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MSCI® 10/40 Equity Indices Methodology

1. Introduction

The UCITS III (Undertakings for Collective Investment in Transferable Securities) directive imposes, among other restrictions, investment limits to funds incorporated in member states of the European Union. The directive constrains the weight of any single group entity, as defined therein, at 10% of a fund's total assets and the sum of the weights of all group entities representing more than 5% of the fund at 40% of the fund's total assets.

The MSCI 10/40 Equity Indices take into account these investment limits and represent the constrained version of the MSCI Standard Equity Indices, offering a pertinent benchmarking alternative for UCITS III compliant funds. This document describes the methodology that MSCI uses to calculate its 10/40 Equity Indices by applying the weight constraints set forth herein to the non-constrained, free-float adjusted market capitalization weighted MSCI Standard Index Series (herein, "Parent Indices").

2. Guiding Principles

In designing an appropriate methodology for constructing the MSCI 10/40 Equity Indices from underlying non-constrained indices, the following principles have guided MSCI.

2.1 Reflecting the 10% and 40% concentration constraints

Reflecting the 10% and 40% concentration constraints is the primary consideration in terms of both index construction and index maintenance. Ensuring timely and on-going reflection of the constraints requires a 10/40 Equity Index to be rebalanced as soon as the weights of one or more group entities exceed the constraints. In practice, this requires that rebalancings take place as of the close of the day when the constraints are breached, such that the index will comply with the weight restrictions before the opening of the following trading day.

2.2 Minimizing turnover in the 10/40 Equity Index

Due to absolute and/or relative market price movements, a 10/40 Equity Index could potentially be rebalanced at the end of every trading day in order to remain compliant with the 10/40 framework. This would result in significant index turnover and exorbitant costs for a portfolio to track the index. Therefore, keeping the on-going index turnover in a 10/40 Equity Index to a reasonable level is an important guiding principle of the 10/40 Equity Index construction and maintenance methodology.

2.3 Minimizing tracking error to the Parent Index

Minimizing the tracking error between the 10/40 Equity Index and the Parent Index is another important objective of the current methodology. This is achieved by a regular rebalancing of the 10/40 Equity Index relative to the constituents' weights in the Parent Index, as well as by features in the index construction and maintenance process which aim at minimizing the difference between the 10/40 Equity Index and the Parent Index.

3. Index Construction and Maintenance Methodology

The following are the salient features of the MSCI 10/40 Equity Index methodology reflecting the investment restrictions of the UCITS III directive.

3.1 Group entities

3.1.1 Definition

In order to take into account the definition of group entities as set forth in the UCITS III directive, financial accounts of listed companies holding stakes of 20% or more in other listed companies are analyzed in order to determine whether these stakes should be considered as controlling stakes and, consequently, whether both companies should be considered as belonging to the same group entity. Under International Accounting Standards, a parent company is required to consolidate its investment in subsidiaries, defined as companies it controls.

3.1.2 Maintenance

MSCI will make an annual review of all group entities, which will coincide with the August Quarterly Index Review. Any change in a group entity resulting from a corporate event will be implemented at the time of the event. Updates triggered by the disclosure of new public information unrelated to corporate events or corrections to existing group entities will be implemented as of the close of the last business day of the month.

3.2 Construction and rebalancing of 10/40 Equity Indices

The 10/40 Equity Indices methodology follows a systematic approach using an iterative process which minimizes not only index turnover but also the tracking error and extreme deviation from the Parent Index. The process consists in analyzing all possible capping combinations in order to determine the optimal weight distribution which complies with the 10/40 investment restrictions.

3.2.1 Constraint targets

In order to ensure that the indices are not subject to constant rebalancing and hence to excessive index turnover caused by short-term market movements, group entities' weights are capped at levels below the 10/40 constraints. Under the MSCI methodology, at the point of constructing or rebalancing the 10/40 Equity Indices, the weight of any single group entity cannot exceed 9% of the 10/40 Equity Index and the sum of the weights of all group entities representing more than 4.5% cannot exceed 36% of the 10/40 Equity Index. In other terms, a "buffer" is used, which is set equal to 10% of the value of each constraint.

