



CF BITCOIN NY TWAP

Methodology Guide

Version: 1.0

Version Date: 22nd July 2022

Contents

1	Version History.....	3
2	Overview.....	4
3	Definitions.....	5
4	Methodology and Ground Rules.....	6
4.1	Methodology.....	6
4.1.1	Qualitative Description.....	6
4.1.2	Mathematical Representation.....	6
5	Contingency Calculation Rules.....	7
5.1	Delayed Data and Missing Data.....	7
5.2	Erroneous Data.....	7
5.3	Delayed Calculation & Publication.....	8
5.4	Expert Judgement.....	8
5.5	Calculation Failure.....	8
6	Restatement & Republishing.....	9
6.1	Restatement of a CF Bitcoin NY TWAP Value with a Replacement CF Bitcoin NY TWAP Value.....	9
7	Market Failure Event.....	10
8	Parameters.....	11
9	Specifications.....	12
10	Methodology Review and Changes.....	13

1 Version History

Version	Version Date	Changes to Previous
1	22 nd July 2022	N/A

2 Overview

The CF Bitcoin TWAP has been created to facilitate the settlement and valuation of regulated financial products that seek to synchronise with the traditional US market close of 1600 New York time. The methodology has been specifically designed to ensure that it is fit for this purpose. No further applications of the CF Bitcoin TWAP have been taken into consideration in its design.

Underlying Economic Reality

The CF Bitcoin TWAP is intended to measure the underlying economic reality of the exchange of the base asset for the quote asset, including markets where the quote asset is made fungible with the Accepted Assets and vice versa. This is accomplished by the use of transactional input data from Constituent Exchanges.

3 Definitions

Accepted Asset: a digital asset that is a fully reserve backed digital token, commonly referred to as a “stablecoin”, that seeks to peg its value to that of the quote asset, where the stablecoin issuer operates a 1:1 redemption facility that is accessible to all Accepted Asset holders. Furthermore, only digital assets that solely hold reserve assets that are in line with the prevailing regulations enforced for government security money market funds in major jurisdiction such as the US, UK and EU. Accepted Assets are subject to the approval of the CF Cryptocurrency Index Family Oversight Function in accordance with the CF Cryptocurrency Index Family Oversight Function Specifications

Accepted Asset List:

Name	Ticker Symbol
USD Coin	USDC

API: Application programming interface.

Calculation Day: Any day for which the CF Bitcoin NY TWAP is published.

Constituent Exchange: A cryptocurrency trading venue that conforms to the CF Constituent Exchange Criteria

Relevant Transaction: Any cryptocurrency versus cryptocurrency or legal tender spot trade that occurs during¹ the TWAP Period on a Constituent Exchange in the Relevant Pair that is reported through its API to the Calculation Agent.

Retrieval Time: One minute after the end of the TWAP Period on a given Calculation Day, as given by the server clock of the Calculation Agent.

TWAP Period: A period of time equal to the TWAP Period Length leading up to the Effective Time, as defined in Section 8.

¹ Exclusive of start time but inclusive of end time when truncated to millisecond precision

4 Methodology and Ground Rules

4.1 Methodology

4.1.1 Qualitative Description

The CF Bitcoin NY TWAP is calculated based on the Relevant Transactions of all Constituent Exchanges. Calculation steps on any given Calculation Day are as follows:

1. All Relevant Transactions are added to a joint list, recording the trade price and size for each transaction.
2. The CF Bitcoin NY TWAP is given by the arithmetic mean of the prices of all Relevant Transactions

4.1.2 Mathematical Representation

The following table shows the symbols used in the mathematical representation of the CF Bitcoin TWAP.

Symbol	Name	Description	Type
T	Effective time	The time as of which Bitcoin TWAP is calculated	Parameter, see Section 8
τ	TWAP period length	The length of the time-period prior to the effective time during which transaction data is collected	Parameter, see Section 8
I_τ	TWAP period trades count	The number of trades in τ	Output
p_i	TWAP period trade price	The price of the i th trade	Input

The Bitcoin TWAP at the effective time T , $BTWAP_T$, is given by:

$BTWAP_T = \frac{1}{I_\tau} \sum_{i=1}^{I_\tau} p_i$	Eq. 1
--	--------------

5 Contingency Calculation Rules

5.1 Delayed Data and Missing Data

Delayed data and missing data are treated according to the following rules:

