Bond Indices | Global
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Calculation methodologies

Bank of America Merrill Lynch

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On Bloomberg:
IND<GO>
On GM Portal (institutional client website):
www.baml.com/mercury
Public website:
www.mlindex.ml.com
BofA Merrill Lynch Index Hotline:
New York: +1 646 556 2900
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Total return calculations

Calculating index values

The daily closing Index value is a function of the prior month-end index value and the current month-to-date return:

$$IV_n = IV_0 \times (1 + TRR_n)$$

where:

IV_n = closing index value on day n

IV_0 = closing index value on prior month-end

TRR_n = month-to-date index total return on day n

The month-to-date return of an index (TRR_n) is equal to the sum of the individual constituent returns times their respective beginning of month weights:

$$TRR_n = \sum_{i=1}^{k} B_i TRR_n \times B_i Wgt_0$$

where:

TRR_n = Index month-to-date total return on day n

$BiTRR_n$ = month-to-date total return on day n of bond i

$BiWgt_0$ = beginning of month weight of bond i

Periodic returns between any two dates can be derived from the beginning and end of period index values. Since index values represent closing levels, period returns will include market movement on the end of period date but exclude market movement on the beginning of period date. Therefore, to capture returns for the month of June, divide the June 30 Index value by the May 31 Index value:

$$TRR = \frac{IV_n}{IV_0} - 1$$

where:

TRR = periodic total return

IV_n = closing index value on the end of period date

IV_0 = closing index value on the beginning of period date

Annualized returns are derived from period total returns:

$$AnnTRR_n = (1 + TRR_n)^{365/d} - 1$$

where:

$AnnTRR_n$ = annualized total return for period n

TRR_n = periodic total return for period n

d = number of actual days in period n

Rules for calculating index values on holidays

- Weekdays on which WM Company/Reuters does not publish closing FX rates are treated as "global holidays."
- No indices are published on global holidays unless a global holiday falls on the last calendar day of the month.
- All indices are published on global business days and the last calendar day of every month.
- If the last calendar day of a month falls on a global holiday, prices are updated in all local markets that are open. Prices in all markets that are closed are rolled from the prior business day and accrued interest is calculated for the new settlement date.
- If the last calendar day of the month falls on a weekend, all prices are rolled from the last business day and accrued interest is calculated for the new settlement date.

Calculating bond total returns in local currency terms

Month-to-date total returns are calculated daily for each bond in its currency of denomination (i.e., local total return). Cash flows from bond payments that are received during the month are retained in the index as a separate line item until the end of the month and then are removed as part of the rebalancing. Cash does not earn any reinvestment income while it is held in the Index. With the exception of US mortgage pass-through and US structured products (ABS, CMBS and CMOs), accrued interest is calculated assuming next calendar day settlement (including when the next calendar day is a non business day). Accrued interest for US mortgage pass-through and US structured products is calculated assuming same-day settlement.

$$BTRR_n = \frac{\left(P_n + AI_n\right) - \left(P_0 + AI_0\right) + C \times \left(1 + \frac{r}{d}\right)^t}{P_0 + AI_0}$$

where:

$BTRR_n$ = individual bond month-to-date total return on day n

P_n = current day price

P_0 = prior month-end price

AI_n = current day accrued interest

AI_0 = prior month-end accrued interest

C = coupon payments received during the period (including capital payments at current market value)

r = reinvestment rate (currently zero)

t = number of days between the receipt of the cash flow and day n

d = day count convention for reinvestment asset

US mortgage pass-through total return formula

$$TRR = \frac{\left(\left(P_n + AI_n\right) - \left(P_0 + AI_0\right) + \left[\frac{C}{12} \times \left(1 + \frac{r}{d \times 100}\right)^t\right]\right)}{P_0 + AI_0} + \left(1 - f\right) \times \frac{\left[\left(100 \times \left(1 + \frac{r}{d \times 100}\right)^t\right) - \left(P_n + AI_n\right)\right]}{P_0 + AI_0}$$

$$f = \left(1 - SPP\right) \times \left(1 - SMM\right)$$

$$SMM = 1 - \left(1 - \frac{CPR}{100}\right)^{1/12}$$

$$SPP = \left(\frac{\frac{WAC_0}{1200}}{\left(1 + \frac{WAC_0}{1200}\right)^{WAM_0} - 1}\right)$$

where:

TRR = month to date total return

P_n = current day price (assuming cash settlement)

P_0 = prior month-end price (assuming cash settlement)

AI_n = current day accrued interest (assuming cash settlement)

AI_0 = prior month-end accrued interest (assuming cash settlement)

C = net coupon stated in percentage terms

r = reinvestment rate stated in percentage terms (currently zero)

d = day count for reinvestment asset

t = time to/since cash flow payment date (settlement date minus cash flow payment date)

SPP = schedule principal payment percentage

SMM = single monthly mortality

CPR = most recently reported constant prepayment rate

WAC_0 = weighted average gross coupon rate as of the previous month stated in percentage terms

WAM_0 = remaining maturity (in terms of number of months) as of the previous month

US mortgage pass-through cash settlement price calculation

US mortgage pass-through cash settle prices are derived from the current month regular (forward) settlement price up to the date before the roll date using the following formula:

$$P_c = \left[\left(P_r + AI_r \right) \times \left(\frac{1}{\left(1 + \frac{r}{d \times 100} \right)^n} \right) \right] - AI_c$$

where:

P_c = cash settle price

P_r = regular (forward) settle price for current month settlement

AI_c = cash settle accrued interest

AI_r = regular (forward) settle accrued interest for current month settlement

r = 1-month Libid stated in percentage terms

n = number of days between cash settle date and regular (forward) settle date

d = number of days in the year based on Libor daycount convention (360)

US mortgage pass-through cash settle prices are derived from the next month regular (forward) settlement price on the roll date through the end of the month using the following formula:

$$P_c = \left[\left(\frac{C}{12} + 100 \times \left(1 - f_e \right) \right) \times \left(\frac{1}{\left(1 + \frac{r}{d \times 100} \right)^{n_1}} \right) \right] + \left[\left(P_r + AI_r \right) \times f_e \times \left(\frac{1}{\left(1 + \frac{r}{d \times 100} \right)^{n_2}} \right) \right] - AI_c$$

where:

P_c = cash settle price

P_r = regular (forward) settle price for next month settlement

AI_c = cash settle accrued interest

AI_r = regular (forward) settle accrued interest for next month settlement

r = 1-month Libid stated in percentage terms

n_1 = number of days between cash settle date and the next month cash flow payment date

n_2 = number of days between cash settle date and regular (forward) settle date

C = net coupon stated in percentage terms

f_e = estimated factor based on most recently reported actual CPR

d = number of days in the year based on Libor daycount convention (360)

US ABS, CMBS and CMO total return formula

$$TRR = \frac{(P_n + AI_n) - (P_0 + AI_0) + (P_{CF} + I_{CF})\left(1 + \frac{r}{d \times 100}\right)^t}{(P_0 + AI_0)} - \frac{(1 - f)(P_n + AI_n)}{(P_0 + AI_0)}$$

where:

TRR = individual bond month-to-date total return
P_n = current day price (assuming cash settlement)
P_0 = prior month-end price (assuming cash settlement)
AI_n = current day accrued interest (assuming cash settlement)
AI_0 = prior month-end accrued interest (assuming cash settlement)
I_{CF} = interest cash flow received
P_{CF} = principal cash flow received
f = end of period factor divided by the beginning of period factor
r = reinvestment rate (currently zero)
t = number of days between the receipt of the cash flow and day *n*
d = day count convention for the reinvestment asset

Converting returns into another base currency unhedged

Unhedged returns are converted into a given base currency using the following formulas:

$$CRR = \frac{FX_n}{FX_0} - 1$$

$$TRR_{converted} = \left[\left(1 + TRR_{local}\right) \times \left(1 + CRR\right)\right] - 1$$

where:

CRR = currency return

FX_n = end-of-period FX rate (stated in terms of the number of units of the base currency per one unit of the currency of denomination of the bond)

FX_0 = beginning-of-period FX rate (stated in terms of the number of units of the base currency per one unit of the currency of denomination of the bond)

$TRR_{converted}$ = total return of the bond converted into the base currency unhedged

TRR_{local} = local total return of the bond

Converting returns into another base currency hedged

Currency hedged index returns assume a rolling 1-month forward hedge where forward contracts are purchased in an amount equal to the full market value of the index (including accrued interest) at the beginning of the month. In addition to the formulas used to calculated unhedged converted returns, hedged returns require the following additional formulas:

$$CRUTRR = CRR \times \left(1 + TRR_{local}\right)$$

$$FCR = \frac{FWD_0}{FX_0} - 1$$

$$HR = HPct \times \left(FCR - CRR\right)$$

$$TRR_{hedged} = TRR_{local} + CRUTRR + HR$$

$$HIV_n = HIV_0 \times \left(1 + TRR_{hedged}\right)$$

Where:

CRUTRR = currency return on unhedged local total return

FCR = forward contract return

FWD_0 = beginning-of-period forward rate (stated in terms of the number of units of the base currency per one unit of the currency of denomination of the bond)

HR = hedge return

HPct = percentage hedged

TRR_{hedged} = total return hedged into the base currency

HIV_n = closing hedged index value on day *n*

HIV_0 = closing hedged index value on prior month-end

Sample hedged return calculation

The following example illustrates the December 2005 hedged return calculation for The BofA Merrill Lynch Euro Government Index (EG00) hedged into CHF

EG00 Hedged Index Value 30-Nov-05: 301.565
EG00 Local Total Return December 2005: 1.061%