3.2.2 Fixing capping combinations (pivots)

The algorithm caps the weights of certain group entities at 9% and 4.5%. The difference between the group entities' fixed and original weights will be proportionally allocated to the uncapped group entities.

3.2.3 Adjusting the cumulative limit

The 36% limit is checked only after proportional allocation has been completed successfully; hence if a proportional allocation is not successful, the solution for the weight distribution iteration is abandoned and the next iteration is explored. However, if the allocation succeeds and the sum of the group entities' weights above 4.5% exceeds 36%, the algorithm will allocate the overweight to the group entities with weights below 4.5%.

3.2.4 Checking for compliance and evaluating quality

The resulting discrete solution is then tested for compliance and rejected if it triggers a breach of the constraints. If compliant, the solution will be compared to the preceding best iteration based on three criteria: index turnover, extreme deviations and tracking error. If the result is better, the solution will be kept and if the result is worse, the solution will be discarded.

The algorithm will then proceed to the next iteration.

Please refer to Appendix I and Appendix II for more detailed information on the dynamic rebalancing algorithm methodology.

3.3 Maintenance process of the 10/40 Equity Indices

3.3.1 Quarterly Index Reviews

The 10/40 Equity Indices are rebalanced to the Parent Index on a quarterly basis on the last business day of February, May, August and November. In order to minimize the tracking error of the 10/40 Equity Indices relative to the Parent Indices, the rebalancing process is run based on the Parent Index's constituents' weights.

3.3.2 Rebalancing due to non-compliance

The MSCI 10/40 Equity Indices are also rebalanced on an "as needed" basis. This means that a 10/40 Index is rebalanced at the end of any day on which the constraints as specified above are breached. The breach of the constraints can be, for example, triggered by the market performance of one constituent.

The rebalancing of the index in this case is done relative to the existing constituents' weights as explained in Appendix I and Appendix II, as opposed to rebalancing relative to the constituents' weights in the Parent Index. This feature of the methodology helps to significantly reduce the index turnover, as rebalancing to the Parent Index may increase or decrease the weight of constituents which are not in breach of the constraints.

The rebalancing will take place as of the close of the day when the index breaks the constraints, based on closing prices, such that the 10/40 Index will always be within the constraints before the opening of the following trading day.

3.3.3 Additions and deletions due to corporate events

The general treatment of additions and deletions due to corporate events aims at minimizing turnover in the 10/40 Equity Indices.

A security added to the Parent Index following a corporate event (acquisition, spinoff or merger) will also be added to the 10/40 Index with an estimated capped weight, which is determined using capping factors as explained in Appendix III. Following the inclusion, the 10/40 Index will only be rebalanced relative to the existing constituents' weights if the 10/40 constraints are breached.

The deletion of a constituent from the Parent Index following a corporate event will trigger its deletion from the 10/40 Index. The 10/40 Index will only be rebalanced relative to the existing constituents' weights if the 10/40 constraints are breached.

3.3.4 Rebalancing due to an IPO added to the Parent Index as an early inclusion

The early inclusion of an IPO in the Parent Index and consequently in the 10/40 Equity Index will trigger the rebalancing of the 10/40 Equity Index relative to the constituents' weights in the Parent Index.

This process ensures that an event with significant impact on the market structure of a country is correctly reflected in the 10/40 Equity Index.

As a reminder, an IPO which is considered for early inclusion in the Parent Index should be significant in size, i.e. above 4 times the minimum size threshold of the country, and meet all the MSCI inclusion criteria as set forth in the MSCI Standard Index Series Methodology book, section 2.4.1.

