalls after the first year.

c) Step C: Undertakings should report the degree of mismatch calculated as the sum of the discounted cash-flow shortfalls divided by the best Estimate.

This simplified method of determining the degree of mismatch and the high materiality limit have been selected for this exercise only in recognition of the fact

that undertakings have not had the opportunity to structure their portfolios optimally.

4.7 Step 4: calculation of the matching adjustment

Applying to <u>all versions</u> of the matching adjustment

1. For each currency the maximum matching adjustment shall be calculated in accordance with the following principles:

(a) the maximum matching adjustment shall be equal to the difference between the spread of the investment return over the basic risk-free rate of the assets of the assigned portfolio of replicating assets and the associated fundamental spread provided in Appendix MA2. The spread of the investment return over the risk-free rate shall be equal to the difference of the following:

(i) the annual effective rate, calculated as the single discount rate that, where applied to the cash-flows of the portfolio of insurance obligations, results in a value that is equal to the value in accordance with Article 75 of Directive 2009/138/EC of the portfolio of assigned assets;

(ii) the annual effective rate, calculated as the single discount rate that, where applied to the cash-flows of the portfolio of insurance obligations, results in a value that is equal to the value of the best estimate of the portfolio of insurance obligations where the time value is taken into account using the basic risk-free interest rate term structure.

For "Classic" standard and alternative the matching adjustment is equal to the maximum matching adjustment. For "Extended" standard and alternative the matching adjustment is equal to the maximum matching adjustment multiplied by an application ratio, to allow for the degree of matching implicit between the eligible liabilities and the cash-flows of the assigned portfolio of admissible assets. The calculation of this reduction is set out in section 4.8.

The assumptions for the calculation of the fundamental spreads provided in Appendix MA2 depend on the type of matching adjustment being applied.

For the "classic" standard and alternative matching adjustment, as referred to in paragraph 2(a) and 2(b) of Section 4.2, the fundamental spread should be equal to the maximum of:

i. the credit spread corresponding to the sum of the probability of default of the assets and the expected loss resulting from downgrading of the assets.

ii. 75% of the long term average of the spread over the risk-free interest rate of assets of the same duration, credit quality and asset class, as observed in financial market.

For the "extended" standard I and II matching adjustment, as referred to in paragraph 2(c) and 2(d) of Section 4.2, the fundamental spread should be calculated using the same methodology than for the "classic" matching adjustment but with a floor of 80% of the long-term average of the spread over the risk-free interest rate.

For the "extended" alternative matching adjustment, the fundamental spread should be equal to the credit spread that corresponds to the probability of default of the assets only (i.e. the calculation includes neither a component for downgrading risk nor a floor based on the long-term average of the spread).

Eventually, it should be notice that where there are no long-term default statistics that are relevant for the assets, the fundamental spread should be equal to the long-term average of the spread over the risk-free rate as observed in financial market.

2. The matching adjustment in respect of liquid overnight assets such as cash, since they involve no credit exposure, shall be assumed to be zero.

3. Should it be necessary to aggregate the fundamental spread across categories (asset classes, durations and ratings) when calculating the matching adjustment, the market values of assets and the average duration, within the category, should be used as weights.

This is a simplification chosen for the purpose of the assessment only.

4. Insurance undertakings applying the calculation method laid down in paragraph 1 shall not be allowed to apply any other adjustments to the risk-free interest rate term structure for the affected liabilities. In respect of the liabilities of the undertaking to

which a matching adjustment is not applied, other risk-free rate adjustments may be considered as relevant.

Specific to "Classic" standard and "Extended" standard

5. The fundamental spread for assets of credit quality step 3 shall be such that the matching adjustment in respect of these assets does not exceed the higher of the matching adjustment for assets of credit quality step 1 and 2 (see appendix MA1 for details on credit quality steps).

Specific to "Extended" alternative

6. If, in accordance with paragraph 3 of section 4.6, undertakings apply the matching adjustment to the full portfolio of obligations despite not having sufficient admissible assets, the matching adjustment shall be calculated according to 1(a) with the following amendments:

(i) The use of the annual effective rate in paragraph (a)(i) shall be the default option when calculating the maximum matching adjustment. However, if the result of the calculation cannot be deem sound and reliable, undertakings may refer to the spread of their admissible asset yields over the basic risk-free rate directly, rather than as set out in 1(a)(i) and 1(a)(ii) above.
It should still be ensured that cash is not contributing to the matching adjustment.

(ii) The maximum matching adjustment as calculated according to 1(a) is reduced according to section 4.8.

(iii) The effect of introducing the matching adjustment on the full portfolio of obligations does not exceed the difference between the present value of the asset cash-flows of the admissible assets, discounted with the risk-free interest rate curve, and the present value of the asset cash-flows of the admissible assets, discounted with the risk-free interest rate curve including the MA.[8]

[8] This ensures that the effect on the assets is correctly transferred to the liability side and no overestimation occurs by applying the MA (that is in this case derived on the basis of a sub-portfolio) to the whole portfolio.

7. A simplification may be used to adjust the matching adjustment so that the requirement in paragraph 5 (iii) is met. A potential simplification is the application of the proportion as referred to in paragraph 3 (b) of section 4.6 to the matching adjustment as calculated in accordance with paragraph 5.

8. Where undertakings hold assets with a credit quality inferior to credit quality step 3, the related fundamental spread has to be calculated by the undertaking. As part of the "extended" alternative matching adjustment, the fundamental spread is equal to the credit spread that corresponds to the probability of default of the assets and does not include a component for downgrading risk. For performing the calculation, undertakings should refer to most relevant publications and data to determine a suitable probability of default for those assets (apart from government bonds where the fundamental spreads are provided in Appendix MA2). The data used should be based on a long-term view. A recovery ratio of 30% should be assumed in line with EIOPA's calibrations provided for credit quality steps 0 to 3 (see Appendix MA2 provided by EIOPA on those calibrations).

Specific to "Classic" alternative and "Extended" alternative

9. Regarding assets at credit quality step 3, undertakings should apply the fundamental spread data provided by EIOPA without accounting for the capping mechanism, i.e. the matching adjustment can exceed the one for credit quality step 1 and 2.

4.8 Step 4a: calculation of the application ratio

The methodology for calculating the application ratio described below has been chosen for the purpose of this impact assessment and does not pre-empt any future developments. The design and the calibration will be subject to further technical work following the final outcome of the Solvency II requirements.

Specific to "Extended" standard I and "Extended" alternative

1. The application ratio shall ensure that insurance undertakings incur no losses due to mismatching and forced sales of assets with a probability of 99.5% over the period till run-off of the obligations. Internal models are not to be used for the calculation of the application ratio, i.e. the shocks provided in paragraph 6 and 8 below are to be applied also by internal model users.

2. The application ratio shall apply to all insurance obligations to which this matching adjustment is applied, including those that do not include options for policyholders.

3. The application ratio in respect of a portfolio of eligible obligations shall be calculated according to the following formula:

$$\text{Application ratio} = \max\left(0 , 1 - \frac{discounted - cash - flow - shortfall}{best - estimate}\right)$$

Where:

Discounted-cash-flow-shortfall reflects the mismatch caused by the incidence of lapse risk, mortality risk, disability-morbidity risk and/or life catastrophe risk.

