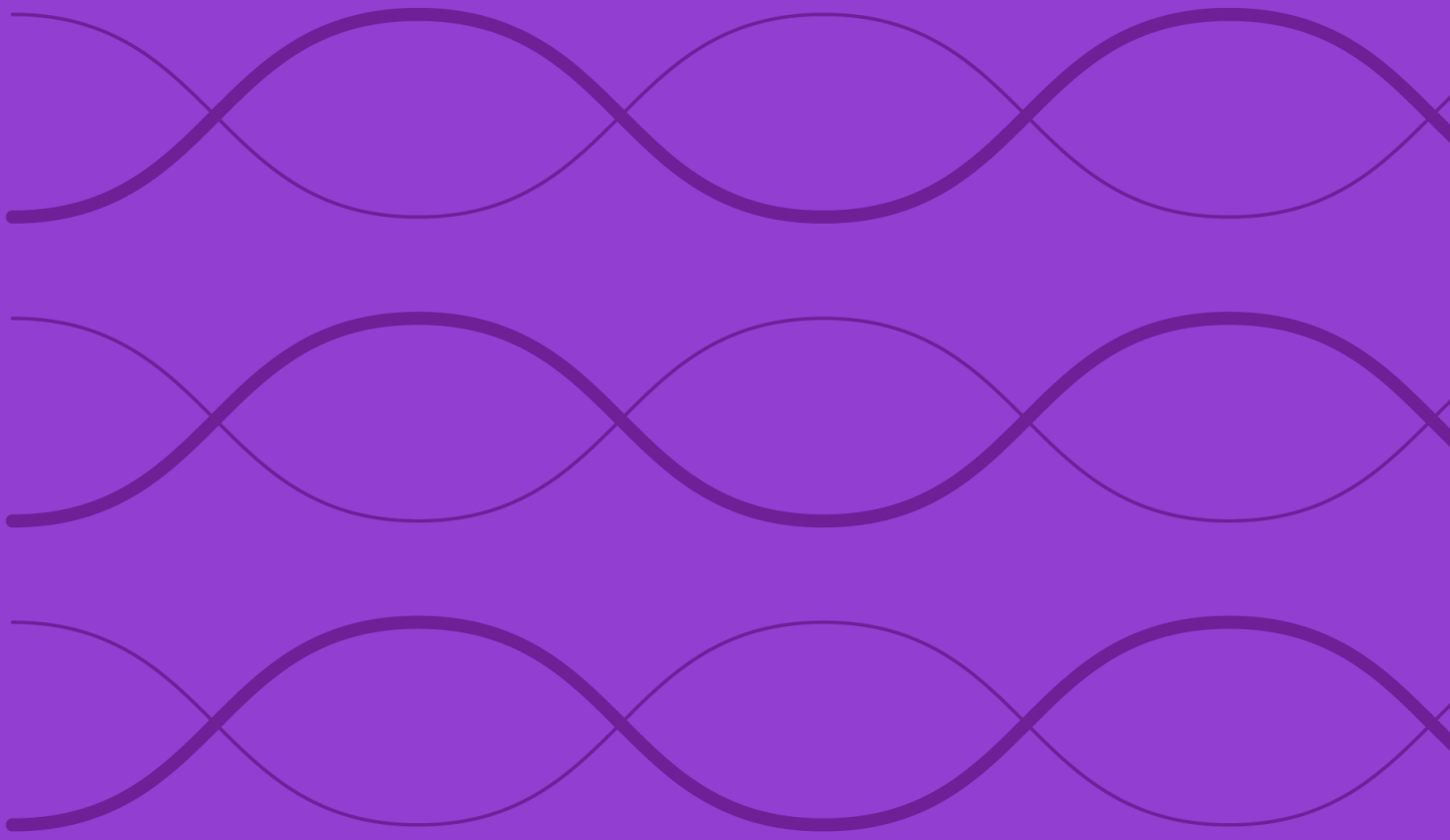
MORNINGSTAR Indexes

Morningstar® Dynamic Hedging Methodology



December 2023

Overview

The Morningstar Dynamic Hedged Indexes aim to represent the performance of a strategy that is long the benchmark index and short currency forwards, whose notional amount is based on weights of foreign currencies in the benchmark index.

