SIFMA®

Securities Industry and
Financial Markets Association

The logo on this form may have been updated. The content of this document has not been modified since its original website posting. In light of rapidly changing business and regulatory environments, current accuracy cannot be assured.

Appendix C

The BMA Designated Yield Curve

This appendix was prepared with substantial assistance from Andrew Kalotay Associates, Inc.

Updated May 13, 2004

A. Introduction

This Appendix C describes in more detail the Designated Yield Curve that is used in the BMA ECS Formula described in Appendix A, when computing the Purchase Price and the OAS Associated Quotation of an ECS.

Capitalized terms not otherwise defined herein shall have the meaning set forth in the Guidelines, Appendix A, Appendix B, and below.

The Designated Yield Curve for a given Issuer is a constant maturity yield curve that is obtained by computing the Spread Adjustments and adding them to the most recently quoted Yields of the Designated Bills and Designated Notes for the Issuer. The Spread Adjustments are computed from the Yields of the Designated Bills and Designated Notes using a Tension Spline.

The Constant Maturity Yields for the Designated Tenors 3m, 6m, and 1y can also be computed by adding an Issuer-supplied Spread Adjustment to the appropriate LIBOR Yield, which is computed using live Futures Prices.

B. Definitions

1. **Constant Maturity Yield.** The term “Constant Maturity Yield” refers to one of the Yields comprising the Designated Yield Curve. Each Constant Maturity Yield is associated with a Designated Tenor and is obtained by adding the appropriate Spread Adjustment to either the Yield of the corresponding Designated Security or the LIBOR Rate for the Designated Tenor.

2. **Curve Settlement Date.** The term “Curve Settlement Date” has the meaning set forth in Appendix A.

3. **Designated Bill.** The term “Designated Bill” refers to a bill whose Yield is used in the construction of the Designated Yield Curve.

   A Designated Bill will be a newly issued security and will replace the previous Designated Bill on the first business day following the bill’s auction date.

Copyright © 2003 The Bond Market Association

4. **Designated Note.** The term “Designated Note” refers to a fixed coupon note or bond whose Yield is used in the construction of the Designated Yield Curve. A Designated Note will be either a newly issued security or an existing “off the run” security.

   If a new Designated Note is a newly issued security, then it will replace the previous Designated Note for that Designated Tenor on the first business day following the pricing of the new Designated Note.

   If a new Designated Note is an existing “off the run” security, then the Issuer will announce at least one business day in advance what the new Designated Note is and when it will replace the previous Designated Note.

5. **Designated Security.** The term “Designated Security” refers to an actively traded security whose Yield is used in the construction of the Designated Yield Curve.

   A Designated Security is associated with each Designated Tenor. For each Designated Tenor 3m, 6m, or 1y, the Designated Security is a Designated Bill. For each Designated Tenor 2y, 3y, 4y, 5y, 7y, 10y, or 30y, the Designated Security is a Designated Note.

6. **Designated Yield Curve.** The term “Designated Yield Curve” is comprised of a set of Designated Tenors and corresponding Constant Maturity Yields. During trading hours, the Designated Yield Curve is updated whenever the Yield of a Designated Security or a Futures Price is updated.

7. **Designated Tenors.** The term “Designated Tenors” refers to the tenors 3m, 6m, 1y, 2y, 3y, 4y, 5y, 7y, 10y, 30y. Associated to each Designated Tenor is a Designated Security.

8. **Fixed LIBOR Rate.** The term “Fixed LIBOR Rate” for a given tenor 1m or 3m refers to last BBA[1] fixing of the USD LIBOR rate for that tenor. The 1m Fixed LIBOR Rate will be denoted by $L_{1\text{m}}$, and the 3m Fixed LIBOR Rate by $L_{3\text{m}}$.

9. **Fixing Date.** The term ”Fixing Date” means the date on which the London Inter-Bank Offered Rate (LIBOR) is established for a LIBOR-based transaction. The LIBOR rate is based on offered inter-bank deposit rates contributed in accordance with the instructions to BBA LIBOR Contributor Banks.

10. **Futures Price.** The term “Futures Price” is the price of a Eurodollar futures contract.

11. **Futures Rate.** The term “Futures Rate” refers to the forward 3-month LIBOR rate implied by the Futures Price. It is equal to 100 minus the Futures Price. Given $i = 1, 2, 3, 4,$ or 5, the i-th Futures Rate will be denoted by F_i.

12. **Futures Settlement Date.** The term “Futures Settlement Date” refers to the settlement date of a Eurodollar futures contract. Given $i = 1, 2, 3, 4,$ or 5, the i-th Futures Settlement Date will be denoted by f_i.

[1] British Bankers Association, `http://www.bba.org.uk`

13. **LIBOR Discount Factor.** The term "LIBOR Discount Factor" for a date t will be denoted by $D(t)$ and refers to the discount factor implied by the Libor Rate $L(t)$. The LIBOR Discount Factor is given by

$$D(t) = \frac{1}{1 + L(t)(t - t_0)/360},$$

where t_0 is the LIBOR Spot Date.

14. **LIBOR Rate.** The term "LIBOR Rate" for a given Maturity Date t refers to the LIBOR rate implied by live Eurodollar futures prices and will be denoted by $L(t)$. It is expressed as a simple interest rate using the actual/360 daycount convention. Note that the LIBOR Rate is different from the Fixed LIBOR Rate.

    The LIBOR Rate for a Designated Tenor is the LIBOR Rate for the appropriate Maturity Date relative to the LIBOR Spot Date. For example, the LIBOR Rate for the Designated Tenor 3m is $L(t)$, where t is the date that is 3 calendar months after the LIBOR Spot Date.

