cf benchmarks

CF Diversified Series

Methodology Guide v1.1

29h July 2022

Table of Contents

1   Version History

Version	Date Issued	Summary of Change	Owner
V1.0	17th January 2022	Launch	CF Benchmarks Management
V1.1	29th July 2022	Parameter Tables: Updated Minimum liquidity ratio	CF Benchmarks Management

2 Introduction

2.1 Index Aims

An index within the CF Diversified Series (the "**Index**") aims to provide index users with diversified exposure to a target capitalisation range of the liquid digital asset universe and deliver the associated "beta" return. Whilst a portfolio of multiple digital assets could be said to be diverse, diversified exposure is only achieved if the portfolio weight is not overly concentrated in a small proportion of the constituents. Since inception, the digital asset market has exhibited a very high degree of concentration of market capitalisation in the largest digital assets. To that end a free float market capitalisation weighting regime, though the purest expression of "beta", would not likely deliver diversified exposure for index users. Indices in traditional asset classes have usually provided diversified exposure in markets with outsized constituents by applying a cap on the weight of any individual constituent, with the resultant "excess weight" re-invested through the divisor. Were this method to be applied to digital assets the combined weight of the two largest digital assets, Bitcoin and Ether, would still be too large to meet investor requirement for diversification and this situation would not likely change for the foreseeable future given the maturity of these assets relative to the rest of the universe.

To meet the needs of investors, the Diversified Index Series will employ the Diversified Market Capitalisation weighting method. This approach enjoys the same benefits as the capping approach:

- Its effect diminishes the more the reference universe exhibits signs of becoming diversified and hence does not result in a large amount of portfolio churn if and when the weighting method is replaced with a conventional free float market capitalisation method
- It delivers a portfolio whose returns will closely track market "beta" by having little impact on constituents that are not showing excessive weight when there is one outsized constituent

This approach also enjoys some further benefits relative to the capping approach:

- The excess weight is not re-invested through the divisor, so it does not lead to situations where the excess weight is applied to the next largest constituent after any that hit the cap leading to those constituents hitting the cap artificially – a drawback of the capping approach that brings about a situation where the portfolio becomes

too concentrated in a small number of constituents and having no proportionate difference in weight - in the current market conditions Bitcoin and Ether

- Promoting diversification as the excess weight is disproportionately distributed to the smallest constituents in the portfolio

The index series has been designed to be investible and to be used as a benchmark as defined by *EU Benchmark Regulations* ("*EU BMR*") including for:

- The performance benchmarking of actively managed portfolios of digital assets and determine relative performance
- The passive replication in investment funds and financial instruments and products
- The settlement of financial instruments including derivative contracts
- As a means of valuing or "marking to market" portfolio holdings of digital assets

2.2   Requirements

For the index series to meet its stated aims it must be:

- Representative

    Index constituents should accurately represent a significant proportion of the market capitalisation and thus reflecting the wider market "beta"

- Replicable

    Index constituents are weighted according to the **Index Parameter Table**, so as to balance diversification, transaction costs and liquidity risks. Constituent eligibility parameters must be set at appropriate levels and buffering will be employed for existing index constituents to further minimise these risks

- Reliable

    The Index shall be capable of calculation and administration in a reliable and robust manner in accordance with all CF Benchmarks Administration Polices and the provisions of *EU BMR*

2.3   Underlying Economic Reality

The Index series is intended to measure the underlying economic reality of the value of the base assets in units of the quote asset as held in a portfolio that seeks to replicate a diversified market beta of the digital assets that represent a fixed proportion of the digital asset market capitalisation. This is done by observing the exchange of the base assets for the quote asset

and vice versa. This is accomplished using transactional input data from Constituent Exchanges, the criteria for eligibility for which are available in the *CF Constituent Exchange Criteria*.

3   Index Parameters

3.1   Eligible Index Constituents

The constituents for any index within the series shall always be the digital assets with the largest market capitalisation within the CF Benchmarks Investable Universe and whose market capitalisation begins within the nth percentile when ranked by Market Capitalisation, parameter defined in the **Index Parameter Table**, as defined by the *CF Digital Asset Index Family – Multi Asset Series Ground Rules – Section 3.*

Digital Assets that are, by their design, pegged to the value of other assets such as but not limited to fiat currency ("stablecoins"), a physical commodity or another digital asset, are not eligible for inclusion. Digital assets whose status as a digital asset is ambiguous or has been questioned by Regulatory and Supervisory Authorities of major jurisdictions including but not limited to the United States of America, the European Union and the United Kingdom, are not eligible for inclusion.