Best-estimate is the best-estimate liability in respect of the portfolio of matched obligations, calculated using the basic risk-free rate only. It should be noted that in case of the negative value for the best-estimate, no application of the matching adjustment can be made.

Where the matching adjustment is negative, no application ratio should be applied.

4. The term *discounted-cash-flow-shortfall* shall be equal to the following:

$$Discounted - cash - flow - shortfall = \sqrt{\sum_{i,j} CorrL_{i,j}.DCFS_i.DCFS_j}$$

Where:

- the sum covers all possible combinations (*i*,*j*) of the risks covered;
- $CorrL_{(i,j)}$ denotes the correlation parameter for life underwriting risk for risks *i* and *j*;
- $DCFS_i$ and $DCFS_j$ denote the discounted cash-flow shortfalls by the incidence of risk *i* and *j* respectively.

5. The correlation parameter CorrL(i,j) referred to in paragraph 10 shall be equal to the item set out in row i and in column j of the following correlation matrix:

i \ *j*	Mortality	Disability	Lapse	Life catastrophe
Mortality	1	0.25	0	0.25
Disability	0.25	1	0	0.25
Lapse	0	0	1	0.25
Life catastrophe	0.25	0.25	0.25	1

6. Depending on the underwriting risks to which the portfolio of life insurance obligations is exposed, the *discounted-cash-flow-shortfall* shall be equal to the sum of net annual discounted cash out-flows after applying the stresses that will occur over the lifetime of the insurance obligations. The net annual discounted cash out-flows are equal to the net discounted cash-flows from the portfolio of obligations (including premium in-flows and any charges applicable on surrender, such as market value adjustments) less the net discounted cash-flows from the assigned portfolio, over the year. Negative net annual discounted cash out-flows should be set to zero. The stresses to be applied are as follows:

a. Lapse: the more severe of the liability cash out-flows associated with an instantaneous lapse of 40% of the policies within the portfolio of matched obligations, and a permanent increase of 50% of the on-going lapse assumptions;

b. Mortality: the liability cash out-flows associated with an instantaneous permanent increase of 15% in the mortality rates;

c. Disability-morbidity: the liability cash out-flows associated with an instantaneous permanent increase of 35% in the disability and morbidity rates in the following 12 months and of 25% for all months after the following 12 months, in combination with an instantaneous permanent decrease of 20% in the disability and morbidity recovery rates in respect of the following 12 months and for all years thereafter.

d. Life CAT: the liability cash out-flows associated with an instantaneous increase of 0.15 percentage point to the mortality rates (expressed as percentages) in the following 12 months.

7. The shocks should only apply to those insurance obligations for which stressed rates lead to an increase in liability cash-flows.

8. If, in accordance with section 4.7, undertakings apply the matching adjustment to the full portfolio of obligations despite not having sufficient admissible assets, the application ratio shall be calculated in respect of the portfolio of admissible assets and the sub-portfolio of insurance obligations as specified in section 4.7.

9. Liquid overnight assets such as cash in the matching portfolio should be considered available to meet cash-flow requirements within the first year only. No cash balances should be taken into account in the calculation of the discounted cash-flow shortfall after the first year.

Paragraph 6 is based on the assumption that insurers will be able to make benefit payments up to one year after those payments fall due. In reality, the insurer should of course be able to make the payment in a much shorter time, at least within a month. However, it seems necessary to relax such a condition in this assessment for reasons of practicability. The derogation refers to this impact assessment exercise only and does not pre-empt any final outcomes of the Solvency II requirements.

Besides, it should be noticed that for insurance obligations subject to SLT health underwriting risks, no stress is provided for insurance obligations subject to Health CAT risk, for practicality reasons.

Specific to <u>"Extended" standard II</u>

8. The application ratio shall be calculated as for "Extended" standard I, but with the stresses amended to reflect a 99.9% severity. The stresses to be applied are as follows:

a. Lapse: the more severe of the liability cash out-flows associated with an instantaneous lapse of 56% of the policies within the portfolio of matched obligations, and a permanent increase of 70% of the on-going lapse assumptions;

b. Mortality: the liability cash out-flows associated with an instantaneous permanent increase of 21% in the mortality rates;

c. Disability-morbidity: the liability cash out-flows associated with an instantaneous permanent increase of 49% in the disability and morbidity rates in the following 12 months and of 35% for all months after the following 12 months, in combination with an instantaneous permanent decrease of 28% in the disability and morbidity recovery rates in respect of the following 12 months and for all years thereafter.

d. Life CAT: the liability cash out-flows associated with an instantaneous increase of 0.21 percentage point to the mortality rates (expressed as percentages) in the following 12 months.

4.9 Example for "Extended" Standard I

Please see separately provided spreadsheet.

4.10 Example for "Extended" Alternative

Please see separately provided spreadsheet.

4.11 Impact of the matching adjustment on the spread risk charge

1. The scenario-based spread risk charge applicable to the obligations to which a matching adjustment, as referred to in paragraph 2(a), 2(b), 2(c), 2(d) and 2(e) of Section 3.2, applies and to the assets of the corresponding assigned portfolio should be calculated as follows:

- To the assets the regular spread risk stress is applicable as would be if the assets were not eligible for the matching adjustment
- For the liabilities a revised matching adjustment which makes partial allowance for the spread stress should be calculated as follows:

$$MA' = (spread + Sup) - (FS + Sup * red\_factor)$$

Where:

Spread and *FS* are the spread as outlined in paragraph 1(a) of Section 4.7 and the relevant fundamental spread;

Sup is equivalent to the 1-year spread stress (called Fup) at the appropriate credit quality step;

Red_factor is as given in the table below:

Credit quality step	0	1	2	3	4	5	6
Reduction factor	0.45	0.50	0.60	0.75	1	1	1

The reduction factors have been set out as part of the framework of the matching adjustment for certain life insurance obligations ("Classic"). For the sake of simplicity, the same reduction factors apply to the other adjustments for the purpose of the Impact Assessment. However, those reduction factors may be revised in the final delegated acts and technical specifications for the adopted matching adjustments in order to take account of the risk of forced sales of assets, which increases undertakings' exposure to spread risk.

5 Detailing of sensitivities

1. Scenarios 1 and 6 include a request for sensitivities to be provided regarding the impact of amending or removing certain conditions to long-term guarantee elements. The following sensitivities are included:

a) If there was no CCP:

It should be assumed that the CCP is not triggered, i.e. the risk free rate term structure does not include the CCP adjustments for the respective obligations (those not meeting the matching adjustment criteria)

b) If the CCP application would be restricted to liabilities with a duration > 7 years:

The obligations initially discounted using the CCP adjusted discount curve (i.e. those not meeting the matching adjustment criteria) shall be split into two parts: those obligations with durations longer than 7 years and all others. Only the obligations with durations longer than 7 years should be discounted with the CCP adjusted discount curve. All others should be discounted applying the non-CCP adjusted risk free rate term structure.

c) If the "classic" MA was subject to alternative conditions:

- The application of the "classic" matching adjustment is restricted to life insurance undertakings. Composite undertakings with a predominate portion of life business should be regarded as life undertakings for this purpose.
- The portfolio of life insurance obligations to which the "classic" matching adjustment is applied and the assigned portfolio of assets are strictly ring-fenced (not just managed, organised or identified separately) from the other activities of the life insurance undertaking, without any possibility of transfer.
- Insurance obligations can be split in line with the approach described for the "extended" matching adjustment standard in section 4.4 paragraph 6.

