



DBIQ User Guidance and Administrator Handbook Overview Deutsche Bank Research Aug 2019

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0 Introduction

Deutsche Bank Index Quant (DBIQ) (a function within DB Research, in turn, within Corporate & Investment Bank (CIB)), which is responsible for launching, daily calculation, rebalancing and retiring of proprietary Deutsche Bank benchmarks. As at Q1 2018, DBIQ maintains over 2500 benchmarks and over 1000 strategies. These tradable proprietary benchmarks are referenced in benchmark-linked products such as total return swaps, certificates and index linked funds.

The ***DBIQ User Guidance and Administrator Handbook Overview*** sets out a summary of the policies, procedures and controls implemented by DBIQ Management to promote sound business practices for the lifecycle management of DB's proprietary benchmarks by the DBIQ Team. The benchmark lifecycle includes benchmark creation, daily management– including selection and rebalancing events, modifications to a benchmark, discovery and correction of errors and benchmark retirement. The handbook also includes DBIQ policy related to quality of benchmarks, input data management. Additional issues related to governance, controls, benchmark classification and risk controls, and conflicts of interest are also addressed.

DBIQ also provides other services to Deutsche Bank including in some cases calculation agent of information only indices, and other private strategies not made available to public. Information on the responsibilities for each index is available on request.

0.1 Key Indexing Principles

DBIQ believes the importance of benchmarks within financial markets requires that the highest standards are upheld during all aspects of the benchmark lifecycle. All DBIQ Team members are expected to behave with integrity and diligence. DBIQ has implemented policies, procedures and controls to manage the quality of benchmarks. Concerns or suspicions of an infringement of any DBIQ policy or about the quality of a benchmark can be escalated to either DBIQ Management, compliance or raised via the DB Whistleblower process.

DBIQ considers three key principles during the benchmark lifecycle management.

Customers are our Highest Priority

The focus of the DBIQ Team is to provide the best possible service to all benchmark users by upholding the highest possible standards of integrity and diligence when calculating benchmarks. These standards are applied for benchmark design, backtesting and ongoing maintenance. User queries are answered in a timely manner.

Accuracy of Calculations and Documentation

Benchmarks are based on a defined set of rules. All efforts are made to ensure benchmark calculations accurately follow these rules. Any discovered breach is reported via the relevant processes. Before benchmark launch, all documentation is reviewed by relevant parties to ensure it accurately reflects the calculations implemented in DBIQ systems.

Timeliness of Calculations

Index levels and values are required for the smooth operation of financial markets and the valuation of financial products. Every effort is made for all relevant benchmark information to be provided to users in a timely fashion. This is typically as soon as possible after all relevant market data is available.

1 User Information

DBIQ is committed to providing high quality benchmarks to its clients and benchmark users. We aim to offer a transparent index maintenance process, welcoming inputs and feedback. Defined processes are observed for benchmark challenges, changes or retirements.

1.1 DB Complaints Policy

DBIQ, as part of Research, is included in Corporate & Investment Bank Complaints policy. Any complaint related to intentional or unintentional breach of policy by a DBIQ team member can be raised

as part of the policy. The link to the policy is http://cib.db.com/_shared/Complaint-process.htm. All complaints are discussed at the quarterly IOC meeting.

1.2 DBIQ Benchmark Challenges Policy

DBIQ's Benchmark Challenges policy has been established to ensure that it runs a high quality business with transparency and accuracy in the benchmark creation and management process. It is a mechanism for benchmark users to raise concerns about a benchmark. DBIQ is committed to giving consideration to every concern raised and to being open in discussions around these concerns to achieve a satisfactory resolution, while simultaneously being cognisant of client needs, conflicts of interest and regulatory requirements during the process.

1.2.1 Why raise a Challenge?

Challenges about a benchmark will comprise incidents where a benchmark user challenges any inputs to a benchmark, the benchmark calculation methodology, the resulting benchmark level or the efficiency and timeliness of the benchmark publication process. In this context, Challenges cover benchmark-specific concerns but exclude issues relating to benchmark-linked products.