EUR/CHF FX Rates:
1-mo Forward Rate 30-Nov-05 = 1.547892
Spot Currency Rate 30-Nov-05 = 1.549907
Spot Currency Rate 31-Dec-05 = 1.554588

Currency Return
= (End Spot Rate / Begin Spot Rate) – 1
= (1.554588 / 1.549907) -1
= 0.302%

Converted Return (unhedged)
= [(1 + Local Total Return) * (1 + Currency Return)] -1
= [(1 + 1.061%) * (1 + 0.302%)] -1
= 1.366%

Currency Return on Unhedged Local Total Return
= Currency Return * (1 + Local Total Return)
= 0.302% x (1 + 1.061%)
= 0.305%

Forward Contract Return
= (Begin 1-mo Forward Rate/Begin Spot Rate) – 1
= (1.5479892 / 1.549907) – 1
= -0.130%

Hedge Return
= %hedge * (Forward Contract Return – Currency Return)
= 1.00 x (-0.130% – 0.302%)
= -0.432%

Converted Return (Hedged)
= Local Total Rtn + Currency Rtn on Unhedged Local Total Rtn + Hedge Rtn
= (1.061%) + (0.305%) + (-0.432%)
= 0.934%

Hedged Index Value 31-Dec
= Hedged Index Value 30-Nov x (1 + MTD Hedged Return 31-Dec)
= 301.565 x (1 + 0.934%)
= 304.381

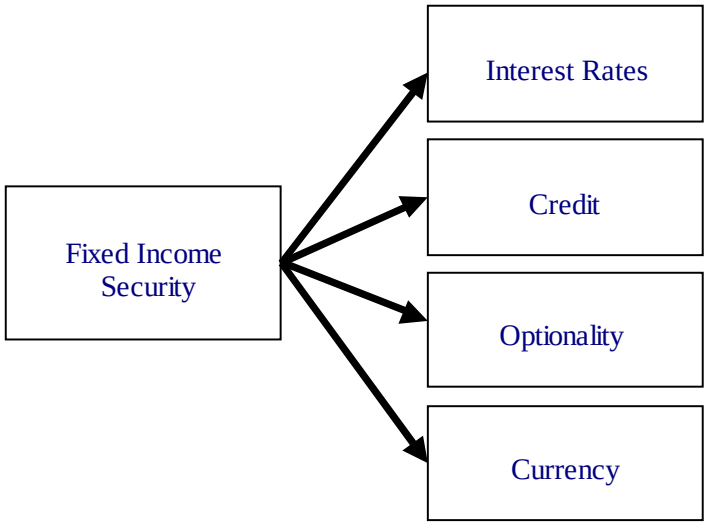
Note: small differences in the above calculations may result from rounding.

Return attribution methodology

A decision to purchase a bond brings with it many different types of risk. A corporate bond, for example, holds the obvious exposure to the credit worthiness of the issuer. But it also contributes to the aggregate interest rate exposure of the portfolio. On top of that, inclusion of a call, put or sinking fund feature may mean an additional element of optionality risk. And finally, depending on the currency of denomination of the cash flows, there may be foreign exchange risk to contend with as well. This complicates the bond selection process, as a particular issue under consideration may look very attractive from one risk perspective (eg, the issuer and spread), but go counter to the desired risk profile of the portfolio in other respects (eg, duration, currency, etc.). As a result, the portfolio manager is constantly working to make the individual positions in the portfolio fit together like an intricate jigsaw puzzle so as to achieve a portfolio profile that, in the aggregate, is aligned with both market views and tolerance levels for each of the major sources of risk.

Performance measurement – the periodic comparison of portfolio returns to those of a selected benchmark index – provides an excellent macro level view of results, but offers little by way of explanation as to how those results were achieved. Performance attribution is a critical portfolio management technique in which each of the major sources contributing to overall portfolio performance is identified. Performance attribution requires a model for determining how much of a bond's return is affected by key risk factors.

Chart 1: Sources of risk in fixed income securities



Source: BofA Merrill Lynch Bond Indices

Decomposing asset returns by source

Return attribution is a process by which the total return of a bond, portfolio, or index is decomposed into a series of primary risk/return factors. The BofA Merrill Lynch return attribution model has identified six key factors[1], summarized in Table 1, each of which isolates the degree to which changes in a specific market variable contributed to the total return of a bond. The starting point for the attribution process is the bond's beginning price, accrued interest and spread. There are a number of ways to define spread – we use option-adjusted spread[2] (OAS) as the basis for the model as it allows us to measure bonds with and without embedded options (eg, call, put, or sink features) in common and consistent terms. We then calculate a series of theoretical prices for the bond by sequentially changing a single pricing assumption while holding all other variables constant until we get to the ending price. A more detailed explanation of the step by step derivation of the factor prices is provided below.

Factor 1: Coupon

Coupon Return measures the contribution to total return of the stated coupon currently in effect. Price is held constant and accrued interest is recalculated to the end of period date. The change in price (always zero since price is held constant) plus the change in accrued interest along with coupons received during the period, if any, divided by the beginning price plus accrued interest is the Coupon Return. An obvious limitation to the explanatory power of Coupon Return is that it does not reflect the automatic change in price that occurs with the passage of time as premium and discount bonds converge to par while approaching maturity. This can amount to a significant portion of price movement for any bond priced at a steep premium or discount – particularly zero coupon and deferred interest bonds. Factor 2, Amortization/Roll, captures the impact of par convergence, thereby allowing for a more complete measure of the net interest return of a bond.

Factor 2: Amortization/Roll

Amortization[3]/Roll return measures the degree to which a bond's price changed simply due to the passage of time. The settlement date is changed to the end of the measurement period, and a theoretical price is derived using the beginning of period OAS, yield curve and implied volatility. The difference between the theoretical Amortization/Roll price and the beginning price divided by the beginning price plus accrued interest is the Amortization/Roll return. Shifting settlement date forward will affect the price of a bond in three ways:

1. Cash flows are closer to their maturity, which means that associated present values converge toward par.

2. Since the cash flows are closer to maturity, the corresponding discount rates are taken from a slightly shorter point on the yield curve. Therefore, in a normal yield curve environment cash flows are discounted at progressively lower rates, while the reverse is true in an inverted yield curve environment.

[1] For US mortgage backed securities, one additional factor, "MBS Principal Paydown", is required. Refer to Table 1 for more detail on the US Mortgage attribution model

[2] Option-adjusted spread is the number of basis points that the fair value government spot curve is shifted in order to equate a bond's discounted cash flows with its market price. See "Option-adjusted spreads" for more detail.

[3] We have abbreviated the Factor 2 label as "Amortization/Roll" return. This attribution factor, however, includes the accretion of discount as well as amortization of premium bonds.

3. In the case of bonds with embedded options, the change in settlement date will affect the time value of the option.

Together, Coupon and Amortization/Roll Return measure the net interest return of a bond.

Factor 3: Curve Shift

Curve Shift return measures the degree to which a bond's price changed as a result of shifts in the general level of interest rates. To establish the amount that the yield curve has shifted, we take an average of the yield changes along the fair value government par coupon curve from year 2 to year 30 (see "Fair value yield curves"). This shift factor is then added to the beginning yield curve and a theoretical Curve Shift price is derived using the beginning OAS and implied volatility along with the shifted yield curve. The difference between the theoretical Curve Shift price and the theoretical Amortization/Roll price divided by the beginning price plus accrued interest is the Curve Shift return.

Factor 4: Curve Reshape

Curve Reshape return measures the degree to which a bond's price changed as a result of changes in the shape of the fair value government yield curve. A theoretical Curve Reshape price is derived using the beginning OAS and implied volatility along with the actual ending yield curve. The difference between the theoretical Curve Reshape price and the theoretical Curve Shift price divided by the beginning price plus accrued interest is the Curve Reshape return.

Factor 5: Volatility Change

Volatility Change return measures the degree to which a bond's price changed as a result of changes in implied volatility. A theoretical Volatility Change price is derived using the beginning OAS along with the actual ending yield curve and implied volatility. The difference between the theoretical Volatility Change price and the theoretical Curve Reshape price divided by the beginning price plus accrued interest is the Volatility Change return.

Factor 6: Spread Change

Spread Change return measures the degree to which a bond's price changed as a result of changes in its spread to the government curve. In theory, the theoretical Spread Change price is derived using the actual ending yield curve, OAS and implied volatility. Since it is the last factor, however, we can eliminate this step as the theoretical price calculated in this manner will equal the actual ending price of the bond. Thus, the difference between the actual ending price of the bond and its theoretical Volatility Change price divided by the beginning price plus accrued interest is the Spread Change returnChart 1

Excess return methodology

Excess return is a measure of relative value that neutralizes the interest rate and yield curve risk of a bond, thereby isolating that portion of its performance that is attributed solely to credit and optionality risks. Excess return is equal to a bond's total return minus the total return of a risk-matched basket of governments or interest rate swaps. There are two main components to excess return:

1. the additional interest income that accrues to the security during the period as a result of a higher starting yield relative to duration-matched governments or swaps, and

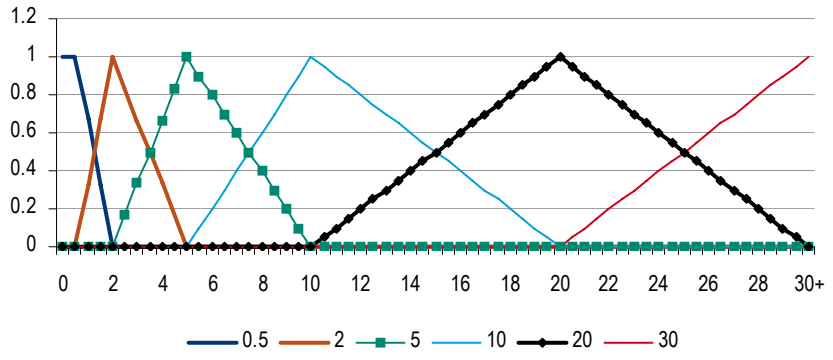
2. the effect of any change in spread during the period on the relative price movement of the security versus risk-matched governments or swaps.