1. Any Relevant Transaction for a given Calculation Day that is not available from a Constituent Exchange's API by the Retrieval Time is disregarded in the calculation of the CF Bitcoin NY TWAP for that Calculation Day.
2. If no Relevant Transaction occurs on a Constituent Exchange on a given Calculation Day or one or more Relevant Transactions occur but for any reason cannot be retrieved by the Calculation Agent, the Constituent Exchange is disregarded in the calculation of the CF Bitcoin NY TWAP for that Calculation Day.
3. If one or more Relevant Transactions occur but for any reason no Relevant Transaction can be retrieved from any Constituent Exchange by the Calculation Agent, a calculation failure for CF Bitcoin NY TWAP occurs for that Calculation Day (see Section 5.5).
4. If no Relevant Transactions occur on any Constituent Exchange on a given Calculation Day then a CF Bitcoin NY TWAP Market Failure Event will be deemed to have occurred (see Section 7)

5.2 Erroneous Data

All Relevant Transactions retrieved by the Calculation Agent for a given Calculation Day are subject to an automated screening for erroneous data according to the following rules:

1. If a Relevant Transaction shows a non-numeric or non-positive trade price or trade size, it is flagged as erroneous.
2. If a Relevant Transaction is reported in a format that deviates from the expected format such that it cannot be parsed, it is flagged as erroneous.
3. If a Relevant Transaction shows an execution time more than one minute in the future of the Calculation Agent's clock, it is flagged as erroneous.

Relevant Transactions flagged as erroneous for a given Calculation Day are disregarded in the calculation of the CF Bitcoin NY TWAP for that Calculation Day.

If all Relevant Transactions of all Constituent Exchanges are flagged as erroneous for a given Calculation Day, a CF Bitcoin NY TWAP calculation failure occurs for that Calculation Day (see Section 5.5).

5.3 Delayed Calculation & Publication

Where for any reason the Administrator is not able to calculate and publish the CF Bitcoin NY TWAP 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 CF Bitcoin NY TWAP for that Calculation Day as soon as it is able to. Should the Administrator not be able to calculate and publish the CF Bitcoin NY TWAP 23:59:59 London time then the provisions of Rule 5.55 shall come into effect.

5.4 Expert Judgement

The Administrator does not utilise expert judgment in the day-to-day calculation of the CF Bitcoin NY TWAP. In extraordinary circumstances Expert Judgement may be exercised by the Administrator in accordance with its codified policies and processes which are available upon request.

5.5 Calculation Failure

If the CF Bitcoin NY TWAP cannot be calculated for a given Calculation Day before 23:59:59 London time, for instance because:

- no Relevant Transaction occurs on any Constituent Exchange on that Calculation Day, or
- one or more Relevant Transactions occur but for any reason cannot be retrieved by the Calculation Agent, or
- all Relevant Transactions retrieved by the Calculation Agent are flagged as erroneous (see Section 5.2); or
- any other reason or circumstance that prevents the orderly calculation of a CF Bitcoin NY TWAP,

Then the CF Bitcoin NY TWAP for that Calculation Day is given by the CF Bitcoin NY TWAP on the previous Calculation Day and this CF Bitcoin NY TWAP value shall be published with a marker of (*).

The occurrence of a CF Bitcoin NY TWAP calculation failure is announced at blog.cfbenchmarks.com

6 Restatement & Republishing

The CF Bitcoin NY TWAP is subject to restatement and republishing before 23:59:59 London time of any given Calculation Day due to errors made by the Calculation Agent or its systems. The CF Bitcoin NY TWAP will not be subject to republishing after this time.

6.1 Restatement of a CF Bitcoin NY TWAP Value with a Replacement CF Bitcoin NY TWAP Value

The Administrator shall only Restate and Republish CF Bitcoin NY TWAP value if both the below conditions are met:

1. **Timeliness** – where the Administrator can **RESTATE** and **REPUBLISH** a CF Bitcoin NY TWAP value before 23:59:59 of the given Calculation Day
2. **Materiality** – where the **RESTATED** CF Bitcoin NY TWAP absolute variance is greater than **0.20%** for the respective CF Bitcoin NY TWAP for the given Calculation Day

Example:

- If the CF Bitcoin NY TWAP on a given Calculation Day is published as **1234.56**
- The CF Bitcoin NY TWAP will only be **RESTATED** if it is:
 - Greater than **1237.03**
 - OR
 - Less than **1232.09**

Where the above conditions are met the Administrator shall announce on its website that a restatement and republishing of the CF Bitcoin NY TWAP will take place for that Calculation Day.