Matters that do qualify as Challenges

Challenges can be raised with regard to errors resulting from regular or periodic updates to

- Any DBIQ benchmark.
- The source or value of input data into a benchmark calculation. The source of input data must be that specified in index documentation. Value of input data if challenged will be escalated to the corresponding data source for verification.
- Metadata like security setup including corporate actions, holiday calendars.
- Calculation errors resulting from errors in codes, templates or manual errors.
- Errors in benchmark selection or benchmark rebalancing events including incorrect selection date, incorrect rebalance date, incorrect list of securities chosen.

Matters that do not qualify as Challenges

- Challenges do not cover benchmark recalculation resulting from official exchanges (e.g. LSE) republishing prices after benchmark levels have been published; data feed errors from external vendors (like Reuters) where issues in data feeds result in delays or republishing of index because accurate input data was not received on time. Subsequent to such external vendor related data issues, affected DBIQ benchmark levels will be corrected in line with DBIQ's Benchmark Restatement rules in Section 9 of this policy.
- Repricing issues relating to benchmark-linked products. For such matters clients should approach their client representative, sales person, or structurer.
- Complaints against individual DBIQ team employees cannot be made using the Challenges process.
- Questions about whether the benchmark is representative of the underlying objective or whether the methodology is appropriate for the purpose envisaged should be agreed at the time of the benchmark launch and should be reviewed regularly for relevance.

Matters not qualifying as Benchmark Challenges can be raised under the DB Complaint Policy as discussed above.

1.2.2 Raising a Challenge

A Benchmark Challenge can be raised by sending an email to the "index data" group email (index.data@db.com) or to any member of the DBIQ team, specifying the following information: Ticker, Benchmark Name, Description and details of the issue (benchmark level, input levels, calculations or methodology), date of issue / incident, and frequency of occurrence, if relevant.

1.2.3 Handling of the Challenge Process

All Benchmark Challenges will be reviewed by DBIQ and the group will aim to provide at least initial feedback within one business day. If the Challenge is considered valid, DBIQ will fix the immediate issue underlying the Challenge within one business day. The root cause and the long-term fix (where

applicable) will be identified within one week of the Challenge being received, but may in exceptional cases take longer. DBIQ will aim to implement the required fix that addresses the Challenge as soon as practicable, and at typically within one week of identifying the fix. Challenges that result in the discovery of systemic issues may take longer to fix. In this case the challenger will be informed and appropriate notifications will be made either on DBIQ's web site or via email.

1.3 Managing Changes to and Retirements of Benchmarks

The DBIQ design and launch process is designed to ensure new benchmarks are sustainable. A key requirement is that benchmarks can follow the rules on an ongoing basis with a minimal need for changes.

Occasionally changes in the underlying markets or dynamics may necessitate a review and potentially a change to the benchmark. DBIQ will consider retiring a benchmark if either the underlying market dynamics no longer allow for accurate calculation or DBIQ understands the benchmark is no longer used and is unlikely to be used in the future.

The DBIQ team periodically review a number of factors concerning input data, calculation and if relevant user challenges to determine if benchmarks should be subject to a detailed review and potentially a material change or retirement.

In these events DBIQ endeavours to engage users in a consultation and give a suitable notice period so users can react to the change. DBIQ encourages clients to monitor for announcements concerning benchmarks they reference. When considering a retirement, DBIQ will consult with known users to provide a suitable transition period and when possible a replacement benchmark.

DBIQ encourages all users to implement the following measures to allow a transition between benchmarks in the event DBIQ retires a benchmark or makes a change that means the benchmark is no longer suitable for the user.

- When selecting and reviewing the suitability of a benchmark, consider potential alternative benchmarks so that in the event of a change or retirement the alternative may be used as a fall-back.
- Inform DBIQ on the DBIQ benchmarks they use so that effective consultation on potential changes and retirements can occur.
- Ensure contracts linked to DBIQ benchmarks have suitable fall-back provisions.