The hedge basket is comprised of fair value governments (or swaps) that together are key rate duration-matched to the bond at six key nodes: the 6-month, 2-year, 5-year, 10-year, 20-year and 30-year points on the curve. The hedge basket is also matched to the bond's currency of denomination. For example, a sterling-denominated corporate bond is compared to U.K. Gilts or sterling interest rate swaps.

Calculating key rate durations

The key rate duration calculation is similar to calculating effective duration but the par coupon yield curve is shifted at only one node at a time while the other five nodes are held unchanged. The shift amounts for the points on the curve in between the node that is shifted and the preceding and subsequent nodes are linearly interpolated (Chart 2). The sum of a bond's six key rate durations will, in most cases, closely match its effective duration.

Chart 2: Shifting the curve at each key rate duration node



Source: BofA Merrill Lynch

Creating fair value government and swap hedge securities

The governments (or swaps) used to construct the hedge basket are synthetic securities that are derived from the par coupon fair value government (or swap) yield curve in each market[4]. At the beginning of each month (ie, the last calendar day of the preceding month), a series of synthetic securities are created for 6-month, 2-year, 5-year, 10-year, 20-year and 30-year points on the curve. On that day, each synthetic security is priced at par, has a coupon and yield equal to the corresponding rate (in semi-annual terms) for the comparable maturity point on the fair value curve, and has an interest accrual date equal to the beginning of period date. Since these are initially par coupon securities priced exactly at the par coupon fair value curve, 100% of the hedge security's key rate duration exposure will fall on the node that corresponds to its maturity on the start date.

Weighting the key rate duration-matched basket

At the beginning of each month (i.e., the last calendar day of the preceding month), a key rate duration-matched basket of fair value synthetic government (or swap) securities is created for each Index constituent. Each par coupon government (or swap) in the hedge basket (and the residual cash position) has key rate duration exposure at only one of the six nodes, whereas a constituent bond will typically have exposure at several nodes. The key rate duration of each hedge security, times its percentage weight, equals the constituent bond key rate duration for that corresponding node. For example, on July 31, 2010, the EUR-denominated Carrefour 3.875% 4/21 had an 8.2136 key rate duration exposure to the 10-year node (Table 2). That exposure was matched by allocating 92.10% of the euro government hedge basket to the 10-year fair value government security, which had an 8.918 key rate duration at that node (8.9184 x 92.097% = 8.2136). The sum of the hedge basket key rate durations and the Carrefour key rate durations both equal 9.0876, which also matches the Carrefour effective duration.

Table 1: Carrefour SA 3.875 4/21 excess return hedge basket as of July 31, 2010

		Fair value par coupon government bond hedge basket							
KRD node	CAFP KRD	Cash	6mo	2yr	5yr	10yr	20yr	weight[1]	Wgt KRD
Cash	0.0000	0.0000						-3.067%	0.0000
6mo	0.0025		0.4990					0.499%	0.0025
2yr	0.0481			1.9826				2.424%	0.0481
5yr	0.1790				4.8177			3.716%	0.1790
10yr	8.2136					8.9184		92.097%	8.2136
20yr	0.6445						14.8795	4.332%	0.6445
	9.0876								9.0876

[1] equals bond key rate duration divided by par coupon government key rate duration for the given node

Source: BofA Merrill Lynch Bond Indices

[4] All euro and euro legacy currency denominated securities are compared to synthetic fair value governments based on the euro fair value curve, which is derived from a blended basket of French and German government bonds. The U.S. Treasury fair value curve excludes the current and previous on-the-run notes and bonds from its sample population. All markets exclude callable governments from the sample population. See "Fair value yield curves" for more detail.

Calculating excess return

Over the course of the month, the fair value government (or swap) securities roll down the curve and are priced by discounting their cash flows at the corresponding spot rates that are derived from the par coupon fair value yield curve. A total return is then calculated for each security in the hedge basket and multiplied by its beginning weight. The sum of the weighted hedge security total returns is subtracted from the constituent bond total return to arrive at the excess return. In the Carrefour example discussed previously, the 10-year fair value government bond began the month with a maturity of exactly 10-years, a yield and coupon of 2.878 and a price of 100.00. At the end of the month it had a remaining maturity of 9 years and 11 months, and was priced at a 2.440% yield taken from the corresponding point on the curve on August 31, 2010. That produced a 4.924% total return for that security. The product of the five hedge security returns and their respective weights equaled 5.07%. The Carrefour total return was 5.91%, leaving an excess return of 0.84%.

Table 2: Carrefour SA 3.875 4/21 excess return for August 2010

	July 31, 2010			August 31, 2010			
Term	Par cpn fair value govt yield	Start value	Term	Par cpn fair value govt yield	End value[1]	weight Jul-31	Hedge basket Total return
Cash	0.520		Cash				0.046%
6mo	0.419	100.000	5mo	0.353	100.063	0.50%	0.063%
2yr	0.862	100.000	1yr 11mo	0.607	100.557	2.42%	0.557%
5yr	1.833	100.000	4yr 11mo	1.412	102.238	3.72%	2.238%
10yr	2.878	100.000	9yr 11mo	2.440	104.924	92.10%	4.924%
20yr	3.437	100.000	19yr 11mo	2.918	110.109	4.33%	10.109%
Hedge basket total return							5.07%
Carrefour SA 3.875 4/21 total return							5.91%
Carrefour SA 3.875 4/21 excess return							0.84%

[1] based on par coupon government bond cash flows discounted at the Aug 31, 2010 spot curve

Source: BofA Merrill Lynch Bond Indices

The month-to-date excess return of an index is equal to the weighted average of the individual excess returns of its constituents based on beginning of period weights.

$$ER_{Index} = \sum_{i=1}^{k} ER_i W_i$$

where:

ER_{Index} = excess return of the index

ER_i = excess return of index constituent bond *i*

W_i = beginning of month weight of index bond *i*

k = the number of bonds in the index

For annualized excess return the annualized total return of the hedge basket is subtracted from the annualized total return of the index/bond.

Fair value yield curves

Government nominal yield curves

Fair value government spot yield curves are derived from a universe of bond prices using government index constituents plus, in some cases, 3-month Libor to supplement the front end of the curve. Specifically, the zero discount function is parameterized as a linear combination of a family of exponential functions. When a coupon bond is stripped as a set of coupon and principle payments, each cash flow is discounted using this parameterized discount function and the optimal fit is obtained by minimizing the sum of the squares of the differences of the individual bond theoretical and actual prices:

$$obj = \min \sum_i \Delta P_i^2$$

$$\Delta P_i = P_i - \sum_j C_{ij} df_j$$

Where:

P_i = the actual bond price,

C_{ij} = the bond cash flows

df_j = the discount function

The goodness of fit and stiffness of the curve can be adjusted by increasing or decreasing the number of exponential basis functions and the exponent parameter.

A closer look at the fitted values of long and short bond prices using this method shows that, while long and short bond price discrepancies are comparable, the fitted bond yield discrepancy deteriorates rapidly towards zero maturity, creating instability on the front of the fitted yield curve. That is due to the fact that the price of a very short duration bond is minimally sensitive to yield changes. For example, a 10bp move for a bond with only 3 months to maturity amounts to 0.025 price change, whereas the same move would translate into a 1.50 price change for a 15 year duration bond. Therefore any adjustment to the front end of the curve does not improve the objective function by much and therefore the method will do a better job fitting long yields than short yields.

For that reason, we modify the formula and look at both price and yield discrepancies, using a method that increases the weight of short duration bonds and improves the stability of the front end as follows:

$$obj = \min \sum_i \Delta P_i^2 + \Delta y_i^2$$

This can be restated as follows:

$$obj = \min \sum_i \Delta P_i^2 (1 + \Delta y_i^2 / \Delta P_i^2) = \min \sum_i \Delta P_i^2 w_i$$

$$w_i = 1 + \frac{1}{risk_i^2}$$

Where risk is the dollar risk of the bond (dP_i/dy_i)

Notes on security selection:

1. The US Treasury fair value curve excludes the current and previous on-the-run issues.

2. The euro government fair value curve is comprised of all index qualifying French and German government bonds.

3. All markets exclude callable governments from the sample population.

4. In markets where there are a limited number of short bonds to represent the front end of the curve, 3-month Libor is used as an additional input, where available. If 3-month Libor is not available rates are held constant from the shortest bond observation to the 3-month point.

Government real yield curves

Real yield curves are derived from inflation-linked bonds using the same principle that a single curve is used to discount all bonds' cash flows, all of which are stated in real terms. The real curve is bootstrapped from the observed market prices. As a result, the curve will exactly match the real yields of the observed inflation-linked securities and there will be no rich/cheap spreads. A bootstrap approach is used largely due to the fact there are comparatively fewer observed securities to work with than in the nominal bond markets. While the resulting curve accurately prices the bonds, it is not useful for purposes of comparing richness or cheapness of the observed securities.

Corporate fair value curves

Our corporate spread curve model assumes that spread and spread duration are the two factors driving bond price movement. This greatly simplifies the relationship of a bond's price versus characteristics such as coupon, maturity, amortization, call schedule etc. Unlike other methods where price is directly modeled against the curve, and only bullet bonds can be used, our approach may use all bonds in a given index universe. This is important in markets where a significant portion of outstanding bonds have embedded options.