    The computation of the LIBOR Rate $L(t)$ is described in Section E.

15. **LIBOR Spot Date.** The LIBOR Spot Date is the Value Date, with the Fixing Date set equal to the Trade Date. Note that Trade Date has the meaning set forth in Appendix A.

16. **LIBOR Yield.** The term "LIBOR Yield" for a Designated Tenor is the LIBOR Rate expressed as a bond equivalent yield. The LIBOR Yield Y is computed from the LIBOR Rate L for that Designated Tenor as follows:

$$Y = 2[(1 + L(t)(t - t_0)/360)^{1/y(t_0,t)} - 1],$$

where t_0 is the LIBOR Spot Date, t is the Maturity Date associated with the Designated Tenor, and $y(t_0, t)$ is the Year–Fractions Between the LIBOR Spot Date t_0 and the Maturity Date t, as defined in Appendix A.

17. **Remaining Tenor.** The term "Remaining Tenor" refers to the time in years from the Standard Settlement Date to the maturity date of a Designated Security. The Remaining Tenor t is computed as follows:

$$t = \frac{\text{Days from Standard Settlement Date to maturity}}{365.25}.$$

18. **Tension Spline.** The term "Tension Spline" refers to a tension spline curve, as described in Section D below.

19. **Spread Adjustment.** The term "Spread Adjustment" refers to the spread that is added to either the Yield of a Designated Security or the LIBOR Yield to obtain the corresponding Constant Maturity Yield. There is a Spread Adjustment associated with each Designated Tenor.

The Spread Adjustment for the Yield of a Designated Security is computed using the most recently quoted Yields of the Designated Securities. Details of how the Spread Adjustment is calculated are provided below in Section C.

The Spread Adjustment for a LIBOR Yield is provided at the start of each trading day by the Issuer and remains the same throughout that day.

20. **Value Date.** The term ”Value Date” means the date that is two London business days after the Fixing Date, adjusted for London and New York holidays [2]

21. **Yield.** The term “Yield” refers to the yield–to–maturity of a Designated Security, as defined in standard references using the 30/360 daycount convention. The Yield is always a semiannually compounded bond-equivalent–yield. During trading hours, the Yield of a Designated Security corresponds with a live indicative quote for the security.

C. Computation of the Spread Adjustments

Let $\tau_1, \ldots, \tau_M$ denote the Designated Tenors in years. Let $t_1, \ldots, t_M$ denote the Remaining Tenors of the corresponding Designated Securities. Let $y_1, \ldots, y_M$ denote the Yields of the Designated Securities.

Let f be a Tension Spline with tension equal to 0.756 that joins the points $(t_1, y_1), \ldots, (t_M, y_M)$. For each $i = 1, \ldots, M$, the Constant Maturity Yield p_i associated with the Designated Tenor τ_i is given by

$$p_i = f(\tau_i).$$

The corresponding Spread Adjustment is $p_i - y_i$.

D. Tension Spline

Given a positive number σ and points $(t_1, y_1), \ldots, (t_M, y_M)$, the Tension Spline with tension σ that joins these points is the unique continuously twice differentiable function f that satisfies the following conditions:

$$\begin{aligned} f(t_i) &= y_i,\ 1 \le i \le M \\ f''(t_1) &= 0 \\ f''(t_M) &= 0, \\ f'' - \sigma^2 f &\text{ is linear on each interval } (t_i, t_{i+1}),\ 0 \le i \le M, \end{aligned}$$

where $t_0 = -\infty$ and $t_{M+1} = +\infty$.

Details of how to compute a Tension Spline can be found in the book *Numerical Analysis: Mathematics of Scientific Computing*, by David Kincaid and Ward Cheney.

E. Computation of the LIBOR Rate from Fixed LIBOR Rates and Eurodollar Futures Rates

[2] This term is intended to be consistent with the official BBA definition of Value Date. See `http://www.bba.org.uk/public/libor/4307` for details.

The LIBOR Rate for each Futures Settlement Date f_i, $i = 1, 2, 3, 4, 5$, is computed as follows.

If the first Futures Settlement Date is within a month of the Curve Settlement Date, then the LIBOR Rate for the first Futures Settlement Date is equal to the 1m Fixed LIBOR Rate. Otherwise, it is computed using the 1m and 3m Fixed LIBOR Rates as follows:

$$L(f_1) = \frac{t_{3m} - f_1}{t_{3m} - t_{1m}} L_{1m} + \frac{f - t_{1m}}{t_{3m} - t_{1m}} L_{3m},$$

where t_{1m} is the date that is 1 calendar month after the LIBOR Spot Date, and t_{3m} is the date that is 3 calendar months after the LIBOR Spot Date.

The LIBOR Rate for subsequent Futures Settlement Dates f_i, $i > 1$, are computed recursively from the Futures Rate F_{i-1} using the following

$$L(f_i) = \frac{360}{f_i - t_0} \left(\frac{1 + F_{i-1}(f_i - f_{i-1})/360}{D(f_{i-1})} - 1 \right),$$

where t_0 is the LIBOR Spot Date and $D(f_{i-1})$ is the LIBOR Discount Factor for the date f_{i-1}.

Given a Maturity Date t that falls between Futures Settlement Dates f_{i-1} and f_i, the corresponding LIBOR Rate is given by

$$L(t) = \frac{f_i - t}{f_i - f_{i-1}} L(f_{i-1}) + \frac{t - f_{i-1}}{f_i - f_{i-1}} L(f_i).$$