The index is rebalanced monthly, usually on the first trading day of the month, using foreign-currency weights and corresponding notional amounts determined one business day before the first business day of the month. The index is also rebalanced intramonth if certain thresholds are breached for example due to market price movements or due to intramonth additions or deletions of securities. The thresholds are monitored daily. Once an intramonth threshold breach is detected (that is on the "breach day"), the hedges are reset on the next business day (that is on the "reset day") with foreign-currency weights at the close of breach day adjusted for any corporate actions and rebalances, effective on the reset day

The notional amounts hedged remain constant until the next monthly or intramonth reset and are not modified on account of price movement, corporate action, or rebalance and reconstitution of the underlying index. The daily index calculation marks-to-market the one-month forward contracts using a linear interpolation of spot and forward prices based on the one-month forwards.

Index Inception and Performance Start Date

The index parameters, inception dates, and the performance start dates, when the first back tested index values were calculated for all the indexes in the family, are provided in Appendix 6.

Index Calculation

The Morningstar Dynamic Hedged Index comprises three components:

- The unhedged Equity Value in the base currency.[1]
- The Hedge Impact (represents the profit or loss on the forward contracts) in the base currency.
- The Accrued Cash in the base currency.

These components represent the distribution of the total value of the dynamically hedged portfolio among the value of the equity investment, marked-to-market value of the positions held in currency forward for hedging the currency exposures[2] and the cash value accrued due to a change in the positions held in currency forward due to intramonth resets. The distribution of the total value of the dynamically hedged portfolio among these components changes due to market movements or due to monthly or intramonth resets.

The daily index calculation marks-to-market the one-month forward contracts using a linear interpolation of spot and forward prices based on the one-month forwards. At each monthly reset, the weights of the currencies to be hedged in the index are reset based on the price movement since the last reset. Additionally, the forward contracts for the foreign currencies are rolled over to the next month.

An intramonth reset occurs if the Total Value Ratio or the Coverage Ratio (as described in the Appendix) breaches a certain limit. For example, if the threshold is set at 10%, an intramonth breach occurs if the ratio is above 1.10 or below 0.90. The threshold can be different for the Total Value Ratio and Coverage Ratio. The threshold can also be set for only one of the two ratios. In a special condition that both the ratios breach the threshold on the same day, the procedure for resetting the Total Value Ratio is implemented.

The calculation of the hedged index follows the same calendar as the underlying equity index.

If currencies are added or deleted to the underlying Morningstar Equity Indexes in between monthly resets, then no additional forwards are created for new currencies intra month.

[1] The base currency is defined as the currency in which an investor invests in the international equity markets. All the foreign-currency exposures are hedged back to the base currency.

[2] Currency exposures are defined as the weight of the currency in which the securities are quoted in the underlying unhedged equity index

Unhedged Equity Value Calculation

The unhedged Equity Value, is calculated as follows:

- At the first business day of the month,

$$Equity\_Value(M) = HedgedIndex_{M-1} * \frac{EquityIndex_M}{EquityIndex_{M-1}}$$

- If a Total Value Ratio breach is detected on a business day (t-1), then, on the reset day (t), the Hedge Impact and Accrued Cash from (t-1) are added to the Equity Value,

$$Equity\_Value(t) = Equity\_Value(t-1) * \frac{EquityIndex_t}{EquityIndex_{t-1}} + HI(t-1) + AccuredCash(t-1)$$

- Otherwise, the Equity Value follows the changes in the underlying unhedged Morningstar Equity Index,

$$Equity\_Value(t) = Equity\_Value(t-1) * \frac{EquityIndex_t}{EquityIndex_{t-1}}$$

Where,

t = Index calculation date
M = First business day of the month
$EquityIndex_t$ = Value of the unhedged equity index in base currency on the calculation date
$EquityIndex_{t-1}$ = Value of the unhedged equity index in base currency on a business day before the calculation date
$EquityIndex_{M-1}$ = Value of the unhedged equity index in base currency on the last business day of the previous calendar month
$HedgeIndex_{M-1}$ = Value of the Morningstar Dynamic Hedged Index on the last business day of the previous calendar month
$Equity\_Value(t-1)$ = Value of the unhedged Equity Value on a business day before the calculation date
$HI(t-1)$ = Hedge Impact on a business day before the calculation date
$AccruedCash(t-1)$ = Accrued Cash on a business day before the calculation date

