



CoinShares Hourly Reference Rates

Methodology

July 2nd, 2021

Version History

Readers can access other versions of the methodology for the CoinShares Hourly Reference Rates online when they become available on The CoinShares Group website (www.coinshares.com) and on Compass Financial Technologies website (www.compassft.com).

Date	Version	Change	Author(s)
June 25 th , 2021	1.0	Methodology Publication	Guillaume Le Fur and Edouard Mouton (Compass Financial Technologies)
July 2 nd , 2021	1.1	Adding 4pm Fixing Code	Guillaume Le Fur and Edouard Mouton (Compass Financial Technologies)

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1 Introduction

This document covers the methodology of the CoinShares Hourly Reference Rates (the *Indices* or the *Index*). They represent transparent cryptocurrency reference prices with independent governance and oversight.

Rates are computed hourly, every day of the year. They are calculated at the end of every hour and are published around 5 minutes after the end of the hour.

The CoinShares Hourly Reference Rates can be accessed online on the Compass Financial Technologies website (www.compass-ft.com) or on Bloomberg or Refinitiv.

The CoinShares Hourly Reference Rates have been designed to provide institutional investors with independent and robust cryptocurrency reference prices.

The CoinShares Hourly Reference Rates are owned by CoinShares (Holdings) Limited. The Benchmark Administrator and Calculation Agent is Compass Financial Technologies (France).

The CoinShares Hourly Reference Rates can be accessed online on the CoinShares Group website (www.coinshares.com) and on the Compass Financial Technologies website (www.compassft.com) along with additional information about the Rates.

The CoinShares Hourly Reference Rates are available for the following cryptocurrencies:

CoinShares Hourly Reference Rates		
Index	Bloomberg Code	Refinitiv Code
CoinShares Bitcoin Hourly Reference Rate - Continuous	CSBTCHR Index	.CSBTCHR
CoinShares Bitcoin Hourly Reference Rate - 4pm Fixing	CSBTC16R Index	N/A

Table 1: CoinShares Hourly Reference Rates Publication Codes

2 Data Source

2.1 Data Provider

The daily price levels of CoinShares Hourly Reference Rates are based on the historical tick-by-tick trade data and order book snapshots provided by Kaiko (www.kaiko.com).

Kaiko is an independent digital assets market data provider based in Paris and has been operating since 2014. Kaiko collects, normalizes, stores, and delivers raw, normalized trade and quote data on 74 exchanges and more than 9,000 pairs. Kaiko has worked with over 300 customers globally, including, funds, institutions, regulators, academics and crypto start-ups. Kaiko's methodology is fully public and can be found on their website. Their data collection runs on multiple redundant global centers, which ensures the consistency of data delivery and their data is versioned to avoid being impacted by breaking changes.

2.2 Selected Exchanges

The CoinShares Hourly Reference Rates pricing methodology is performed through tracking a subset of exchanges. The Selected Exchanges list and the weighting allocation by exchange are defined by the CoinShares Hourly Reference Rates Steering Committee based on liquidity and reputation constraints. The CoinShares Hourly Reference Rates Steering Committee can review this list and the weights as necessary as possible. In case where the exchanges list is amended and/or the weights change, the index rebalances based on the new Selected Exchanges list and the new weights on the next weekday following the index committee decision. This date is called the Rebalancing Date $R(t)$.

As of June 25th, the list of Selected Exchanges and Weights are as below:

CoinShares Hourly Bitcoin Reference Rate	
Exchange	Weight
Coinbase	1/3
Bitstamp	1/3
Kraken	1/3

3 Hourly Rates Calculation

3.1 Calculation formula

Each day, CoinShares Hourly Reference Rates are calculated based on the collection of all observable transactions and order book snapshots of all respective Selected Exchanges. The calculation methodology of the CoinShares Hourly Reference Rate level for cryptocurrency c on date t for the hour h_i follow the steps below:

1. All the published trades on Selected Exchanges for cryptocurrency c against USD are used in the hourly reference rate calculation.
2. On each Selected Exchange, the exchange trades are grouped into a number of equally-sized 1-minute time intervals.
3. In each time interval $[t_{i-1}, t_i[$ and on each Selected Exchange E_j , the interval price $P_{i,j}$ is calculated as the volume-weighted average trade price:

$$P_{i,j} = \frac{\sum_{k=1}^{tn(t_i,j)} tp_k \times ts_k}{\sum_{k=1}^{tn(t_i,j)} ts_k} \quad (1)$$

where $tn(t_i, j)$ is the number of trades on exchange E_j during the period of $[t_{i-1}, t_i[$, tp_k is the trade price of the k^{th} trade and ts_k is the trade size of the k^{th} trade. If no trades occurs during the interval, the latest exchange mid price in this interval will be used as interval price $P_{i,j}$.

$$P_{i,j} = 0.5 \times (bp(t_i, j) + ap(t_i, j)) \quad (2)$$

where we take the last orderbook snapshot during the period $[t_{i-1}, t_i[$ and note $bp(t_i, j)$ as the best bid price, and $ap(t_i, j)$ as the best ask price.

4. For each hour h_i and for each exchange $E(j)$, the exchange fixing price $P(h_i, j)$ is calculated as follows:

$$P(h_i, j) = \frac{\sum_{k=1}^{60} P_{k,j}}{60} \quad (3)$$

If no price $P_{k,j}$ is available for an interval, it will not contribute to $P(h_i, j)$ and we will only calculate the hourly average price of all the contributing interval.

5. CoinShares Hourly Reference Rate $P(h_i)$ is calculated as the weighted average of all the exchange fixing price $P(h_i, j)$. The weight w_k of each exchange is static and defined as described in Section 2.2

$$P(h_i) = \frac{\sum_{k=1}^N w_k \times P(h_i, k)}{\sum_{k=1}^N w_k} \quad (4)$$

where N is the number of Selected Exchanges

Also, for an exchange $E(j)$ if no price $P_{k,j}$ used to compute $P(h_i, j)$ is available, then the exchange $E(j)$ will not contribute to the computation of $P(h_i)$. The hourly average price will be based only on the contributing Selected Exchanges.

In addition, if, for all exchanges $E(j)$, no interval price $P_{k,j}$ is available, the CoinShares Hourly Reference Rate $P(h_i)$ will not be calculated and contributed for the hour h_i .

3.2 Data Filters - Clean Data

Data is identified as erroneous and therefore discarded when reported in the wrong format (trade price or trade size that are non-numeric, non-positive, or in a format that deviates from the expected one).

3.3 Delayed and Missing Data

The transactions that cannot be retrieved by the Index calculation time are disregarded. If, for any cryptocurrency, no transactions occur or can be retrieved for any exchange on a specific partition, this exchange is disregarded for the calculation of the affected Indices on that day for the specific hour. Any delay or absence of trade data is reported to the CoinShares Hourly Reference Rates Steering Committee and the selected course of action is formally announced.

3.4 Exceptional Circumstances

The calculation of the CoinShares Hourly Reference Rates is obstructed when there are no reported transaction or all transactions are rejected as suspicious on all of the Selected Exchanges, or when no data is provided from the data provider, or due to any other unforeseen events.

In the event of failure of the data provider to deliver relevant data, the CoinShares Hourly Reference Rates Steering Committee will do its best effort to determine relevant cryptocurrency prices from alternative providers that are readily available.

In this scenario, Indices levels will be based on the cryptocurrency price determined by the CoinShares Hourly Reference Rates Steering Committee.

If, for any cryptocurrency, no transactions occur or can be retrieved for more than 3 consecutive business days, a CoinShares Hourly Reference Rates Steering Committee meeting will be called to determine the most appropriate action.

3.5 Rounding of Data

The CoinShares Hourly Reference Rates levels are computed with all decimals available and are published with the number of decimals described below:

CoinShares Hourly Reference Rates	
Index	Decimals
CoinShares Bitcoin Hourly Reference Rate	2

Table 2: CoinShares Hourly Reference Rates - Publication Rounding Policy

3.6 Calculation Frequency and Dissemination

The CoinShares Hourly Reference Rates are computed hourly, every day of the year. They are calculated at the end of every hour and are published 5 minutes after the end of the hour.