- The assets allocated to the lowest credit quality step of investment grade assets shall be limited to 10% (rather than 33.33%) of the total value of assigned assets.

All the four conditions listed above should be met at the same time.

d) If assets under the "extended" MA are invested in a hypothetical portfolio:

It should be assumed that the asset composition can be changed instantaneously and without any cost to increase the MA benefit. The changed ("hypothetical") asset composition should be based on assumptions that do not contradict the business reality (e.g. reflecting investment constraints) and good risk management practice. The "extended" Matching adjustment and its impact should be recalculated based on the "hypothetical" portfolio.

e) Netting shortfalls and surpluses for "extended" MA application ratio calculation:

It should be assumed that in section 4.8 (6), negative net annual cash out-flows should not be set to zero provided that they can compensate positive net annual cash-outflows at a later date.

f) If a strict cash-flow matching requirement was to be applied to the "extended" alternative MA:

Future cash-flows of the assigned portfolio of assets need to replicate each of the future cash-flows of the portfolio of insurance obligations in line with the criteria applied for "extended" MA standard I & II.

g) If a fixed asset cash-flow requirement was to be applied to the "extended" alternative MA:

Assets need to have fixed cash-flows in line with the criteria applied for "extended" MA standard I & II.

h) If a credit quality limit was to be applied to the "extended" alternative MA:

The 33.33% limit to assets of credit quality step 3 applies in line with the criteria applied for "extended" MA standard I & II. And at the same time, the

MA of those assets of credit quality steps 3 should not exceed the higher of MA for credit quality steps 1 and 2.

i) If the alternative "extended" MA was done with the extended MA conditions for MA level:

The fundamental spread shall be:

- equal to the sum of the following: (i) the credit spread corresponding to the probability of default of the assets; and (ii) the credit spread corresponding to the expected loss resulting from downgrading of the asset.
- no lower than 80 % of the long term average of the spread over the basic risk free interest rate of assets of the same duration, credit quality and asset class, as observed in financial markets.

The probability of default referred to under (i) shall be based on long-term default statistics that are relevant for the asset in relation to its duration, credit quality and asset class.

2. Simple estimation approaches to determine the outputs for those sensitivities are allowed.

Appendix MA1: Association of credit assessments with credit quality steps

The credit assessments of an External Credit Assessment Institution (ECAI) are to be associated with the following credit quality steps:

Credit assessment provided by ECAIs		Credit quality steps associated
Standard & Poor's/Fitch	**Moody's**	
AAA	Aaa	0
AA	Aa	1
A	A	2
BBB	Baa	3
BB	Ba	4
Lower than BB, unrated	Lower than Ba, unrated	5-6, -

Appendix MA2: Fundamental Spreads provided by EIOPA

Please see separately provided spreadsheets named MA2. Undertakings should contact their NSA via the Q&A process in case relevant government bond fundamental spread data are missing, EIOPA might be able to provide these upon request.

It should also be noted that for all currencies apart from GBP, the EUR fundamental spreads should be applied for corporate bonds.

Appendix DC1: Summary of data sources and input parameters for all currencies

Currency	Abbr.	Bloomberg code of ref. instr.	LLP (Y)	Credit rate adjustment			UFR (%)	Convergence Speed (Y)	
				30/12/2011	31/12/2009	31/12/2004		Scenario 0 & 5	Scenario 1-4 & 6-12
Euro	EUR	EUSAYY	30/20	35	20	10	4.2	40	10
British pound	GBP	BPSWYY	50	35	20	10	4.2	40	10
US Dollar	USD	USSWYY	30	35	20	10	4.2	40	10
Japanese Yen	JPY	JYSWYY	20	35	20	10	4.2	40	10
Swiss Franc	CHF	SFSWYY	15	35	20	10	4.2	40	10
Swedish Krona	SEK	SKSWYY	10	35	20	10	4.2	40	10
Danish Krone**	DKK	EUSAYY	30/20	35	20	10	4.2	40	10
Norwegian Krone	NOK	NKSWYY	10	35	20	10	4.2	40	10
Czech Koruna	CZK	CKSWYY	15	35	20	10	4.2	40	10
Polish Zloty (1)	PLN	C119XX	10	35	20	10	4.2	40	10
Hungarian Forint	HUF	HFSWYY	15	35	20	10	4.2	40	10
Romanian Lei	RON	RNSWYY	10	35	20	10	4.2	40	10
Bulgarian Lev	BGN	EUSAYY	30/20	35	20	10	4.2	40	10
Turkish Lira	TRY	TYSWYYV3	10	35	20	10	4.2	40	10
Iceland Krona*	ISK	IKSWYY	5	35	20	10	4.2	40	10
Estonian Kroon	EKK	EUSAYY	30/20	35	20	10	4.2	40	10
Latvian Lats	LVL	EUSAYY	30/20	35	20	10	4.2	40	10
Lithuanian Litas	LTL	EUSAYY	30/20	35	20	10	4.2	40	10
Canadian Dollar	CAD	CDSWYY	20	35	20	10	4.2	40	10
Australian Dollar	AUD	ADSWYY	30	35	20	10	4.2	40	10
Singaporean Dollar	SGD	SDSWYY	20	35	20	10	4.2	40	10
Malaysian Ringgit*	MYR	MRSWYY	5	35	20	10	4.2	40	10
South Korean Won*	KRW	KWSWYY	10	35	20	10	4.2	40	10
Thai Baht*	THB	TBSWYY	10	35	20	10	4.2	40	10
Hong Kong Dollar	HKD	HDSWYY	10	35	20	10	4.2	40	10
Taiwanese Yuan*	TWD	NTSWYY	10	35	20	10	4.2	40	10
Chinese Yuan Renminbi*	CNY	CCSWYY	15	35	20	10	4.2	40	10
South African Rand	ZAR	SASWYY	30	35	20	10	4.2	40	10
Mexican New Peso	MXN	MPSWYY	20	35	20	10	4.2	40	10
Indian Rupee*	INR	IRSWYY	10	35	20	10	4.2	40	10
Brazilian Real*	BRL	BCSWYY	10	35	20	10	4.2	40	10

* For these currencies data are not available at this stage, i.e. no discount curves are provided.

** Treated as currncy pegged to the euro.

(1) For the Polish zloty government bond curves are used instead of swap curves.

Appendix DC2: Assessment of the entry point into extrapolation (last liquid point, LLP)

The entry point to extrapolation is determined as the minimum of:

- the highest maturity for which markets for reference instruments that fulfil the ADLT criteria are available, and
- the highest maturity where the general (overall) bond market can be considered as active, deep, liquid and transparent.

