

# **S&P Digital Market Indices** *Methodology*

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# Table of Contents

Introduction	3
<b>Index Objective</b>	<b>3</b>
<b>Index Series</b>	<b>3</b>
<b>Pricing and Reference Data Source</b>	<b>3</b>
<b>Supporting Documents</b>	<b>4</b>
Eligibility Criteria	5
<b>Index Universe</b>	<b>5</b>
<b>Eligibility Factors</b>	<b>5</b>
<b>S&amp;P Broad Digital Market Indices Eligibility Factors</b>	<b>5</b>
Index Construction	6
<b>S&amp;P Cryptocurrency Broad Digital Market: Size Classification</b>	<b>6</b>
<b>Constituent Selection</b>	<b>6</b>
<b>Constituent Weightings</b>	<b>6</b>
<b>Index Calculation</b>	<b>6</b>
Index Maintenance	7
<b>Rebalancing</b>	<b>7</b>
<b>Additions and Deletions</b>	<b>7</b>
<b>Currency of Calculation and Additional Index Return Series</b>	<b>7</b>
<b>Base Date and History Availability</b>	<b>7</b>
Index Governance	8
<b>Index Committee</b>	<b>8</b>
Index Policy	9
<b>Announcements</b>	<b>9</b>
<b>Pro-forma files</b>	<b>9</b>
<b>Calculation Schedule</b>	<b>9</b>
<b>Rebalancing</b>	<b>9</b>
<b>Unexpected Exchange Closures</b>	<b>9</b>
<b>Recalculation Policy</b>	<b>9</b>
<b>Contact Information</b>	<b>9</b>
Index Dissemination	11
<b>Tickers</b>	<b>11</b>
<b>Index Data</b>	<b>11</b>

<b>Web site</b>	<b>11</b>
Appendix I: Market Capitalization Classification	12
<b>Classification</b>	<b>12</b>
Disclaimer	14
<b>Inherent Risks with respect to Digital Assets</b>	<b>14</b>
<b>Performance Disclosure/Back-Tested Data</b>	<b>14</b>

# Introduction

## Index Objective

The S&P Digital Market Indices measure the performance of digital assets listed on trading facilities (“exchanges”)<sup>1</sup> included among the primary markets defined in *Eligibility Criteria*.

## Index Series

The index series includes the following:

- **S&P Bitcoin Index.** The index measures the performance of Bitcoin.
- **S&P Ethereum Index.** The index measures the performance of Ethereum.
- **S&P Cryptocurrency MegaCap Index.** The index measures the performance of Bitcoin and Ethereum digital assets.
- **S&P Cryptocurrency Broad Digital Market (BDM) Index.** The index measures the performance of digital assets satisfying the additional liquidity and market capitalization requirements detailed in *Eligibility Criteria*.
  - **S&P Cryptocurrency LargeCap Index.** The index is a subset of the BDM that measures the performance of the constituents of the BDM with the largest market capitalization.
  - **S&P Cryptocurrency BDM Ex-MegaCap Index.** The index is a subset of the BDM that measures the performance of the constituents of the BDM excluding the constituents of the S&P Cryptocurrency MegaCap Index.
  - **S&P Cryptocurrency BDM Ex-LargeCap Index.** The index is a subset of the BDM that measures the performance of the constituents of the BDM, excluding constituents of the S&P Cryptocurrency LargeCap Index.
  - **S&P Cryptocurrency LargeCap Ex-MegaCap Index.** The index is a subset of the BDM that measures the performance of the constituents of the S&P Cryptocurrency LargeCap Index, excluding the constituents of the S&P Cryptocurrency MegaCap Index.

## Pricing and Reference Data Source

The indices use Lukka Inc.,<sup>2</sup> a cryptocurrency data provider, as the data source for digital asset pricing and reference data, via the Lukka Prime and Lukka reference data products. Lukka uses a Fair Market Value pricing and valuation data methodology, which is designed to align the cryptocurrency ecosystem to GAAP and IFRS guidelines.

For more information on Lukka Inc., please refer to the Lukka website, <https://data.lukka.tech/prime/>.

**Investment Disclosure.** S&P Global, Inc., the parent of S&P Dow Jones Indices LLC, is an investor in Lukka Inc.<sup>3</sup> In addition, representatives of Lukka Inc. may provide consultative services to the Index Committee (see *Index Governance*) from time to time.

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<sup>1</sup> The term exchange as used in this methodology does not refer to a “national securities exchange” that has registered with the Securities Exchange Commission (“SEC”) or other comparable securities exchange registered in another jurisdiction.

<sup>2</sup> S&P DJI reserves the right to add to or change the data provider at any time.

