

Control Framework - Index Integrity

Morningstar Indexes

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Overview

Morningstar Indexes have clearly defined, and substantiated governance procedures and internal controls intended to ensure the benchmark's integrity and representativeness.

Input Data

Morningstar Indexes measures and calculates the sufficiency of all data inputs for its Indexes to assure that the accuracy of a Benchmark is sufficiently met. These determinations include checks like variance reporting, rebalancing and reconstitution QA, and missing data alerts to minimize operational risks.

As a global leader in research and data collection, Morningstar Indexes relies on both data collected 'in-house' by Morningstar Equity Data team and engages third-party vendors to source data.

Index Maintenance

Morningstar Indexes are rebalanced and reconstituted on specific dates as laid out in their respective rulebooks. During this process, each index methodology is evaluated to ensure it is still achieving the strategy, purpose and objective it's meant to measure. While undertaking a material methodology change, Morningstar will follow appropriate change process to include all public announcements and applicable consultations with relevant stakeholders.

Index Calculation

Morningstar Indexes enlists the services of external calculation agents. In addition to the robust quality checks of our external vendors, Morningstar Indexes has a host of secondary validations in place to further confirm the accuracy of the index calculations.

Index Restatement

Morningstar Indexes strives to deliver the highest-quality data. Despite Morningstar's focus on excellence, index-level and/or constituent inaccuracies may occur as a result of a late or missed dividend, a pricing error, an incorrect application of methodology, or any other missed/incorrectly applied data input. We have a detailed policy to determine whether an index should be recalculated.

Input Data

Successful benchmark determination is heavily dependent on the quality of input data, as a result we have specific control framework in place to manage data inputs. As a global leader in research and data collection, Morningstar Indexes relies on both data collected 'in-house' by Morningstar Equity Data team and engages third-party vendors to source data.

Collected Data

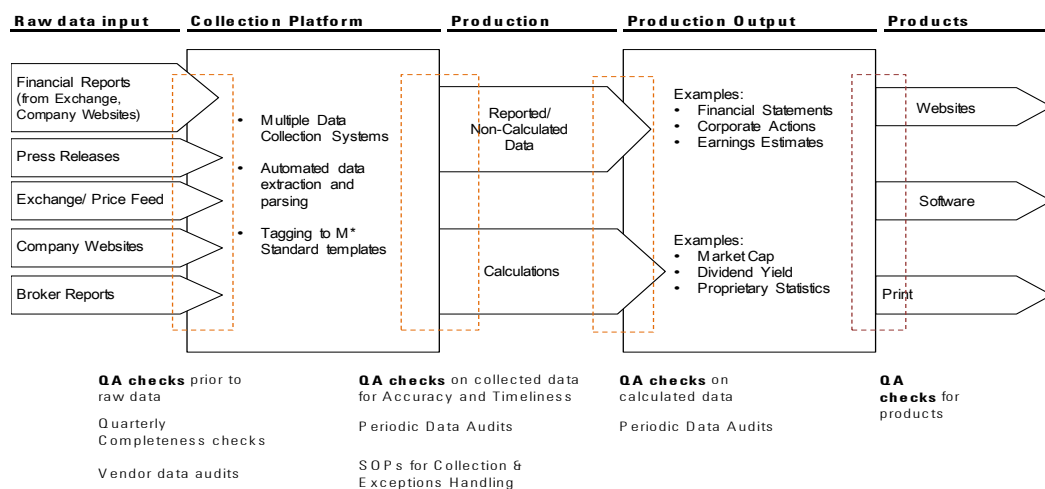
Morningstar Equity Data integrates several strong solutions into one complete platform that provides 98% coverage of global market value and historical data from as early as 1975. The data features proprietary statistics and information unavailable from any other source, developed using stringent quality screens and tests to ensure accuracy.