The entry point to extrapolation or last liquid point (LLP) is equal to the minimum of the last liquid point for the reference instruments and the last liquid point for bonds in general. Where the markets for the reference instruments or where bonds in that currency do not meet the criteria of Art. 34 (3) TP21 of the implementing measures for longer maturities, the basic risk free interest rate term structure for these maturities is extrapolated.

ADLT assessment for reference instruments and the general bond market

The general bond market refers to all bonds in a currency, i.e. sovereigns plus corporate (including financial) bonds. When assessing whether a market is transparent it needs to be assessed at least:

a) appropriateness of data provider choice;

b) frequency of data update;

c) simple availability checks, and

d) plausibility checks and monitoring.

In addition, an assessment of depth and liquidity has to be performed both for the reference instruments as well as for the general bond market.

A market is assumed deep if transactions involving a large quantity of financial instruments used in the replications can take place without significantly affecting the price of the instruments. Conversely, a market is liquid if financial instruments can readily be converted through an act of buying or selling without causing a significant movement in the price.

There are a number of methods to measure whether a market fulfils the aforementioned definitions. A non-exhaustive list of indicators for the assessment of depth and liquidity in a market is described below:

- Bid-ask spread: the price difference between the highest price a buyer would pay and the lowest price for which a seller would settle
- Trade frequency: number of trades that take place within a defined period of time
- Trade volume
- Trader quotes/dealer surveys (incl. dispersion of answers)
- Quote counts (1): number of dealer quotes within a few day window
- Quote counts (2): number of dealers quoting
- Number of pricing sources
- Assessment of large trades and movement of prices (depth)
- Residual volume approach (for bonds only)

For the bond market, the assessment includes an analysis of the ability of insurers to match their insurance liabilities with bonds. Where it would no longer be possible for insurers to match insurance liabilities with bonds of the same currency, this is reflected in the last liquid point. The assessment of the reference instrument(s) and the general bond market are performed independently of each other.

The consideration of a number of different measures/indicators takes account of a number of issues. First, liquidity (including depth) is an abstract concept that essentially measures to what extent supply meets demand. There are essentially three principal dimensions to liquidity: depth (the amount of trade volume that can be executed without impacting price), tightness (or breadth; the ease of purchase/sale or the ratio of suppliers/demanders, typically measured by the bid ask spread) and resilience (the amount of time before prices return to pre-large trade levels. None of the proxies is able to cover perfectly all dimensions of liquidity, notwithstanding the fact that the indicators may also be "diluted" by factors unrelated to liquidity.

Second, markets can considerably differ, e.g. in size, and one all-encompassing methodology may not appropriately capture this difference. Furthermore, a single indicator may not capture well enough new market developments. For the

aforementioned reasons, common thresholds for all currencies are also not appropriate and may be inconsistent with some of the general requirements for the risk free rate, such as robustness, practicability, or incentive effects. The analysis shall have regard to the specificities of the market and apply expert judgement where appropriate.

Hence, it is advisable to look at a number of indicators in conjunction and draw the conclusions based on a joint assessment. Past research on quantitative measures for liquidity appears to be inconclusive on what would be the best proxy. The bid-ask spread seems to be the most common measure. It is simple, most abundant and directly related to supply and demand. However, it is silent on the market depth. Moreover, some large volume trades do not trade within the bid-ask spread, i.e. sellers offer some discount or buyers buy at a premium, and some orders such as immediate-or-cancel and all-or-nothing may not go onto the order book.

Appendix DC3: Background material on the credit risk adjustment

Swap rates constitute the primary calculation basis for the derivation of the risk free term structure under Solvency II. Although government bonds should be used as substitutes to swaps, if no active swap market exists in a given currency at given maturities, it is safe to assume for practicality reasons, and thus solely for the purpose of this assessment, that mainly swap rates will be used. For this reason the credit and basis risk adjustment is structured mainly to filter out the credit risk from swap rates.

Regarding the modalities of the risk adjustment, it is observed that:

- The same adjustment is applied to all currencies (i.e. the credit risk adjustment has the same size in basis points for all currencies);
- The adjustment is applied uniformly across all maturity points (i.e. a parallel shift of the observed swap term structure is done to cater for credit risk);
- The adjustment varies over time.

Furthermore, it is acknowledged that only a very limited amount of "direct" counter party credit risk pertains to swap agreements, since: (1) swap counterparties typically have to fulfil minimum credit rating eligibility requirements; (2) there are exit clauses if such minimum rating thresholds are passed after the initialisation of the swap; (3) credit enhancement is provided by collateral and mark-to-market arrangements; (4) credit risk is assumed only over the reset period of the swap. While the "direct" swap counterparty risk is minute, and can be assumed away for the purposes of the long-term guarantee assessment, the swap rates are still not risk-free. It is observed that the rates underlying swap agreements carry counterparty risk, since they originate from unsecured interbank market transactions. For example, the floating leg of Euro area swaps is based on Euribor rates. Given that the floating leg is reflecting counterparty credit risk, also the fixed will embed credit risk, since in an efficient market the fixed leg will be based on expectations to future realisations of the floating rate, over the duration of the swap arrangement. This "indirect" type of credit risk, which is assumed to also account for basis risk, is the material reason why observed swap rates need to be adjusted.

Previous EIOPA exercises, e.g. QIS5 and Stress Tests, have assumed a 10bp credit risk adjustment. While a framework for the determination of the credit risk adjustment is still under preparation and without prejudging the outcome are these works in any way or form, for the purpose of the LTGA the determination of the adjustment takes into account the difference of swap and overnight rates.

The adjustment is based on an indicator that is generally accepted and widely used as a gauge for the "health" of the banking sector and expresses the difference between the price of unsecured lending and the price of lending over one-day, where the latter can be seen as "secure lending" although there are no risk mitigation applied apart from the short duration of the operation.

Based on an analysis of the overnight market compared to the swap market, it is suggested to use an adjustment of 35bp for the reference day of 30/12/2011.

Appendix DC4: Setting the ultimate forward rate

Components of the Ultimate Forward Rate

The assumption for the extrapolation in Solvency II is that the forward rates at the long end of the term structure converge to a macro-economically assessed ultimate forward rate (UFR). While being subject to regular revision, the ultimate long term forward rate should be stable over time and only change due to changes in long-term expectations.

The most important economic factors explaining long term forward rates are long-term expected inflation and expected real interest rates. From a theoretical point of view it can be argued that there are at least two more components: the expected long-term nominal term premium and the long-term nominal convexity effect.

The term premium represents the additional return an investor may expect on risk-free long dated bonds relative to short dated bonds, as compensation for the longer term investment. This factor can have both a positive and a negative value, as it depends on liquidity considerations and on preferred investor habitats.

The convexity effect arises due to the non-linear (convex) relationship between interest rates and the bond prices used to estimate the interest rates. This is a purely technical effect and always results in a negative component.

According to guidance from trilogue parties, the UFR shall not contain any term premium. The assessment of the UFR is based on the estimates of the expected inflation and the expected short term real rate only.

