

# INDEX METHODOLOGY

Bloomberg Galaxy bitcoin Index

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## INTRODUCTION

The Bloomberg Galaxy bitcoin Index ("Index") is designed to measure the performance of a single bitcoin traded in USD. The index is owned and administered by Bloomberg Index Services Limited ("BISL" or "Administrator") and is co-branded with Galaxy Digital Capital Management LP ("Galaxy").

The Index can be accessed on the Bloomberg Terminal® via ticker BTC Index <GO>.

BISL administers the Index according to three guiding principles:

1. Data Integrity	Pricing Sources are selected for liquidity and reliability and approved for use following risk and suitability assessments. Cryptocurrencies must meet minimum thresholds for daily traded USD-value.
2. Representative	The Index seeks to provide a proxy for the bitcoin market.
3. Continuity	The Index is intended to be responsive to the changing nature of the market in a manner that does not completely reshape the character of the Index from year to year.

## CONSTITUENT PRICING

The Bloomberg CFIX rate fixings are designed as reference points for Cryptocurrencies.

The term "fixings" refers only to such Cryptocurrency fixing rates and not to any other rate, calculation or other information that may be related to, or associated with, such fixings that are made available by Bloomberg. Based on pricing provided by the Bloomberg Generic Price ("BGN") using Bloomberg's well-known data, technology and distribution platforms, CFIX is made broadly available to the investment community with the objective of providing Cryptocurrency fixings that are reliable, representative, and transparent.

The CFIX mid-price for bitcoin is used to derive the end-of-day Index level. CFIX is a simple average of the BGN price for any given Cryptocurrency over a 15 minute window between 16:00:00 and 16:15:00 ET.

A BGN price is calculated and used in the calculation of intraday Index levels. The BGN price is generated with real-time pricing data from multiple Pricing Sources (see "Intraday Index Levels" section).

## INDEX DISTRIBUTION

The closing Index Level is calculated using the CFIX from 16:15:00 ET and published after review and quality checks. Intraday Index levels will be calculated and published on the Bloomberg Terminal from 18:15:00 ET to 16:15:00 ET (22 hours).

## INDEX CALCULATION

The Index level is calculated using the following formula:

$$Index_t = \frac{P_t}{D_t}$$

Where

Index<sub>t</sub> = Index level on day t

P<sub>t</sub> = Intraday BGN price or end of the day CFIX price for a bitcoin on day t, expressed in USD

D<sub>t</sub> = Index Divisor (starting value of 1, divisor adjustment are described in the following section)

An indicative intraday level for the Index is published every 15 seconds. This level uses intraday BGN pricing.

The Base Level for the Index was set at 1000 on May 1, 2018.

## DIVISOR ADJUSTMENT

In a situation where there are changes to bitcoin protocol and/or network or the methodology of how the BGN bitcoin prices used in the calculation of this Index are being determined, a Divisor adjustment will be needed to maintain the continuity of the Index.

$$D_t = D_{t-1} * \text{Adjustment Factor}$$

The following scenarios may require a divisor adjustment. Given that cryptocurrencies are still a young and fairly immature asset class, we anticipate that other scenarios requiring a divisor adjustment may be identified beyond the ones listed below by BISL over time.

1. Hard Fork - Bitcoin forks are defined as changes in the protocol of the bitcoin network or as the situations that occur "when two or more blocks have the same block height". A fork influences the validity of the rules. Forks are typically conducted in order to add new features to a Blockchain, to reverse the effects of hacking or catastrophic bugs.

The adjustment factor for a Hard Fork will be derived based on the analysis of the changes to the Blockchain and the value of the original and post-fork cryptocurrencies.

2. Change in BGN Pricing calculation - In circumstances where there is a change in the BGN pricing methodology, the divisor adjustment will be used to maintain the continuity of the index levels.

## DATA PROVIDERS AND DATA EXTRAPOLATION

The Index is rules-based, and its construction is designed to consistently produce Index Levels without the exercise of discretion. The Index is produced without the interpolation or extrapolation of input data. As further discussed below, the Index uses defined data backups and/or level carry-forwards rather than interpolation or extrapolation, but the Administrator will update this Methodology and its internal procedures should either become necessary.

In addition, the Administrator seeks to avoid contributions of input data that may be subject to the discretion of the source of such data and instead seeks to use input data that is readily available and/or distributed for a number of non-index or benchmark creation purposes. Accordingly, the Indices require no 'contributors' to

produce and no codes of conduct with any such sources are required.

### **END-OF-DAY INDEX LEVEL**

The official end-of-day Index level is calculated using the Bloomberg Crypto Price Fixings (CFIX) at 16:15:00 ET and rounded to two decimal places.

### **INTRADAY INDEX LEVEL**

The intraday Index Level is calculated using Bloomberg BGN bitcoin price.