We use the Nelson-Siegel model to build the corporate spread curves. It is a four-parameter formula that can account for the many shapes observed in the curvature of term structures. While this approach was originally applied to building traditional rate-maturity curves, we borrow the model and simply apply it to fitting OAS-duration curves.

The universe of bonds is prescreened from the relevant index universe (eg, US corporates, AA-rated). While ratings are updated only monthly for purposes of selecting constituents for rating sub-indices, they are updated daily for purposes of determining observations for rating category corporate spread curves. Next, the median OAS and the average of deviates (the absolute difference of the OAS and median OAS) are calculated. A spread outside the band of four-times the average of deviates is excluded from the fitting. Finally, the parameters are adjusted to achieve an optimal solution by minimizing the sum of the square of the differences between the bonds and the fitted curve. The bonds are duration-weighted for purposes of calculating the best fit. In addition, depending on the curve, the bonds may be additionally market-weighted, or equal-weighted.

Once the OAS-duration curve is fit, it is just a matter of overlaying it on the underlying government curve to generate the resulting spot and par-coupon corporate yield curves. Since the corporate par curve is a function of maturity, an iterative process is applied to guarantee the resulting par curve is consistent with the OAS-duration curve. The iterative process adjusts the corporate par coupon rate at each maturity point to match the OAS-duration curve.

Option-adjusted spread

Fixed rate corporate and government bonds

Option-adjusted spread is the number of basis points that the fair value government spot curve is shifted in order to match the present value of discounted cash flows to the bond's price. For securities with embedded options, such as call, sink or put features, a log normal short interest rate model is used to evaluate the present value of the securities potential cash flows. In this case, the OAS is equal to the number of basis points that the short interest rate tree must be shifted in order to match discounted cash flows to the bond's price.

- For non-call perpetual bonds the final maturity is set to an assumed date well over 100 years in the future.
- For callable perpetual bonds, the first call date is treated as the final maturity.
- For fixed-to floating rate securities the first call date is treated as the final maturity.

Floating rate corporate bonds

For Libor floating rate securities with embedded options (e.g., call, put, etc.), OAS is assumed to follow a Gaussian (normal) distribution based on a given spread volatility that is derived from the actual historical spread volatility (monthly spread volatility for currency-rating buckets is based on data from July 1998 with a 90% exponential decay – ie, a 5 year half life) for the bond's peer group (summary rating category buckets within each currency of denomination). This randomized spread is added to the government interest rate tree to discount projected cash flows (based on the Libor forward curve). The OAS is equal to the number of basis points that the short interest rate tree plus the randomized spread must be shifted in order to match discounted cash flows to the bond's price.

Mortgage pass-through securities and CMOs

For US mortgage pass-through securities, interest rate/prepayment models are used to generate projected cash flows and forward curves (256 scenarios). OAS is the number of basis points that is added to the one-month semi-annually compounded forward zero curves in each scenario in order to match the average present value of discounted cash flows across all scenarios to the bond's price.

Structured products (ABS, CMBS and CMOs)

For US structured products, a projected cash flow is generated (single scenario) using the pricing speed (provided by IDC). OAS is the number of basis points that is added to the one-month semi-annually compounded forward US Treasury spot curve in order to match the average present value of discounted cash flows to the bond's price.

Floating rate ABS

For US floating rate ABS, yield is calculated based on the assumption that the current coupon rate will be constant over the remaining life of the bond. OAS is the number of basis points that the spot US Treasury curve must be shifted in order to match the present value of the bond's cash flows to its price. For the OAS calculation, projected cash flows are based on the Libor forward rate curve. Therefore, in a very low Treasury/Libor rate environment, OAS can be higher than yield. Projected cash flows are generated as follows:

1. A set of cash flows is generated daily using a constant projected index value (equal to the prior day closing index value) for all months after the next reset. The cash flows after the next reset are adjusted by the difference between the current day and the previous closing index values. These adjusted cash flows are used to calculate yield.

2. A set of cash flows is generated daily using a constant projected index value (equal to the prior day closing index value) for all months after the next reset. The cash flows after the next reset are adjusted by the projected forward Libor curve. These adjusted cash flows are used to calculate OAS.

Sharpe and information ratios

Sharpe and information ratios are risk-adjusted return measures that help to facilitate meaningful comparisons of one asset class versus another. The key difference between them is that the Sharpe ratio risk-adjusts the index return relative to a short risk-free asset while the information ratio risk-adjusts the index return relative to comparable duration matched government securities. The two ratios are calculated as follows:

$$\text{Sharpe ratio} = \frac{\text{Average monthly difference between the index total return and the risk free rate}}{\text{Standard deviation of the index monthly total returns}}$$

$$\text{Information ratio} = \frac{\text{Average monthly excess return over risk matched governments}}{\text{Standard deviation of monthly excess returns over governments}}$$

For USD indices, we use the 3-Month US Treasury Bill Index total return (G0O1) for the risk-free rate. All other currencies use the total return of their respective 3-Month Constant Maturity LIBOR Indices (LEC3 for EUR, LBP3 for GBP, LJY3 for JPY, LCD3 for CAD and LAD3 for AUD).

The excess returns used in the information ratio compare bond returns to a basket of key rate duration matched fair value government securities. See "Excess return methodology" for more detail.

Composite rating algorithm

BofA Merrill Lynch index composite ratings are updated once a month as part of the rebalancing process. Composite rating changes take effect on the last calendar day of the month based on information available up to and including the rebalancing lock-out date (the third business day prior to the last business day of the month). Rating upgrades or downgrades occurring after that day will not be considered in the current month rebalancing and will get incorporated at the following month's rebalancing.

For example, assuming there are no global holidays in between, if August 31 fell on a Friday the rebalancing lock-out date would occur on August 28. Therefore, a bond that was downgraded to below investment grade on August 28 would transition from the investment grade index to the high yield index at the August 31 rebalancing. Conversely, if the bond was downgraded on August 29, it would remain in the investment grade index for the month of September and transition to high yield at the September 30 rebalancing.

BofA Merrill Lynch Index composite ratings are the simple averages of ratings from Moody's, S&P and Fitch. The composite rating is calculated by assigning a numeric equivalent to the ratings in each agency's scale (Table 1). The average of the numeric equivalents for each agency that rates a bond is rounded to the nearest integer and then converted back to an equivalent composite rating using the scale in Table 1. If only two of the designated agencies rate a bond, the composite rating is based on an average of the two. Likewise, if only one of the designated agencies rates a bond, the composite rating is based on that one rating.

Table 3: Ratings scale for calculating composite

Numeric	Composite	Moody's	S&P	Fitch
1	AAA	Aaa	AAA	AAA
2	AA1	Aa1	AA+	AA+
3	AA2	Aa2	AA	AA
4	AA3	Aa3	AA-	AA-
5	A1	A1	A+	A+
6	A2	A2	A	A
7	A3	A3	A-	A-
8	BBB1	Baa1	BBB+	BBB+
9	BBB2	Baa2	BBB	BBB
10	BBB3	Baa3	BBB-	BBB-
11	BB1	Ba1	BB+	BB+
12	BB2	Ba2	BB	BB
13	BB3	Ba3	BB-	BB-
14	B1	B1	B+	B+
15	B2	B2	B	B
16	B3	B3	B-	B-
17	CCC1	Caa1	CCC+	
18	CCC2	Caa2	CCC	CCC
19	CCC3	Caa3	CCC-	
20	CC	Ca	CC	CC
21	C	C	C	C
22	D		D	D

Source: BofA Merrill Lynch Bond Indices

Sample calculations

The following examples demonstrate the composite rating calculation for several index constituents as of August 31, 2008 (rebalancing lock-out date = August 26, 2008):

- *Coventry Health, CVH 5.95% March 15, 2017*
  Moody's: Ba1 = 11
  S&P: BBB = 9
  Fitch: BBB- = 10
  $(11+9+10)/3 = 10 \Rightarrow BBB3$

- *Tyson Foods, TSN 6.60% April 1, 2016*
  Moody's: Ba1 = 11
  S&P: BBB- = 10
  Fitch: BB+ = 11
  $(11+10+11)/3 = 10.667 \Rightarrow 11 \Rightarrow BB1$

Rating hierarchy for asset classes

While our composite rating is generally derived from individual bond ratings, in some cases other ratings are used as an alternative. Table 2 lists the rating types, in order of priority, used for each issuer group to calculate the composite rating. For example, if a government guaranteed security has a bond rating from at least one of the three designated agencies, then its composite rating will be based on the bond rating(s). If the bond is not rated by any of the three agencies, then issuer ratings from the three agencies are used as an alternative. On the other hand, corporate bonds only use bond ratings.

Table 4: Hierarchy of rating types used by asset class

Issuer group	Composite rating based on
Sovereigns (i.e., sovereign debt denominated in the issuer's local currency)	Local currency long term sovereign debt rating
Foreign Sovereigns (i.e., sovereign debt denominated in a foreign currency)	Foreign currency long term sovereign debt rating
Quasi-Governments (i.e., Agency, Local Authority, Government Sponsored/Guaranteed, Supranational)	1) Bond rating
	2) Senior unsecured debt issuer rating (foreign currency issuer rating is used for bonds denominated in a currency other than the local currency of the issuer's country of domicile). Note: issuer rating is used only for unsubordinated debt.
US Agency MBS	Ginnie Mae collateral: US local currency long-term debt sovereign rating
	Fannie Mae & Freddie Mac collateral: senior unsecured debt issuer rating
Covered bonds	Bond rating
US Municipals	Bond rating
ABS and CMBS	Bond rating
Corporate bonds	Bond rating
Preferreds	Bond rating

Source: BofA Merrill Lynch Bond Indices

Sector classification schema

The BofA Merrill Lynch Bond Indices use a four-tier classification schema which appears in Table 6. The schema classifies constituent securities at four levels: asset class (level 1), group (level 2), category (level 3) and sub-category (level 4). The name of each sector is followed by its corresponding four character code in parentheses.