The CoinShares Hourly Reference Rate levels are published on the CoinShares Group website (www.coinshares.com) and on the Compass Financial Technologies website (www.compassft.com). They are also distributed to Bloomberg and Refinitiv under the ticker symbols listed in the following table

CoinShares Hourly Reference Rates		
Index	Bloomberg Code	Refinitiv Code
CoinShares Bitcoin Hourly Reference Rate - Continuous	CSBTCHR Index	.CSBTCHR
CoinShares Bitcoin Hourly Reference Rate - 4pm Fixing	CSBTC16R Index	N/A

Table 3: CoinShares Hourly Reference Rates Publication Codes

4 Index Governance

4.1 Index Administrator

Compass Financial Technologies (France) is the Administrator of the Index ("the Index Administrator"). The Index Administrator is responsible for the day-to-day management of the Index and is also responsible for decisions regarding the interpretation of these rules.

4.2 Index Calculation Agent

Compass Financial Technologies (France) is the Calculation Agent of the CoinShares Hourly Reference Rates. It is responsible for the day-to-day management of Indices computation according to this methodology.

4.3 Index Committees – Supervisor

Compass Financial Technologies has established governance functions to review and provide challenges on all aspects of the Indices determination process. Governance functions are managed by the Compass Oversight Committee and by the CoinShares Hourly Reference Rates Steering Committee.

Compass Oversight Committee:

The Compass Oversight Committee oversees all areas of the benchmark determination processes. It is responsible for supervising and controlling the Index operations team on all Compass Indices and all indices administrated by Compass. It is also responsible for:

1. Periodic review of incidents
2. Making final decisions in case the Index operations team are not capable or allowed to take decisions
3. Defining and implementing organisation procedures for the Index operations team
4. Defining and overseeing measures that allow for mitigation of operational risks
5. Supervising internal or external audit results
6. The implementation and supervision of the potential codes of conduct that have to be implemented

The Committee is comprised of senior representatives of Compass Financial Technologies and external industry experts.

CoinShares Hourly Reference Rates Steering Committee:

The CoinShares Hourly Reference Rates Steering Committee is responsible for:

1. Determining the calculation methodology and the rules governing the publication of the CoinShares Hourly Reference Rates
2. Making periodic reviews of the CoinShares Hourly Reference Rates to validate the robustness of the methodology and to analyse the impact of methodology changes
3. Organising consultation with CoinShares Hourly Reference Rates stakeholders if necessary
4. Ensuring that CoinShares Hourly Reference Rates offers a reliable and representative view of the market

The CoinShares Hourly Reference Rates Steering Committee is composed of members from Compass and may include individuals or representatives of companies, academics, external counsels, or market participants.

The CoinShares Hourly Reference Rates Steering Committee assembles once a year in June. However, at the request of a member of the committee, the Committee may meet on any other day of the year to discuss potential "market emergency" and "force majeure" events or any other situation, which makes an extraordinary meeting necessary.

All Committee decisions will be published without delay following the Committee decision.

The CoinShares Hourly Reference Rates Steering Committee members as of June 2021 are:

- Edouard Mouton, Compass Financial Technologies
- Guillaume Le Fur, Compass Financial Technologies
- Pierre Porthaux, Coinshares
- Townsend Lansing, Coinshares

As of June 25th, 2021, Townsend Lansing chairs the CoinShares Hourly Reference Rates Steering Committee.

5 Methodology Changes - Maintenance

This methodology may be supplemented, amended in whole or in part, revised or withdrawn at any time. Supplements, amendments, revisions and withdrawals may also lead to changes in the way the Index is compiled or calculated or affect the Index in another way.

In the absence of exceptional circumstances affecting the Index calculation or methodology, this Methodology is reviewed annually. The review will include, inter alia, the following points:

1. Verify if the methodology and computation are still in line with the original purpose of the Index
2. Make sure the quality and quantity of the input data remain sufficient

Changes made to this methodology are published after the review date and implemented on a reasonable time horizon.

CoinShares may terminate a CoinShares Hourly Reference Rate due to certain extraordinary market circumstances. These circumstances include, but are not limited to:

1. The liquidity in one of the underlying cryptocurrencies of a CoinShares Hourly Reference Rate declines and becomes not sufficient enough to provide an efficient market
2. The underlying cryptocurrency of a CoinShares Hourly Reference Rate experiences a contentious hard fork in which both forks survive

Changes or termination will be subject to the review and approval of the CoinShares Hourly Reference Rates Steering Committee which will receive all the information related to the change or termination. In case of material changes, a notice will be provided at least two weeks in advance.