<sup>3</sup> For information on S&P Global’s investment in Lukka, please see [here](#).

## Supporting Documents

This methodology is meant to be read in conjunction with supporting documents providing greater detail with respect to the policies, procedures and calculations described herein. References throughout the methodology direct the reader to the relevant supporting document for further information on a specific topic. The list of the main supplemental documents for this methodology and the hyperlinks to those documents is as follows:

Supporting Document	URL
S&P DJI Digital Assets Policies & Practices and Index Mathematics Methodology	<a href="#">S&amp;P DJI Digital Assets Policies, Practices, &amp; Mathematics Methodology</a>

The index methodology is maintained, and the indices are calculated and managed independently by S&P Dow Jones Indices according to S&P Dow Jones Indices' standard policies and procedures, including the policies and procedures governing S&P Dow Jones Indices' independent Index Committee. Any changes to or deviations from this methodology are made in the sole judgment and discretion of S&P Dow Jones Indices so that the indices continue to achieve their objectives.

# Eligibility Criteria

## Index Universe

To determine the index universe of digital assets, S&P considers only those digital assets traded on exchanges covered by Lukka Prime. The pricing process includes:

1. the screening of eligible exchanges, based on criteria such as oversight, efficiency, data transparency, data integrity, and
2. the inclusion of digital assets that trade on those select exchanges.

## Eligibility Factors

Digital assets in the index universe must satisfy the following, as of each rebalancing reference date, to be eligible for index inclusion:

**Listed and Trading.** Digital assets must have traded for at least three months on a Lukka-recognized exchange and have traded for at least 60 calendar days during the three months prior to the rebalancing reference date.

The listing & trading rules do not apply to digital assets that forked intra-rebalancing. The inclusion or exclusion of such digital assets is determined by the Index Committee.

*For more information on forks please refer to the S&P DJI Digital Assets Policies & Practices and Index Mathematics Methodology.*

## S&P Broad Digital Market Indices Eligibility Factors

In addition to the above, digital assets must also satisfy the following to be eligible for the S&P Broad Digital Asset Indices.

**Market Capitalization:** have a market capitalization greater than or equal to US\$ 10 million (current constituents US\$ 8 million). For these indices, “market capitalization” refers to the product of “Effective Coin Supply” multiplied by coin price.

*For more information on market capitalization and Effective Coin Supply, please refer to the S&P DJI Digital Assets Policies & Practices and Index Mathematics Methodology.*

**Liquidity:** have a three-month median daily value traded (MDVT) of US\$ 100,000 (current constituents US\$ 80,000).

At the Index Committee’s discretion, an MDVT of shorter period may be allowed for hard-forked assets of current constituents.

# Index Construction

## **S&P Cryptocurrency Broad Digital Market: Size Classification**

For the S&P Cryptocurrency Broad Digital Market Asset Indices, eligible digital assets are classified by market capitalization, i.e. LargeCap, MidCap, and SmallCap.

*For information on the size classification process, please refer to Appendix I.*

## **Constituent Selection**

**S&P Bitcoin Index, S&P Ethereum Index, and S&P Cryptocurrency MegaCap Index.** At each rebalancing the eligible digital assets are selected and form each index.

**S&P Cryptocurrency Broad Digital Market (BDM) Index.** At each rebalancing, all eligible digital assets are selected and form the index.

**S&P Cryptocurrency LargeCap Index.** At each rebalancing, the eligible digital assets classified as LargeCap are selected and form the index.

**S&P Cryptocurrency BDM Ex-LargeCap Index.** At each rebalancing, the eligible digital assets not classified as LargeCap are selected and form the index.

**S&P Cryptocurrency BDM Ex-MegaCap Index and S&P Cryptocurrency LargeCap Ex-MegaCap Index.** At each rebalancing, the constituents of the S&P Cryptocurrency BDM Ex-MegaCap and S&P Cryptocurrency LargeCap Ex-MegaCap are the constituents of the S&P Cryptocurrency Broad Digital Market Index and S&P Cryptocurrency LargeCap index, respectively, excluding the constituents of the S&P Cryptocurrency MegaCap.

## **Constituent Weightings**

The indices are market capitalization weighted.

## **Index Calculation**

The indices calculate by means of the divisor methodology used in S&P DJI Digital asset indices.

*For more information on index calculation, please refer to S&P DJI Digital Assets Index Mathematics Policies and Practices Methodology.*

# Index Maintenance

## Rebalancing

The indices rebalance quarterly, with the changes implemented after the index close on the third Friday of March, June, September, and December. Digital assets that are added, removed or re-weighted at rebalances use prices based on the Lukka pricing fix times to determine the indices official close calculation. For these indices, the official close time is 4:00PM ET.