Table 5: BofA Merrill Lynch Index sector classification schema

Level 1 – Asset class	Level 2 – Group	Level 3 – Category	Level 4 – Sub-category
Sovereign (SOV)	Sovereign (SOV)	Sovereign (Sov)	Sovereign (Sov)
Quasi & Foreign Government (QGVT)	Quasi & Foreign Government (QGVT)	Agency (Agcy)	Agency (Agcy)
		Foreign Sovereign (FSov)	Foreign Sovereign (FSov)
		Government Guaranteed (Guar)	Government Guaranteed (Guar)
		Local-Authority (LGvt)	Local-Authority (LGvt)
		U.S. Taxable Municipal (TaxM)	Taxable Pre-Refunded (TPre)
			Taxable ETM (TEtm)
			Taxable GO - State (TGos)
			Taxable GO - Local (TGol)
			Taxable Revenue - Airport (TAir)
			Taxable Revenue - Education (TEdu)
			Taxable Revenue - Health (THlt)
			Taxable Revenue - Hospitals (THos)
			Taxable Revenue - Pollution Control (TPcr)
			Taxable Revenue - Industrial Development Revenue (TIdr)
			Taxable Revenue - Leasing COPS & Appropriations (TLea)
			Taxable Revenue - Single Family Housing (TShn)
			Taxable Revenue - Multi-Family Housing (TMhn)
			Taxable Revenue - Tax (TTax)
			Taxable Revenue - Tobacco (TTob)
			Taxable Revenue - Toll & Turnpike (TTol)
			Taxable Revenue - Transportation (TTrn)
			Taxable Revenue - Power (TPow)
			Taxable Revenue – Utilities - Other (TUtl)
			Taxable Revenue - Water & Sewer (TWtr)
			Taxable Revenue – Misc (TMis)
		Supranational (Supr)	Supranational (Supr)
Securitized/Collateralized (COLL)	Covered (COVR)	Jumbo Pfandbriefe (JPfn)	Jumbo Pfandbriefe (JPfn)
		Regular Pfandbriefe (RPfn)	Regular Pfandbriefe (RPfn)
		Non-Pfandbriefe Covered (NPfn)	Non-Pfandbriefe Covered (NPfn)
	Securitized (SEC)	Asset Backed (ABS)	ABS Automobile (ABau)
			ABS Credit Cards (ABcc)
			ABS Home Equity Loans (ABhe)
			ABS Manufactured Housing (ABmh)
			ABS Miscellaneous ABS (ABmi)
			ABS Utilities (ABut)
		Collateralized Mortgage Obligation (CMO)	PAC (PAC)
			Sequential (SEQL)
			PAC Z (PACZ)
			Sequential Z (SEQZ)
			Support Z (SUPZ)
			CMO Other (CMOT)
			Structured IO (STIO)
			Structured PO (STPO)
			Trust IO (TRIO)
			Trust PO (TRPO)
		Commercial Mortgage Backed (CMBS)	Commercial Mortgage Backed (CMBS)
		Mortgage Backed (MBS)	Mortgage Backed (MBS)

Table 5: BofA Merrill Lynch Index sector classification schema

Level 1 – Asset class	Level 2 – Group	Level 3 – Category	Level 4 – Sub-category
Corporate (CORP)	Financial (FNCL)	Banking (Bank)	Banking (Bank)
		Financial Services (FinS)	Brokerage (Brkg)
			Cons/Comm/Lease Financing (CFin)
			Investments & Misc Financial Services (Invs)
		Insurance (Insr)	Insurance Brokerage (InsB)
			Life Insurance (InsL)
			Monoline Insurance (InsG)
			Multi-Line Insurance (InsM)
			P&C (InsP)
	Industrials (INDU)	Automotive (Auto)	Auto Loans (AuLn)
			Auto Parts & Equipment (AuPt)
			Automakers (Autm)
		Basic Industry (Basc)	Building Materials (BldM)
			Chemicals (Chem)
			Forestry/Paper (Papr)
			Metals/Mining Excluding Steel (Metl)
			Steel Producers/Products (Stee)
		Capital Goods (CapG)	Aerospace/Defense (Aero)
			Diversified Capital Goods (DCap)
			Machinery (Mach)
			Packaging (Pack)
		Consumer Cyclical (CCyc)	Apparel/Textiles (Text)
			Department Stores (Dept)
			Discount Stores (Disc)
			Household & Leisure Products (Hshl)
			Food & Drug Retailers (FRet)
			Restaurants (Rest)
			Specialty Retail (Spec)
		Consumer Non-Cyclical (CNcy)	Beverage (Bevg)
			Consumer-Products (ConP)
			Food - Wholesale (FWhl)
			Tobacco (Toba)
		Energy (Enrg)	Energy - Exploration & Production (EnEx)
			Gas Distribution (GasD)
			Integrated Energy (Engl)
			Oil Field Equipment & Services (OilE)
			Oil Refining & Marketing (OilR)
		Healthcare (Hcar)	Health Facilities (HFac)
			Health Services (Hlth)
			Managed Care (MCar)
			Medical Products (HDev)
			Pharmaceuticals (Phar)
		Media (Medi)	Media - Broadcast (MedB)
			Media - Diversified (MedD)
			Media - Services (MedS)
			Media-Cable (MedC)
			Printing & Publishing (Prnt)
		Real Estate (REst)	Housing Association (Hous)
			RealEstate Dev & Mgt (ReDM)
			REITs (REIT)
		Services (Serv)	Airlines (Airl)
			Building & Construction (Bldg)
			Gaming (Game)
			Environmental (Evir)
			Hotels (Hotl)
			Leisure (Leis)
			Railroads (Rail)
			Support-Services (Supp)
			Theaters & Entertainment (Thea)
			Transportation Excluding Air/Rail (Tran)

Table 5: BofA Merrill Lynch Index sector classification schema

Level 1 – Asset class	Level 2 – Group	Level 3 – Category	Level 4 – Sub-category
		Technology & Electronics (Tech)	Computer Hardware (Comp)
			Electronics (Elec)
			Office Equipment (OffE)
			Software/Services (SWar)
			Telecommunications Equipment (TelE)
		Telecommunications (Tcom)	Telecom - Integrated/Services (TInt)
			Telecom - Fixed Line (TFxd)
			Telecom - Wireless (TWis)
	Utility (UTIL)	Utility (Util)	Electric-Distr/Trans (EleD)
			Electric-Generation (EleG)
			Electric-Integrated (EleI)
			Non-Electric Utilities (UtlN)
U.S. Tax-Exempt Municipals (MUNI)	Refunded (REFD)	Refunded (Refd)	Pre-Refunded (Pref)
			ETM (Etm)
	GO (GO)	GO - State (Gost)	GO - State (Gost)
		GO - Local (Golo)	GO - Local (Golo)
	Revenue (REV)	Revenue - Airport (Airp)	Revenue - Airport (Airp)
		Revenue - Education (Edu)	Revenue - Education (Edu)
		Revenue - Health (Heal)	Revenue - Health (Heal)
		Revenue - Hospitals (Hosp)	Revenue - Hospitals (Hosp)
		Revenue - Pollution Control (Pcr)	Revenue - Pollution Control (Pcr)
		Revenue - Industrial Development Revenue (Idr)	Revenue - Industrial Development Revenue (Idr)
		Revenue - Leasing COPS & Appropriations (Leas)	Revenue - Leasing COPS & Appropriations (Leas)
		Revenue - Single Family Housing (Shng)	Revenue - Single Family Housing (Shng)
		Revenue - Multi-Family Housing (Mhng)	Revenue - Multi-Family Housing (Mhng)
		Revenue - Tax (Taxr)	Revenue - Tax (Taxr)
		Revenue - Tobacco (Tob)	Revenue - Tobacco (Tob)
		Revenue - Toll & Turnpike (Toll)	Revenue - Toll & Turnpike (Toll)
		Revenue - Transportation (Trns)	Revenue - Transportation (Trns)
		Revenue - Power (Powr)	Revenue - Power (Powr)
		Revenue - Utilities - Other (Utly)	Revenue - Utilities - Other (Utly)
		Revenue - Water & Sewer (Watr)	Revenue - Water & Sewer (Watr)
		Revenue - Misc (Misc)	Revenue - Misc (Misc)
Preferred Securities (PFD)	Pfd-Quasi Government (PQGV)	Pfd-Quasi Government (Pqgv)	Pfd-Quasi Government (Pqgv)
	Pfd-Financial (PFNC)	Pfd-Banking (Pban)	Pfd-Banking (Pban)
		Pfd-Financial Services (Pfin)	Pfd-Financial Services (Pfin)
		Pfd-Insurance (Pins)	Pfd-Insurance (Pins)
	Pfd-Industrials (PIND)	Pfd-Automotive (Paut)	Pfd-Automotive (Paut)
		Pfd-Basic Industry (Pbas)	Pfd-Basic Industry (Pbas)
		Pfd-Capital Goods (Pcap)	Pfd-Capital Goods (Pcap)
		Pfd-Consumer Cyclical (Pccy)	Pfd-Consumer Cyclical (Pccy)
		Pfd-Consumer Non-Cyclical (Pcny)	Pfd-Consumer Non-Cyclical (Pcny)
		Pfd-Energy (Penr)	Pfd-Energy (Penr)
		Pfd-Healthcare (Phca)	Pfd-Healthcare (Phca)
		Pfd-Media (Pmed)	Pfd-Media (Pmed)
		Pfd-Real Estate (Pres)	Pfd-Real Estate (Pres)
		Pfd-Services (Psrv)	Pfd-Services (Psrv)
		Pfd-Technology & Electronics (Ptec)	Pfd-Technology & Electronics (Ptec)
		Pfd-Telecommunications (Ptco)	Pfd-Telecommunications (Ptco)
	Pfd-Utility (PUTI)	Pfd-Utility (Puti)	Pfd-Utility (Puti)
Derivative (Drvt)	Swap (Swap)	Interest rate Swap (Irsw)	Interest rate Swap (Irsw)
		Inflation Swap (Infs)	Inflation Swap (Infs)
CASH (CASH)	CASH (CASH)	CASH (CASH)	CASH (CASH)