Appendix I

Rebalancing Algorithm: Technical Specifications

Definitions

- ICL : Individual cap limit (9%)
- CCL : Combined cap limit (36%)
- CT : Combination Threshold (4.5%)
- Cap pivot : The lowest weighted group entity at ICL
- High pivot : The highest weighted group entity at CT
- Low pivot : The lowest weighted group entity at CT
- Fixing Weight: Under/overweight obtained after all pivots have been fixed
- High caps : Group Entities above CT and below ICL
- Low caps : Group Entities below CT
- Variable caps : High and low caps not fixed (not forced to ICL or CT)
- Area weight : Sum of all the group entity weights above the CT

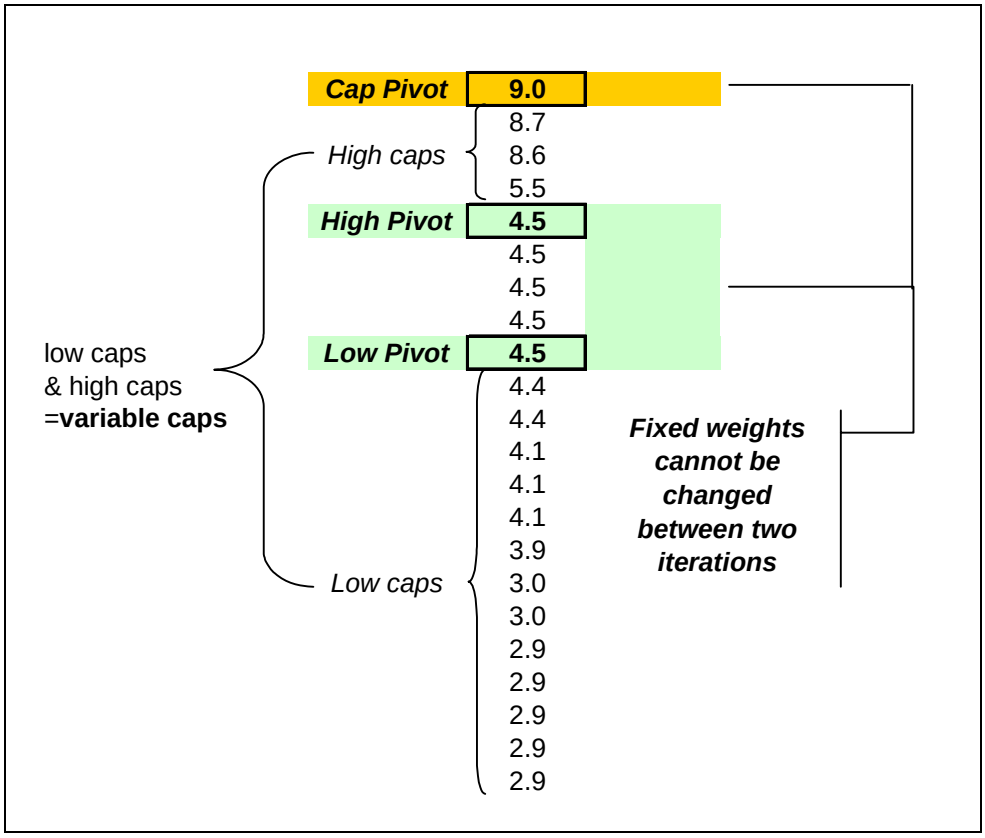

Figure 1: Defining terms

Method and order

There are 3 *pivots* that define a discrete solution (low, high and cap). They fix some weights at the ICL and CT limits. For each discrete solution, allocation/removal of weight differential between the original weights and the capped weights is applied based on a proportional ratio. Iterating in that way may often give more than one solution. The best solution is then chosen, based on defined quality criteria, as set forth below. The pivots are searched in the following order: cap pivot, high pivot, and low pivot.

Pivot order:

1. Set cap pivot first; then for each cap pivot position (including none[1]).
2. Iterate over high pivots (including none), then for each high/cap pivot position (including none).
3. Iterate over low pivots (including none if there is no high pivot).