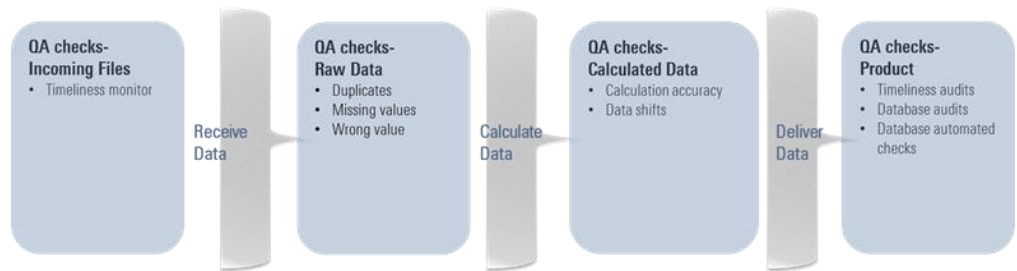
Morningstar Equity Data grew through acquisitions, and collectively have been a data vendor for more than 30 years. We have about 150 clients globally of equity data feeds and API.

Morningstar data is known for its comprehensiveness and its quality. The collection program operates around a disciplined quality program that applies across our company globally. Based on LEAN Six Sigma principles for finding and eliminating errors and inefficiencies, our quality program trains Morningstar staff members to seek continuous improvement in our products, services, and processes. We seek to deliver error-free data as quickly as possible.

Data analyst teams are organized according to countries and sectors, in order to drive more specialized knowledge and better quality updates. We also ensure analysts are well trained and equipped with clear collection methodologies and SOPs. We continuously review and update our SOPs to ensure that they are up-to-date with the current reporting practices by companies.

In addition, Quality Assurance checks are used at every point in the data collection and production process, as shown in the diagrams below. This helps ensure that accurate data is passed to each downstream system





Finally, Morningstar Quality team performs regular audits to measure quality in terms of accuracy, completeness and timeliness. This provides an independent assessment on data quality. Based on the audit results, we also use LEAN tools such as Fish Bone Analysis to root cause any data issues and brainstorm solutions to address the underlying causes.

Vendor Management

Morningstar Indexes may use third-party vendors to provide feeds of exchange/market data to calculate an index. These third-party vendors may also provide company information, number of shares, company shareholdings, dividends, and corporate events. This distribution of data is maintained via written licensed agreements between Morningstar Inc. and the third-party data vendors that state the specific functions of the third party. Further information regarding Morningstar Indexes' third-party data vendors may be obtained on request from indexes@morningstar.com

- A. Morningstar has clearly defined written arrangements in place with third parties that participate in the benchmark determination process. These arrangements ensure that third-party involvement in the benchmark determination process maintains accuracy and minimal operational risk.
- B. Morningstar monitors third-party vendors by establishing data delivery agreements and standards to hold vendors to a Morningstar standard. File delivery times and other quality-assurance checks are in place to actively track the integrity of third-party services. In the event of data discrepancy or delayed deliverables, Morningstar will contact the third-party vendor's client-services representative.
- C. Stakeholders in Morningstar Indexes are provided all relevant information such as the identity and roles of third parties involved in the benchmark determination process.
- D. Morningstar Indexes ensures through its controls framework that potential operational risks arising from third parties are duly managed. Additionally, third-party data centers hold independent contingency plans and report to Morningstar when necessary.

Data Sufficiency

As a benchmark administrator Morningstar aims to establish clear guidelines regarding the hierarchy of data inputs and dependency on expert judgment.

Morningstar Indexes are based on prices sourced from regulated trading venues, including those for equities, fixed income, and commodities. For our end-of-day equity indexes we use the official closing prices from exchanges, as detailed in our [Morningstar Indexes Closing Prices](#) document. If a price is missing for a certain day, we use the last available closing price.

If a stock is suspended from trading or delisted, resulting in a last-traded price that does not represent the value of the stock, then the average of the last bid and ask is used (as outlined in the “Bankruptcy, Extreme Financial Distress, and/or Delisting” section of our [Style Indexes rulebook](#)).

