



Citi World Government Bond Index – Developed Markets

INDEX METHODOLOGY



Citi World Government Bond Index – Developed Markets

The Citi World Government Bond Index - Developed Markets (WGBI-DM) measures the performance of fixed-rate, local currency, investment-grade sovereign bonds issued in developed markets. The Index composition is based on the global sovereign markets and constituents of the Citi World Government Bond Index (“WGBI”)¹, excluding any markets that are classified as emerging. Citi Fixed Income Indices classifies a country to be “emerging” if it is defined by the International Monetary Fund (IMF) World Economic Outlook to be among “emerging and developing economies” or if it is defined by the World Bank (WB) to be among “low-income economies” or “lower middle-income economies” or “upper-middle-income economies”.

A new developed market entering the WGBI will also enter the Citi World Government Bond Index - Developed Markets at the same time. Markets being removed from the WGBI because they have met WGBI’s exit criteria will also be removed from the Citi World Government Bond Index - Developed Markets.

Composition and Design Criteria

Figure 1 details the design criteria and calculation assumptions for the WGBI, which also apply to the Citi World Government Bond Index - Developed Markets.

Figure 1 Design Criteria and Calculation Assumptions for the Citi World Government Bond Index

Coupon	Fixed-rate
Minimum Maturity	At least one year
Market Size	<p>Entry: The outstanding amount of a market’s eligible issues must total at least USD 50 billion, EUR 40 billion and JPY 5 trillion for the market to be considered eligible for inclusion.</p> <p>Exit: When the outstanding amount of a market’s eligible issues falls below half of all the entry-level market size criteria, namely USD 25 billion, EUR 20 billion and JPY 2.5 trillion, for three consecutive months, the market will be removed from the next month’s profile.</p>
Minimum Issue Size	<p>Americas Canada: CAD 2.5 billion (excludes Bank of Canada Cash Management bond buybacks) United States: USD 5 billion public amount outstanding (excludes Federal Reserve holdings)</p> <p>Europe, Middle East, and Africa Denmark: DKK 20 billion Eurozone Markets: EUR 2.5 billion Norway: NOK 20 billion Sweden: SEK 25 billion Switzerland: CHF 4 billion United Kingdom: GBP 2 billion (excludes Bank of England holdings)</p> <p>Asia Pacific and Japan Australia: AUD 750 million Japan: JPY 500 billion; 20+ year bonds: JPY 450 billion (excludes Bank of Japan holdings and Ministry of Finance buybacks) Singapore: SGD 1.5 billion</p>
Minimum Credit Quality²	<p>Entry: A- by S&P and A3 by Moody’s, for all new markets.</p> <p>Exit: Below BBB- by S&P and Baa3 by Moody’s.</p>
Barriers-to-Entry	<p>Entry: A market being considered for inclusion should actively encourage foreign investor participation and show a commitment to its own policies.</p> <p>Exit: Circumstances can change over time and a country may find that revising its policies makes sense for its national welfare. However, it is possible that new policies, including but not limited to ownership restrictions and capital controls, can have the effect of limiting investors’ ability to replicate the returns of that country’s portion of the Index. In that case, it may be necessary to remove that country from the Index.</p>

¹ For more information on the Citi World Government Bond Index, please see Citi’s *Index Guide* on www.yieldbook.com/citi-indices.

² Each month, the upcoming month’s Index constituents are “fixed” on the profile fixing date. The credit qualifications of the Index are treated as provisional. This distinction will allow a market to be removed from the Index after the fixing if it becomes rated below investment-grade by both S&P and Moody’s. This exception window is kept open until 5:00 p.m. New York time on the second to last business day of the month for removal only. Removal from the Index, on or after the fixing date, is not reversible except by qualifying for the Index once again, which takes a minimum of six months. There is no specific rule concerning default or what constitutes default. Conceivably, a market could technically default, but an immediate rescue could leave its existing bonds in the investment-grade category. Only a downgrade to below investment-grade would trigger a credit-related expulsion from the Index.