Iteration

In cases where the weight distribution of the index exceeds the 10/40 constraints the pivot positioning is as follows:

1. Cap pivot iteration goes from position 0 to 4 (0=none, 4 is the max. allowed by the 10/40 constraints).
2. High pivot position cannot go below cap pivot position +1.
3. The sum of weights between low and high pivots cannot exceed (group entity's sum)-(cap pivot position * ICL)
4. Low pivot position can't go below high pivot position.

Quality Criteria

The best discrete solution will be based on three quality criteria: lowest turnover, lowest maximum increase factor and minimum distance from the Parent Index.

The following formulas are used to define the quality criteria:

1. **Turnover** $= \sum abs(W_{final_i} - W_{original_i})$
2. **Max relative increase** $= \max_{\text{all weights}} \left(\frac{W_{final_i}}{W_{original_i}} - 1\right)$
3. **Distance** $= \sqrt{\sum (W_{final_i} - W_{original_i})^2}$

W: Weight

[1] A flat weight distribution of the Parent Index might not warrant the setting of a cap pivot.

Appendix II

Rebalancing Algorithm: Calculations description for each iteration

Fixing weight set and allocation

By fixing the pivots, some weights must be forced at the ICL (individual cap limit) and/or CT (combination threshold). Consequently, we obtain a positive or negative weight called "fixing weight". That fixing weight must then be allocated proportionally (if applicable) to low and high caps.

ID	Orig.	Fixed	Fixing weight	
1	12.0	9.0	**3.0**	
2	8.7	9.0	**-0.3**	***Cap Pivot***
3	8.6	8.6		*High caps*
4	5.5	5.5		
5	4.8	4.8		
6	4.7	4.5	**0.2**	***High Pivot***
7	4.7	4.5	**0.2**	
8	4.5	4.5		
9	4.4	4.5	**-0.1**	
10	4.3	4.5	**-0.2**	
11	4.3	4.5	**-0.2**	
12	4.2	4.5	**-0.3**	
13	4.1	4.5	**-0.4**	
14	4.0	4.5	**-0.5**	***Low pivot***
15	3.9	3.9		*Low caps*
16	3.0	3.0		
17	3.0	3.0		
18	2.9	2.9		
19	2.9	2.9		
20	2.9	2.9		
21	2.6	2.6		
	100.0	98.6	**1.4**	***Fixing weight***
		40.1	***Sum of high caps and low caps***	

Figure 2: Getting fixing weight for a set of pivots

Once obtained, the fixing weight is allocated to the high and low caps proportionally to their respective weights. In some cases it may happen that no low caps or no high caps exist, but there must be at least one of them if the fixing weight is not 0.

ID	Orig.	Fixed	Allocated
1	12.0	9.0	9.0
2	8.7	9.0	9.0
3	8.6	8.6	8.9
4	5.5	5.5	5.7
5	4.8	4.8	5.0
6	4.7	4.5	4.5
7	4.7	4.5	4.5
8	4.5	4.5	4.5
9	4.4	4.5	4.5
10	4.3	4.5	4.5
11	4.3	4.5	4.5
12	4.2	4.5	4.5
13	4.1	4.5	4.5
14	4.0	4.5	4.5
15	3.9	3.9	4.0
16	3.0	3.0	3.1
17	3.0	3.0	3.1
18	2.9	2.9	3.0
19	2.9	2.9	3.0
20	2.9	2.9	3.0
21	2.6	2.6	2.7
	100.0	98.6	100.0

Figure 3: allocating fixing weight

The weights are changed without regard to the CCL limit. The factor is computed by the ratio between the fixing weight and the sum of low and high caps. In our example, the factor will be 1+(fixing weight / sum variable caps) → 1+(1.4/40.1)=1.03

When allocating or removing weight, none of the pivots are moved. That is to say: if a factor (positive or negative) brings a group entity to the CT or ICL value, the result is abandoned and the next pivots iteration is explored.