As the Index weights shall be determined by initially using the free float market capitalisation, any digital assets where the Administrator cannot reliably determine the *Total Fungible Supply Likely to be Available for Trading* as defined in the *CF Digital Asset Index Family - Multi Asset Series Ground Rules* shall also be excluded.

To be able to reliably determine the pricing of any constituent of the Index any digital assets that is not listed on 2 (two) or more constituent exchanges shall not be eligible for Inclusion.

3.2   Index Denomination

The Index series is denominated in U.S. Dollars.

3.3   Index Return Types

The index series is available in two return variants:
- **Total Return:** Inclusive of distributions (such as forks, airdrops amongst others) - the definition and treatment of distributions are defined in the *CF Digital Asset Index Family - Multi Asset Series Ground Rules – Section 8 Treatment of Distribution*s
- **Price Return:** Exclusive of distributions

3.4   Calculation & Publication Frequency

The Index series shall be calculated at the frequency stated in the **Index Parameter Table**.

3.5 Constituent Reviews

Constituent Reviews are carried out twice a year as described In the *CF Digital Asset Index Family - Ground Rules Section 3 - Constituent Review* and employ the below constituent review buffers:

- Where a digital asset that is an existing index constituent reaches a market capitalisation that is fully above the $(n + 0.5\%)^{th}$ percentile it will exit the index
- Where a digital asset that is not an existing index constituent reaches a market capitalisation that starts within the $(n - 0.5\%)^{th}$ percentile it will enter the index

3.6 Constituent Weighting

The constituents are weighted using **Diversified Market Capitalisation** as defined in *CF Digital Asset Index Family - Multi Asset Series Ground Rules – Section 4.*

3.7 Index Constituent Pricing Sources (Input Data)

3.7.1 Spot Rate

The Index Constituent Pricing Source shall be the CF Spot Rates available at https://www.cfbenchmarks.com.

3.7.2 Settlement Price

The Index Constituent Pricing Source shall be the CF Benchmarks Reference Rates available at www.cfbenchmarks.com. The respective methodologies for each of these pricing benchmarks is available at www.cfbenchmarks.com.

Should these sources become permanently unavailable then *CF Digital Asset Index Family - Multi Asset Series Ground Rules - Section 6 Input Data Hierarchy* shall be applied after review by the CF Digital Assets Index Family Oversight Function.

3.8 Rebalance Frequency

The Index shall be rebalanced quarterly as described in the *CF Digital Asset Index Family - Ground Rules – Section 6 Rebalance Procedure*.

3.8.1 Rebalance Free Float Supply Determination Time

Time of the free float supplies determination used in the rebalance weight calculation: 16:00:00 UTC on the day which is 8 business days prior to the Rebalance Implementation Point.

3.8.2 Rebalance Price Determination Time

Time of the price determination used in the rebalance weight calculation and specified in the **Index Parameter Table**.

3.8.3 Rebalance Implementation Point

At the Index Calculation & Publication time on the first business day of Rebalance month.

3.8.4 Rebalance Determination Pricing Sources

The Index Rebalance Determination Pricing Source shall be the CF Benchmarks Reference Rates or Settlement Prices available on www.cfbenchmarks.com.

The respective methodologies for each of these pricing benchmarks is available at https://www.cfbenchmarks.com/documentation.

Should these sources become permanently unavailable then *CF Digital Asset Index Family Ground Rules - Section 6 Input Data Hierarchy* shall be applied after review by the CF Digital Asset Index Family Oversight Function.

4   Index Parameter Table

4.1   Index Composition Parameters

- Diversified Large Cap

Index Name	CF Diversified Large Cap Index
Inception Date	December 1st 2021
Inception Value	1000
Base Currency	USD
Constituent Pricing Sources	CF Digital Asset Reference Rates
Constituent Selection Method	All constituent falling within the 95% percentile ranked by market capitalisation
Return Types	- Total Return - Price Return
Calculation & Publication Frequency	- Spot Rate: Every second, every day, 365 days a year - Settlement Price: Once per day, 365 days a year
Constituent Minimum Liquidity Requirement	0.05%
Constituent Minimum Monthly Asset Turnover	2%
Buffers for Exclusion of an Existing Constituent at reconstitution	50% of the Minimum Full Market Cap 50% of the Minimum Liquidity Ratio 50% of the Minimum Turnover Ratio
Increment Parameter	4%
Rebalance Frequency	Quarterly – 1st business day of March, June, Sep, Dec

