MSCI UNEXPECTED MARKET CLOSURE INDEXES METHODOLOGY

November 2018

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1 INTRODUCTION

The MSCI Unexpected Market Closure Indexes methodology aims to account for unexpected market closure events affecting the trading of underlying MSCI Index constituents on the day of a scheduled index futures expiry. In case of such events, adjustments to the market performance of a given MSCI Index denoted by its index level will be made available as an Unexpected Market Closure Index level on subsequent days, at the resumption of the affected markets.

2 CALCULATING THE MSCI UNEXPECTED MARKET CLOSURE INDEX LEVEL

The MSCI Unexpected Market Closure Index level is calculated for any given underlying MSCI Index as per the following steps

- Unexpected Market Closure Event detection
- Corporate Events treatment
- Calculation of Unexpected Market Closure Index level
- Conversion to target currency

2.1 UNEXPECTED MARKET CLOSURE EVENT DETECTION

An unexpected closure of the stock exchange on which the underlying Index constituents are listed will lead to interruption in trading of these constituents on scheduled index futures expiry day. There can be a number of circumstances that could affect trading on a given stock exchange with varying degrees and periods of impact. For an Unexpected Market Closure Index level to be calculated as per MSCI Unexpected Market Closure Indexes methodology, MSCI will monitor for such events based on the following definition.

Unexpected Market Closure Event: Definition

An event on a given market (stock exchange) will be considered an “Unexpected Market Closure Event” when all of the below criteria are met:

- It is a regular business day[1] for that stock exchange (Unexpected Market Closure Events cannot occur on scheduled stock exchange holidays)
- A limitation on trading[2] remains in effect during the half hour period preceding the close of trading for that exchange. In order to account for the differences in liquidity patterns across Frontier Markets that are classified into very low, low or average liquidity markets, the potential limitation on trading is evaluated for the entire period of trading hours for such exchanges

[1] For exchanges that have a scheduled holiday on index futures expiry day, the business day prior to the scheduled index futures expiry will be considered for determination of the Unexpected Market Closure Event

[2] A limitation on trading will be recognized as complete lack of trading for associated index constituent listed on given exchange

- Interruption in trading affects at least 50% of the securities (by number) within MSCI ACWI + Frontier Markets IMI[3] constituents listed on that exchange. In order to account for the differences in liquidity patterns across Frontier Markets that are classified into very low, low or average liquidity markets, if such an exchange lists fewer than 5 MSCI ACWI + Frontier Markets IMI constituents, the interruption in trading should affect all constituents listed on the particular exchange

For example, on the day of the index futures expiry that is a regular business day for a stock exchange on which x constituents of the MSCI ACWI + Frontier Markets IMI are listed, if (x/2) or more constituents[4] do not trade within the last half hour of the scheduled trading close, the exchange will be noted to suffer an Unexpected Market Closure Event.

MSCI may attempt to determine the veracity of the outage on the stock exchange leading to an Unexpected Market Closure Event being detected. In cases where any contrary information is available noting business as usual proceedings on the stock exchange, MSCI will proceed with regular use of same-day prices and spot FX rates for securities listed on the stock exchange within the underlying Index for the index level calculation.

The securities in the underlying Index affected by suspensions, halted by reason of price movements otherwise exceeding pre-set levels permitted by the relevant exchange (i.e. circuit breakers being triggered), etc. on the expiry day, which do not trade in the half hour preceding the close of the stock exchange will be considered interrupted. For evaluating the fulfilment of the criterion of at least 50% securities within MSCI ACWI + Frontier Markets IMI being interrupted, these securities will contribute towards the check for this threshold violation.

A decision to permanently discontinue trading (i.e. delisting) in one or more of the stocks which then comprise the index will not be counted while determining the Unexpected Market Closure Event.

A stock exchange that has reopened for trading during a day on which an outage had occurred during earlier trading hours on the index futures expiry day will not be considered disrupted if it stays open through the last half hour preceding the scheduled market close.

The “reopen day” for a stock exchange suffering from an Unexpected Market Closure Event on index futures expiry day will be a regular trading day after the index futures expiry day when it does not suffer an Unexpected Market Closure Event as defined earlier.

[3] Please refer to the MSCI Global Investable Market Indexes methodology at https://www.msci.com/index-methodology

[4] for odd values of x, (x/2) is rounded up to the next integer value

2.2 CORPORATE EVENTS AND DIVIDENDS TREATMENT

The Corporate events for the calculation of the Unexpected Market Closure Index level are maintained and implemented in accordance with the respective underlying Index Methodology. The details regarding specific treatment of corporate events relevant to the Indexes can be found in the underlying Index methodology books.