Making assumptions about expectations this far in the future for each economy is difficult. However, in practice a high degree of convergence in forward rates can be expected when extrapolating at these long-term horizons.

Depending on the scenario, the UFR is reached within 10 or 40 years past the last liquid point (LLP) in the sense that it is reasonably close (i.e. not more than 3 BP away) to the UFR.

For reasons of pragmatism and the fact that it is impossible to credibly assess nominal interest rates , EIOPA suggests to use only one UFR, currently set at 4.2% (i.e. 2.2% long term growth rate and 2% inflation rate assumption). Nevertheless, EIOPA is cognisant of the fact that these are simplifying assumptions and hence invites participants to share their view on this approach. EIOPA is particularly interested of whether industry sees a need for further buckets in particular where the UFR is reached within 10 years past the LLP.

Estimation of expected long term inflation rate

The inflation data for the OECD-countries in the period 1994 – 2010, with price index (MEI) = Consumer prices - Annual inflation, are shown in Table 2 below.

Table 2: Inflation 1994 – 2009 OECD Countries and some Non-OECD members

Subject		Consumer prices: all items																
Measure		Growth on the same period of the previous year																
Frequency		Annual																
Time		94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
Country																		
Australia		1,9	4,6	2,6	0,3	0,9	1,5	4,5	4,4	3,0	2,8	2,3	2,7	3,5	2,3	4,4	1,8	2,8
Austria		3,0	2,2	1,9	1,3	0,9	0,6	2,3	2,6	1,8	1,4	2,1	2,3	1,4	2,2	3,2	0,5	1,8
Belgium		2,4	1,5	2,1	1,6	0,9	1,1	2,5	2,5	1,6	1,6	2,1	2,8	1,8	1,8	4,5	-0,1	2,2
Canada		0,2	2,1	1,6	1,6	1,0	1,7	2,7	2,5	2,3	2,8	1,9	2,2	2,0	2,1	2,4	0,3	1,8
Chile		0,7	0,7	7,4	6,1	5,1	3,3	3,8	3,6	2,5	2,8	1,1	3,1	3,4	4,4	8,7	0,4	1,4
Czech Republic		10,0	9,1	8,8	8,5	10,7	2,1	3,9	4,7	1,8	0,1	2,8	1,9	2,6	3,0	6,3	1,0	1,5
Denmark		2,0	2,1	2,1	2,2	1,8	2,5	2,9	2,3	2,4	2,1	1,2	1,8	1,9	1,7	3,4	1,3	2,3
Estonia		..	..	..	..	8,7	3,3	4,0	5,7	3,6	1,3	3,0	4,1	4,4	6,6	10,4	-0,1	3,0
Finland		1,1	0,8	0,6	1,2	1,4	1,2	3,0	2,6	1,6	0,9	0,2	0,6	1,6	2,5	4,1	0,0	1,2
France		1,7	1,8	2,0	1,2	0,6	0,5	1,7	1,6	1,9	2,1	2,1	1,7	1,7	1,5	2,8	0,1	1,5
Germany		2,8	1,8	1,4	1,9	1,0	0,6	1,4	1,9	1,5	1,0	1,7	1,5	1,6	2,3	2,6	0,4	1,1
Greece		10,9	8,9	8,2	5,5	4,8	2,6	3,2	3,4	3,6	3,5	2,9	3,5	3,2	2,9	4,2	1,2	4,7
Hungary		18,9	28,3	23,5	18,3	14,2	10,0	9,8	9,1	5,3	4,7	6,7	3,6	3,9	8,0	6,0	4,2	4,9
Iceland		1,6	1,7	2,3	1,8	1,7	3,2	5,1	6,4	5,2	2,1	3,2	4,0	6,7	5,1	12,7	12,0	5,4
Ireland		2,4	2,5	1,7	1,4	2,4	1,6	5,6	4,9	4,6	3,5	2,2	2,4	3,9	4,9	4,1	-4,5	-0,9
Israel		12,4	10,0	11,3	9,0	5,4	5,2	1,1	1,1	5,7	0,7	-0,4	1,3	2,1	0,5	4,6	3,3	2,7
Italy		4,1	5,2	4,0	2,0	2,0	1,7	2,5	2,8	2,5	2,7	2,2	2,0	2,1	1,8	3,3	0,8	1,5
Japan		0,7	-0,1	0,1	1,8	0,7	-0,3	-0,7	-0,8	-0,9	-0,2	0,0	-0,3	0,2	0,1	1,4	-1,3	-0,7
Korea		6,3	4,5	4,9	4,4	7,5	0,8	2,3	4,1	2,8	3,5	3,6	2,8	2,2	2,5	4,7	2,8	2,9
Luxembourg		2,2	1,9	1,2	1,4	1,0	1,0	3,2	2,7	2,1	2,0	2,2	2,5	2,7	2,3	3,4	0,4	2,3
Mexico		7,0	35,0	34,4	20,6	15,9	16,6	9,5	6,4	5,0	4,5	4,7	4,0	3,6	4,0	5,1	5,3	4,2
Netherlands		2,8	1,9	2,0	2,2	2,0	2,2	2,3	4,2	3,3	2,1	1,2	1,7	1,2	1,6	2,5	1,2	1,3
New Zealand		1,7	3,8	2,3	1,2	1,3	-0,1	2,6	2,6	2,7	1,8	2,3	3,0	3,4	2,4	4,0	2,1	2,3
Norway		1,4	2,4	1,2	2,6	2,3	2,3	3,1	3,0	1,3	2,5	0,5	1,5	2,3	0,7	3,8	2,2	2,4
Poland		33,0	28,0	19,8	14,9	11,6	7,2	9,9	5,4	1,9	0,7	3,4	2,2	1,3	2,4	4,2	3,8	2,6
Portugal		5,4	4,2	3,1	2,3	2,8	2,3	2,9	4,4	3,6	3,3	2,4	2,3	3,1	2,5	2,6	-0,8	1,4
Slovak Republic		13,4	9,8	5,8	6,1	6,7	10,6	12,0	7,3	3,1	8,6	7,5	2,7	4,5	2,8	4,6	1,6	1,0
Slovenia		21,0	13,5	9,9	8,4	7,9	6,2	8,9	8,4	7,5	5,6	3,6	2,5	2,5	3,6	5,7	0,9	1,8
Spain		4,7	4,7	3,6	2,0	1,8	2,3	3,4	3,6	3,1	3,0	3,0	3,4	3,5	2,8	4,1	-0,3	1,8
Sweden		2,2	2,5	0,5	0,7	-0,3	0,5	0,9	2,4	2,2	1,9	0,4	0,5	1,4	2,2	3,4	-0,5	1,2
Switzerland		0,9	1,8	0,8	0,5	0,0	0,8	1,6	1,0	0,6	0,6	0,8	1,2	1,1	0,7	2,4	-0,5	0,7
Turkey		105,2	89,1	80,4	85,7	84,6	64,9	54,9	54,4	45,0	21,6	8,6	8,2	9,6	8,8	10,4	6,3	8,6
United Kingdom		2,0	2,7	2,5	1,8	1,6	1,3	0,8	1,2	1,3	1,4	1,3	2,0	2,3	2,3	3,6	2,2	3,3
United States		2,6	2,8	2,9	2,3	1,6	2,2	3,4	2,8	1,6	2,3	2,7	3,4	3,2	2,9	3,8	-0,4	1,6
Euro area (17 countries)		..	..	..	1,7	1,2	1,2	2,2	2,4	2,3	2,1	2,2	2,2	2,2	2,1	3,3	0,3	1,6
European Union (27 countries)		..	..	..	7,3	4,6	3,0	3,5	3,2	2,5	2,1	2,3	2,3	2,3	2,4	3,7	1,0	2,1
G7		2,2	2,3	2,3	2,0	1,3	1,4	2,2	2,0	1,3	1,8	2,0	2,4	2,4	2,2	3,2	-0,1	1,4
OECD - Europe		8,6	8,7	7,6	7,2	7,0	5,4	5,7	5,6	4,9	3,0	2,4	2,4	2,6	2,7	3,9	1,2	2,4
OECD - Total		4,8	6,1	5,7	4,8	4,2	3,6	4,0	3,7	2,8	2,4	2,3	2,6	2,6	2,5	3,7	0,5	1,9
OECD - Total excluding high inflation countries		2,4	2,5	2,4	2,1	1,6	1,5	2,6	2,5	1,7	2,0	2,2	2,5	2,5	2,3	3,5	0,4	..
Non-OECD Member Econ.	Brazil	2075,9	66,0	15,8	6,9	3,2	4,9	7,0	6,8	8,5	14,7	6,6	6,9	4,2	3,6	5,7	4,9	5,0
	China	24,3	16,8	8,3	2,8	-0,8	-1,4	0,4	0,7	-0,8	1,2	3,9	1,8	1,5	4,8	5,9	-0,7	3,3
	India	10,2	10,2	9,0	7,2	13,2	4,7	4,0	3,8	4,3	3,8	3,8	4,2	5,8	6,4	8,3	10,9	12,0
	Indonesia	8,5	9,5	8,0	6,2	58,4	20,5	3,7	11,5	11,9	6,8	6,1	10,5	13,1	6,4	10,2	4,4	5,1
	Russian Federat.	307,5	197,5	47,9	14,7	27,8	85,7	20,8	21,5	15,8	13,7	10,9	12,7	9,7	9,0	14,1	11,7	6,9
	South Africa	8,9	8,7	7,4	8,6	6,9	5,2	5,3	5,7	9,5	5,7	-0,7	2,1	3,2	6,2	10,1	7,2	4,1