Hedge Impact Calculation

The Hedge Impact is the net value of the forward position, which is calculated daily as follows (all currency exchange rates are in terms of the amount of foreign currency per 1 unit of base currency):

$$HI(t) = HedgeValue_{reset(t)} \times \sum_{i=1}^{n} \left\{ W_{i,reset(t)} \times FXRate_{i,reset(t)} \times \left(\frac{1}{FFRate_{i,reset(t)}} - \frac{1}{FFRate_{i,interpolated(t)}} \right) \right\}$$

Where,

t = Index calculation date
M = First business day of the month
$HI(t)$ = Index Hedge Impact at time t
n = Number of foreign currencies in the underlying equity index as on the previous monthly reset date

$HedgeValue_{reset(t)}$ = Notional value of the currencies sold forward at the time of reset (monthly or intramonth reset) in the base currency, which is applicable at time t

This term equals,
$HedgeIndex_{M-1}$ …at the first business day of the month (t),
$HedgeIndex_{t-1}$… on the reset day (t) when (t-1) is the breach day of Total Value Ratio breach,
$Equity\_Value_{t-1}$ …on the reset day (t) when (t-1) is the breach day of Coverage Ratio breach,
$HedgeValue_{reset(t-1)}$…on all other days

$W_{i,reset(t)}$ = Weight of the currency i in the underlying equity index at the time of reset (t)

On the first business day of the month (t), this is the weight as of the close of one business day before the first business day of the month, but taking into account any changes in the index constituents due to rebalancing and/or corporate actions becoming effective on the first business day of the month ($W_{i,M-1}$)
At the intramonth reset, the currency weight at reset day (t) is as of close of one business day before the reset day, but taking into account any changes in the index constituents due to rebalancing and/or corporate actions becoming effective on the reset date ($W_{i,t-1}$)
Otherwise, it is same as $W_{i,reset(t-1)}$

$FXRate_{i,reset(t)}$ = Spot rate of the currency i at the time of reset (monthly reset or intramonth reset) which is applicable at time t. This term determines the notional amount of the foreign currency to be sold corresponding to its weight in the index.

On the first business day of the month (t), spot rate is as of one business day before the start of the current calendar month ($FXRate_{i,M-1}$)
At the time of intramonth reset, the spot rate at reset day (t) is one business day before the reset day ($FXRate_{i,t-1}$)
Otherwise, it is same as $FXRate_{i,reset(t-1)}$

$FFRate_{i,interpolated(t)}$ = Interpolated forward rate of the currency i on day t. This term is used to mark-to-market the one-month forward contracts using a linear interpolation of spot and forward prices based on the one-month forwards. Its calculation is defined in the Appendix.

$FFRate_{i,reset(t)}$ = Forward rate of the currency i at the time of reset (monthly reset or intramonth reset) which is applicable at time t.
At the first business day of the month (t), this is the 1-month forward for the currency i one business day before the start of the current calendar month,
At the time of intramonth reset, this term equals $FFRate_{i,interpolated(t)}$ on the reset day (t),
Otherwise, it is same as $FFRate_{i,reset(t-1)}$

Accrued Cash Calculation

Cash is generated in the index due to intramonth reset of positions in the currency forwards. Accrued Cash is calculated as follows:

- At the first business day of the month the Accrued Cash is reset to 0

$$AccruedCash(M) = 0$$

- If there is a Total Value Ratio breach as on a business day (t-1), then on the reset day (t), the Accrued Cash contains one business day (that is number of days between reset day and breach day) realized profit/loss from the forward contracts and the interest earned on the previous Accrued Cash for one business day,

$$AccruedCash(t) = HedgeValue_{reset(t-1)}$$
$$\times \sum_{i=1}^{n} \left\{ W_{i,reset(t-1)} \times FXRate_{i,\,reset(t-1)} \times \left(\frac{1}{FFRate_{i,interpolated(t-1)}} - \frac{1}{FFRate_{i,\,interpolated(t)}} \right) \right\}$$
$$+ (AccruedCash(t-1) * DailyCashRet_t)$$