For our real-time equity indexes, we also use real-time prices from exchanges. All closing values of Morningstar indexes are calculated in U.S. dollars, yen, pounds sterling, and euro using an average WM/Reuters bid and ask price at 16:00 GMT.

Index Maintenance

Successful benchmark determination is heavily dependent on the quality of reconstitution and rebalancing, as a result we have specific control framework in place to manage the processes that determine index membership and weightings.

Eligible Universe

Each index series is constructed by applying selection and weighting criteria to a curated eligible universe of securities. The integrity of the final index portfolio is dependent on a timely, accurate and complete eligible universe. The eligible universe determination process is powered by an enterprise data management system that creates accurate, consistent and transparent content. The content is curated based on a set of policies and procedures and ultimately analysts manage an exception queue when data fails a thorough set of data management policies.

To determine the eligible universe for our Global Equity Index series Morningstar is concerned with 1) identification of equity or equity like securities and 2) Assigning the Country of Classification for each company. The two criteria ultimately define eligibility.

Security Type Quality Assurance

1. Based on new input events from multiple data vendors for security type assignment resulting in a new security type, surface new security type in comparison to previous assignment in the context of universe eligibility. Changes are validated through raw publicly available data sources such as company filing documents, websites and stock exchanges.
2. Security type is manually assigned for edge or ambiguous cases and for distinction between preferred and preferred-equity, stocks that do not provide a guaranteed fixed return are considered eligible.

Country of classification Quality Assurance

1. In 95% of cases Country of Classification is determined when the country of incorporation and country of primary listing agree.
2. For the remaining 5% of cases, Country of Classification assignment is surfaced in an exception queue for manual intervention. Final determination is based on geographic distribution of revenues and assets, primary business country, headquarters, shareholder base, and tax haven status.

3. Changes in the country assignment compared to previous determinations will pass to a second validation queue and are evaluated and validated using publicly available data by an unbiased secondary assessment.

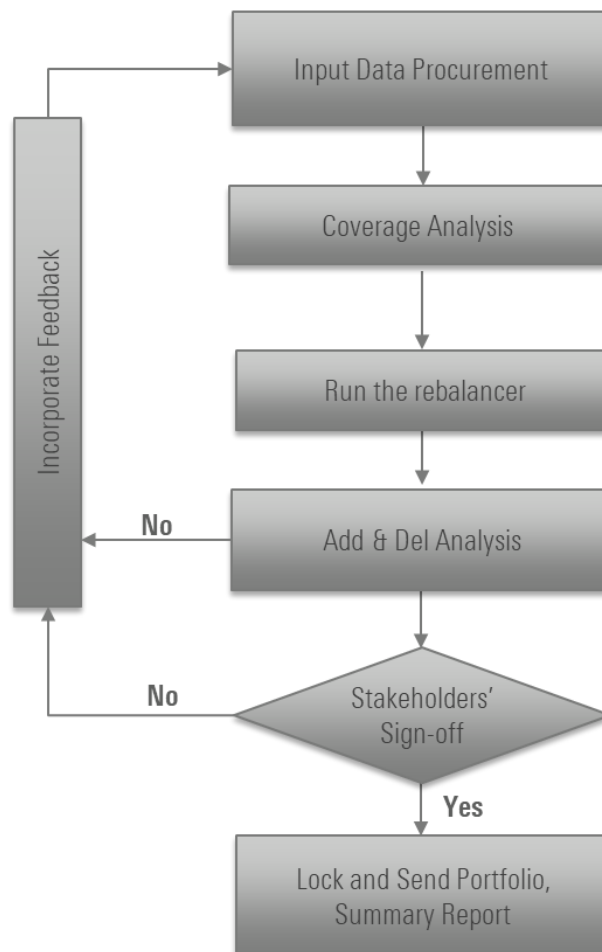
Equity Indexes - Reconstitution & Rebalancing

In addition to the robust quality checks that Morningstar's internal and external data providers employ, Morningstar Indexes has a host of secondary validations in place to further confirm the accuracy of the input data:

Validations are categorized into three main themes: 1) Completeness, 2) Accuracy and 3) Timeliness.