In the event of Unexpected Market Closure Events on index futures expiry day affecting stock exchanges on which underlying Index constituents are listed, corporate events related to all securities listed only on the affected exchanges, with ex-date between index futures expiry day until the reopen day of listing exchanges will be deferred to the first non-disrupted reopen day for the market for the calculation of the Unexpected Market Closure Index level.

For Corporate events on underlying Index constituents with ex-date on or after index futures expiry day until the reopen day of stock exchanges suffering an Unexpected Market Closure Event, if Price Adjustment Factor (PAF) needs to be applied, all such respective adjustments for the index constituent are aggregated as a $PAF_{aggregate}$, and applied to the closing market price of the affected security on the first non-disrupted reopen day.

Similarly, for dividends on underlying Index constituents with ex-date between index futures expiry day until the reopen day of listing exchanges affected by Unexpected Market Closure Events, the reinvestment within the MSCI Daily Total Return (DTR) Indexes will be made as of the close of the reopen day.

The Index constituent deletions within the Unexpected Market Closure Index level calculation follow the treatment within the underlying Index. In cases where the constituent being deleted is affected by an Unexpected Market Closure Event, if the security trades on the non-disrupted reopen day, then the closing market price from the reopen day will be used for deletion. If the security stopped trading during the effective days of the Unexpected Market Closure Event, a deletion price consistent with the underlying Index will be used.

Further details regarding the treatment of corporate events and dividends relevant to the MSCI Indexes can be found in the MSCI Corporate Events Methodology and in the MSCI Index Calculation methodology book respectively.

The underlying Index methodology books, the MSCI Index Calculation methodology book and the MSCI Corporate Events methodology book are available at:

https://www.msci.com/index-methodology

2.3 CALCULATION OF UNEXPECTED MARKET CLOSURE INDEX LEVEL

The MSCI Unexpected Market Closure Index level is calculated as per the MSCI Index Calculation methodology, with adjustments for the calculation noted in this methodology book to enable replicability of index performance at index futures expiry.

On the day of the scheduled index futures expiry, if there are no Unexpected Market Closure Events affecting any underlying Index constituents, the index level will be considered final for the current expiry period and no adjustments will be made to this value.

In the presence of any Unexpected Market Closure Event affecting any exchange within the underlying Index on the index futures expiry day, an Unexpected Market Closure Index level will be provided on subsequent business days to account for the interruption in trading. The Unexpected Market Closure Index level will be updated at the close of the first reopen day for each of the affected stock exchanges until no such index constituents remains affected, or 5 business days have elapsed after the expiry day.

The Unexpected Market Closure Index level is calculated using closing market prices[5] from the index futures expiry day for stock exchanges that operate as per regular schedule, while closing market prices from the reopen day for stock exchanges that are affected by Unexpected Market Closure Events are used. The WM Reuters Spot FX rates from the same day corresponding to security prices are used for the index level calculation.

The index level on the index futures expiry day will be the same as the underlying MSCI Index level. If any exchanges listing the constituents of the underlying MSCI Index suffer any Unexpected Market Closure Events, adjustments will be available starting on the next business day, contingent upon reopening of the affected exchange.

Unexpected Market Closure Index levels will only be calculated for a fixed period of 5 business days following scheduled index futures expiry. If any of the affected exchanges do not reopen at the close of this period, the security prices from expiry day will be carried over for the calculation of the final Unexpected Market Closure Index level for the period.

2.3.1 UNEXPECTED MARKET CLOSURE INDEX LEVEL

The Unexpected Market Closure Index level for the Price Index level of a MSCI Index will be calculated as

[5] As per MSCI Closing price policy in MSCI Index Calculation methodology

$$UnexpectedMarketClosurePriceIndexLevelUSD_{t+k} = PriceIndexLevelUSD_{t-1} * \frac{IndexAdjustedMarketCapUSD_{t+k}}{IndexInitialMarketCapUSD_t}$$

Where:

- $UnexpectedMarketClosurePriceIndexLevelUSD_{t+k}$ is the Unexpected Market Closure Index level for index futures expiry on *t,* calculated after *k* business days due to Unexpected Market Closure Events; *k* = 0 when there are no such events and maximum allowed value of k is 5.
- $PriceIndexLevelUSD_{t-1}$ is the Price Index level in USD at time t-1.
- $IndexAdjustedMarketCapUSD_{t+k}$ is the Adjusted Market Capitalization of the index in USD at time *t+k.*
- $IndexInitialMarketCapUSD_t$ is the Initial Market Capitalization of the index in USD at time *t.*

The Unexpected Market Closure Daily Total Return Index level also accounts for impact of daily dividends, in addition to applying the change in the market performance to the previous period Index level

