

## J.P. Morgan EMU Government Bond Index

### Index Methodology and Profile

#### Highlights

The J.P. Morgan EMU (Economic and Monetary Union) Government Bond Index aims to track the performance of eligible fixed-rate, euro-denominated domestic government debt issued by Eurozone countries. The index currently includes liquid government bonds issued by Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal and Spain (Greece was removed in April 2012 due to restructuring of debt).

#### 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>	Issues must have minimum €1 billion notional outstanding to be eligible
<b>Currency</b>	Euro denominated
<b>Country Eligibility</b>	Issued by a Eurozone country

#### Index Characteristics and Methodology

<b>Pricing</b>	Bid and Ask prices are taken from a third party pricing source <sup>1</sup>
<b>Aggregate Return</b>	Weighted average of bond total 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>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
<b>Credit Rating</b>	There is no credit rating criteria for the standard EMU Index

#### Defining the universe of EMU instruments

The EMU Government Bond Index consists of regularly traded, fixed-rate, domestic currency government bonds issued by Eurozone countries.

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

#### Instrument Type

The EMU 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.

<sup>1</sup> **PricingDirect Inc.**, a market-based professional valuation service and a wholly owned subsidiary of JPMorgan Chase & Co, is utilized as the primary source for instrument level pricing ensuring transparency around pricing sourcing and consistency/accuracy of index constituent valuations.

## Country Eligibility

If an existing euro zone country leaves the EMU, the country would be excluded from the EMU Index.

## EMU Rebalancing

Rebalancing takes place monthly on the last weekday of each month, regardless of any local holiday. On rebalance day, eligible new bonds must be settled on or before month-end to enter the index at the close-of-business, and bonds which fail to comply with the index criteria will be removed. Any additional taps or buybacks that occur during the month will also be reflected at this time.

Credit rating changes that take place before the 15<sup>th</sup> of each month will be reflected in the index at the same month-end. Rating changes after the 15<sup>th</sup> of each month will take effect in the index at the following month-end.

## Credit Rating

The EMU Index does not exclude countries based on credit ratings and therefore span both Investment Grade and High Yield local currency government bond markets across Eurozone countries.

## Liquidity

The EMU Index only includes securities that satisfy liquidity considerations including but not limited to:

- *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 Oct 31<sup>st</sup>, 2018, the EMU Government Bond Index contains 310 bonds.
- The average index yield is 1.36% with an average modified duration of 7.56 years.

Figure 1: Summary of Country Weight Exposure

Country	Weight (%)
France	25.32
Italy	21.68
Germany	17.44
Spain	14.54
Belgium	6.20
Netherlands	5.30
Austria	3.72
Portugal	2.24
Ireland	1.96
Finland	1.60

Source: J.P. Morgan, as of Oct 31<sup>st</sup>, 2018

Figure 2: Monthly return (% , local currency) of the EMU Index, 2013- 2018:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual/ YTD
<b>2013</b>	-0.5%	0.2%	0.7%	2.6%	-1.3%	-1.5%	0.7%	-0.6%	0.7%	1.5%	0.4%	-0.6%	2.4%
<b>2014</b>	2.3%	0.7%	1.0%	1.0%	1.0%	1.1%	0.9%	1.9%	0.1%	0.3%	1.4%	1.1%	13.5%
<b>2015</b>	2.3%	0.8%	1.2%	-1.5%	-1.6%	-2.6%	2.4%	-1.1%	1.4%	0.9%	0.5%	-1.0%	1.7%
<b>2016</b>	1.9%	0.9%	0.5%	-1.2%	1.0%	2.3%	0.8%	-0.3%	0.2%	-2.1%	-1.6%	0.7%	3.1%
<b>2017</b>	-2.1%	1.2%	-0.6%	0.6%	0.6%	-0.5%	0.2%	0.8%	-0.4%	1.1%	0.3%	-0.8%	0.4%
<b>2018</b>	-0.4%	0.2%	1.6%	-0.4%	-1.2%	0.8%	-0.4%	-0.6%	-0.1%	0.0%	-	-	-0.5%

Source: J.P. Morgan

### Where to find the EMU Index?

<b>Bloomberg Ticker</b>	JNEUGGEU
<b>DataQuery</b>	DB(BIGI,EMU,TRADED,TR,,EUR)
<b>Morgan Markets</b>	<a href="http://www.jpmm.com">www.jpmm.com</a>
	Research -> Index-> Economic and Monetary Union (EMU)

## 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:

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

$b$  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.

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

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<sub>t</sub>*

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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