Data extracted on 06 Oct 2011 10:56 UTC (GMT) from OECD.Stat

Singapore, Malaysia, Thailand, Hong Kong and Taiwan are not included in the list from the OECD database. The data for these currencies are taken from Eco-Win (Reuters) database, and presented in Table 3 below.

Table 3: Inflation 1994-2010 Certain Asian Countries

Country		Year								
	Consumer Prices	1994	1995	1996	1997	1998	1999	2000	2001	
Hong Kong,	CPI, Total, Index, 2004-05=100	9,6 %	7,0 %	6,7 %	5,2 %	-1,6 %	-4,0 %	-2,1 %	-3,6 %	
Malaysia,	Total, Index, 2005=100	3,5 %	3,2 %	3,3 %	2,9 %	5,3 %	2,5 %	1,2 %	1,2 %	
Singapore,	All items, Index, 2009=100	2,9 %	0,8 %	2,0 %	2,0 %	-1,4 %	0,7 %	2,1 %	-0,6 %	
Thailand,	Total, Index, 2007=100	4,7 %	7,5 %	4,7 %	7,7 %	4,3 %	0,6 %	1,5 %	0,7 %	
Taiwan,	Total, Index, 2006=100	2,7 %	4,6 %	2,5 %	0,3 %	2,1 %	0,1 %	1,6 %	-1,7 %	

Country										
	Consumer Prices	2002	2003	2004	2005	2006	2007	2008	2009	2010
Hong Kong,	CPI, Total, Index, 2004-05=100	-1,5 %	-1,9 %	0,3 %	1,4 %	2,3 %	3,8 %	2,0 %	1,3 %	3,3 %
Malaysia,	Total, Index, 2005=100	1,7 %	1,2 %	2,1 %	3,2 %	3,1 %	2,4 %	4,4 %	1,1 %	2,0 %
Singapore,	All items, Index, 2009=100	0,4 %	0,7 %	1,3 %	1,3 %	0,8 %	3,7 %	5,5 %	-0,5 %	4,6 %
Thailand,	Total, Index, 2007=100	1,7 %	1,7 %	3,0 %	5,8 %	3,5 %	3,2 %	0,4 %	3,5 %	3,0 %
Taiwan,	Total, Index, 2006=100	0,8 %	-0,1 %	1,6 %	2,2 %	0,7 %	3,3 %	1,3 %	-0,2 %	1,2 %

The inflation rate that we have to estimate has to cover the expected one-year inflation rate 20 - 60 years from now, and beyond. The expected inflation should not solely be based on historical averages of observed data, as the high inflation rates of the past century do not seem to be relevant for the future. The fact is that in the last 15-20 years many central banks have set an inflation target or a range of inflation target levels and have been extremely successful in controlling inflation, compared to previous periods.

In order to have a robust and credible estimate for the UFR, the standard expected long term inflation rate is set to 2 per cent per anno, consistently to the explicit target for inflation most central banks operate with.

It is arbitrary to say whether the inflation differences we see today and have seen the last 15-16 years will persist up to 60 -100 years into the future. It is therefore suggested to apply an inflation rate of 2% for each currency.

Estimation of expected real rate of interest

We expect that the real rates should not differ substantially across economies as far out as 100 years from now. Elroy Dimson, Paul Marsh and Mike Staunton provide a global comparison of annualized bond returns over the last 111 years (1900 to 2010) for the

following 19 economies: Belgium, Italy, Germany, Finland, France, Spain, Ireland, Norway, Japan, Switzerland, Denmark, Netherlands, New Zealand, UK, Canada, US, South Africa, Sweden and Australia[9].

Figure 1: Real return on bonds 1900 – 2010

Source: Dimson, Marsh and Staunton – Credit Suisse Global Investment Returns Yearbook 2011