1.4 Further Information

More information about DBIQ's policies and procedures can be obtained by email (index.data@db.com) or calling DBIQ at the following numbers: UK +44-20-7545-0505 and US +1-212-250-8998.

2 Conflicts of Interest

Deutsche Bank AG, when acting administrator to a benchmark and also in one or more other roles¹ related to issuance of securities or entering into swap transactions which reflect the performance of that benchmark, is likely to encounter certain conflicts of interest. Many of these will have been mitigated by the Bank's established policies and procedures and the enhanced control framework. Where these conflicts of interest cannot be sufficiently mitigated they will be disclosed in a timely manner.

The regulator will be notified immediately in case of changes to any existing or potential conflicts of interest. Such changes will also be reflected in DBIQ policies and made available to users/regulator.

Some of the identified conflicts of interests may include Deutsche Bank AG:

- engaging in transactions for its proprietary accounts and for accounts under its management;
- acting in more than one capacity within the overall benchmark process;
- providing price or other market data used in the benchmark determination process;
- issuing other, and in some cases competing, derivative instruments in respect of the Underlying;
- conducting hedging transactions;

¹ These other roles may include calculation agent, index sponsor, user, index product issuer and/or data provider

- applying additional fees;
- entering into distribution agreements with various financial institutions and other intermediaries;
- acting as market-maker for the Securities;
- acting as swap counterparty;
- acting as market-maker for the underlying reference product(s) and or security/ies;
- acting in another capacity for the underlying reference product(s) and or security/ies such as underwriter or in a commercial banking capacity for such issuer; and/or
- receiving non-public information with respect to the Underlying subject to its Information Barriers Policy for handling such information.

Further details of these conflicts of interests can be found in the Base Prospectus or relevant Product Documentation. Deutsche Bank Group's Conflicts of Interests Policy can be found here: <https://www.db.com/company/en/media/Conflicts-of-Interest-Policy.pdf>

3 Governance

3.1 Organisational Structure Outline

The DBIQ Team at Deutsche Bank sits in the Deutsche Bank Research department.

The Deutsche Bank Research department is part of CIB Research and operates within the CIB. It has physical barriers, reporting and supervision lines and compensation arrangements such that they are also separated from other areas of the bank such as CIB Equities, CIB Fixed Income & Currencies (FIC) and Asset Management (AM).

DBIQ Reporting Structure

The Head of the DBIQ Team takes responsibility for all aspects of running the benchmark administration platform. He reports into the COO of Deutsche Bank Research, who in turn reports into the Global Head of Deutsche Bank Research who is a member of the CIB Executive Committee. The entire benchmark development research team (split between London, New York and Mumbai) reports directly to the DBIQ Head.

The DBIQ IT team have their own IT reporting structure up to the Head of the Global Technology which is independent of the CIB Equities, CIB Fixed Income & Currencies (FIC) and AM divisions. The IT team is dedicated to benchmark development and has a dotted reporting line into the DBIQ Head with no reporting lines into any other DB business unit.

Third-party outsourcing service vendors provide both IT and business process services. The IT outsourcing teams report to the Global Technology IT team as well as their own internal reporting structures. Some members of the IT outsourcing teams also report into DBIQ Head; these members are responsible for index development and maintenance but do not have access to production environment. Similarly the business process teams, in addition to their company's reporting structure, report directly to DBIQ Head and DBIQ Research Analysts and are only permitted to take instructions from either DBIQ Head or DBIQ Research Analysts with respect to DBIQ Benchmark Administrator functions. The business process teams are organised into asset-class specific teams which report to their respective Team Leads, who in turn report to the Country Team Lead.

The **DBIQ Management Team** is made up of teams from three divisions within Deutsche Bank, Research, IT Development and IT Production Management. The Management Team will hold periodic meetings to discuss all aspects of DBIQ management and inform decisions for the respective sub teams.

