

## J.P. Morgan Government Bond Index (GBI) United Kingdom Short-term Custom Maturity Index

### Methodology and Factsheet

#### Highlights

The J.P. Morgan Government Bond Index (GBI) United Kingdom Short-term Custom Maturity Index aims to track the performance of eligible fixed-rate, pound sterling-denominated United Kingdom government bonds maturing within the next 3 months to 5 years. The index is based on the composition and established methodology of the J.P. Morgan Government Bond Index Aggregate (GBI-Aggregate).

#### Index Criteria

<b>Minimum Issue Size</b>	Minimum US\$1 billion equivalent
<b>Instrument Type</b>	<b>Includes:</b> Fixed-rate and zero-coupon bonds <b>Excludes:</b> Bills, floating-rate bonds, capitalization/amortizing bonds, bonds with callable, puttable, or convertible features
<b>Remaining Maturity</b>	Remaining maturity at rebalance is at least 3 months and less than 5 years
<b>Currency Denomination</b>	Pound Sterling denominated
<b>Issuers</b>	United Kingdom central government
<b>Credit Quality Classification</b>	Lowest rating of three (Moody's, S&P, Fitch)

#### Index Characteristics and Methodology

<b>Pricing</b>	Mid prices are taken from a third party pricing source, PricingDirect
<b>Aggregate Return</b>	Weighted average of bond returns using mid prices
<b>Rebalancing</b>	Rebalances on the last weekday of the month. If FX rates from WM Reuters are unavailable on the last weekday of the month (i.e. Good Friday), indices are rebalanced on the previous business day.
<b>Coupon Reinvestment</b>	Immediately reinvested in to the respective local market returns
<b>FX Rates</b>	All FX rates used for hedged/unhedged returns are as of 4pm London time provided by WM/Reuters
<b>Hedging Strategy</b>	Assume a 1-month currency forward position that begins on rebalance day and ends on next rebalance day
<b>Weighting</b>	Market capitalization based weighting
<b>Holiday Calendar</b>	UK market calendar
<b>Bloomberg Ticker</b>	GBIEUKSG Index

Source: JPMorgan Chase & Co.

## Instrument type

Only fixed-rate and zero coupon bonds are included. Bills, floating-rate and capitalization, amortizing bonds or bonds with callable, puttable or convertible features are not part of the indices.

## Liquidity

- *Pricing*: Bonds must trade with enough frequency to prevent stale price quotations
- *Availability*: Bonds must be regularly traded in size at acceptable bid-offer spreads and readily redeemable for cash. A reasonable two-way market must exist for the instrument to be included in the index portfolio.
- *Replication costs*: Investors should be able to replicate the index without incurring excessive transaction costs.

## Bond calculations

**Calculations are according to market convention**: all calculations including accrued interest, duration, yield, etc., are done according to local market convention using parameters (ex-dividend rules, settlement conventions, etc.). All calculations are gross of tax and ignore transactions costs.

**Bond pricing**: Pricing for our underlying instruments is provided on a daily basis from Pricing Direct, a third party valuation vendor. In the event the primary source for pricing is unable to provide a quote, the Index Group reserves the right to consider the use of an appropriate alternative source for index inputs. Please see <http://www.pricing-direct.com> for further details.

**Returns and return indices**: return indices on individual bonds are calculated on a daily basis and measure bond performance over time:

- Principal return index is based on changes in clean price
- Interest return index is based on changes in accrued interest
- Total return index is based on changes in both clean price and accrued interest

**Reinvestment of coupons**: the J.P. Morgan indices are always fully invested. All coupons received are immediately reinvested back into the local market.

**Interest accruals**: interest is accrued starting from the bond's dated date up to the first coupon value date. Accrued interest is calculated according to market convention, on a settlement day basis. Interest is accrued by value or settlement date. Weekly, seven days of interest are accrued, including the weekend.

In markets with ex-dividend rules, if a bond is purchased after the ex-dividend date the purchaser will not receive the bond's next coupon. In order to compensate the buyer of the bond, the price paid for the bond must be less than the clean market price, thus, accrued interest will be negative.

**Coupon value date**: The coupon value date is the trade date associated with settlement on coupon date (the day the coupon is paid). Thus, the coupon value date is the last trade date which an investor may purchase a bond and have that bond settle prior to payment of the subsequent coupon. On coupon value date, accrued interest resets to zero, and accruals begin towards the next coupon.

**Yield**: effective annual rate of return, expressed as a percentage. For the J.P. Morgan Government Bond Index body of data, yields are all calculated as yield-to-maturity, which is the discount rate that the present value of future payments equals the price of the security.

## Index calculations

The index rebalances on the last weekday of each month. Bonds comprising the indices are required to have more than 3 months remaining to maturity on rebalance day for inclusion in the index.

If FX rates from WM Reuters are unavailable on the last weekday of the month (i.e. Good Friday), indices are rebalanced on the previous business day.

The index is weighted by the component countries' aggregate normalized market capitalization (dirty price times par outstanding). The weights change monthly on each rebalance day, and those weights remain active for the remainder of that month.

Daily indicative pricing for each security and FX rate is closely scrutinized and are reconciled using market movements and other pricing sources as guidance. As necessary, an established alternate source will be used to maintain the integrity of daily index calculations. On any given calculation day, if the primary source is unable to provide a quote, the Index Group reserves the right to consider the use of an appropriate alternate source for index inputs, such as pricing and FX. If a permanent switch for the primary third party pricing source is necessary, clients will be notified in advance prior to any official switch.