The Unexpected Market Closure Index level for the Daily Total Return (DTR) Index level of a MSCI Index will be calculated as

$$UnexpectedMarketClosureDTRIndexLevelUSD_{t+k} = DTRIndexLevelUSD_{t-1} * \frac{(IndexAdjustedMarketCapUSD_{t+k} + IndexDividendImpactUSD_{t+k})}{IndexInitialMarketCapUSD_t}$$

Where:

- $UnexpectedMarketClosureDTRIndexLevelUSD_{t+k}$ is the Unexpected Market Closure Index level for index futures expiry on *t,* calculated after *k* business days due to Unexpected Market Closure Events; *k* = 0 when there are no such events and maximum allowed value of k is 5.
- $DTRIndexLevelUSD_{t-1}$ is the Daily Total Return Index level in USD at time *t-1.*
- $IndexDividendImpactUSD_{t+k}$ is the gross or net amount of dividends in USD to be reinvested in the index in USD at time *t+k.*

2.3.2 INDEX MARKET CAPITALIZATION

$$IndexAdjustedMarketCapUSD_{t+k} = \sum_{V \in I,t} \sum_{s \in V,j} \frac{EndOfDayNumberOfShares_{t-1} * PricePerShare_{t+j} * InclusionFactor_t * PAF_{tAggregate}}{FXrate_{t+j}}$$

$$IndexInitialMarketCapUSD_t = \sum_{s \in I,t} \frac{EndOfDayNumberOfShares_{t-1} * PricePerShare_{t-1} * InclusionFactor_t}{FXrate_{t-1}}$$

Where:

- $EndOfDayNumberOfShares_{t-1}$ is the number of shares of security *s* at the end of day *t-1 listed on stock exchange V*.
- $PricePerShare_{t+j}$ is the price per share of the security *s* at time *t+j. When the listing exchange V is not undergoing an Unexpected Market Closure Event i.e. j is 0 for stock exchanges that have no interruptions on index futures expiry day t. j is reopen day for each affected stocks exchanges*
- $PricePerShare_{t-1}$ is the price per share of security s at time *t-1*.
- $InclusionFactor_t$ is the inclusion factor of the security s at time *t*. The inclusion factor can be one or the combination of the following factors: Foreign Inclusion Factor, Domestic Inclusion Factor, Growth Inclusion Factor, Value Inclusion Factor, Index Inclusion Factor (*).
- $PAF_{tAggregate}$ is the aggregate Price Adjustment Factor of the security s at time *t+k*, as described in the Corporate Events treatment section.
- $FXrate_{t+j}$ is the FX rate of the price currency of security s vs USD at time *t+j*. It is the value of 1 USD in foreign currency.
- $FXrate_{t-1}$ is the FX rate of the price currency of security s vs USD at time *t-1*. It is the value of 1 USD in foreign currency.

2.3.3 DIVIDEND IMPACT

$$IndexDividendImpactUSD_{t+k} = \sum_{s \in I,t} \frac{EndOfDayNumberOfShares_{ex-date-1} * DividendPerShare_{t+k} * InclusionFactor_t}{FXrate_{t+k}}$$

Where:

- $EndOfDayNumberOfShares_{ex-date-1}$ is the number of shares of the security s at the end of the dividend *ex-date-1*.
- $DividendPerShare_{t+k}$ is the gross or net dividend per share expressed in the same currency unit as the price per share of the security s to be reinvested at time *t+k*.

2.4 CONVERSION TO TARGET CURRENCY

The Unexpected Market Closure Index level for the underlying MSCI Index can be calculated into any currency by converting the index in USD into the selected currency using the formula below. The FX rate from the index futures expiry day will be used for the conversion of the Unexpected Market Closure Index level from USD to target currency.

If the base date of the index is prior to the start date of the currency, the indexes will be rebased and converted using the following formula:

$$UnexpectedMarketClosureIndexLevelinCurrency_{t+k} = 100 * \frac{UnexpectedMarketClosureIndexLevelinUSD_{t+k}}{IndexLevelinUSD_{currency\_base\_date}} * \frac{FXrate_t}{FXrate_{currency\_base\_date}}$$

Note that 100 in the formula is the base value. This base value can be different than 100 (e.g. 1000 depending on the indexes).

- If the base date of the index is equal or posterior to the start date of the currency, the indexes will be converted only, using the following formula:

$$UnexpectedMarketClosureIndexLevelinCurrency_{t+k} = UnexpectedMarketClosureIndexLevelinUSD_{t+k} * \frac{FXrate_t}{FXrate_{index\_base\_date}}$$

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* = toll free

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