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4.2   Settlement Price Variants Parameters

- London Settlement Price

Calculation & Publication Time	• Spot Rate: Every second • Settlement Price: Between 16:05 and 16:30 London time
Rebalance Price Determination Time	16:00:00 London time on the day which is 6 business days prior to the Rebalance Implementation Point

- New York Settlement Price

Calculation & Publication Time	• Spot Rate: Every second • Settlement Price: Between 16:05 and 16:30 New York time
Rebalance Price Determination Time	16:00:00 New York time on the day which is 6 business days prior to the Rebalance Implementation Point

- Brazil Settlement Price

Calculation & Publication Time	• Spot Rate: Every second • Settlement Price: Between 16:05 and 16:30 Brazil time
Rebalance Price Determination Time	16:00:00 Brazil time on the day which is 6 business days prior to the Rebalance Implementation Point

4.3   Tickers

CF Diversified Large Cap Index, London Time, Total Return, Spot Rate	CFDLCLDN_RTI_TR
CF Diversified Large Cap Index, London Time, Total Return, Settlement Price	CFDLCLDN_RR_TR
CF Diversified Large Cap Index, London Time, Price Return, Spot Rate	CFDLCLDN_RTI_PR
CF Diversified Large Cap Index, London Time, Price Return, Settlement Price	CFDLCLDN_RR_PR
CF Diversified Large Cap Index, New York Time, Total Return, Spot Rate	CFDLCUS_RTI_TR

CF Diversified Large Cap Index, New York Time, Total Return, Settlement Price	CFDLCUS_RR_TR
CF Diversified Large Cap Index, New York Time, Price Return, Spot Rate	CFDLCUS_RTI_PR
CF Diversified Large Cap Index, New York Time, Total Return, Spot Rate	CFDLCUS_RTI_TR
CF Diversified Large Cap Index, Brazil Time, Total Return, Settlement Price	CFDLCBRT_RR_TR
CF Diversified Large Cap Index, Brazil Time, Price Return, Spot Rate	CFDLCBRT_RTI_PR
CF Diversified Large Cap Index, Brazil Time, Price Return, Settlement Price	CFDLCBRT_RR_PR
CF Diversified Large Cap Index, Brazil Time, Price Return, Settlement Price	CFDLCBRT_RR_PR

4.4   Expert Judgement

The Administrator does not utilise expert judgment in the day-to-day calculation of the index. In extraordinary circumstances Expert Judgement may be exercised by the Administrator in the calculation, constituent review and rebalance procedure for the index. This will be done in accordance with its codified policies and processes which are available upon request.

5 Index Calculation Method

5.1 Definitions

Symbol	Name	Description
t	Effective time	The time at which the index is calculated
k_i	Rebalance Implementation Time	The time when the rebalance parameters are implemented at the ith rebalance
r_i	Rebalance Free Float Supply Determination Time	The time when the Free Float supply is determined at the ith rebalance
s_i	Rebalance Price Determination Time	The time of the price determination used at the ith rebalance
v_i	Rebalance weight Determination Time	The time of the weight determination used at the ith rebalance: $v_i = max\,(s_i,\ r_i)$
$c \in C_i$	Index Constituents	The list of constituents that are determined to be index constituents at the ith rebalance
$s_{r_i}^c$	Rebalance Determination Free Float Supply	The free float supply of constituent c used at the Rebalance Free Float Supply Determination Time
$\varrho_{s_i}^c$	Rebalance Determination Price	The price of constituent c used at the Rebalance Price Determination Time s_i. Note that this may be different from the Constituent Pricing Source
M_i^c	Free Float Market Capitalisation	The Free Float Market Capitalisation of constituent c at the ith rebalance
p_t^c	Constituent Pricing Source	The price of constituent c at time t
$\varrho_{s_i}^c$	Rebalance Determination Price	The price of constituent c used at the ith Rebalance Price Determination Time. Note that this may be different from the Constituent Pricing Source
$\varrho_{k_i}^c$	Rebalance Implementation Price	The price of constituent c used at the ith Rebalance Implementation Time. Note that this may be different from the Constituent Pricing Source

