Trend Indicator Methodology

March 2024

Table of Contents

Introduction

Objective

The Trend Indicator family is a set of dynamic signals designed to convey the presence, direction, and strength of momentum in the price of a digital asset. Each trend indicator is calculated and published daily derived from historical daily levels of the underlying reference price index ("Underlying Index") for each digital asset as detailed in Table 1.

Table 1: Trend Indicators

Trend Indicator	Underlying Index	Underlying Index Decimal Precision
Bitcoin Trend Indicator (BTI)	CoinDesk Bitcoin Price Index (XBX)	2
Ether Trend Indicator (ETI)	CoinDesk Ether Price Index (ETX)	2

Each Trend Indicator will have one of five possible daily values, with each value corresponding to an indicated direction and strength of trend in the price of the underlying digital asset as shown in Table 2.

Table 2: Trend Indicator Values

Trend Indicator Value	Indication
1	Significant uptrend
0.5	Uptrend
0	No trend
-0.5	Downtrend
-1	Significant Downtrend

Highlights

The family of Trend Indicators was created by CoinDesk Indices ("CDI") and launched in March 2023.

This methodology was created by CDI to achieve the above-stated objective. There may be circumstances or market events that require CDI, in its sole discretion, to deviate from or amend these rules to ensure each Trend Indicator continues to meet the Objective.

Input data

For each Trend Indicator, the historical time series for the Underlying Index is the sole input data for the calculation of each Trend Indicator.

Calculation

Daily reference prices

The historical time series used to calculate each Trend Indicator is the value of each Underlying Index at 4 p.m. Eastern Time[1]. The 180 most recent observations, up to and including the current day, are used in the calculation. Each underlying index value is rounded to the decimal precision detailed in Table 1.

Calculation methodology

Overview
The calculation of each Trend Indicator is an average of four component inputs. Each component input is the result of comparing a shorter-term and a longer-term moving average of the level of its Underlying Index. When the shorter-term moving average is greater than or equal to (less than) the corresponding longer-term moving average, the component's input value is set to +1 (-1), indicating an uptrend (downtrend).

The possible values of each Trend Indicator detailed in Table 2 above represent the range of possible values of averaging the four component inputs.

Moving average crossover pairs
The four component inputs used in the calculation of each Trend Indicator are derived by comparing the moving average pairs detailed in Table 2, with each moving average expressed as a half-life[2] in days.

Table 3: Moving Average Pairs

Moving average pair (MAP)	Shorter-term half-life	Longer-term half-life
1	1 days	5 days
2	2.5 days	10 days
3	5 days	20 days
4	10 days	40 days

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[1] The 4 p.m. Eastern Time values reflect the last calculated value of the Underlying Index prior to 4 p.m. Eastern Time.

[2] Each moving average period is defined as a half-life rather than a complete lookback window. The Trend Indicators use exponentially decaying weights to measure moving averages. A half-life is the period by which one half of the weight of the average has been recognized.

Exponentially weighted moving averages

Moving averages are exponentially weighted using a fixed window of 180 observations. Moving average windows are calculated using a Decay Factor (λ) that sets the half-life of the exponentially weighted moving average equal to the corresponding half-life shown in Table 3. A Normalization Factor (NF) is also calculated and included to correct for the residual averaging weight beyond 180 observations[3]. Both are shown in Table 4.

Table 4: Decay Factor and Normalization Factor

Half-life (h)	Decay Factor (λ)	Normalization Factor (NF)
1 day	0.5	1.0000
2.5 days	0.757858283	1.0000
5 days	0.870550563	1.0000
10 days	0.933032992	1.0000
20 days	0.965936329	1.0020
40 days	0.982820599	1.0462

Trend Indicator Calculation

For each day t, the Trend Indicator is calculated as follows:

$$TI_t = \frac{\left(MAP_{1,t} + MAP_{2,t} + MAP_{3,t} + MAP_{4,t}\right)}{4}$$

where,

$$MAP_{1,t} = SIGN\left(MA_{1,t} - MA_{5,t}\right)$$
$$MAP_{2,t} = SIGN\left(MA_{2.5,t} - MA_{10,t}\right)$$
$$MAP_{3,t} = SIGN\left(MA_{5,t} - MA_{20,t}\right)$$
$$MAP_{4,t} = SIGN\left(MA_{10,t} - MA_{40,t}\right)$$

and

$$SIGN(x) = IF(x \geq 0,1,-1)$$

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[3] Since the methodology uses a fixed 180-day window with exponentially declining weights, the total weights over 180-days add up to slightly less than zero. To correct for this, the weights are normalized by dividing 1 by the sum of the weights over 180 days. This normalization factor is negligible for the shorter half-lives and more substantial for the longer half-lives.

And, for each half-life (h),

$$MA_{h,t} = \sum_{i=0}^{179}(1-\lambda_h)\lambda_h{}^i \times NF_h \times UI_{t-i}$$

where *h* represents each moving average half-life, λ represents the corresponding Decay Factor, and NF represents the corresponding Normalization Factor, all as shown in Table 4, and *UI* represents the Reference Price, i.e., the level of the Underlying Index at 4 p.m. Eastern Time on the day indicated.

Calculation time

The calculation will take place each day at approximately 16:10 Eastern Time, or as soon as is practical thereafter.

Data distribution

Following the calculation, the daily trend indicator values will be available through a CoinDesk API. Please contact info@coindesk-indices.com for details.

Please see Table 5 for launch dates and historical data availability for each Trend Indicator.

Table 5: Trend Indicator Data Availability

Trend Indicator	Launch Date	First Value Date
Bitcoin Trend Indicator (BTI)	04/13/2023	5/1/2015
Ether Trend Indicator (ETI)	04/13/2023	8/28/2018

Data availability

If all inputs are available prior to calculation, each Trend Indicator will be calculated and published. In the event an input required for the calculation of one or more Trend Indicators is not available at the time of publication, the publication of the impacted Trend Indicator will be delayed until all required data are available.

Governance

Each Trend Indicator is governed by the Systematic Signals Committee (the "Committee"). The Committee provides ongoing oversight of the signals and the Trend Indicator methodology (the "Methodology"). The Committee meets on a periodic basis and is primarily responsible for the following functions:

1. Ownership, maintenance, and regular reviews of the Methodology.
2. Review and approval of material changes to the Methodology.
3. Determine the impact of market events on the application of the Methodology.
4. Use of Discretion during the application of the Methodology.
5. Mitigate conflicts of interest by ensuring decisions and announcements are aligned with the Methodology and internal procedures.

Appendix 1: Methodology Changes

The table below provides a summary of material changes, if any, to this Index Methodology.

Effective Date	Prior Treatment	Updated Treatment

Appendix 2: Document Revision History

Date	Description
March 20, 2024	Annual methodology review resulting in minor edits and clarifications
March 13, 2023	Initial Version

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