The rebalancing reference date to determine eligibility is the last calendar days of February, May, August, and November, respectively. Rebalancing reference data used to determine digital asset eligibility and supply is captured based on data available from Lukka after the index close on the reference dates.

Proforma rebalancing results are published beginning one week prior to the rebalancing effective date.

## Additions and Deletions

Any digital asset that Lukka no longer covers is removed at the subsequent rebalancing.

*For more information on additions and deletions please refer to the [S&P DJI Digital Assets Index Mathematics Policies and Practices Methodology](#).*

## Currency of Calculation and Additional Index Return Series

The indices calculate in U.S. dollars.

In addition to the indices detailed in this methodology, additional return series versions of the indices may be available, including, but not limited to: currency, currency hedged, decrement, fair value, inverse, leveraged, and risk control versions. For a list of available indices, please refer to the [S&P DJI Methodology & Regulatory Status Database](#).

*For information on various index calculations, please refer to [S&P Dow Jones Indices' Index Mathematics Methodology](#).*

*For the inputs necessary to calculate certain types of indices, including decrement, dynamic hedged, fair value, and risk control indices, please refer to the [Parameters](#) documents available at [www.spdji.com](http://www.spdji.com).*

## Base Date and History Availability

Index history availability, base dates, and base values are shown in the table below.

Index	Launch Date	First Value Date	Base Date	Base Value
S&P Bitcoin Index	05/03/2021	01/01/2014	01/01/2014	100
S&P Ethereum Index	05/03/2021	04/04/2016	04/04/2016	100
S&P Cryptocurrency MegaCap Index	05/03/2021	02/28/2017	02/28/2017	100
S&P Cryptocurrency Broad Digital Market Index	07/13/2021	02/28/2017	02/28/2017	100
S&P Cryptocurrency LargeCap Index	07/13/2021	02/28/2017	02/28/2017	100
S&P Cryptocurrency BDM Ex-MegaCap Index	07/13/2021	02/28/2017	02/28/2017	100
S&P Cryptocurrency BDM Ex-LargeCap Index	07/13/2021	02/28/2017	02/28/2017	100
S&P Cryptocurrency LargeCap Ex-MegaCap Index	07/13/2021	12/18/2017	12/18/2017	100



# Index Governance

## Index Committee

An S&P Dow Jones Indices' Index Committee maintains the indices. The Index Committee consists solely of full-time employees of S&P Dow Jones Indices. The Committee meets regularly. The Committee may revise index policy covering rules for the selection of digital assets, including the eligibility criteria, or other matters.

S&P Dow Jones Indices considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all Index Committee discussions are confidential.

S&P Dow Jones Indices' Index Committees reserve the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules stated in this document or supplemental documents, clients will receive notice, whenever reasonably possible.

The Index Committee may apply discretion to make decisions that differ from the index methodology in certain circumstances, including to avoid unnecessary turnover, excessive index changes or adjustments, or possible market disruption.

The Index Committee reserves the right in its sole discretion to cease or suspend publication of an index and/or remove a digital asset that becomes subject to a legal, regulatory or practical concern (e.g., because the digital asset may be an unregistered security, allegations of trading manipulation, the digital asset potentially implicates U.S. or other economic sanctions, inclusion of privacy features that may pose anti-money laundering concerns, the digital asset is subject to a hacking event) or due to potential market disruption.

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

*For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P DJI Digital Assets Index Mathematics Policies and Practices Methodology.*

# Index Policy

## Announcements

All index constituents are evaluated daily for data needed to calculate index levels and returns. All events affecting the daily index calculation are typically announced in advance via the Index Corporate Events Report (.SDE), delivered daily to all clients. Any unusual treatment of a digital asset event may be communicated via email to clients.

*For more information, please refer to the S&P DJI Digital Assets Indices Policies & Practices and Index Mathematics Methodology.*

## Pro-forma files

In addition to the corporate events file (.SDE), S&P Dow Jones Indices provides constituent pro-forma files each time the index rebalances. The pro-forma file is typically provided daily in advance of the rebalancing date and contains all constituents and their corresponding weights and index coins effective for the upcoming rebalancing. Since index coins are assigned based on prices on the rebalancing reference date the actual weight of each coin at the rebalancing will differ from these weights due to market movements.

*Please visit [www.spdji.com](http://www.spdji.com) for a complete schedule of rebalancing timelines and pro-forma delivery times.*

## Calculation Schedule

The indices calculate on all business days. If there is a market disruption, or with the data provider, the indices calculate based on the last available price.