- If there is a Coverage Ratio breach as on a business day (t-1), then on the reset day (t), the Accrued Cash contains realized profit/loss from the forward contracts and the previous Accrued Cash plus the interest earned on the previous Accrued Cash,

$$AccruedCash(t) = HedgeValue_{reset(t-1)}$$
$$\times \sum_{i=1}^{n} \left\{ W_{i,reset(t-1)} \times FXRate_{i,reset(t-1)} \times \left(\frac{1}{FFRate_{i,\,reset(t-1)}} - \frac{1}{FFRate_{i,\,interpolated(t)}} \right) \right\}$$
$$+ (AccruedCash(t-1) * (1 + DailyCashRet_t))$$

- Otherwise,

$$AccruedCash(t) = AccruedCash(t-1) * (1 + DailyCashRet_t)$$

Where

$DailyCashRet(t)$ = Return on cash between the previous business day (t-1) and the calculation date (t)

$$\left(\frac{days(t-1,t)}{360} \times CashRate_{t-1} \right)$$

$days(t-1,t)$ = The number of business days between (t-1) and (t) (including day t)

$CashRate_{t-1}$ = Short-term rate as of one business day prior to the calculation date (t)

Morningstar Dynamic Hedged Index Calculation

The Morningstar Dynamic Hedged Index can be calculated by adding up the three components calculated in the previous sections that is the unhedged Equity Value, the Hedge Impact, and the Accrued Cash (all in base currency):

$$HedgedIndex(t) = Equity\_Value(t) + HI(t) + AccruedCash(t)$$

Where

Equity_Value(t) =Unhedged Equity Value as on the calculation date (t)

$HI(t)$ = Hedge Impact as on the calculation date (t). This term is the net value of the forward position as of date t

$AccruedCash(t)$ = Accrued Cash on the index calculation date (t)

Index Maintenance and Calculation

Reconstitution and Rebalancing

The index is reset monthly on the first business day of the month. The index can also be reset intramonth due to a breach in the Total Value Ratio or Coverage Ratio thresholds, which are monitored daily.

Index Calculation and Price Data

Details about index calculations and price data can be found in their respective rulebooks: Morningstar Indexes Calculation Methodology and Equity Closing Prices Used for Index Calculation.

Methodology Review and Index Cessation Policy

The index methodology is continually reviewed to ensure it achieves all stated objectives. These reviews consider corporate action treatment, eligibility requirements, and maintenance procedures. Subscribers to the index will be notified before any methodology changes are made. For more details, refer to the Morningstar Index Methodology Change Policy.

Morningstar Indexes notifies all subscribers and stakeholders of the index that circumstances might arise that require a material change to, or a possible cessation of, the index. These circumstances are generally not within Morningstar's control and may include significant changes to the underlying market structure, inadequate access to necessary data, geo-political events, and regulatory changes. In addition, factors such as low usage or methodology convergence may result in the cessation of an index.

Because the cessation of the index or benchmark index could disrupt subscriber products that reference this index, all subscribers are encouraged to have robust fallback procedures if an index is terminated. For more details, refer to the Morningstar Index Cessation Process.

Data Correction and Precision

Intraday Index Data Corrections

Commercially reasonable efforts are made to ensure the accuracy of data used in real-time index calculations. If incorrect price or corporate action data affects index daily highs or lows, it is corrected retroactively as soon as is feasible.

Index-Related Data and Divisor Corrections

Incorrect pricing and corporate action data for individual issues in the database will generally be corrected upon detection. In addition, an incorrect divisor of an index, if discovered within two days of its occurrence, will be fixed retroactively on the day it is discovered to prevent an error from being carried forward. Commercially reasonable efforts are made to correct an older error subject to its significance and feasibility.

For more details, refer to the Recalculation Guidelines.

Computational and Reporting Precision

For reporting purposes, index values are rounded to two decimal places and divisors are rounded to appropriate decimal places.