The BGN is a sophisticated pricing algorithm that produces accurate indications of bid and ask quotes that are derived from multiple approved Cryptocurrency Pricing Sources.

BGN prices are designed to track executable bid and ask input rates from a select subset of Bloomberg's bitcoin pricing sources, which have met selection criteria such as pricing consistency, frequency, and quality. Pricing sources are anonymous to users and the sources themselves and the pricing sources change from time-to-time depending on the quality of data they provide. Each source is assigned a quality score based on numerous factors including update frequency and spike frequency. Price inputs are not limited to quotes from market making firms; rather, price inputs include quotes from any market participant whose quotes are executable on a pricing source's market.

Bloomberg undertakes a periodic review of the appropriateness of specific data used in the calculation and validation of the BGN rates.

This review is intended, among other things to assist in ensuring the BGN rates are based on reliable and observable market data that reflect the economic reality of a given market.

The BGN construction is designed to consistently produce levels without interpolation or extrapolation of input data. In addition, as noted above, sources are anonymous to users and the sources themselves at each pricing point and the data received is ancillary to the source's primary purpose of soliciting bitcoin transactions from the market.

Approved bitcoin pricing sources have, at a minimum, represented to Bloomberg that they have documented compliance programs that include, but are not limited to, Anti-Money Laundering (AML) and Know Your Customer (KYC) policies, and have provided Bloomberg with an organizational and/or ownership chart.

Errors related to intraday levels will not be restated, as real time levels are considered indicative only. Intraday index levels are calculated from 18:15:00 ET to 16:15:00 ET on every Index Business Day.

## BACK FILL PRICING METHODOLOGY

For Index Levels prior to May 1, 2018, calculations have been performed using BGN bitcoin prices rather than CFIX. When no price was available, the previously available BGN price was used.

## INDEX PUBLICATION DAYS

The Index is published on New York Stock Exchange trading days<sup>1</sup>, also referred to as Index Business Days.

## STRESS EVENTS

If CFIX is unavailable due to unforeseen events, the Index will be calculated using the last available CFIX. If CFIX is unavailable for more than three consecutive Index Business Days, escalation to the PROC will be made to determine the publication of index levels.

## LIMITATIONS OF THE INDEX

Though the Indices are designed to be representative of the markets they measure or otherwise align with their stated objective, they may not be representative in every case or achieve their stated objective in all instances. They are designed and calculated strictly to follow the rules of this Methodology, and any Index Level or other output is limited in its usefulness to such design and calculation.

Markets can be volatile, including those market interests which the Indices intend to measure or upon which the Indices are dependent in order to achieve their stated objective. For example, illiquidity can have an impact on the quality or amount of data available to the Index Administrator for calculation and may cause the Indices to produce unpredictable or unanticipated results.

In addition, market trends and changes to market structure may render the objective of the Index unachievable or to become impractical to replicate by investors.

## BENCHMARK OVERSIGHT AND GOVERNANCE

### Benchmark Governance, Audit and Review Structure

BISL uses two primary committees to provide overall governance and effective oversight of its benchmark administration activities:

- The Product, Risk & Operations Committee ("PROC") provides direct governance and is responsible for the first line of controls over the creation, design, production and dissemination of benchmark indices, strategy indices and fixings administered by BISL, including the Indices. The PROC is composed of Bloomberg personnel with significant experience or relevant expertise in relation to financial benchmarks. Meetings are attended by Bloomberg Legal & Compliance personnel. Nominations and removals are subject to review by the BOC, discussed below.
- The oversight function is provided by Bloomberg's Benchmark Oversight Committee ("BOC"). The BOC is independent of the PROC and is responsible for reviewing and challenging the activities carried out by the PROC. In carrying out its oversight duties, the BOC receives reports of management information both from the PROC as well as Bloomberg Legal & Compliance members engaged in second level controls.

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<sup>1</sup> <https://www.nyse.com/markets/hours-calendars>

On a quarterly basis, the PROC reports to the BOC on governance matters, including but not limited to client complaints, the launch of new benchmarks, operational incidents (including errors & restatements), major announcements and material changes concerning the benchmarks, the results of any reviews of the benchmarks (internal or external) and material stakeholder engagements.

#### Internal and External Reviews

BISL's Index administration is also subject to Bloomberg's Compliance function which periodically reviews various aspects of its businesses in order to determine whether it is adhering to applicable policies and procedures, and assess whether applicable controls are functioning properly. In addition, Bloomberg may from time to time appoint an independent external auditor with appropriate experience and capability to review adherence to benchmark regulation. The frequency of such external reviews will depend on the size and complexity of the operations and the breadth and depth of the Index use by stakeholders.