*A complete holiday schedule for the year is available at [www.spdji.com](http://www.spdji.com).*

## Rebalancing

The Index Committee may change the date of a given rebalancing for reasons including market holidays occurring on or around the scheduled rebalancing date. Any such change will be announced with proper advance notice where possible.

## Unexpected Exchange Closures

For information on Unexpected Exchange Closures, please refer to S&P DJI Digital Assets Indices Policies & Practices and Index Mathematics Methodology.

## Recalculation Policy

For information on the recalculation policy, please refer to S&P DJI Digital Assets Indices Policies & Practices and Index Mathematics Methodology.

*For information on Calculations and Pricing Disruptions, Expert Judgment and Data Hierarchy, please refer to S&P DJI Digital Assets Indices Policies & Practices and Index Mathematics Methodology.*

## Contact Information

For questions regarding an index, please contact: [index\\_services@spglobal.com](mailto:index_services@spglobal.com).

# Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at [www.spdji.com](http://www.spdji.com), major quote vendors (see codes below), numerous investment-oriented Web sites, and various print and electronic media.

## Tickers

The table below lists headline indices covered by this document. All versions of the below indices that may exist are also covered by this document. Please refer to the [S&P DJI Methodology & Regulatory Status Database](#) for a complete list of indices covered by this document.

Index	Ticker
S&P Bitcoin Index (USD)	SPBTC
S&P Ethereum Index (USD)	SPETH
S&P Cryptocurrency MegaCap Index (USD)	SPCMC
S&P Cryptocurrency Broad Digital Market Index (USD)	SPCBDM
S&P Cryptocurrency LargeCap Index (USD)	SPCBLC
S&P Cryptocurrency BDM Ex-MegaCap Index (USD)	SPCBXM
S&P Cryptocurrency BDM Ex-LargeCap Index (USD)	SPCBXL
S&P Cryptocurrency LargeCap Ex-MegaCap Index (USD)	SPCLXM

## Index Data

Daily index level data is available via subscription.

For product information, please contact S&P Dow Jones Indices, [www.spdji.com/contact-us](http://www.spdji.com/contact-us).

## Web site

For further information, please refer to S&P Dow Jones Indices' Web site at [www.spdji.com](http://www.spdji.com).

# Appendix I: Market Capitalization Classification

## Classification

The algorithm described in this section defines the classification process, by the seven-day median Market Capitalization (MC) of the eligible digital assets into three clusters: LargeCap, MidCap, and SmallCap. The seven-day median Market Capitalization is calculated by taking the seven-day median price of each asset and multiplying by its circulating coin supply as of the rebalancing reference date. The algorithm is a simplified version of a k-means algorithm with the following parameters:

1. the clustering algorithm is based on only one dimension, the natural logarithm of MC;
2. the clusters are fixed: LargeCap, MidCap, and SmallCap;
3. and the initial points for the Large and Small clusters are the largest and smallest digital asset in the eligible set.

As in any k-means algorithm a constituent  $a$  will be classified in a cluster  $X$  if the centroid of the cluster is the closest to  $a$  among all the cluster centroids. Once a constituent is allocated to a cluster the centroid of that cluster is recalculated and the process continues with the next constituent. This makes the process dependent of the order the constituents are classified. Using the fact that we only consider one dimension (MC) we avoid that dependency as shown below.

The distance used for the classification is simply the absolute value of the difference between the natural logarithms of the market capitalization:

$$d(a, b) = |\log_e a - \log_e b|$$

The algorithm:

1. Calculate the natural logarithm of the MC (LogMC) of each eligible asset.
2. Large Centroid Candidates and Distance to Large Centroid Candidates:
  - a. Large Centroid Candidate for each constituent:
    - i. For the constituent with the largest LogMC asset, the Large Centroid Candidate is the LogMC of this constituent.
    - ii. For the rest of the constituents, the Large Centroid Candidate is the average LogMC of the assets with strictly larger LogMC.
  - b. Calculate the Distance to the Large Centroid Candidate for each constituent.
3. Small Centroid Candidates and Distance to Small Centroid Candidates.
  - a. Small Centroid Candidate for each constituent:
    - i. For the constituent with the smallest LogMC asset, the Small Centroid Candidate is the LogMC of this asset.
    - ii. For the rest of the constituents, the Small Centroid Candidate is the average LogMC of the assets with strictly smaller LogMC.
  - b. Calculate the Distance to the Small Centroid Candidate for each constituent.
4. Mid Centroid and Distance to Mid Centroid.
  - a. Mid Centroid: The mid centroid is the asset with the largest LogMC for which the distance calculated in Step 2b is larger or equal to the distance calculated in Step 3b.
  - b. Calculate the Distance to the Mid Centroid for each constituent.