Bringing a group entity to the same value as a pivot (CT or ICL) will be equivalent to exploring another pivot combination. This is performed in any event because the process iterates through all possible pivot positions.

CCL over weight set and allocation

Then the CCL is calculated and checked for compliance (in our example, it must not exceed 36%). Note also that in our example the area weight has been reduced by the fixing weight step, but is still above 36%, so it must be corrected here. The CCL overweight must be removed proportionally from the high caps and allocated to the low caps.

ID	Orig.	Fixed	Allocated	
1	12.0	9.0	9.0	
2	8.7	9.0	9.0	
3	8.6	8.6	8.9	**37.6** ***sum CCL***
4	5.5	5.5	5.7	**19.6** ***sum high caps***
5	4.8	4.8	5.0	
6	4.7	4.5	4.5	
7	4.7	4.5	4.5	
8	4.5	4.5	4.5	
9	4.4	4.5	4.5	
10	4.3	4.5	4.5	
11	4.3	4.5	4.5	
12	4.2	4.5	4.5	
13	4.1	4.5	4.5	
14	4.0	4.5	4.5	
15	3.9	3.9	4.0	
16	3.0	3.0	3.1	
17	3.0	3.0	3.1	
18	2.9	2.9	3.0	**21.9** ***sum low caps***
19	2.9	2.9	3.0	
20	2.9	2.9	3.0	
21	2.6	2.6	2.7	
	100.0	98.6	100.0	**1.6** ***area over weight***
				0.92 High caps factor
				1.07 Low caps factor

Figure 4: Checking and allocating CCL over weight

As the sums of variable high and low caps are not identical, two distinct factors have to be computed, one to reduce the high variable caps and one to increase the low ones. In order to compute these two factors, there must be at least one high and one low cap. In other words, if any of the two variable caps areas is equal to 0, the solution is abandoned and the next pivots iteration is explored.

The large caps factor is computed by the ratio of the area over weight over the sum of high caps. In the above example the factor will be 1-(area over weight / sum high caps) → 1-(1.6/19.6)=0.92

The small caps factor is computed by the ratio of the area over weight over the sum of low caps. In the above example the factor will be 1+(area over weight / sum low caps) → 1+(1.6/21.9)=1.07

ID	Orig.	Fixed	Allocated	Final result	
1	12.0	9.0	9.0	9.0	
2	8.7	9.0	9.0	9.0	
3	8.6	8.6	8.9	8.2	36.0
4	5.5	5.5	5.7	5.2	
5	4.8	4.8	5.0	4.6	
6	4.7	4.5	4.5	4.5	
7	4.7	4.5	4.5	4.5	
8	4.5	4.5	4.5	4.5	
9	4.4	4.5	4.5	4.5	
10	4.3	4.5	4.5	4.5	
11	4.3	4.5	4.5	4.5	
12	4.2	4.5	4.5	4.5	
13	4.1	4.5	4.5	4.5	
14	4.0	4.5	4.5	4.5	
15	3.9	3.9	4.0	4.3	
16	3.0	3.0	3.1	3.3	
17	3.0	3.0	3.1	3.3	
18	2.9	2.9	3.0	3.2	
19	2.9	2.9	3.0	3.2	
20	2.9	2.9	3.0	3.2	
21	2.6	2.6	2.7	2.9	
	100.0	98.6	100.0	100.0	

Figure 5: Reallocating CCL overweight

Check constraints and quality

The result is then tested for ordering (i.e., none of the group entities has crossed a rank) and for constraint breaches. It is rejected if it is not compliant, otherwise it is compared to the previous result and the best one is kept based on the quality criteria as explained in Appendix I.