## Appendix A: Bond Total Return Methodology

### A. Standard Case

The total return for an individual bond between days (t-1) and (t) is calculated as shown below:

$$Total\ Return_t = \left( \frac{P_t + A_{v(t)}}{P_{t-1} + A_{v(t-1)}} \right) - 1$$

$Total\ Return_t$	Total return value on day t, incorporating both principal and interest
$P_t$	Local market closing clean pricing of a bond on day t.
$A_{v(t)}$	Accrued interest for a bond on day t; it is calculated up to, but excluding the value date v(t)
$t$	Current market day
$t - 1$	Previous market day determined by the market's holiday calendar

Accrued interest for a bond is based on the following formula:

$$A_{v(t)} = \left( \frac{C_{v(t)} \times d_{v(t)}}{d_y} \right)$$

$C_{v(t)}$	Next coupon to be paid on a bond after the value date v(t)
$d_{v(t)}$	Number of days of accrued interest used to calculate : it can be zero or negative
$d_y$	Number of days in a year according to a bond's day count convention

Total return indices for individual bonds are calculated as shown below:

$$Index_t = Index_{t-1} \times Total\ Return_t$$

$Index_t$	Index value on day t
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The base for the index level is December 31st, 2014 = 100.

### B. On Coupon Value Date

On coupon value date, the accrued interest for specific bond is reset to zero. On that date, the coupon value will be added into calculation of the total return and the associated index.

$$Total\ Return_t = \left( \frac{P_t + C_{v(t)}}{P_{t-1} + A_{v(t-1)}} \right) - 1 \qquad Index_t = Index_{t-1} \times \left( \frac{P_t + C_{v(t)}}{P_{t-1} + A_{v(t-1)}} \right)$$

## Appendix B: Bond Yield Methodology

Calculation of yield to maturity in the GBI indices is a two-step process. First, the following equation is solved iteratively for the discount rate (r):

$$P + A = \sum_{n=1}^{i-1} \left( \frac{C_i}{b} \right) \times [1 - \sum f_k] \times r^{t_i} + \sum f_i R_i \times r^{t_i} + f_F \times (R_F + A_F) \times r^{t_F}$$

$P$	Clean Price
$A$	Accrued interest through the value date
$r$	Discount rate
$d_t$	Number of days from settlement to coupon payment $i$ (final payment if $i = F$ )
$d_y$	Number of days in the year
$t_i$	Time to the $i$ th cash flow expressed in coupon periods
$N$	Number of coupon payments left
$F$	Indicator for final redemption if $F > N$ (else, ignore this term)
$C_i$	Annual coupon rate in the $i$ th period (percentage of face value)
$f_i$	Fraction of current amount outstanding redeemed on the $i$ th coupon payment date (or on the final redemption date if $i = F$ )
$R_i$	Redemption price on the $i$ th coupon payment date (or on the final payment date if $i = F$ )
$A_F$	Additional accrued interest from the final coupon date $N$ to the final redemption date $F$

Once the discount factor is obtained, the true yield is calculated as follows:

$$Yield = 100 + \left[ \frac{1 \left( \frac{1}{b} \right)}{r} - 1 \right] \times b$$

$b$  Basis of yield quote ( $b=1$ = annual,  $b=2$ = semi-annual, etc.)

## Appendix C: Total Return Calculation Methodology

Total return for a portfolio of bonds between days (t-1) and (t) is calculated as shown below.

$$Total\ Return_t = \sum_{n=1}^{bonds} \left[ \left( \frac{P_{n_t} + A_{n_{v(t)}} (if\ A_{v(t)} < A_{v(t-1)}) + C_{v(t)}}{P_{n(t-1)} + A_{n_{v(t-1)}}} \right) - 1 \right] * \frac{ParOuts_{n_t}}{ParOuts_{n_{t-1}}}$$

The total return index is calculated as shown below:

$$T.R.\ Index_t = T.R.\ Index_{t-1} * Total\ Return_t$$

$n$	Indicates a given bond within the market portfolio. "n" moves from 1 to "bonds," with "bonds" being the last bond in the portfolio.
$t$	Current market day
$t-1$	Previous market day determined by the market's holiday calendar
$P_{n_t}$	Local market closing clean price of a bond $n$ on day $t$

$A_{n_{v(t)}}$	Accrued interest for a bond n on day t; it is calculated up to, but excluding the value date $v(t)$
$C_{v(t)}$	Next coupon to be paid on a bond after the value date $v(t)$
$ParOuts_t$	Par value outstanding in local currency. This value remains constant through a given month. This value is rebalanced for new issues, retiring issues and auctions as part of the month end process.
$\langle if A_{v(t)} < A_{v(t-1)} \rangle$	Equals 1 if the boolean expression is true; otherwise, it equals zero. This boolean will be true when t is equal to coupon value date and accrued interest is reset to zero.
$Total Return_t$	Total return value on day t, incorporating both principal and interest
$Index_t$	Index value on day t

For any questions or for additional information, please contact [index.research@jpmorgan.com](mailto:index.research@jpmorgan.com)

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## Global Index Research

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