

## J.P. Morgan Government Bond Index United States

### Index Methodology and Profile

#### Highlights

The J.P. Morgan Government Bond Index (GBI) United States aims to track the performance of eligible fixed-rate, US Dollar-denominated treasury bonds issued by the United States Government. The index is based on the composition and established methodology of the J.P. Morgan Government Bond Index Aggregate (GBI-Aggregate).

#### Index Criteria

<b>Instrument Type</b>	<b>Included:</b> Liquid, bullet, fixed-rate coupon bonds <b>Excluded:</b> Callable, puttable, inflation linked or convertible features
<b>Remaining Maturity</b>	Remaining maturity at rebalance is at least 13 months
<b>Amount Outstanding</b>	Minimum US\$1 billion
<b>Currency</b>	US Dollar denominated
<b>Country Eligibility</b>	Issued by the United States Government

#### Index Characteristics and Methodology

<b>Pricing</b>	Bid and Ask prices are taken from a third party pricing source
<b>Aggregate Return</b>	Weighted average of bond returns using closing 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>Holiday Calendar</b>	Calculated on every weekday
<b>Coupon Treatment</b>	Immediately reinvested back into the index
<b>FX Rates</b>	All FX rates are as of 4pm London time provided by WM Reuters

#### Defining the universe of the Government Bond Index United States instruments

The J.P. Morgan Government Bond Index (GBI) United States Index consists of regularly traded, fixed-rate, US Dollar-denominated treasury bonds issued by the United States Government.

Eligibility for US Dollar-denominated domestic debt issues is determined using the following criteria:

#### Instrument Type

The index only includes liquid, bullet, fixed-rate coupon instruments. Floating-rate, inflation linked, and capitalizing/amortizing bonds are not eligible for index inclusion. Additionally, 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. Regular pricing must be available through the primary third-party pricing source.
- *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.

## Index Profile, Characteristics and Returns

- As of May 31<sup>st</sup>, 2018, the Government Bond Index (GBI) United States contains 255 bonds.
- The average index yield is 2.81% with an average duration of 6.4 years.

Figure 1: Monthly return (% , local currency) of the GBI United States, 2013- 2018:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual YTD
2013	-1.0%	0.6%	0.1%	1.0%	-2.0%	-1.3%	-0.2%	-0.5%	0.8%	0.6%	-0.4%	-1.1%	-3.4%
2014	1.6%	0.3%	-0.3%	0.6%	1.1%	-0.2%	-0.2%	1.2%	-0.6%	1.1%	0.9%	0.3%	6.1%
2015	2.9%	-1.8%	0.7%	-0.6%	-0.2%	-1.0%	1.0%	0.0%	0.9%	-0.4%	-0.4%	-0.1%	0.9%
2016	2.2%	1.0%	0.1%	-0.1%	0.0%	2.4%	0.4%	-0.6%	-0.1%	-1.2%	-2.8%	-0.1%	1.1%
2017	0.2%	0.5%	0.0%	0.7%	0.7%	-0.1%	0.1%	1.2%	-0.9%	-0.1%	-0.1%	0.4%	2.5%
2018	-1.4%	-0.8%	1.0%	-0.8%	0.9%	-	-	-	-	-	-	-	-1.2%

Source: J.P. Morgan

## Where to find the Government Bond Index (GBI) United States Index?

Bloomberg Ticker	JPMTUS
DataQuery	DB(BIGI,US,TRADED,TR,,USD)
Morgan Markets	<a href="http://www.jpmm.com">www.jpmm.com</a>
	Research -> Index-> GBI Aggregate Index Family

## 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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### 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.

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

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<sub>t</sub>*

Index value on day t

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**Global Index Research**

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