# Technical explanation of 2015 Field Testing yield curves derivation

The approach used by the IAIS for the derivation of the yield curves has been developed for 2015 Field Testing purposes and will be reviewed on the basis of the Field Testing results and additional feedback collected from Volunteers (e.g. through the Qualitative Questionnaire).

## Methodology description:

The Smith-Wilson methodology allows determining the parameters of a continuous pricing function out of a set of observed market prices. The price function obtained is the market price at valuing time for a zero coupon bond paying 1 at some future date t (the maturity).

This continuous function then allows computing a price for any maturity, whether matching the observed market prices maturities, in-between the maturities of observed market prices (interpolation), or beyond the last reliably observed maturity (extrapolation).

A property of the pricing function obtained by applying the Smith-Wilson methodology is the ability to replicate an observed market price when the maturity matches with an observed market price. This provides a level of market consistency sometime missing in alternative interpolation and/or extrapolation methodologies.

Another characteristic of this methodology, due to the properties of the mathematical functions around which the Wilson pricing function are built, is to produce a derivable pricing function. The derivative of this pricing function is also derivable. This allows obtaining a forward intensity (continuous version of the forward rate) with a "smooth" shape, meaning there are valuable mathematical properties of this derivative.

In order to be able to produce a pricing function going beyond the longest maturity for which a market price can be reliably observed, a long term anchor for the pricing function is needed. A final parameter, called “alpha” is then needed to set the speed of convergence between the last reliably observed market instrument and the long term anchor.

In the Smith-Wilson method the pricing function P(t), for all t>0, is set up as the sum of a term e-LTFR.t for the asymptotical long term behaviour of the discount factor and a linear combination of N kernel functions Ki(t), i=1,2,…,N (the number N of kernel functions being equal to the number of observed maturities).

The conceptual process of using this methodology to produce a yield curve is to select a set of observed market instruments, determine the external parameters needed (long term anchor defined as the Long Term Forward Rate and speed of convergence “alpha”) and obtain as a result the list of parameters.

## Currencies provided:

Yield curves have been derived for the top 35 traded currencies (see page 12 of <http://www.bis.org/publ/rpfx13fx.pdf>), see embedded spreadsheet.



## Basic curve implementation choices:

1. For the sake of the Field Testing 2015, market prices mostly based on swaps have been collected from a commercial data provider[[1]](#footnote-1). To acknowledge that these instruments are only a proxy of risk free observations, a flat 10 basis point adjustment has been applied on these raw market observations. Given the usually decreasing liquidity of instruments of longer maturities, the set of observed instrument has been capped at 30 Years. For a number of currencies, the practical set of observed maturities stops at an earlier maturity[[2]](#footnote-2).
2. The Long Term Forward Rate has been determined using a simple macro-economic approach by adding two components: a long term objective for inflation and a long term forecast for average growth. Both of these components have been set according to the high level results of a recent OECD macroeconomic long term forecast[[3]](#footnote-3).
3. Given that the OECD study retains a single target time for all countries, the speed of convergence has been determined in a reverse way. For each currency the “alpha” parameter retained is the parameter allowing a forward rate within 1 basis point of the asymptotic long term target at the common convergence target of 60 years to be reached.

## Adjustment:

Field Testing 2015 necessitates for each currency two sets of yield curves: an adjusted curve for discounting purposes and an unadjusted curve which is needed to determine the magnitude of the interest rate stresses[[4]](#footnote-4) as well as the discounting factors for the Consistent and Comparable MOCE under a Cost of Capital approach.

1. For 2015 Field testing, an adjustment based on the spread is based on an observed broad basket of investment grade corporate bonds for the main currencies, with a default of 50 basis points for other currencies. The IAIS will collect feedback regarding a potential review of this methodology during Field Testing, through the Questionnaire.
2. This adjustment has been applied on the values of the observed instruments (up to the cut-off point for extrapolation), under the assumption that this premium can be earned. While no adjustment is explicitly applied on the part of the curve beyond that maturity, the way the pricing parameters are mathematically determined is equivalent to an effective gradual phasing out of this adjustment after the last observed liquid maturity.

1. The data provider used has been selected only on the criteria of immediate availability of a valid license for data extraction. This shouldn’t be seen as an official IAIS advice to use a particular market data provider. [↑](#footnote-ref-1)
2. The list of used cut-off maturities is available in Table 1, paragraph 127 of the technical specifications. [↑](#footnote-ref-2)
3. The list of used Long Term Forward Rates is available in Table 1, paragraph 127 of the technical specifications. [↑](#footnote-ref-3)
4. Applying the stresses on the discounting curve would in practice stress the adjustment applied, leading to an overlap with the credit risk scope. [↑](#footnote-ref-4)