Decisions related to index management will be made by Research team members from the DBIQ Management Team. The DBIQ Head will have the casting vote in case of split decisions. The Research team members will become responsible for all expert judgements. Individual senior team members have the authority to make expert judgements when they consider appropriate. These are subject to review by the DBIQ Management Team.

Decisions on infrastructure projects and maintenance are the responsibility of all DBIQ Management Team members. The IT Development Manager would draw up plans for the maintenance taking input from Research and Production Management team members.

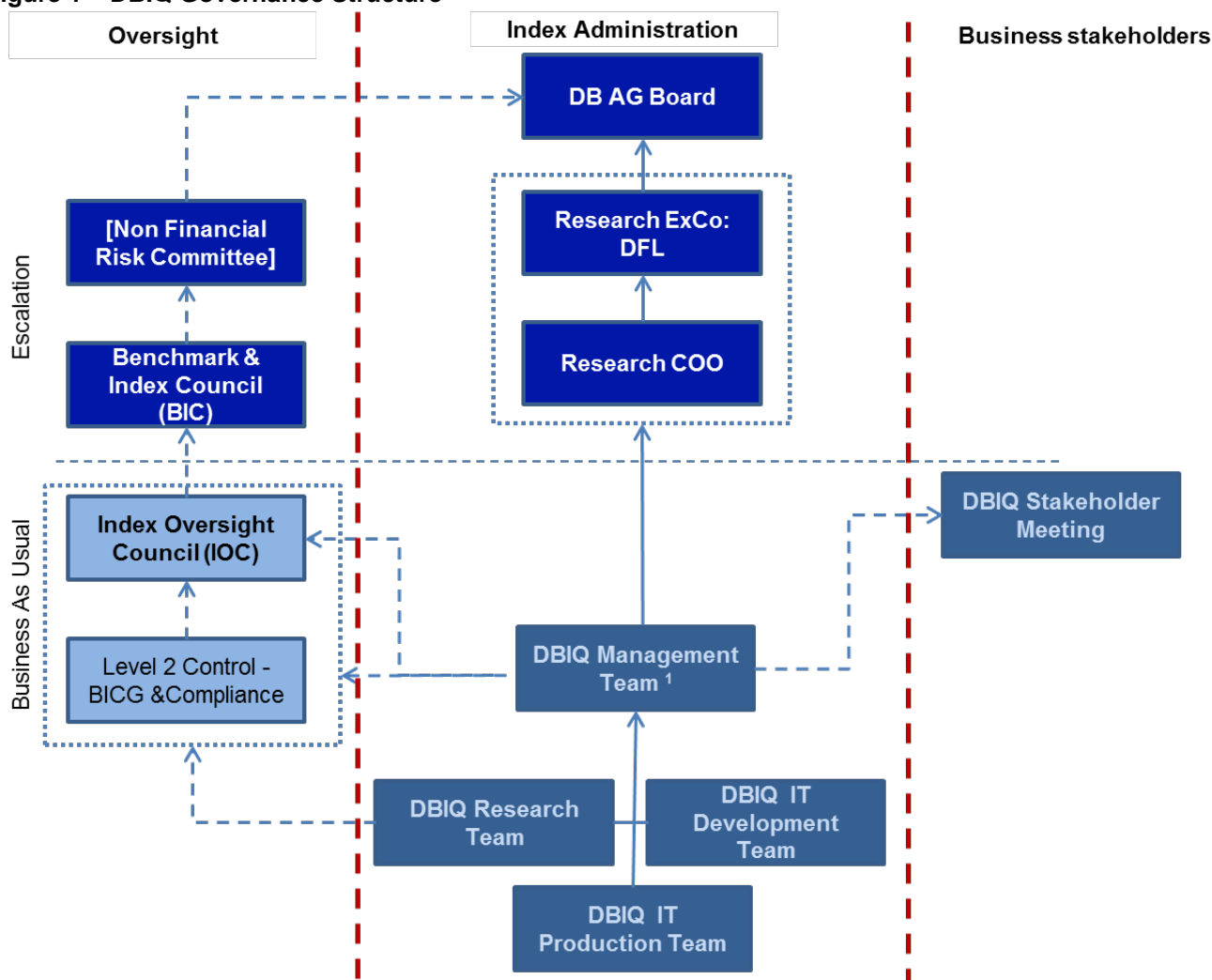
It is the responsibility of the DBIQ Management Team to provide reports to the IOC and validate that the DBIQ team operates in accordance with its Policies, Procedures and Controls.