### INDEX AND DATA REVIEWS

The Index Administrator will review the Indices (both the rules of construction and data inputs) on a periodic basis, not less frequently than annually, to determine whether they continue to reasonably measure the intended underlying market interest, the economic reality or otherwise align with their stated objective. More frequent reviews may result from extreme market events and/or material changes to the applicable underlying market interests.

In addition to material changes, BISL may from time to time terminate one or more Indices ("Discontinued Indices"), whether due to changes in market structure, a lack of requisite data, insufficient usage, or for other regulatory or practical concerns. The process for terminating such Discontinued Indices is as follows:

The PROC will review proposed terminations, taking into account the reasons for termination, the impact on users (if any), the availability of alternative products and other such factors. If termination is approved, users will be provided as much prior notice as is reasonable under the circumstances, typically 90 days. In the event there is little or no known usage identified, the Discontinued Indices may be terminated with less (or no) notice, as applicable. In the event the Discontinued Indices are licensed for use as the basis of an ETF or other widely-available financial product or is otherwise determined by BISL to be an important benchmark without reasonable substitutes, the notice period may be extended, as warranted. Any advance notice period is subject to BISL being reasonably able to continue administering and calculating such benchmark during such period (for example, BISL has access to requisite data on commercially reasonable terms, is not subject to any litigation or other claims, has adequate internal resources and capabilities, etc.). Terminations and associated user engagement decisions made by the PROC are subject to review by BISL's oversight function, the BOC.

Criteria for data inputs include reliable delivery and active underlying markets. Whether an applicable market is active depends on whether there are sufficient numbers of transactions (or other indications of price, such as indicative quotes) in the applicable constituents (or similar underlying constituent elements) that a price (or other value, as applicable) may be supplied for such constituent(s).

Other than as set forth in this Methodology, there are no minimum liquidity requirements for Index constituents and/or minimum requirements or standards for the quantity or quality of the input data.

The review will be conducted by product managers of the Indices in connection with the periodic rebalancing of the Indices or as otherwise appropriate.

Any resulting change to the Methodology deemed to be material (discussed below) will be subject to the review of the PROC under the oversight of the BOC, each of which committees shall be provided all relevant information and materials it requests relating to the change. Details regarding the PROC and BOC are

described [below].

Material changes will be reflected and tracked in updated versions of this Methodology.

BISL's Index administration is also subject to Bloomberg's Compliance function which periodically reviews various aspects of its businesses in order to determine whether it is adhering to applicable policies and procedures, and assess whether applicable controls are functioning properly.

Material changes related to the Indices will be made available in advance to affected stakeholders whose input will be solicited. The stakeholder engagement will set forth the rationale for any proposed changes as well as the timeframe and process for responses. The Index Administrator will endeavour to provide at least two weeks for review prior to any material change going into effect. In the event of exigent market circumstances, this period may be shorter. Subject to requests for confidentiality, stakeholder feedback and the Index Administrator's responses will be made accessible upon request.

In determining whether a change to an Index is material, the following factors shall be taken into account:

- The economic and financial impact of the change;
- Whether the change affects the original purpose of the Index; and/or
- Whether the change is consistent with the overall objective of the Index and the underlying market interest it seeks to measure

## **STAKEHOLDER ENGAGEMENT**

BISL is engaged with its users through various channels, including via help desks, sales personnel and direct communication with business personnel. To help ensure the Index remains an accurate representation of the Cryptocurrency markets, BISL endeavors to meaningfully incorporate these engagements into improvements in processes and service. Prior to any material change that might meaningfully impact users, BISL consults more broadly with stakeholders, where appropriate, before a recommendation is presented to the BOC for approval. This concept of shared ownership enables BISL to produce the most relevant indices and helps ensure responsiveness to user needs.

## **EXPERT JUDGMENT**

The Indices are rules-based, and their construction is designed to consistently produce values without the exercise of expert judgment or discretion. Nevertheless, BISL may use expert judgment or discretion with regards to the following:

- Index restatements
- Extraordinary circumstances during a market emergency
- Data interruptions, issues, and closures

When expert judgment or discretion is required, BISL undertakes to be consistent in its application, with recourse to written procedures outlined in the methodology of the Indices and internal procedures manuals. In certain circumstances exercises of expert judgment or discretion are reviewed by senior members of BISL management and Bloomberg Compliance teams, and are reported to the Product, Risk & Operations Committee (PROC), BISL's governance committee, which operates under the supervision of BISL's oversight function, the Benchmark Oversight Committee (BOC). BISL also maintains and enforces a code of ethics to prevent conflicts of interest from inappropriately influencing index construction, production, and distribution, including the use of expert judgment or discretion.