Figure 1 Design Criteria and Calculation Assumptions for the Citi World Government Bond Index, continued

Composition	<p>Sovereign debt denominated in the domestic currency.</p> <p>Securities included: Fixed-rate non-callable bonds – unless otherwise stated in Figure 3. For Eurozone Markets, fixed-rate bonds originally issued in their euro-converting currency are included.</p> <p>Securities excluded: Variable rate, floating rate, fixed-to-floating rate, index-linked, retail directed, bills, stripped zero coupon, convertibles, savings, and private placements.</p> <p>For more information on market specific security types, refer to Figure 3.</p>
Weighting	Market capitalization
Rebalancing	Once a month at the end of the month.
Reinvestment of Cash Flow	At daily average of the local currency one-month Eurodeposit rate. Calculated from actual scheduled payment date of the cash flow through the end of the reporting period.
Pricing	<p>Citi trader pricing except for Singapore (provided by the Monetary Authority of Singapore), and Switzerland (provided by Swiss Exchange). All pricing is generally taken as of local market close.</p> <p>For more information on local market close, refer to Figure 4.</p>
Calculation Frequency	Daily
Settlement Date	<p>Monthly - Settlement is on the last calendar day of the month.</p> <p>Daily - Same day settlement except if the last business day of the month is not the last calendar day of the month; then, settlement is on the last calendar day of the month.</p>
Fixing Date	Each month, the upcoming month's Index constituents are "fixed" on the profile fixing date ³ . Each year's scheduled fixing dates are published on the Citi Fixed Income Indices website (www.yieldbook.com/citi-indices).

Figure 2 Additional Design Criteria and Calculation Assumptions for the Citi World Government Bond Index - Developed Markets

Country Eligibility	All markets that are included in the WGBI, excluding any emerging markets
Index Base Date	December 31, 1984

Figure 3 Citi World Government Bond Index - Developed Markets Composition

Country	Security Type
Australia	Excludes tax rebate bonds
Austria	Includes Bundesanleihen Excludes Bundesobligationen bonds
Belgium	N/A
Canada	N/A
Denmark	Excludes mortgage credit bonds
Finland	Excludes sinking fund, putable, extendable, housing fund and yield bonds
France	Includes Obligations Assimilables du Trésor (OATs) and Bons du Trésor a Intérêt Annuel Normalisé (BTANs)
Germany	Includes Bundesrepublik, Schatzanweisungen, Bundesobligationen, Unity bonds, Treuhandanstalt, and Treuhandobligationen Excludes Schuldscheine, Unverzinsliche, Bundespost, Bundesbahn, and European Recovery Program Bonds
Ireland	N/A
Italy	Includes Buoni del Tesoro Poliennale (BTPs)

³ Fixing dates provide a clear reference point for index users to know in advance of any changes to the composition of the index for the upcoming month. On each fixing date, publicly available securities information is used to determine index eligibility and indicative values for the following month's index profile.

Figure 3 Citi World Government Bond Index - Developed Markets Composition, continued

Country	Security Type
Japan	Includes callable bonds Excludes JGBs for individuals and discount bonds
Netherlands	N/A
Norway	Includes benchmark bonds Excludes loans and lottery loans issued before 1991
Singapore	N/A
Spain	Includes Bonos and Obligaciones del Estado Excludes discount bonds (Letras and Pagares del Tesoro)
Sweden	Includes Riksobligationer
Switzerland	Includes callable bonds Excludes book liabilities
United Kingdom	Includes callable, partly paid and convertible (into other gilt issues) bonds Excludes rump gilts and perpetuals (undated)
United States	Includes callable bonds

PRICING

Source

The pricing source for the Citi World Government Bond Index - Developed Markets is discussed in Figure 1.

Timing

Citi's fixed income indices are calculated Monday through Friday except Christmas Day (observed) and New Year's Day (observed). When a market observes a holiday, Citi Fixed Income Indices uses the closing prices from the previous available day as the closing prices for index calculations on such holiday for that market.

In order to determine whether a holiday is applicable for index determination purposes Citi Fixed Income Indices considers the local market where the bond is domiciled as well as the location of the trading hub ("Trading Center") for that sector.

A market is considered to be on holiday if either that market or its defined Trading Center is observing a holiday. Figure 4 shows the local markets, Trading Centers (in parentheses), and local times used to determine the closing prices for Citi's fixed income indices.

As an example, New York is the Trading Center for U.S. and Canada; as such, when the U.S. is observing a holiday, the closing prices used for the bonds in both U.S. and Canadian markets for that day are the closing prices from the previous day irrespective of whether the Canadian market is open or not on such day. If Canada is observing a holiday but New York (its Trading Center) is not, the closing prices for the Canadian bonds for that day are from the previous day.