Source: BofA Merrill Lynch Bond Indices

Price sources and timing

Table 6: Primary sources for BofA Merrill Lynch index constituent valuations

Market	Primary price source	Timing	
US and Canada:			
US Treasuries	BofAML traders (with tolerance boundaries on variance vs. IDC)	3:00pm ET	
US mortgages	BofAML traders	3:00pm ET	
US agency, foreign govt, corporate, ABS, CMBS, CMO, taxable municipals, high yield	Interactive Data Corporation (IDC)	3:00pm ET	
US preferred	IDC	4:00pm ET	
US tax exempt municipals	JJ Kenny	3:00pm ET	
Canada sovereign	BofAML traders	3:00pm ET	
C$ non-sovereign high grade and high yield	Statpro	3:00pm ET	
Europe:			
Sterling high grade and high yield	IDC	4:15pm London	
Euro high grade and high yield	IDC	4:15pm London	
All other Continental Europe	IDC	4:15pm London	
Japan and Australia			
JGBs	broker to broker	5:00pm local	
Japan credit	combination of JSDA and IDC	5:00pm local	
All A$ indices	IDC	5:00pm Sydney	
Other debt markets:			
Brazil	Statpro	4:15pm local	
Mexico	Statpro	2:30pm local	
Nigeria	Statpro	4:00pm local	
Israel	Statpro	5:00pm local	
Chile, Colombia, Egypt	Thomson Reuters	3:00pm local	
Morocco	Thomson Reuters	4:00pm local	
All other local debt markets	IDC	local market close	
External (USD and EUR) emerging market sovereign and credit	IDC	USD 3pm ET;	EUR 4:15pm London
Swaps and FX:			
All nominal and IL swaps	BofAML traders	USD 3:00pm ET;	EUR/GBP 4:00pm London
Libor	BBAM	11:00am London	
Spot and forward FX rates	The WM Company	4:00pm London	

Source: BofA Merrill Lynch

Glossary

Table 7: BofAML bond index glossary

Field name	Definition
# of Issues	See Number of Issues.
$ Market value (USD terms)	The full market value of the index constituent securities converted into USD terms. It does not include cash payments received during the month and retained by the index. See Market Value ex Cash.
% Excess Return vs. AAA Muni	The total return percentage of a bond minus the total return percentage of a risk-matched basket of Muni AAA GOs. The Muni AAA GO basket is comprised of synthetic securities derived from the fair value Muni AAA GO yield curve. The hedge basket is key rate duration-matched to the bond at six nodes: 6-month, 2-year, 5-year, 10-year, 20-year and 30-year. The excess return of an index is equal to the average of its constituent security excess returns, weighted by their full market values as of the beginning of the period.
% Excess Return vs. Governments	See Excess Return % vs Govts.
% Excess Return vs. Muni	See % Excess Return vs. AAA Muni.
% Excess Return vs. Swap	See Excess Return % vs Swaps.
% Hedged	The percentage of the index full market value at the beginning of the measurement period that is hedged into a given base currency using currency forwards, with 100% indicating fully hedged returns and 0% indicating unhedged returns. See Hedge Return Percentage.
% Market value	The sum of the full market values of all bonds within a given segment of the index divided by the sum of the full market values of all bonds in the entire index, including cash payments received during the period and retained by the index. See % Weight.
% of	The full market value, including cash payments received and retained, of a selected index divided by the full market value of another selected index. (Note: if the first index is a sub-index whose constituents are completely contained within the second index (ie, its parent), then the "% of" field shows the sub-index share of the parent index. If some or all of the first index's constituents are not constituents of the second index, the "% of" calculation simply shows the relative size of the two indices.)
% Price return	See Price Return Percentage.
% Total return	See Total Return Percentage.
% Weight	The full market value of a constituent bond (excluding any cash payments paid during the month) divided by the sum of the full market values of all constituent securities in an index including all cash payments received during the month and retained by the index.
Accrued Interest	For a bond, the accrued interest in percentage terms times the face value of the bond. For an index, the sum of accrued interest values for all constituent securities.
Accrued Interest %	The interest earned on a bond, but not yet paid or received, through the settlement date stated as a percent of face value.
Accrued Interest Value	See Accrued Interest.
Asset Swap	An asset swap is a swap of a bond's fixed coupon for a floating rate coupon pegged to Libor. For a bond, asset swap spread is the spread over the forward Libor (swap) curve that equates the present value of the floating rate instrument to the present value of the bond's cash flows where the cash flows of both instruments are discounted using the swap. The price of a bond with embedded options, such as call or put features, is adjusted to strip away the option value. Asset swap spread is calculated in semi-annual terms, regardless of the bond coupon frequency, as the fixed cash flows are always swapped against semi-annual floating payments. In addition, the swap is calculated on a par basis, meaning that a cash position is added to (removed from) a discount (premium) bond to adjust its price to 100. For an index, the average of its constituent security asset swap spreads, weighted by full market value.
Base currency	The base currency that is used for purposes of calculating returns (which may be hedged or unhedged) and for conversion of bond/index valuations such as face value, full market value, etc.
Beginning Index Value	The total return index value (stated in local, converted unhedged or converted hedged terms) at the beginning of the measurement period. See Total Return Index Value.
Bond Ticker	See Ticker.
Calculation [method]	The basis on which yield and risk measures have been calculated. Conventional uses the bond's actual cash flow frequency as the basis for calculations. Semi-annual yield calculations assume a semi-annual coupon frequency. Semi-annual risk calculations (duration, convexity, etc.) are calculated by discounting the bond's actual cash flows using the semi-annual yield.

Table 7: BofAML bond index glossary

Field name	Definition
Cash	For a bond, cash is the amount received during the month from coupon payments plus interest on coupon payments received at the applicable reinvestment rate, if any, stated as a percentage of face value. For an index it is the sum of the cash position (cash percentage times face value) for all constituent securities converted into a given base currency. (Note: when determining the weight of a constituent in an index, cash is not included as part of the constituent's full market value, but it is included in the index full market value.)
Cash Value	See Cash.
Change in Govt OAS	The change in the Govt OAS during the period. For an index, this includes the impact of rebalancing changes that occur during the period. See Govt OAS.
Change in Govt OAS (incl. rebalancing impact)	See change in Govt OAS.
Change in Libor OAS	The change in the Libor OAS during the period, inclusive of the impact of rebalancing changes that occur during the period. See Libor OAS.
Change in Libor OAS (incl. rebalancing impact)	See change in Libor OAS.
Change in Spread to Worst	The change in Spread to Worst during the period, inclusive of the impact of rebalancing changes that occur during the period. See Spread to Worst vs Govt.
Composite Rating	For a constituent bond, composite rating is the simple average of the Moody's, S&P and Fitch bond ratings. For an index it is the average of its constituent security composite ratings, weighted by full market value.
Contribution to Modified Duration	The modified duration to maturity of a bond, or group of bonds, times its weight in a given index. See Mod Dur to Maturity.
Contribution to modified duration to worst	The modified duration to worst of a bond, or group of bonds, times its weight in a given index. See Mod Dur to Worst.
Convexity to Maturity	The second derivative of a security's price with respect to its yield divided by the security's price, where it is assumed that the bond will be redeemed at its final maturity date without regard to any embedded options such as call or put features. When Convexity to Maturity is stated in conventional terms, the bond cash flows to its final maturity date are discounted using its conventional yield. When stated in semi-annual terms, the bond cash flows to its final maturity date are discounted using its semi-annual yield. For an index it is the average of its constituent security convexities to maturity, weighted by full market value.
Convexity to Worst	The second derivative of a security's price with respect to its yield divided by the security's price. For bonds with embedded options, such as call or put features, Convexity to Worst is calculated to the redemption date that produces the lowest yield for bonds with call features or the highest yield for bonds with put features (the "workout date"). When Convexity to Worst is stated in conventional terms, the bond cash flows to the workout date are discounted using its conventional yield. When stated in semi-annual terms, the bond cash flows to the workout date are discounted using its semi-annual yield. For an index it is the average of its constituent security convexities to worst, weighted by full market value.
Country of Risk	The International Organization for Standardization (ISO) country code of the issuer's country of risk. The assignment of an issuer's country of risk takes four factors into account (listed in order of importance): management location, country of primary listing, country of revenue and reporting currency of the issuer. Management location is defined by country of domicile unless location of such key players as the Chief Executive Officer (CEO), Chief Financial Officer (CFO), Chief Operating Officer (COO), and/or General Counsel is otherwise.
Country of Risk (Eurozone Grouped)	The Country of Risk where all Eurozone countries are combined in a single group under the EURC code. See Country of Risk.
Country of Risk (Eurozone itemized)	The Country of Risk where all Eurozone countries are shown individually. See Country of Risk.
Coupon	For a bond, its stated rate of interest; for an index the average of its constituent security coupons, weighted by full market value.
Currency	The currency of denomination of the cash flows paid by a bond. Where used as a grouping category, Eurozone Grouped indicates that all euro legacy currencies are grouped under the EUR currency code while Eurozone Itemized indicates that euro legacy currencies are shown individually.
Currency of Denomination (Eurozone Grouped)	See Currency.
Currency of Denomination (Eurozone Itemized)	See Currency.
Currency Return	See Currency return percentage.
Currency return percentage	For an index, currency return percentage in a given base currency is equal to the difference between the index total return percentage in local currency terms and its total return percentage in the selected base currency.
Cusip	The Committee on Uniform Securities Identification Procedures number assigned by the CUSIP Service Bureau for U.S. and Canadian companies. For a bond that does not have an official Cusip number, the Bloomberg bond ID number is shown. In addition, where used as an input, the field will also accept Bloomberg bond ID numbers.