## **RESTATEMENT POLICY**

BISL makes every effort to provide accurate calculation of its indices. However, to the extent a material error in Index values is uncovered following its publication and dissemination, a notification will be sent to Index clients alerting them of such error and the expected date of a revised publication, if warranted. BISL considers the following factors in determining whether to restate. Not all conditions need to be present to warrant a restatement, and certain factors may be more determinative than others depending on the circumstances of the given error.

1. The relative importance of the data field impacted by the error
2. When the error occurred and when it was discovered
3. The number of indices impacted
4. Whether the impacted indices are linked to tradable products
5. The magnitude of the error
6. The burden of restatement on client re-processing relative to the impact of the error
7. The impact of the restatement on analytical tools

## **RISKS**

Unlike traditional stock and commodity exchanges, bitcoin pricing sources face a number of risks, including but not limited to, distributed denial-of-service ("DDoS"), interruption of trading, hacking of user accounts, lack of standards and naming convention for symbols, and an unstable technological and legal environment (causing changes in fee structure, blocking of funds withdrawal, etc.). Suspension or disruption of market trading in bitcoin may adversely affect the value of the Index.

## GLOSSARY OF TERMS

Administrator: A benchmark administrator provides indices that are used in financial products and is responsible for all aspects of administration pertaining to the benchmark, including but not limited to, calculation, maintenance, rebalancing, dissemination/distribution and governance.

Base Date: An Index's Base Date is the day the Base Level is assigned.

Base Level: An Index's Base Level is an arbitrary Index Level (typically 100 or 1,000) assigned to the Base Date, from which Index Levels are calculated going forward and back filled.

BGN: BGN refers to Bloomberg Generic price. The BGN is a sophisticated pricing algorithm that produces accurate indications of quotes that are derived from multiple quality sources.

- For a BGN to be computed for a Cryptocurrency, the Cryptocurrency must be priced by at least two approved Pricing Sources
- The BGN algorithm calculates the BGN median bid and median ask prices for the Cryptocurrency
- The BGN mid-price is the average of the BGN bid and BGN ask prices
- Data from Pricing Sources are the executable bid and ask prices - not executed trade prices.

Blockchain: Blockchain is a digitized, decentralized, public ledger of all Cryptocurrency transactions.

Bloomberg Index Services Limited or BISL: Index provider and administrator.

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BMR/EU BMR: BMR/EU BMR or European Benchmark Regulation is a regulation that came into effect on January 1, 2018, and a regime for Benchmark Administrators to ensure the accuracy and integrity of benchmarks (<https://www.esma.europa.eu/policy-rules/benchmarks>).

BOC: Benchmark Oversight Committee.

CFIX: Bloomberg Crypto Price Fixings or CFIX is designed as a reference point for Cryptocurrencies. It is a simple average of the BGN pricing source for any given Cryptocurrency over a 15 minute window between 16:00:00 ET and 16:15:00 ET. The CFIX generates the simple average of all the BGN ticks within the window for the bid and ask separately; the mid is the arithmetic average of the bid and ask. CFIX will price once a day and publish immediately after the pricing engine has computed the simple average. There may be slight variances in publication times, within seconds, due to a variance in tick volume per currency and the amount of machine time required to compute those. CFIX will publish Monday to Friday when the BGN is pricing and not over weekends.

Cryptocurrency Pricing Sources: Pricing Sources are trading platforms that facilitate buying and selling Cryptocurrencies online. Many Pricing Sources refer to themselves as "exchanges," which can give the misimpression that they are regulated or meet regulatory standards of a national securities exchange. Many of the U.S.-based digital Cryptocurrency trading platforms have elected to be state-regulated "money-transmission services". Traditionally, from an oversight perspective, these predominantly state-regulated payment services have not been subject to direct oversight by the SEC or the CFTC.

Hard Fork: A hard fork occurs when a Blockchain protocol is radically changed, such that it becomes incompatible with older versions. In effect, participants taking part in transactions on the old Blockchain must upgrade to the new one in order to continue validating transactions in the new Blockchain. However, participants that do not upgrade may continue to support and validate transactions on the old Blockchain protocol separately. The result: a Blockchain splits into two - hence the name "hard fork". If there are nodes

permanently supporting the new chain, then the two chains will co-exist. Users that once held digital assets on an older Blockchain before the protocol change at a pre-specified Blockchain length will now also hold an amount of new coins on the altered Blockchain. This new Cryptocurrency has essentially been derived from an older Cryptocurrency as well as its associated Blockchain's transaction history. As per the Index methodology, hard forks are considered to be new Constituents.

Index Business Day: Days on which the Index is published (New York Stock Exchange trading days).

Index Level: The level of the Index determined in accordance with the methodology set forth under "INDEX CALCULATION".

Liquid: A liquid asset can be converted into cash with minimal impact to the price received in the open market. Liquidity is measured by 30-day median daily value traded in USD.

PROC: Product, Risk and Operations Committee.

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