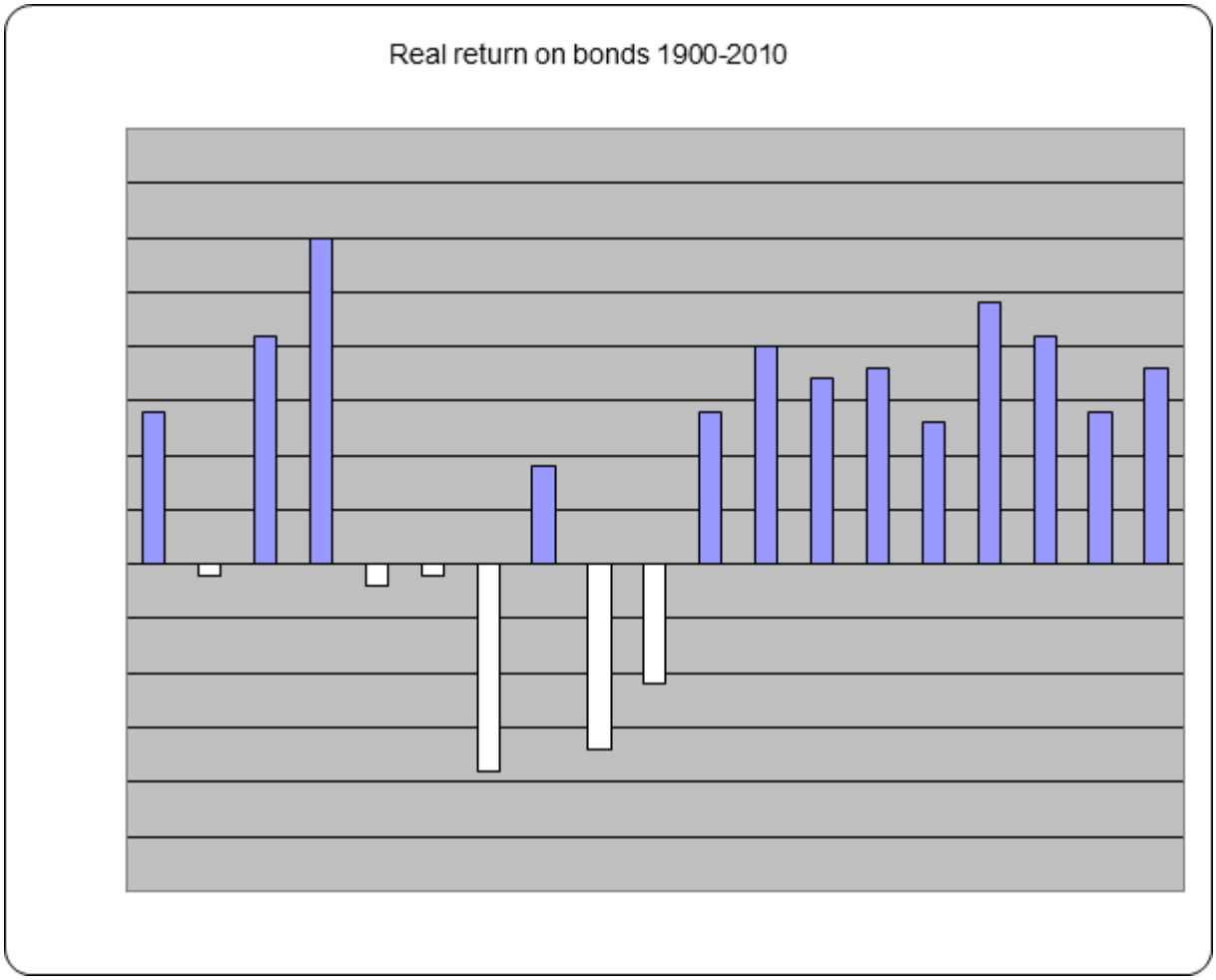


Figure 1 shows that, while in most countries bonds gave a positive real return, six countries experienced negative returns. Mostly the poor performance dates back to the first half of the 20th century and can be explained with times of high or hyperinflation[10].

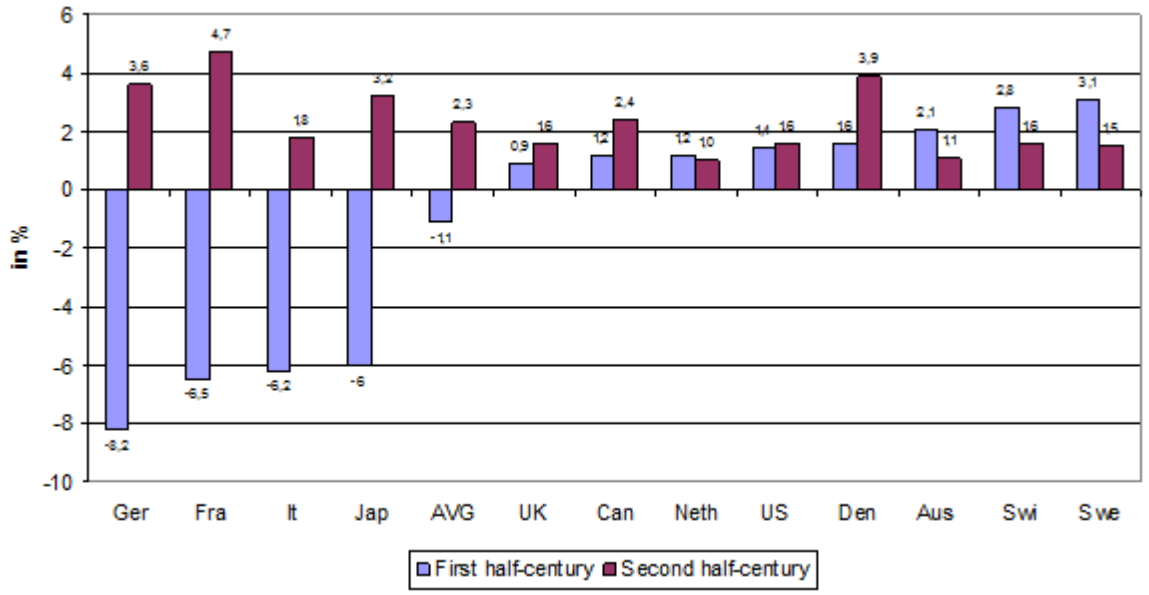
[9] Credit Suisse Global Investment Returns Yearbook 2010, To be found at www.tinyurl.com/DMS2010

[10] German hyperinflation in 1922/1923, in Italy an inflation of 344% in 1944, in France 74% in 1946 and in Japan 317% in 1946.

Aggregating the real returns on bonds for each currency[11] to an annual rate of real return on globally diversified bonds gives a rate of 1.6 per cent.

In an earlier publication, the same authors compared the real bond returns from the second versus the first half of the 20th century for the following 12 economies: Italy, Germany, France, Japan, Switzerland, Denmark, Netherlands, UK, Canada, US, Sweden and Australia[12]. The average real bond return over the second half of the 20th century was computed as annually 2.3 per cent (compared to -1.1 percent for the first half of the 20th century).

*Figure 2: Real bond returns: first versus second half of 20th century**
Source: Dimson, Marsh and Staunton (ABN-Amro/London Business School)



* Data for Germany excludes 1922-23. AVG = Average

In light of the above data, 2.2 per cent, the expected real interest rate that was assessed for QIS5 continues to be an adequate estimate for the expected real interest rate.

[11] Average where each return is weighted by its country's GDP.