Exceptions

While Morningstar will seek to apply the method described above, the market environment, supervisory, legal, financial, or tax reasons may require an alternative approach to be adopted. A decision to take an alternative approach will be made by the relevant Morningstar Indexes Methodology Committee, and in all instances, the application of a nonstandard process will be reported to the Morningstar Indexes Oversight Committee.

Appendixes

Appendix 1: Modifications to the Rulebook

Section	Description of change	Update Date
Appendix 2: Interpolated Forward Rate Calculation	Updated the formula for Interpolated Forward Rate	December 2023
Appendix 4: Coverage Ratio calculation	Updated the formula for Coverage Ratio	December 2023
Appendix 6: List of Indexes	Changed Coverage Ratio threshold from 1% to 5% and changed Total Value Ratio threshold from 4% to 10%	December 2023

Appendix 2: Interpolated Forward Rate Calculation

The index implements a linear interpolation of spot and forward prices based on the one-month forwards. The formula used is as follows:

$$FFRate_{interpolated(t)} = FXRate_t + \left(\left(FFRate_{1M(t)} - FXRate_t \right) \times \frac{D - t}{D - d} \right)$$

Where

$FXRate_t$ = Spot rate at time t
$FFRate_{1M(t)}$ = 1-month forward rate at time t
t = Current day of the month
D = 1 business day prior to next monthly reset date
d = 1 business day prior to previous monthly reset date

Note: The monthly reset date is set as the 1st business day of the month

Appendix 3: Total Value Ratio Calculation

The Total Value Ratio is calculated using the below formula:

- At last business day of the month,

$$TotalValueRatio\ (t) = \left(\frac{Equity\_Value(t) + HI(t) + AccruedCash(t)}{HedgedIndex(t)} \right)$$

- Otherwise,

$$TotalValueRatio\ (t) = \left(\frac{Equity\_Value(t)}{HedgedIndex(t)} \right)$$

Where

$Equity\_Value(t)$ = the unhedged Equity Value as on the calculation date (t)
$HI(t)$ = the Hedge Impact as on the calculation date (t)
$AccruedCash(t)$ = the Accrued Cash as on the calculation date (t)

The Total Value Ratio will resolve to 1.00 on every last business day of the month.

Appendix 4: Coverage Ratio Calculation

The Coverage Ratio is calculated using the below formula:

$$CoverageRatio\ (t) = \frac{\sum_{i=1}^{n}\left\{W_{i,t}\times\left(\frac{W_{i,reset(t)} * HedgeValue_{reset(t)} * FXRate_{i,reset(t)}}{Foreign\_Equity\_Value_{i,t}}\right)\right\}}{\sum_{i=1}^{n} W_{i,t}}$$

Where

$W_{i,t}$ = The weight of currency i in the underlying equity index as of close of the calculation day (t), but taking into account any changes in the index constituents due to rebalancing and/or corporate actions becoming effective on the next business day

n = Number of foreign currencies in the underlying equity index as on the previous monthly reset date

Appendix 5: Foreign-Currency Equity Value

The Equity Value in the foreign currency i, is calculated as follows:

- On the first business day of the month,

$$Foreign\_Equity\_Value_{i,M} = W_{i,M-1} * HedgedIndex_{M-1} * FXRate_{i,M-1} * \frac{EquityIndexForeign_{i,M}}{EquityIndexForeign_{i,M-1}}$$

- If a Total Value Ratio breach is detected on a business day (t-1), then, on the reset day (t), the Hedge Impact and Accrued Cash from (t-1) are added to Equity Value,

$$Foreign\_Equity\_Value_{i,t} = Foreign\_Equity\_Value_{i,t-1} * \frac{EquityIndexForeign_{i,t}}{EquityIndexForeign_{i,t-1}}$$

$$+W_{i,t-1} * (HI(t-1) + AccruedCash(t-1)) * FXRate_{i,t-1}$$

- Otherwise, Equity Value follows the underlying unhedged equity index in the foreign currency,

$$Foreign\_Equity\_Value_{i,t} = Foreign\_Equity\_Value_{i,t-1} * \frac{EquityIndexForeign_{i,t}}{EquityIndexForeign_{i,t-1}}$$