Appendix III

General formula for weight calculation

A *constrained* index can be defined based on a *parent* index as long as they share the list of constituents. The weight of a security *s* in the parent index at a time *t* will become the unconstraint weight $uw_{s,t}$:

$$uw_{s,t} = \frac{MC_{s,t}}{\sum_i MC_{i,t}} \qquad s \in \text{Index}, i \in \text{Index}$$

where $MC_{s,t}$ = market capitalization of security *s* at time *t*.

We can define a constraint weight $cw_{s,t}$ for a security *s* at a time *t* with the help of a constraint factor:

$$cw_{s,t} = \frac{uw_{s,t} \times Factor_{s,t}}{\sum_i (uw_{i,t} \times Factor_{i,t})} \qquad s \in \text{Index}, i \in \text{Index}$$

Constraint factor calculation for the 10/40 Equity Indices

In the case of the 10/40 Equity Indices, each group entity, and thus the securities composing this group entity, will be assigned a constraint factor whenever the 10/40 index is rebalanced to its parent index, i.e. at every Quarterly Index Review. This factor will remain constant between rebalancings to the parent index for a particular group entity, unless one or more securities of the group entity is involved in a corporate event. In this last situation, a specific rule for corporate events will be applied to calculate the new factor for the securities involved in the event. This allows MSCI to compute the new weights of the securities in the 10/40 index and to include them without rebalancing the whole 10/40 index. If the 10/40 constraints are breached, it will trigger the rebalancing relative to the existing constituents' weights. If the rule is not applicable, i.e. in the case of an IPO, then the factor cannot be calculated and the rebalancing to the parent index is triggered.

Constraint factor at rebalancing time

The constraint factor for a security *s* at a rebalancing time *r* is defined as follows:

$$Factor_{s,r} = \frac{AW(GE, r)}{\sum_g uw_{g,r}} \qquad s \in GE, g \in GE$$

where AW = the assigned weight (fixed) to the Group Entity (GE) at rebalancing time *r*
and $uw_{s,r}$ = uncapped opening weight of security *s* at time *r*.

Constraint factor between rebalancings

Without corporate event

If no corporate event involved a security *s*, its factor will remain constant between rebalancings.
The constraint factor for a security *s* at a time *t*, if *t* is not a rebalancing time, is defined as:

$$Factor_{s,t} = Factor_{s,t-1}$$

With corporate event

We can define the corporate event CE as a transformation from one security set to another, from a time t-1 to a time t:

$$\begin{Bmatrix} a_1 \\ a_2 \\ \vdots \\ a_m \end{Bmatrix} \xrightarrow{CE} \begin{Bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{Bmatrix} \qquad m \geq 0, n \geq 0$$

$$A \xrightarrow{CE} B \qquad a \in A, b \in B$$

We can have, for example, a corporate event where a company a1 and a company a2 merge into a company b. Consequently, companies a1 and a2 will be deleted from the Parent Index as well as from the 10/40 Index and company b will have to be assigned a constraint weight in the 10/40 Index.

We define the constraint factor for security b at a time t, $b \in B$ and $b \in Index$, as:

$$Factor_{b,t} = \frac{\sum_{k=1}^{m} Factor_{a_k,t-1} \times MC_{a_k,t-1} \times IF_{a_k,t-1}}{\sum_{k=1}^{m} MC_{a_k,t-1} \times IF_{a_k,t-1}} \qquad a_k \in A, a_k \in \text{Index at time t - 1}$$

where $MC_{s,t}$ = market capitalization of security *s* at time *t*

and $IF_{s,t}$ = Inclusion Factor of the security *s* in the Index at *t* in order to adjust the market capitalization to the free-float of the security.

This formula can also be expressed as:

$$Factor_{b,t} = \frac{\sum_{k=1}^{m} Factor_{a_k,t-1} \times ucw_{a_k,t-1}}{\sum_{k=1}^{m} ucw_{a_k,t-1}} \qquad a_k \in A, a_k \in \text{Index at time t - 1}$$

where $ucw_{s,t}$ = uncapped closing weight of the security *s* in the Index at time *t*.

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