London is another Trading Center where related markets (Eurozone markets and Sweden) follow the observed holidays and for which the closing prices used on such holiday for those related markets are the previously available closing prices. For example, if London is observing a holiday, the closing prices used for the bonds in Germany, France, Italy, and other Eurozone countries, Denmark, Norway and Sweden are the prices from the previous available day irrespective of whether these related local markets are open or not on such day⁴.

Eurozone countries are considered as a single bloc and they use the European Central Bank's Trans-European Automated Real Time Gross Settlement Express Transfer (TARGET) calendar in place of the local market calendars to determine holidays. As such, the closing prices used for all Eurozone countries on any holiday under the TARGET closing days' calendar are the previously available closing prices of the respective countries.

⁴ To be clear, although an individual local market may be open for trading when its defined Trading Center is closed, Citi Fixed Income Indices will not update closing prices for such day for this related local market and we will use previously available closing prices for index calculation.

Figure 4 Local Markets with Local Closing Times and Defined Trading Centers⁵

Americas		Europe, Middle East, and Africa (continued)	
Canada	3:00 p.m. (New York)	Denmark	4:15 p.m. (London)
United States	3:00 p.m. (New York)	Norway	4:15 p.m. (London)
Europe, Middle East, and Africa		Sweden	4:15 p.m. (London)
Austria*	4:15 p.m. (London)	Switzerland	5:00 p.m. (Zurich)
Belgium*	4:15 p.m. (London)	United Kingdom	4:15 p.m. (London)
Finland*	4:15 p.m. (London)	Asia Pacific and Japan	
France*	4:15 p.m. (London)	Australia	4:30 p.m. (Sydney)
Germany*	4:15 p.m. (London)	Japan	3:00 p.m. (Tokyo)
Ireland*	4:15 p.m. (London)	Singapore	4:30 p.m. (Singapore)
Italy*	4:15 p.m. (London)		
Netherlands*	4:15 p.m. (London)		
Spain*	4:15 p.m. (London)		

*Eurozone member state

INDEX SECTORS CLASSIFICATIONS

Maturity

In addition to the broad categories published, sub-sector breakdowns are also provided for many of Citi's fixed income indices. One such sub-division is based on the remaining maturity of the underlying securities. The maturity sector buckets are defined by including all underlying issues with a remaining average life at least equal to the lower bound, but less than the upper bound of the particular category. For example, the one-to-three-years sector of the Citi World Government Bond Index - Developed Markets includes all securities with a remaining average life of at least one year, but less than three years. The set of bonds is then held constant for the calculation month, even if the average life declines below the lower bound of the maturity bucket.

Index Quality

An index quality is assigned to each index bond as of profile fixing. The quality is first mapped to the Standard & Poor's Financial Services LLC ("S&P") rating. If a bond is not rated by S&P but it is rated by Moody's Investor Service, Inc. ("Moody's"), the S&P equivalent of the Moody's rating is assigned to the index quality. If a bond is rated by neither S&P nor Moody's, the bond is not assigned an index quality. If a bond is rated as investment-grade by one rating agency and high-yield by the other, the S&P equivalent of the investment-grade rating is assigned to the index quality. These ratings remain unchanged for the entire performance month.

EXCHANGE RATES

Citi Fixed Income Indices uses the The World Markets Company Plc ("WM")/Reuters closing spot and forward rates. WM takes several snapshots at regular intervals centered on the fixing time of 4:00 p.m. London time and selects the median rate for each currency. All rates are mid-market quotations and appear on Reuters (see WMRSPOT01).

RETURN COMPUTATION

Total returns are computed on the assumption that each security is purchased at the beginning of the period and sold at the end of the period. An issue's total rate of return is the percentage change in its total value over the measurement period. The components of total return for each security are price change, principal payments, coupon payments, accrued interest, and reinvestment income on intra-month cash flows. The total returns are market capitalization weighted using the security's beginning-of-period market value (see Figure 5). In the case of multi-currency or non-base indices, the total return also includes currency movement (see Figure 6).

⁵ Defined Trading Center is shown in parenthesis e.g. (New York) for Canada.