Table 7: BofAML bond index glossary

Field name	Definition
Description	For a bond the issuer name; for an index the official index name.
Detail Composite Rating	See Composite Rating.
Effective Convexity	The second derivative of a security's price with respect to changes in the semi-annual par yield curve, divided by the security's price. For an index it is the average of its constituent security effective convexities, weighted by full market value. See Effective Duration.
Effective Duration	Effective duration is the percentage change in the price of a bond given a parallel shift in the semi-annual par coupon government yield curve while keeping option-adjusted spread constant. A theoretical price is calculated by discounting the bond's cash flows using the shifted yield curve. An option pricing model is used to account for the impact of embedded options such as call or put features. For US mortgage-backed securities, prepayment and interest rate models are used to project security cash flows and the forward curve under multiple interest rate paths for the shifted yield curve scenario. Each set of cash flows is discounted by the forward curve corresponding to its interest rate path, and the average of the net present values of all of the sets of cash flows is the theoretical price for the scenario. For US ABS and CMBS securities, a single static set of cash flows are projected using an assumed pricing prepayment speed. For an index, it is the average of its constituent security effective durations, weighted by full market value.
Effective Duration (OAD)	See Effective Duration.
Effective Yield	Effective yield is the yield of a hypothetical bullet bond created by stripping out the option value of a bond with embedded optionality such as a call or put features. For US ABS, CMBS and CMO securities, effective yields are based on a static set of cash flows generated using the assumed pricing prepayment speed. For US MBS, interest rate and prepayment models are used to project a set of future cash flows under a single interest rate scenario. The average life of the security is equal to the average time to each of the projected principal payments weighted by their future values. That average life is converted to a long-term equivalent PSA (ie, the PSA that will generate cash flows having the same average life) and the cash flows generated by the long-term equivalent PSA are used to derive the yield. For an index, it is the average of its constituent security effective durations, weighted by full market value.
Effective Yield (OAY)	See Effective Yield.
Ending Index Value	The total return index value (stated in local, converted unhedged or converted hedged terms) at the end of the measurement period. See Total Return Index Value.
Excess Return % vs Govts	The total return percentage of a bond minus the total return percentage of a risk-matched basket of governments. The government basket is comprised of synthetic securities derived from the fair value government yield curve corresponding to the currency of denomination of the bond. The hedge basket is key rate duration-matched to the bond at six nodes: 6-month, 2-year, 5-year, 10-year, 20-year and 30-year. The excess return of an index is equal to the average of its constituent security excess returns, weighted by their full market values as of the beginning of the period.
Excess Return % vs Swaps	The total return percentage of a bond minus the total return percentage of a risk-matched basket of interest rate swaps. The swap basket is comprised of synthetic securities derived from the fair value swap yield curve corresponding to the currency of denomination of the bond. The hedge basket is key rate duration-matched to the bond at six nodes: 6-month, 2-year, 5-year, 10-year, 20-year and 30-year. The excess return of an index is equal to the average of its constituent security excess returns, weighted by their full market values as of the beginning of the period.
Excess Return vs. Govt	See Excess Return % vs Govts.
Excess Return vs. Swap	See Excess Return % vs Swaps.
Excess Rtn % MTD	The month-to-date total return percentage of a bond minus the month-to-date total return percentage of a risk-matched basket of governments. See Excess Return % vs Govts.
Face Value	For a bond, the face value of the security held by the index. For capitalization weighted indices, the face value of a constituent is equal to the total amount outstanding of the bond issue. For indices that use alternative weighting schemes, the face value of a constituent will differ from the total amount outstanding of the bond issue. The Face Value of an index is equal to the sum of the face values of its constituent securities converted into a given base currency.
Full Market Value	Full market value in local currency terms. (Note 1: for bonds, full market value is equal to face value times price plus accrued interest; for indices, full market value also includes cash payments received and retained by the index during the period. Note 2: euro legacy bonds are converted into EUR terms.)

Table 7: BofAML bond index glossary

Field name	Definition
Govt OAS	For a bond, the option-adjusted spread of the bond measured vs the underlying government yield curve corresponding to the bond's currency of denomination. Option-adjusted spread is the number of basis points that the fair value government spot curve is shifted in order to match the present value of discounted cash flows to the bond's price. For securities with embedded options, such as call, sink or put features, a log normal short interest rate model is used to evaluate the present value of the securities potential cash flows. In this case, the OAS is equal to the number of basis points that the short interest rate tree must be shifted in order to match discounted cash flows to the bond's price. For US securitized products interest rate/prepayment models (US MBS, CMOs) or pricing speeds (ABS, CMBS) are used to generate forward curves and projected cash flows. OAS is the number of basis points that must be added to the one-month semi-annually compounded forward zero curves in each scenario in order to match the average present value of discounted cash flows across all scenarios to the bond's price. For an index, the average of its constituent security government option-adjusted spreads, weighted by full market value.
Hedge Return	See Hedge return percentage.
Hedge Return Percentage	For a bond or an index, hedge return percentage in a given base currency is equal to the difference between the index total return percentage fully hedged into a given base currency minus its unhedged total return percentage in that same base currency, times the percentage of the bond/index currency exposure that has been hedged.
Inception Date	The date that the index history begins. It is typically earlier than the date the index was first published, which is referred to as the Launch Date. See Launch Date.
Income Return %	The return of a bond or index attributed to its coupon (including both received and/or accrued coupons, but not including amortization of premiums or accretion of discounts). Income return percentage is equal to total return percentage minus price return percentage. See Total Return Percentage, Price Return Percentage.
Income Return (Local)	See Income Return %.
Index Name	The official name of the index.
ISIN	The International Securities Identification Number (ISIN).
Issue Year	The year the security was issued.
Issuer Country	See Country of Risk.
Issuer State (U.S. munis)	The State in which a US municipal securities issuer is domiciled.
Launch Date	The date the index was first published (not available for all indices). It is typically later than the date the index history begins, which is referred to as the Index Inception Date. See Inception Date.
Level 1 Asset Class	See Sector Level 1.
Level 2 Group	See Sector Level 2.
Level 3 Subgroup	See Sector Level 3.
Level 4 Detail	See Sector Level 4.
Libor OAS	For a bond, the option-adjusted spread of the bond measured vs the underlying swap curve corresponding to the bond's currency of denomination. For an index, the average of its constituent security Libor option-adjusted spreads, weighted by full market value.
Mac Dur to Maturity	See Macaulay Duration.
Macaulay Duration	For a bond, the weighted average time to maturity of its cash flows without consideration given to embedded options such as call, put and/or sink feature. For an index, it is the average of its constituent security Macaulay durations, weighted by full market value.
Market Value Ex Cash	The sum of the market values of the constituent securities of an index converted into a given base currency. Constituent security market values are equal to price plus accrued interest times face value. Market Value ex Cash does not include any coupon payments received during the period and retained by the index.
Market Weighted Coupon	See Coupon.
Maturity	Generally Maturity is the final stated maturity of a constituent security. For callable perpetual securities it is the first call date. For fixed to floating rate securities it is the last call date during the fixed rate coupon period. For perpetual preferred securities it is 12/31/2200. For US mortgage pass-through securities it is an date derived from the security's average life.
Mkt Wgt Coupon	See Coupon.