3.2 Governance Framework

The DBIQ Governance Framework has been developed to provide oversight of the DBIQ platform. Governance as documented in Figure 2 below. Level 1 governance is covered by the DBIQ Head and DBIQ Management Team with escalations being made to Level 2 - Compliance and the Benchmark and Index Control Group (BICG) as necessary. The next level of governance is provided by the Index Oversight Council (IOC) which is made up of employees from across the bank. The structure and function of this council is designed to provide oversight of the index administration function. The membership and mandate of this council is outlined in the Terms of Reference of IOC.

Any material changes in regards to the governance framework, such as organisational, staff and/or remuneration structure will be notified by Deutsche Bank to the regulator. For such purpose, a change in the governance structure, the function and position of BICG, IOC and BIC or a change in remuneration policy will be considered a material change.

Figure 1 – DBIQ Governance Structure



1. DBIQ Management Team includes senior staff from Research and IT Development and Production. It is charged with making all Index Administration related decisions. This has no impact on divisional reporting lines.

The Benchmark and Index Control Group (“BICG”) is an independent function within Non-Financial Risk (NFR) responsible for benchmark-related controls across DB Group. BICG maintains an effective risk management framework comprising standards and policies, control execution and monitoring as well as analysis and reporting, building on an interaction with the business divisions (1st Line) and other control functions (2nd Line). BICG strengthens the controls and transparency of DB’s benchmark activity and, as part of the 2nd LoD, provides independent oversight and monitoring of benchmark activities globally across all asset classes/business lines.

IOC

BICG is responsible for organising the IOC meeting on a quarterly basis. Its mandate is to oversee all aspects of provision of indices and benchmarks administrated by Deutsche Bank.

In particular the following may require the attention of the Council, which would then provide advice and recommendations to the relevant sign-off parties, who then provide formal approval for their area of accountability:

1. Team Organisation (including Outsourcing oversight);
2. Policies and Procedures (including any Code of Conducts, where necessary);
3. Risk assessment and control framework;
4. Index Administration, Governance, Index Use:
 - a. new index launch approvals
 - b. consultation on cessations
 - c. oversight around contributions if applicable
 - d. review of plans and actions in the event of index changes or cessations, nomination of index substitutes, etc.
5. Methodology reviews, methodology changes and consultations;
6. Assessment of Internal and External Audits or reviews, and monitoring the implementation of identified remedial actions;
7. Assessment of issues (including issues on input data), client complaints and challenges;
8. Regulatory requirements relating to Index administration activities.

Detailed terms of reference for the IOC are available from BICG on request.

4 Management and Quality of Benchmark

The DBIQ benchmark administrator handbook outlines the standards and principles applied across the benchmark administrator platform. These are designed to ensure the quality of benchmarks produced by DBIQ and a framework by which core controls can be implemented and managed.

Beyond the platform specific controls, every benchmark published by DBIQ is expected to meet a number of standards to ensure its quality. These cover the core aspects of benchmarking best practices.

All DBIQ benchmarks are designed to be rules based. The rules describe all aspects of the benchmark methodology;

Core calculation formula and logic – defined standards for benchmark calculation that cover the economics of calculating various benchmark styles.

Methods for security selection and weight determination – Benchmark rules for selection and rebalancing must reflect the theory and spirit of the benchmark as provided in the summaries. The benchmark design includes elements to manage the risk profile of the portfolio.

Price and other data sources – These policies and processes promote the use of high quality data in DBIQ

Discretion within the benchmark – DBIQ should not exercise discretion when calculating benchmarks. Unambiguous rules are required with any exceptions approved by IOC.