Where

$EquityIndexForeign_{i,t}$ = Value of the unhedged equity index in foreign currency i on the calculation date

$EquityIndexForeign_{i,t-1}$ = Value of the unhedged equity index in foreign currency i on a business day before the calculation date

$EquityIndexForeign_{i,M-1}$ = Value of the unhedged equity index in foreign currency i on the last business day of the previous calendar month

$Foreign\_Equity\_Value_{i,t-1}$ = Value of the unhedged Equity Value in foreign currency i on a business day before the calculation date

$W_{i,M-1}$ = On the first business day of the month (t), this is the weight as of the close of one business day before the first business day of the month, but taking into account any changes in the index constituents due to rebalancing and/or corporate actions becoming effective on the first business day of the month

$W_{i,t-1}$ = At the intramonth reset, the currency weight at reset day (t) is as of close of one business day before the reset day, but taking into account any changes in the index constituents due to rebalancing and/or corporate actions becoming effective on the reset day

Appendix 6: List of Indexes

Hedged Index	Underlying Equity Index	Inception Date	Performance Start Date	Coverage Ratio Threshold	Total Value Ratio Threshold	Base Currency & Return Variant
Morningstar Developed Markets Minimum Volatility (USD) Reduced Carbon Select Dynamic Hedged GBP	Morningstar Developed Markets Minimum Volatility (USD) Reduced Carbon Select GBP	August 8, 2022	August 5, 2022	5%	10%	GBP (GR, PR, NR)
Morningstar Developed Markets Minimum Volatility (USD) Reduced Carbon Select Dynamic Hedged EUR	Morningstar Developed Markets Minimum Volatility (USD) Reduced Carbon Select EUR	August 8, 2022	August 5, 2022	5%	10%	EUR (GR, PR, NR)
Morningstar Developed Markets Minimum Volatility (USD) Reduced Carbon Select Dynamic Hedged USD	Morningstar Developed Markets Minimum Volatility (USD) Reduced Carbon Select USD	January 27, 2023	March 1, 2022	5%	10%	USD (GR, PR, NR)

About Morningstar Indexes

Morningstar Indexes was built to keep up with the evolving needs of investors—and to be a leading-edge advocate for them. Our rich heritage as a transparent, investor-focused leader in data and research uniquely equips us to support individuals, institutions, wealth managers, and advisors in navigating investment opportunities across major asset classes, styles, and strategies. From traditional benchmarks and unique IP-driven indexes to index design, calculation, and distribution services, our solutions span an investment landscape as diverse as investors themselves.

Morningstar Indexes Methodology Committee

The Morningstar Indexes Methodology Committee oversees all new index development, index methodology changes, and cessation of indexes for any indexes where Morningstar owns the intellectual property. This committee is also charged with ensuring that indexes align with Morningstar Research principles and values. The group comprises members of the index team with index research, product development, product management, client service, index implementation, and operation expertise who provide the first layer of governance over index design and methodology.

Morningstar Indexes Operations Committee

The Morningstar Indexes Operations Committee governs the processes, systems, and exception handling of the day-to-day management of all live indexes, including index rebalancing and reconstitution, restatements, market classification, and contingency management. The committee oversees the annual review of index methodology (as required by U.K. and EU benchmark regulations, or BMR), ensuring that methodologies remain fit for purpose and continue to achieve their stated investment objectives. The group comprises members of the index team with data, operations, corporate actions, product development, index launch, client service, and index management experience who provide the first layer of governance over index operations.

Morningstar Indexes Oversight Committee

The Morningstar Indexes Oversight Committee is responsible for the index oversight function as per the requirements of the U.K. and European BMR, providing independent oversight of all aspects of the governance of benchmark administration as required by the relevant BMR. Its remit extends to all calculation and administration-related business activities of Morningstar Indexes, including administration of Morningstar-owned benchmarks as well as client-owned benchmarks and index calculation. The oversight function is part of the organizational structure of Morningstar but is separate and independent from the index business, index management, and the other index committees.

www.indexes.morningstar.com

Contact Us

indexes@morningstar.com

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