Figure 5 Total Rate of Return Calculation Methodology

Beginning-of-Period Value

(Beginning Price + Beginning Accrued) x Beginning Par Amount Outstanding

End-of-Period Value

[(Ending Price + Ending Accrued) x (Beginning Par Amount Outstanding - Principal Payments)] + Coupon Payments + Principal Payments + Reinvestment Income

Total Rate of Return (%)

$$\left[\left(\frac{\text{End-of-Period Value}}{\text{Beginning-of-Period Value}} \right) - 1 \right] \times 100$$

A note on precision: Returns are computed to at least six decimal places but reported to a maximum of five. In addition, owing to rounding errors inherent in computer floating-point arithmetic, the last digit in any reported value may sometimes be off by one from its true value.

Figure 6 Total Rate of Return Calculation Methodology for Base Currency Returns, Unhedged

Total Rate of Return (%)

$$\left\{ \left[1 + \left(\frac{\text{Local Currency Return}}{100} \right) \right] \times \left(\frac{\text{End-of-Month Spot Rate}}{\text{Beginning-of-Month Spot Rate}} \right) - 1 \right\} \times 100$$

This equation holds true only if the spot rates are quoted as base currency per unit of foreign currency.

The monthly currency-hedged return is calculated by using a rolling one-month forward exchange contract as a hedging instrument. The face value of the contract is equal to the estimated end-of-month full market value. To calculate this value, the bond's yield is assumed to be unchanged from the beginning of the month. Any known cash flows are then taken into account, such as coupon or principal payments, and interest expected to accrue for the period is also added in. This calculation leaves the intra-month changes in bond prices from yield movements unhedged. Any principal movement resulting from yield change is then settled at end-of-month spot exchange rates. Figure 7 gives an example of the calculation formula from the point of view of a US investor.

Figure 7 Total Rate of Return Calculation Methodology, Currency Hedged

Beginning-of-Period Value

[(Beginning Price + Beginning Accrued) x Beginning Par Outstanding] x [Beginning-of-Period Spot Exchange Rate $\left(\frac{\text{US Dollar}}{\text{Local Currency}} \right)$]

End-of-Period Value

$$\left(\begin{array}{l} \text{End-of-Period} \\ \text{Local Currency Value,} \\ \text{Assuming Unchanged Yield} \end{array} + \begin{array}{l} \text{Known Intra-Month} \\ \text{Cash Flows and Interest} \\ \text{Expected to Accrue} \end{array} \right) \times \left[\begin{array}{l} \text{Beginning-of-Period} \\ \text{One-Month Forward} \\ \text{Exchange Rate} \\ \left(\frac{\text{US Dollar}}{\text{Local Currency}} \right) \end{array} \right] + \left[\begin{array}{l} \text{Change in Market Value} \\ \text{of Principal Amount Due x} \\ \text{to Yield Change} \end{array} \times \left[\begin{array}{l} \text{End-of-Period} \\ \text{Spot} \\ \text{Exchange Rate} \\ \left(\frac{\text{US Dollar}}{\text{Local Currency}} \right) \end{array} \right] \right]$$

Total Rate of Return (%)

$$\left[\left(\frac{\text{End-of-Period Value}}{\text{Beginning-of-Period Value}} \right) - 1 \right] \times 100$$

DATA CORRECTION

Citi Fixed Income Indices strives to produce error-free indices; however, there are occasions when erroneous data is published. These circumstances may be caused by, but not limited to, calculation or pricing errors, missing data, or incorrect indicative data. On rare occasions, and only in extreme cases, the Citi Fixed Income Indices team may conclude that restatement is required. When determining if restatement is necessary, factors such as the magnitude of the error, the overall impact on the data, the sector affected, and whether the error affects daily and/or monthly results are taken into consideration.

If Citi Fixed Income Indices finds it necessary to restate, an announcement will be posted on the Citi Fixed Income Indices website (www.yieldbook.com/citi-indices) and the data will be redistributed. Subscribers to Index Production News will automatically receive all correction notifications via email.

PERIODIC REVIEW OF INDEX METHODOLOGY

Citi Fixed Income Indices reviews its indices periodically to ensure that their composition adequately represents the intended universe. Index users should be aware that various factors, including factors beyond the control of Citi Fixed Income Indices, might necessitate material changes or termination of an index.

Unless otherwise stated, the index follows the general methodology for Citi's fixed income indices. For details, please see Citi's *Index Guide* on www.yieldbook.com/citi-indices.