The results of the CoinShares Hourly Reference Rates Steering Committee will be published in a press release on Compass Financial Technologies and The CoinShares Group websites and distributed in a timely manner to data vendors and news sources.

6 Expert Judgment

The Indices are based on written and transparent rules and procedures with the purpose of minimising as much as possible the exercise of discretion and expert judgment.

The Indices are built from input data that is not interpolated, extrapolated or adjusted. In case of lack of data, the last available data is employed.

Nevertheless, the exercise of expert judgment may become necessary in case of errors and Index restatements, delayed and missing data, hard forks, airdrops, or unexpected situations arising from market stress.

In the event that expert judgment is exercised, this will be done by resorting to the written procedures reported in the methodology and by communicating the decisions taken to the CoinShares Hourly Reference Rates Steering Committee and the Internal Compliance Function in order to prevent conflicts of interest and to protect the integrity and the independence of the Index determinations. In addition, the interest of the Index users and the market integrity will be taken into account.

7 Errors and Recalculations

Even though the process of Index calculation is completely automated and pre-defined, an error can be discovered after the publication of the Index.

In case of a material error the Index will be redetermined, and the Index clients will be notified about the error and the date of the publication of the redetermined Index. An error is considered material on the basis

of its size, the dates of its discovery and of its occurrence, and the impact of the Index redetermination on the users. The discovery of any error is reported to CoinShares Hourly Reference Rates Steering Committee.

In case a material error is discovered and the Administrator recognises a manipulation or an attempted manipulation of the Index level or the input data it will be reported to the regulator.

8 Potential Limitations

The issues presented in the following non-exhaustive list may limit the ability of some of the Indices to represent the market they are intended to measure, the ease of replication by investors, and more generally the usefulness of the Indices to users.

- The market the Index is meant to measure is volatile. In particular, cryptocurrencies may be subject to market movements much more than traditional asset classes such as stocks and bonds as a consequence of illiquidity, market trends and changes to market structure.
- The input data provider may fail to provide accurate and timely data.
- Cryptocurrency prices are derived from several trading venues, each of which is characterised by a different market structure and the price of a cryptocurrency may sometimes be different across different trading venues. In addition, cryptocurrency exchanges may suffer problems that usually do not affect regulated asset exchanges, such as distributed denial-of-service, trading halt, hacking of private keys, lack of standards comparable to those of regulated exchanges, rapidly evolving technology and uncertain legal frameworks. Finally, the publication of the Indices may cease. Should this occur, the regulation regarding user transitions will be followed, but the existence of a suitable substitute is not assured.

9 Cases not covered in rules

In cases which are not expressly covered in these rules, operational adjustments will take place along the lines of the aim of the index. Operational adjustments may also take place if, in the opinion of the Index Administrator, it is desirable to do so to maintain a fair and orderly market in derivatives on this index and/or this is in the best interests of the investors in products based on the Index and/or the proper functioning of the markets. The Index Administrator will report to the Supervisor if it took a decision about a case which is not specifically covered in the rules for comments and review.

10 Liability

The Index Administrator and the Supervisor are not liable for any losses resulting from supplementing, amending, revising or withdrawing the rules for the index. The Administrator will do everything within its power to ensure the accuracy of the composition, calculation, publication and adjustment of the Index in accordance with relevant rules. However, neither the Index Administrator, nor the Supervisor are liable for any inaccuracy in index composition, calculation and the publication of the Index, the information used for making adjustments to the Index and the actual adjustments. Furthermore, the Index Administrator and the Supervisor do not guarantee the continuity of the composition of the Index, the continuity of the method of calculation of the Index, the continuity of the dissemination of the Index levels, and the continuity of the calculation of the Index.

11 Disclaimer

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Compass Financial Technologies SA

Chemin de Mornex 6
1003 Lausanne, Switzerland

Compass Financial Technologies (France)

106, Rue de Richelieu
75002 Paris, France

info@compass-ft.com