w_i^c	Initial weight	The weight of constituent c based on the market capitalisation at the Rebalance weight Determination Time v_i
w'^c_i	New weight	The weight of constituent c based on the diversified market capitalisation at the Rebalance weight Determination Time v_i
$g^c_{k_i}$	Relative supply	The relative supply of constituent c at the ith rebalance
d_{k_i}	Divisor	Divisor used for the ith rebalance
R_{k_i}	Return factor	Return factor for the ith rebalance
A_{r_i}	Return amount	Return amount used for the ith rebalance
I_t	Index value	Index value at time t
IP	Increment Parameter	Unique input Parameter of the Diversified Market Capitalisation Method – Section 5.2.3
df_n	Diversifying Factor	Factor to apply to the nth interval in the Diversified Market Capitalisation Method - Section 5.2.3

Usage of Parameters between Variants: Parameters ϱ_i^c, p_t^c, R_{k_i}, A_{r_i} and I_t are different between variants of this index family. Each section shall apply to each variant independently, except for those equations which have parameters marked with the variant label:

Type	Label
Spot Rate	RTI
Settlement Price	RR
Total Return	TR
Price Return	PR

5.2   Weighting Methodology

The index weights are calculated using the Diversified Market Capitalisation Method as per *CF Digital Asset Index Family - Multi Asset Series Ground Rules – Section 4.*

5.2.1 Description

The methodology modifies, independently for each constituent, the initial market capitalisation to obtain a new diversified market capitalisation.

The diversifying step is applied incrementally on each percent of the constituent market cap weight.

5.2.2 Initial Weights

The initial weight of constituent c in the index at the ith rebalance:

$$\forall c \in C_i, \qquad w_i^c = \frac{M_i^c}{\sum_{a \in C} M_i^a}$$

Where $\forall c \in C_i, \ M_i^c = s_{r_i}^c * \varrho_{s_i}^{c,RR}$

5.2.3 Diversified Market Capitalisation

The whole index weight (100%) is divided into intervals such that each interval length is the *Increment Parameter IP*.

The diversifying factor df_n corresponds to the nth interval and is defined as follows:

$$\forall n \in \{1,..,25\}, \ \ df_n = \frac{1}{n}$$

The new diversified market capitalisation at the ith rebalance is:

$$\forall c \in C_i, \ M'^c_i = \ M_i^c \left(\frac{IP}{w_i^c} \sum_{n=1}^{F} df_n + df_{F+1} * \frac{R - IP}{w_i^c} \right)$$

Where $\begin{cases} F = floor(\frac{w_i^c}{4}) \\ R = w_{k_i}^c \; modulo \; IP \end{cases}$

5.2.4 New Weights

The new weights at the ith rebalance are inferred from the new diversified market capitalisation:

$$\forall c \in C_i, \qquad w'_i^c = \frac{M'_i^c}{\sum_{a \in C} M'_i^a}$$

5.3   Supply Calculation

The relative supplies $g_{k_1}^c$ can be inferred from the new weights w'_i^c using the following relation:

$$\begin{cases} g_{k_1}^c = \dfrac{w'_1^c I_{k_1}}{\varrho_{k_1}^{c,RR}} \\ \forall i \geq 2, \; g_{k_i}^c = \dfrac{w'_i^c \sum_{a \in C_i} g_{k_{i-1}}^a \varrho_{k_i}^{a,RR}}{\varrho_{k_i}^{c,RR}} \end{cases} \quad (1)$$

The Index inception value I_{k_1} is define in the **Index Parameter Table**.

5.4   Index Calculation

The index value at time t where $k_i \leq t < k_{i+1}$ is given by

$$I_t = \frac{R_{k_i}}{d_{k_i}} \sum_{c \in C_i} g_{k_i}^c p_t^c$$

About R_{k_i}:

At index inception there are no distributions or deductions hence $R_{k_1} = 1$.