CHRONOLOGICAL SUMMARY OF EVENTS

The Citi World Government Bond Index – Developed Markets is introduced in June 2017 including 19 markets. Of these, Australia, Canada, France, Germany, Japan, the Netherlands, Switzerland, the United Kingdom and the United States were part of the index since its base date in December 1984. Denmark joined the index in April 1989. Belgium, Italy, Spain and Sweden joined in October 1992. At that time, Switzerland was removed from the index and rejoined it in April 1996. Austria joined in April 1993, Finland in July 1996, Ireland in April 1997, Norway in September 2003 and Singapore in January 2005.

Figure 8 Tickers* for the Citi World Government Bond Index – Developed Markets

Ticker	Index
SBWDML	Citi World Government Bond Index – Developed Markets, in LCL terms
SBWDMUU	Citi World Government Bond Index – Developed Markets, in USD terms
SBWDMEU	Citi World Government Bond Index – Developed Markets, in EUR terms
SBWDMGU	Citi World Government Bond Index – Developed Markets, in GBP terms
SBWDMYU	Citi World Government Bond Index – Developed Markets, in JPY terms
SBWDMSZU	Citi World Government Bond Index – Developed Markets, in CHF terms
SBWDMUC	Citi World Government Bond Index – Developed Markets, currency-hedged in USD terms
SBWDMEC	Citi World Government Bond Index – Developed Markets, currency-hedged in EUR terms
SBWDMGC	Citi World Government Bond Index – Developed Markets, currency-hedged in GBP terms
SBWDMYC	Citi World Government Bond Index – Developed Markets, currency-hedged in JPY terms
SBWDMSZC	Citi World Government Bond Index – Developed Markets, currency-hedged in CHF terms

* The tickers can be used to access data for the index on Bloomberg and other vendor platforms.

CITI FIXED INCOME INDICES – REGIONAL CONTACTS

Americas +1 212 816 0700 fi.index@citi.com	Asia Pacific +852 2501 2358 fi.index@citi.com	EMEA +44 20 7986 3200 fi.index@citi.com	Japan +81 3 6270 7225 fi.index.tk@citi.com
---	--	--	---

www.yieldbook.com/citi-indices

The information and data (collectively, "Index Data") contained in this Citi Fixed Income Indices Methodology Paper (the "Methodology Paper") is provided by Citigroup Index LLC ("CitiIndex") solely for information purposes with respect to the index discussed herein (the "Index") and nothing in this Methodology Paper constitutes (a) a recommendation or an offer to sell or a solicitation to deal in any financial product, enter into any transaction or adopt any investment strategy or (b) legal, tax, regulatory, financial or accounting advice. None of CitiIndex, its directors, officers, employees, representatives, delegates, contractors or agents (each, a "CitiIndex Person") makes any express or implied representations or warranties as to (a) the accuracy, adequacy or completeness of the Index Data, (b) the levels of the Index at any particular time on any particular date, (c) the advisability of purchasing or entering into any financial product the performance of which is linked, in whole or in part, to the Index, (d) the results to be obtained by the issuer of any product linked to the Index or by any other person or entity, from the use of the Index or any data included therein for any purpose, (e) the merchantability or fitness for a particular purpose of the Index, or (f) any other matter. Each CitiIndex Person hereby expressly disclaims, to the fullest extent permitted by applicable law, all warranties of accuracy, completeness, merchantability or fitness for a particular purpose with respect to the Index and any Index Data. To the fullest extent permitted by applicable law, no CitiIndex Person shall have any liability (direct or indirect, special, punitive, consequential or otherwise) to any person even if notified of the possibility of damages. CitiIndex is not under any obligation to continue the calculation, publication and dissemination of the Index nor shall any CitiIndex Person have any liability for any errors, omissions, interruptions or delays relating to the Index. CitiIndex acts as principal and not as agent or fiduciary of any other person.

The Index reflects the performance of notional investment positions in its constituents. There is no actual portfolio of assets to which any person is entitled or in which any person has any ownership interest. The Index merely identifies certain hypothetical investment positions, the performance of which will be used as a reference point for the purpose of calculating the level of the Index. The Index and the information contained in this Methodology Paper are CitiIndex's proprietary material. No person may use the Index in any way or reproduce or disseminate the information contained in this Methodology Paper without the prior written consent of CitiIndex. The Index is not in any way sponsored, endorsed or promoted by the issuer or sponsor, as applicable, of any of its constituents.

© 2017, Citigroup Index LLC. All rights reserved. Citi, and Citi and Arc Design are trademarks and service marks of Citigroup Inc. or its affiliates and are used and registered throughout the world.