The Administrator shall restate the impacted CF Bitcoin NY TWAP Price as soon as possible and shall do so by overwriting the previously published CF Bitcoin NY TWAP. This restated CF Bitcoin NY TWAP will carry no mark when published and will be final and not subject to any further change or republication.

7 Market Failure Event

Where a Market Failure Event has occurred, this shall be announced by the Administrator on its website. The CF Bitcoin NY TWAP on a day where a Market Failure Event has occurred shall be given by the CF Bitcoin NY TWAP published for the previous Calculation Day. The CF Bitcoin NY TWAP published on a day when a Market Failure Event has occurred shall be marked by a maker (*).

8 Parameters

Index	Effective Time (T)	TWAP Period Length (τ)	Constituent Exchanges
CF Bitcoin NY TWAP	4:00 p.m. New York Time every day	60 minutes	Bitstamp Coinbase LMAX Digital

9 Specifications

Administrator	CF Benchmarks Ltd
Calculation Agent	CF Benchmarks Ltd
Calculation Methodology	Aggregation of trade executions occurring on Constituent Exchanges during the Observation Window for the relevant calculation day

	Ticker Symbol	Relevant Pair	Description	Observation Window Timing	Dissemination Precision
CF Bitcoin NY TWAP	BTCTWAPNY	Bitcoin vs. U.S. Dollars	U.S. Dollar price of one Bitcoin as of 4:00 p.m. New York time every day	3:00pm to 4:00pm New York Time	0.01 US Dollars

10 Methodology Review and Changes

This methodology is subject to internal review by the Administrator and its compliance oversight at least annually.

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.

Should the Administrator deem it necessary to cease providing the CF Bitcoin NY TWAP shall only do so after a consultation process with users and relevant stakeholders that shall be conducted according to the Administrator's policies.

Contact Information

Address	Contact
CF Benchmarks Ltd 6 th Floor One London Wall London EC2Y 5EB United Kingdom	Web: https://www.cfbenchmarks.com Phone: +44 20 7655 6085 Email: contact@cfbenchmarks.com

Notice and Disclaimer

CF Benchmarks Ltd is registered in England with registered number 11654816 and registered office at 6th Floor, One London Wall, London EC2Y 5EB, United Kingdom. CF Benchmarks is authorised by the UK Financial Conduct Authority as a registered Benchmark Administrator (FRN 847100).

This document and all of the information contained in it, including without limitation all methods, processes, concepts, text, data, graphs, charts (collectively, the "Information") is the property of CF Benchmarks Ltd or its licensors, direct or indirect suppliers or any third party involved in making or compiling any Information (collectively, with CF Benchmarks Ltd, the "Information Providers") and is provided for informational purposes only. The Information may not be reproduced or disseminated in whole or in part without prior written consent from CF Benchmarks Ltd.

The Information may not be used to create derivative works or to verify or correct other data or information without prior written consent from CF Benchmarks Ltd. For example (but without limitation), the Information may not be used to create indices, databases, risk models, analytics, software, or in connection with the issuing, offering, sponsoring, managing or marketing of any securities, portfolios, financial products or other investment vehicles utilizing or based on, linked to, tracking or otherwise derived from the Information or any other CF Benchmarks Ltd data, information, products or services.

The user of the Information assumes the entire risk of any use it may make or permit to be made of the Information. CF BENCHMARKS SOEA NOT MAKE ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IT EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION.

Without limiting any of the foregoing and to the maximum extent permitted by applicable law, in no event shall CF Benchmarks have any liability regarding any of the Information for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited, including without limitation (as applicable), any liability for death or personal injury to the extent that such injury results from the negligence or wilful default of itself, its servants, agents or sub-contractors.

None of CF Benchmarks Ltd's products or services recommends, endorses, approves or otherwise expresses any opinion regarding any issuer, securities, financial products or instruments or trading strategies and none of CF Benchmarks Ltd's products or services is intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision and may not be relied on as such.

Any use of or access to products, services or information of CF Benchmarks Ltd requires a license from CF Benchmarks Ltd.