If the application point of distribution and deduction events is at the ith rebalance, let the Return Amount A_{r_i} be the sum of all Distribution Proceeds and Deductions Amounts from said events. Then the return factor shall be:

$$\begin{cases} R_{k_i}^{TR} = R_{k_{i-1}}^{TR} \left(1 + \dfrac{A_{r_i}}{\sum_{c \in C_{i-1}} g_{k_{i-1}}^c \varrho_{k_i}^{c,RR}} \right) \\ R_{k_i}^{PR} = 1 \end{cases}$$

About d_{k_i}:

The divisor is used to scale the index so that the value of the index is fixed at inception and continuous at each rebalancing. The divisor factor shall be:

$$\begin{cases} d_{k_1} = \dfrac{1}{I_{k_1}} \displaystyle\sum_{c \in C_1} g_{k_1}^c p_{k_1}^{c,RR} \\[3ex] \forall i \geq 2,\ d_{k_i} = d_{k_{i-1}} \cdot \dfrac{\sum_{c \in C_i} g_{k_i}^c \varrho_{k_i}^{c,RR}}{\sum_{c \in C_{i-1}} g_{k_{i-1}}^c \varrho_{k_i}^{c,RR}} \end{cases}$$

5.5   Metadata

The *index share* of a constituent is defined as the number of units of a constituent one needs to buy such that the composition of all constituents reproduces the value of the index.

Example:

The index value is 1000. Assume a return factor of 1.6.

$$share_i^c = \frac{R_{k_i}}{d_{k_i}} {g'}_{k_i}^{\,c}$$

Constituent	Price	Weight	Relative supply	Index share
A	$5	50%	62.5	100
B	$2	50%	156.25	250

6 Contingency Calculation Rules

There may be instances where the Index cannot be calculated according to the calculation methodology.

6.1 Delayed Calculation and Dissemination

Where any Constituent Pricing Source for the calculation of the index is delayed, missing or otherwise not available for any index calculation time the index value shall be deemed delayed, where no index value will be published. The index shall resume publication when valid Constituent Pricing Source(s) are published.

Where any Divisor Adjustment Price for the calculation of the index is delayed, missing or otherwise not available for a Rebalance Implementation Point, the index values(s) on and subsequent from Rebalance Implementation Point shall be deemed delayed, where no index value(s) will be published. The index shall resume publication when valid Divisor Adjustment Price(s) are published.

Where for the above or any reason the Administrator is not able to calculate and publish the index within the Dissemination Time on any given Calculation Day then the Administrator shall publish a notification on its website at blog.cfbenchmarks.com informing index users that calculation and publication has been delayed. The Administrator will seek to publish the Index for that Calculation Day as soon as it is able to.

6.2 Calculation Failure

If the index cannot be calculated for a given Calculation Day before 23:59:59 London time, for instance because:

- A Constituent Pricing Source for the calculation time is not published, or published but not retrieved by the Calculation Agent before 23:59:59 London time

- A Divisor Adjustment Price for the Rebalance Implementation Point is not published, or published but not retrieved by the Calculation Agent before 23:59:59 London time

- Any other reason or circumstance that prevents the orderly calculation of the index

Then the index value for that calculation day is given by the index value on the previous calculation day and this index value shall be published with a marker of (*).

The occurrence of any index calculation failure is reported to the CF Oversight Function and announced at blog.cfbenchmarks.com

7   Restatement & Republishing

The Index is subject to restatement and republishing before 23:59:59 London time of any given Calculation Day due to republication of underlying Constituent Pricing Sources, or errors made by the Calculation Agent or its systems. The index shall not be subject to republishing after this time.

7.1   Restatement and Republishing of the Index Level

The Administrator shall only Restate and Republish the index on any given Calculation Day if the Administrator can restate and republish the index before 23:59:59 London of the given calculation day. The Administrator shall announce on its website that a restatement and republishing of the index will take place for that Calculation Day.

The Administrator shall restate the index as soon as possible after the restated Constituent Pricing Source has been published or the errors made by the Calculation Agent, or its systems are acknowledged and shall do so by overwriting the previously published Index level. This restated index level will carry no mark when published and will be final and not subject to any further change or republication.

The index shall be not restated if any Divisor Adjustment Price is republished.

8 Methodology Review and Changes to the Index

This methodology is subject to internal review by the Administrator and the CF Digital Assets Index Family Oversight Function at least annually.

Any changes to this methodology are overseen by the CF Digital Assets Index Family Oversight Function, and in accordance with EU BMR Article 13.

All *material* changes to the methodology shall only be implemented after a consultation process with users and relevant stakeholders that shall be conducted according to the Administrator's policies and overseen by the CF Digital Assets Index Family Oversight Function.

Should the Administrator deem it necessary to cease providing the Index it shall only do so after a consultation process with users and relevant stakeholders that shall be conducted according to the Administrator's policies and overseen by the CF Digital Assets Index Family Oversight Function.