5. Initial Classification: In decreasing order by LogMC the classification is as follows:
  - a. The asset with the largest LogMC is classified as Large,
  - b. An asset is classified as Large if it satisfies both of the following conditions:
    - i. The distance to the Large Centroid Candidate (calculated in Step 2b) is larger than the distance to the Mid Centroid (calculated in Step 4b), and
    - ii. All the assets with larger LogMC have been classified as Large
  - c. An asset is classified as Mid if it satisfies both of the following conditions:
    - i. The distance to the Mid Centroid (calculated in Step 4b) is larger than the distance to the Small Centroid Candidate (calculated in Step 3b), and
    - ii. All the assets with larger LogMC have been classified as Mid or Large
  - d. All remaining assets are classified as Small.
6. Classification Buffer and Final Classification:
  - a. If an asset is new to the BDM its Final Classification is the one determined in Step 5;
  - b. If an asset is an existing constituent of the BDM:
    - i. If the Initial Classification calculated in Step 5 coincides with its Initial or Final Classification calculated at the previous rebalancing, the Initial Classification becomes the final one.
    - ii. If the Initial Classification calculated in Step 5 is different from both its Initial or Final Classification calculated at the previous rebalancing, compare the distance to the Initial Classification Cluster Candidate and the distance to the old Final Classification Cluster reduced by 20%. For example, consider an asset that has an Initial Classification of Large but its previous Final Classification was Mid. In this case, the distance calculated in Step 2b is compared to the distance calculated in Step 4b reduced by 20%. If the former remains smaller than the latter even after reducing the latter by 20% then the asset gets a Final Classification of Large, if not it keeps the old Final Classification of Mid.
    - iii. When an asset is reclassified down (up) in the previous step all assets with lower (higher) LogMC and the same Initial Classification, old Initial Classification, and old Final Classification than this asset are reclassified in the same manner.
7. Liquidity and Number of Exchanges thresholds for Large Cap: If, after step 6, an asset is classified as Large but its three month Medium Daily Value Trade is lower than US \$1 million, or the asset trades on fewer than three Lukka prime exchanges, the asset is reclassified as Mid.

*Note: The algorithm is currently used to identify the constituents of the S&P Cryptocurrency LargeCap Index by utilizing the LargeCap cluster.*

# Disclaimer

## **Inherent Risks with respect to Digital Assets**

The risks of trading digital assets are generally considered to include, without limitation, the following:

**PRICE VOLATILITY** Digital assets have historically experienced significant intraday and long-term price swings.

**SPOT MARKETS** The spot markets through which cryptocurrencies trade are new and largely unregulated. Furthermore, many spot markets and over-the-counter market venues, do not provide the public with significant information regarding their ownership structure, management teams, corporate practices or oversight of customer trading. As a result, the marketplace may lose confidence in, or may experience problems relating to, these venues. Spot markets may impose daily, weekly, monthly or customer-specific transaction or withdrawal limits or suspend withdrawals entirely, rendering the exchange of bitcoin for fiat currency difficult or impossible. Participation in spot markets requires users to take on credit risk by transferring bitcoin from a personal account to a third party's account.

**MARKET ADOPTION** It is possible that digital assets generally or any digital asset in particular will never be broadly adopted by either the retail or commercial marketplace, in which case, one or more digital assets may lose most, if not all, of its value. •

**GOVERNMENT REGULATION** The regulatory framework of digital assets remains unclear and application of existing regulations and/or future restrictions by international, federal and state authorities may have a significant impact on the value of digital assets. •

**SECURITY** There have been significant incidents of digital asset theft and digital assets remain a potential target for hackers. Digital assets that are lost or stolen cannot be replaced, as transactions are irrevocable.

**OTHER** Digital assets are susceptible to error and can be affected by forks, discontinuation and/or suspension in trading

## **Performance Disclosure/Back-Tested Data**

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Information presented prior to an index's launch date is hypothetical back-tested performance, not actual performance, and is based on the index methodology in effect on the launch date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the

general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. In addition, forks have not been factored into the back-test data with respect to the S&P Cryptocurrency Indices. Backtested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI's ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the backtested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices maintains the index and calculates the index levels and performance shown or discussed but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US \$100,000 investment for a 12-month period (or US \$10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US \$1,650), the net return would be 8.35% (or US \$8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US \$5,375, and a cumulative net return of 27.2% (or US \$27,200).

### **Intellectual Property Notices/Disclaimer**

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