Table 7: BofAML bond index glossary

Field name	Definition
Mod Dur to Maturity	The percentage change in the price of a bond for a 100bp change in yield where it is assumed that the bond will be redeemed at its final maturity without regard to any embedded options such as call or put features. For an index, it is the average of its constituent security modified durations to maturity, weighted by full market value. When duration to maturity is stated in conventional terms, the bond cash flows to maturity are discounted using its conventional yield. When stated in semi-annual terms, the bond cash flows to maturity are discounted using its semi-annual yield. For US ABS, CMBS and CMO securities, modified duration to maturity is based on a static set of cash flows generated using the assumed pricing prepayment speed. For US MBS, interest rate and prepayment models are used to project a set of future cash flows under a single interest rate scenario. The average life of the security is equal to the average time to each of the projected principal payments weighted by their future values. That average life is converted to a long-term equivalent PSA (ie, the PSA that will generate cash flows having the same average life) and the cash flows generated by the long-term equivalent PSA are used to derive the modified duration to maturity.
Mod Dur to Worst	The percentage change in the price of a bond for a 100bp change in yield where it is assumed that bonds with embedded options, such as call or put features, will be redeemed on the redemption date that produces the lowest yield for bonds with call features or the highest yield for bonds with put features (the "workout date"). For an index, it is the average of its constituent security modified durations to worst, weighted by full market value. When duration to worst is stated in conventional terms, the bond cash flows to the workout date are discounted using its conventional yield. When stated in semi-annual terms, the bond cash flows to the workout date are discounted using its semi-annual yield. For US ABS, CMBS and CMO securities, modified duration to worst is based on a static set of cash flows generated using the assumed pricing prepayment speed. For US MBS, interest rate and prepayment models are used to project a set of future cash flows under a single interest rate scenario. The average life of the security is equal to the average time to each of the projected principal payments weighted by their future values. That average life is converted to a long-term equivalent PSA (ie, the PSA that will generate cash flows having the same average life) and the cash flows generated by the long-term equivalent PSA are used to derive the modified duration to worst.
Modified Duration	The modified duration to maturity of a bond or index stated in conventional terms. See Mod Dur to Maturity.
Modified Duration to Maturity	The modified duration to maturity of a bond or index stated in conventional terms. See Mod Dur to Maturity.
Modified Duration to Maturity (Conventional)	The modified duration to maturity of a bond or index stated in conventional terms. See Mod Dur to Maturity.
Modified Duration to Maturity (Semi-Annual)	The modified duration to maturity of a bond or index stated in semi-annual terms. See Mod Dur to Maturity.
Modified Duration to Worst	The modified duration to worst of a bond or index stated in conventional terms. See Mod Dur to Worst.
Modified Duration to Worst (Conventional)	The modified duration to worst of a bond or index stated in conventional terms. See Mod Dur to Worst.
Modified Duration to Worst (Semi-Annual)	The modified duration to worst of a bond or index stated in semi-annual terms. See Mod Dur to Worst.
Mortgage WAC	The weighted average coupon of the underlying mortgages that comprise a generic US mortgage pass-through security, weighted by their outstanding loan balances.
Mortgage WALA	The weighted average age of the underlying mortgages that comprise a generic US mortgage pass-through security, weighted by their outstanding loan balances.
Mortgage WAM	The weighted average maturity of the underlying mortgages that comprise a generic US mortgage pass-through security, weighted by their outstanding loan balances.
Number of Issues	The number of constituent securities in an index or index segment.
OAS vs Govt	See Govt OAS.
OAS vs Swap	See Libor OAS.
Option-adjusted spread (OAS)	See Govt OAS.
Par amount	See Face Value.
Par Amount (USD terms)	See Face Value.
Par Weighted Coupon	The average of the index constituent security coupons, weighted by face value.
Par Weighted Price	See Price.
Par Wgt Coupon	See Par Weighted Coupon.
Par Wgt Price	See Price.
Paydown Return	See Paydown Return %.

Table 7: BofAML bond index glossary

Field name	Definition
Paydown Return %	For US MBS, ABS and CMBS securities, paydown return percentage represents the percentage change in value of the security attributed to the scheduled and prepaid principal received during the period. The portion of principal paid down will not participate in any price appreciation/depreciation during the period, but instead realizes a gain or loss equal to the difference between the end of period market price and par times the portion of face value that was paid down. For an index, it is the average of its constituent security paydown return percentages, weighted by their full market values at the beginning of the measurement period.
Price	The clean price of a bond stated as a percentage of face value. For an index it is the average of its constituent security prices, weighted by face value.
Price Return (Local)	The Price Return Percentage during the measurement period in local currency terms. See Price Return Percentage.
Price Return Index Hedged	A value that is set to an arbitrary level (typically 100) at the inception date of the index and thereafter is incremented or decremented by the hedged price return percentage of the index in a given base currency. See Inception Date, Price Return Percentage Hedged.
Price Return Index Value	A value that is set to an arbitrary level (typically 100) at the inception date of the index and thereafter is incremented or decremented by the price return percentage of the index. See Inception Date, Price Return Percentage.
Price Return Percentage	The price return percentage of a bond is equal to its change in price during the measurement period divided by its full market value at the beginning of the measurement period. If price return percentage is stated in a base currency other than the bond's currency of denomination, it also includes the impact of changes in spot currency rates during the period. For an index, it is the average of its constituent security price return percentages, weighted by their full market values at the beginning of the period.
Price Return Percentage Hedged	The price return percentage of a bond or index stated in a given base currency where the currency exposure of the bond/index is hedged with currency forward contracts. See Price Return Percentage.
Rating	See Composite Rating.
Redemption type	A flag that indicates the presence of any features of a bond that could affect its redemption date, such as a call or put feature.
Sector Level 1	The first level of the four tier BofAML bond index sector classification schema. Level 1 designates the sector asset class.
Sector Level 2	The second level of the four tier BofAML bond index sector classification schema. Level 2 designates the sector group.
Sector Level 3	The third level of the four tier BofAML bond index sector classification schema. Level 3 designates the sector category.
Sector Level 4	The fourth level of the four tier BofAML bond index sector classification schema. Level 4 designates the sector sub-category.
Spread	See Govt OAS.
Spread Duration	For a bond, the percentage change in price for a 100bp change in option-adjusted spread (OAS). For an index it is the average of its constituent security spread durations, weighted by full market value.
Spread to Worst vs Govt	For a bond, its yield to worst minus the yield at a point on the fair value government yield curve that corresponds to the bond's expected redemption date, where it is assumed that a bond with embedded options will be redeemed on the date that produces the lowest yield for bonds with call features or the highest yield for bonds with put features (the "workout date"). For US MBS, ABS, CMBS and CMO securities the average life is used in place of the expected redemption date. For an index, the average of its constituent security spreads to worst, weighted based on full market value. See Yield to Worst.
Summary Composite Rating (AAA, AA, etc)	Generic composite rating categories that do not distinguish rating sub-categories. For example, the AA Summary Composite Rating category includes bonds with a composite rating equal to AA1, AA2 or AA3. See Composite Rating.
Ticker	For bonds, this field shows the issuer ticker; for indices it is the four character BofAML reference ticker assigned to the index.
Total Return (Converted)	The total return percentage of an index times the percentage changes in spot currency rates where all constituent securities are converted into a common base currency. See Total Return Percentage.
Total Return (Local)	The total return percentage during the measurement period in local currency terms. See Total Return Percentage
Total Return Index Hedged	A value that is set to an arbitrary level (typically 100) at the inception of the index and thereafter is incremented or decremented by the hedged total rate of return percentage of the index in a given base currency. See Inception Date, Total Return Percentage Hedged.
Total Return Index Value	A value that is set to an arbitrary level (typically 100) at the inception of the index and thereafter is incremented or decremented by the total return percentage of the index. See Total Return Percentage.
Total Return Percentage	The Total Return Percentage of a bond is equal to the sum of its change in price, change in accrued interest, and cash flow payments received during the measurement period divided by its full market value at the beginning of the measurement period. If total return percentage is stated in a base currency other than the bond's currency of denomination, it is multiplied by in the percentage change spot currency rates during the period. For an index, it is the average of its constituent security total return percentages, weighted by their full market values at the beginning of the period.

Table 7: BofAML bond index glossary

Field name	Definition
Total Return Percentage Hedged	The total return percentage of a bond or index stated in a given base currency where the currency exposure of the bond/index is hedged with currency forward contracts. See Total Return Percentage.
Total Return Value	See Total Return Index Value.
TTR % MTD LOC	The month-to-date total return percentage in local currency terms. See Total Return Percentage.
Type	The ranking of the bond with regard to claims on issuer assets or earnings in the event of default.
Weight	See % Weight.
Weighting Method	The basis for determining the weights of constituent securities within an index.
Years to Final Maturity	See Years to Maturity.
Years to Maturity	For a bond, the time from the current settlement date to its final stated maturity measured in years. For an index, the average of its constituent security years to final maturity, weighted by full market value. For US MBS, ABS and CMBS constituents, years to maturity is equal to the security's average life.
Years to Maturity Average Life	See Years to Maturity.
Years to Workout	For a bond, the time from the current settlement date to the expected redemption date. For bonds with embedded options, such as call or put features, the expected redemption date is the date that produces the lowest yield for bonds with call features or the highest yield for bonds with put features. For an index, the average of the constituent security years to workout weighted based on full market value.
Yield Ratio	The effective yield of a bond divided by the yield on the effective duration-matched point on the fair value government yield curve that corresponds to the currency of denomination of the bond. For an index it is the average of its constituent security yield ratios, weight by full market value.
Yield to Maturity	For a bond, the percentage rate of return paid if the security is held to its maturity date without consideration given to any embedded options such as call or put features. When yield to maturity is stated in conventional terms, the bond cash flows to maturity are discounted using a yield based on the same coupon frequency of the bond. When stated in semi-annual terms, the bond cash flows to maturity are discounted using a semi-annual yield. For US MBS, ABS, CMBS and CMO securities, Yield to Maturity is equal to Effective Yield. For an index, it is the average of its constituent security yields to maturity, weighted by full market value.
Yield to Maturity (Conventional)	The yield to maturity of a bond or index stated in conventional terms. See Yield to Maturity.
Yield to Maturity (Semi-Annual)	The yield to maturity of a bond or index stated in semi-annual terms. See Yield to Maturity.
Yield to Worst	For bonds with embedded options, yield to worst is the yield to the redemption date that produces the lowest result for bonds with call features or the highest result for bonds with put features. When yield to worst is stated in conventional terms, the bond cash flows to the workout date are discounted using a yield based on the same coupon frequency of the bond. When stated in semi-annual terms, the bond cash flows to the workout date are discounted using a semi-annual yield. For US MBS, ABS, CMBS and CMO securities, Yield to Worst is equal to Effective Yield. For an index, it is the average of the Yield to Worst of its constituent securities weighted full market value. See Effective Yield.
Yield to Worst (Conventional)	The yield to worst of a bond or index stated in conventional terms. See Yield to Worst.
Yield to Worst (Semi-Annual)	The yield to worst of a bond or index stated in semi-annual terms. See Yield to Worst.

Source: BofA Merrill Lynch

Link to Definitions

Credit

Click here for definitions of commonly used terms.

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