[12] Elroy Dimson, Paul Marsh and Mike Staunton: Risk and return in the 20th and 21th, Business Strategy Review, 2000, Volume 11 issue 2, pp 1-18. See Figure 4 on page 5. The article can be downloaded at: http://docs.google.com/viewer?a=v&q=cache:07V7vM0gu5oJ:citeseerx.ist.psu.edu/viewdoc/download%3Fdoi%3D10.1.1.11.7613%26rep%3Drep1%26type%3Dpdf+Risk+and+return+in+the+20th+and+21th+Centuries&hl=no&gl=no&sig=AHIEtbQbxwuXZNO6ViVlqkV0KZ63LKhB0g

Appendix DC5: Discount curves provided by EIOPA

See separate spreadsheet containing the relevant discount curves for all scenarios and most currencies is provided named DC5. Undertakings should contact their NSA via the Q&A process in case relevant currencies are missing, EIOPA might be able to provide these upon request. Alternatively, EIOPA can also provide the "MatLab" implementation code of the Smith-Wilson model for undertakings to construct those missing curves themselves.

Appendix DC6: Background material on the Smith-Wilson method

This appendix briefly describes how the Smith-Wilson (SW) extrapolation method has been implemented to calculate discount curves relevant for the LTGA.

The SW method applied here follows closely the implementation structure outlined in the EIOPA document entitled "Risk-free interest rates – Extrapolation method", which was drafted to support the QIS5 exercise.

At the outset, SW assumes that the price of a zero coupon rate can be expressed in the following way:

$$P(\tau_t) = e^{-UFR*\tau_t} + \sum_{k=1}^{K} z_k * \sum_{j=1}^{J} c_{k,j} * W(\tau_t, \tau_j) + e(\tau_t), \quad [1]$$

as a function of coupon paying bonds. The variable P denotes the price of a zero coupon bond, e is the exponential function, z_k denotes a set of parameter to be estimated (one parameter for each k), and K is equal to the number of observed bonds/rate points on the maturity scale. There are two maturity counting variables, τ_t and τ_j, that both span the whole set of maturities, at which bonds/rates are observed. The first maturity variable, τ_t, maps the rows of the Wilson function W, and the other maturity variable, τ_j, maps the columns of W: where the former can be interpreted as the maturities at which the final curves is observed, i.e. comprising observed, interpolated and extrapolated maturities, and where the latter contains the maturities at which bond coupon payments are observed. W in the Wilson function serves a purpose akin to the loading matrix in a "traditional" yield curve factor model, e.g. the Nelson-Siegel model or an affine multifactor yield curve model. However, whereas yield curve models traditionally are formulated and estimated on the basis of yield curve data, the Smith-Wilson model is calibrated to the prices of the corresponding fixed income securities. And, the matrix W therefore represents "loadings" for prices at different maturities, and not for yields directly. In other words, the Smith-Wilson methods calibrates the observed rates to the discount function rather than to the yield curve, however, as there if a simple mapping between these two metrics, it is easy to convert the extrapolated discount function to the corresponding discount rate term structure.

The Wilson function is defined in the following way:

$$W(\tau_t, \tau_j) = e^{-UFR*(\tau_t+\tau_j)} * \left\{ a * min(\tau_t, \tau_j) - e^{-a*\max(\tau_t,\tau_j)} * sinh\left[a * min(\tau_t, \tau_j)\right] \right\}. \quad [2]$$

It is observed that this function is symmetric, and approaches zero as τ_t and τ_j increases in value (goes to infinity). It is this latter attribute that facilitates the convergence of the discount curve to the UFR, as seen in equation 1. While these features of the Wilson function may not be immediately clear when inspecting equation 2, a graphical representation can provide some added insights.

Figure 1: An example of the Wilson function

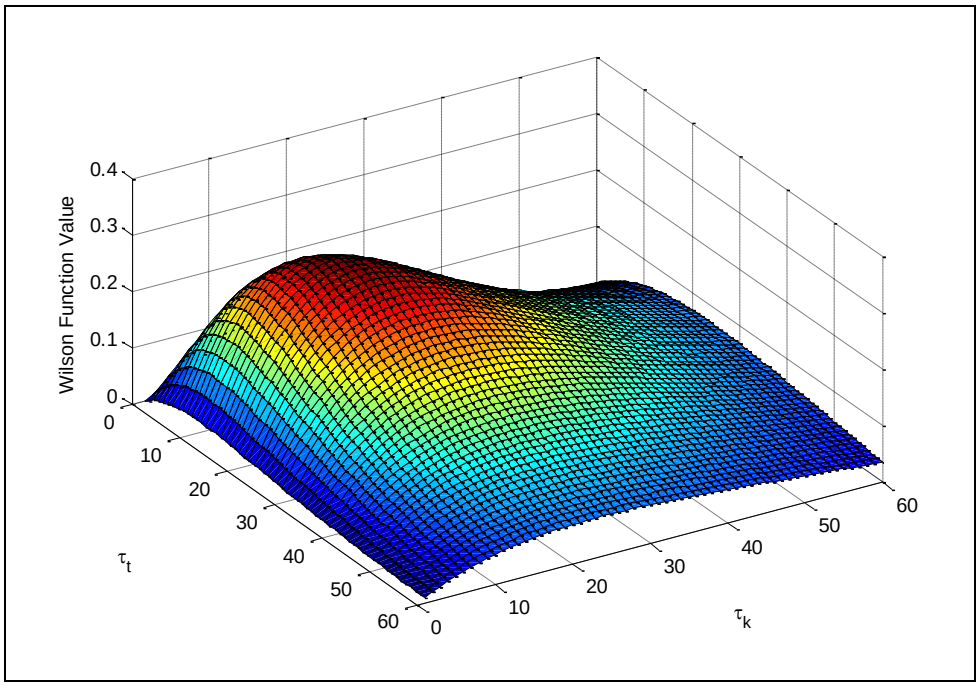


Figure 1 shows an example of the Wilson function for maturities from 1 to 60 years, using a convergence speed of a=0.10.

For the practical application of the Smith-Wilson model it is advantageous to work in matrix notation. As seen in Figure 1, the Wilson function is a symmetric matrix W, defined on the basis of maturity vectors. For the calibration work (τ_j) is be set equal to the maturities at which the calculation basis rate is observed. For the calculation of the final interpolated and extrapolated discount curve (τ_t) is set equal to maturities from 0 to 150 years, where steps of one month is used for maturities below one year, and steps of one year is used for the remaining maturities.

Following the above mentioned EIOPA QIS5 document, the Smith-Wilson method can be written in matrix form as:

$$M = C * u + (C * W * C') * z. \qquad [3]$$

Where M is a vector of ones, expressing that the observed coupon paying bonds are priced at par. This assumption is true under normal market circumstances for bonds, and

probably true in general for our implementation that is based on swap rates. C is a matrix that contains the coupon payments for each bond/swap rate. Effectively, C is a K-by-J matrix, W is the Wilson function and u collects the values of the exponential function in.

It follows from [3] that the SW parameters contained in z can be calculated in the following way:

$$z = (C * W * C')^{-1} * (m - C * u). \quad [4]$$

Armed with the z values, the SW interpolation and extrapolation method follows the matrix version of [1]:

$$P = u + (C * W) * z. \quad [5]$$

The resulting vector P is converted into a discount rate curve by $r_c = \frac{1}{\tau_t} * log\left(\frac{1}{\hat{p}}\right)$, if continuously compounded rates are needed, and $r_d = \left(\frac{1}{\hat{p}}\right)^{\frac{1}{\tau_t}} - 1$, if annually compounded rates are needed.