- ▶ Automated content verification processes to ensure all data required is present for the rebalancing to commence
- ▶ Automated input data accuracy checks that identify abnormal changes in data values
- ▶ Automated input data accuracy checks that identify discontinuities in

Automation of transparent index methodologies is deployed using various technologies including SQL, C#, Java and Python. Multiple levels of testing is performed by Index Maintenance team and supporting technology operations team to ensure that the rules are implemented accurately.



Additions & Deletions

For each index series a list of additions and deletions is generated for the reconstituted portfolios along with the reason. Deletion reasons detail the specific methodology rule or threshold preventing the security from entering the portfolio. Addition reasons detail why the security failed at last reconstitution and the specific rule or threshold allowing entrance to the portfolio at the current reconstitution. These reasons are reviewed and validated through a public source wherever possible. E.g. if a security is getting deleted due to decline in the dividend yield, then the decline is confirmed through public sources.

Additions and deletions are discussed internally within Index Management & Analytics team to ensure the accuracy of the portfolio.

Index Oversight Committee

Additions and deletions are presented to the committee before submitting the portfolio for calculation.

Calculation Agent Review

For indexes that outsourced to a calculation agent, an additional review is performed to identify potential corporate actions, free-float accuracy and low-level eligibility exceptions.

Proforma & Portfolio Implementation

The open file on the effective date of the reconstitution or rebalance are compared to the submitted portfolio to ensure the calculation implementation is complete and accurate. Any discrepancy in the portfolio after incorporating the corporate actions and weight changes due to price movements are highlighted to the calculation agent. The calculation agent in turn restate the impacted portfolio and send the revised files to our client along with notification stating the reason for restatement.

Index Calculation

Morningstar Indexes enlists the services of external calculation agents. In addition to the robust quality checks of our external vendors, Morningstar Indexes has a host of secondary validations in place to further confirm the accuracy of the index calculations. These validations include (but are not limited to):

- ▶ Automated content verification processes to ensure all data required is present in the index calculation data set
 - ▶ Automated input data accuracy checks that identify abnormal changes in data values.
 - ▶ Automated index return verification to foot daily return given the daily security data
- Morningstar has included a copy of the Morningstar Index Control Framework that covers Input data for additional detail.

Index Restatement Guidelines

Morningstar Indexes strives to deliver the highest-quality data. Despite Morningstar's focus on excellence, index-level and/or constituent inaccuracies may occur as a result of a late or missed

dividend, a pricing error, an incorrect application of methodology, or any other missed/incorrectly applied data input.

To determine whether an index should be recalculated, Morningstar Indexes will follow the steps below when an inaccuracy is discovered. Please note that while these guidelines are the standard approach, Morningstar Indexes, in all cases, retains the right to determine and implement the course of action that it deems best. Because multifaceted corporate actions and unprecedented events may occur, Morningstar Indexes also reserves the right to consult with various stakeholders to determine the most appropriate course of action.

- ▶ If an index-level error is identified within five days of its occurrence and the magnitude of the error is 2.5 basis points or greater, Morningstar Indexes will typically recalculate the index and all affected multi asset indexes.
- ▶ If an index-level error is identified after five days of its occurrence and the magnitude of the error is 2.5 basis points or greater, Morningstar Indexes typically will not recalculate the index; however, the issue will be brought to the Morningstar Index Committee, which will make the final decision.
- ▶ If a group of indexes is affected by an error and at least one of the indexes has an error that calls for a recalculate, Morningstar Indexes will restate all affected indexes regardless of the magnitude of the error or the time elapsed since its occurrence.
- ▶ If a calculation agent automatically recalculates an index that is a component of a Morningstar multi asset index, Morningstar Indexes will restate the multi-asset index regardless of the magnitude of the error or the time elapsed since its occurrence.

Morningstar Indexes will apply the aforementioned rules to all asset classes of indexes, along with all markets that our indexes may contain. Clients will be notified at the earliest possibility in the case of a recalculation and file reposting.