Documentation – All benchmarks must have full documentation covering all aspects of the benchmark calculation lifecycle. Documentation covers both benchmark methodology and specific benchmark calculation procedures carried out by the DBIQ team.

Transparency of benchmark – At a minimum all users must be able to access relevant documentation and constituent information. This information is made publically available for widely used benchmarks.

Sustainability of benchmark maintenance – Practicality of daily maintenance is reviewed during design phase. Periodic reviews of benchmarks focus on management concerns and data issues, flagging benchmarks that may require adjustments.

Publication requirements – Benchmarks are made available as soon as practical following the availability of relevant market data.

4.1 Benchmark Creation

The index development process sets out standards which promote the required practices for creation and launch of new benchmarks within the DBIQ platform. It covers the formal steps that must be completed during the development process including best practice guidelines for design and back testing. The development of new benchmarks is completed in a methodical and accurate manner. In order to achieve this there are a number of controls in place to ensure that, prior to starting the development phase of a new benchmark the appropriate stakeholders have been engaged in the design process and the proposed product will deliver the desired benchmark to the end client. All new benchmarks must meet the quality requirements. A full backtest of each benchmark is created, incorporating all relevant rules.

All data is verified to ensure it meets the DBIQ data standards outlined in section 7. For each benchmark, consideration is given to the use of backup data sources and if relevant a data hierarchy. The data hierarchy determines fallback sources should the primary source not be available or of a sufficient quality. Data is considered of sufficient quality if it meets the Price Quality Assurance checks. The data source preferences are applied in the hierarchy design.

Consideration of the likelihood of availability of data during periods of market volatility, turmoil and inactivity is made. In the event that service is likely to be interrupted, appropriate backups are sought and documented.

It is expected that all data used in benchmarks is available to users either directly from DBIQ or from the relevant source or provider via a licence.

4.2 Benchmark Maintenance

DBIQ has robust processes and procedures to aid the daily benchmark lifecycle. Specific benchmark documents cover both rules and processes to manage the maintenance of the benchmarks. Benchmarks are subject to automated checks requiring various sign offs. Appropriate checks are triggered prior to and post each benchmark calculation stage. When deemed appropriate secondary verifications are performed on the benchmark level or benchmark lifecycle events. Benchmarks are published as soon as practical after the time all market data is available.

Additional diligence is applied during selection and rebalancing events. These checks are benchmark specific and typically cover aspects such as;

- Verification of joiners and leavers
- Review of weight changes
- Four eyes review of event
- Review of pricing inputs

4.3 Expert Judgement

In the course of benchmark life cycle management, there may be instances in which DBIQ need to exercise expert judgment with respect to the input data and/or methodology of a benchmark. These instances may be driven by changes in the market, or come to light in the process of correcting benchmark calculations or may arise in cases where benchmarks have discretionary elements.

Expert judgement is defined as the application of a benchmark owner and/or DBIQ Head experience, knowledge and expertise in their sector to make a choice with respect to input data for or methodology for benchmark calculation keeping in mind the purpose of the benchmark and the objective of the end user.

Expert judgement is made in accordance with both the written and spirit of the benchmark rules. If the expert judgement is not prescribed in the rules, the decision is documented. An expert judgement leading to changes in benchmark methodology or data require approval from DBIQ Management Team. The IOC are consulted on cases when the expert judgement may have a significant impact to the benchmark. All cases of expert judgement must be reported to the IOC as part of the quarterly oversight report.

All instances in which expert judgement is applied to change the calculation of a benchmark, whether in terms of methodology or input data are documented. Information on expert judgements is available to users on request.

4.4 Benchmark Statements

DBIQ publishes benchmark statements for each family of benchmarks which are administered under the EU BMR. Any new benchmarks launched will be mapped to an existing list of family of benchmarks or a new benchmark family statement will be published as per the requirements of EU BMR.

4.5 Periodic Review of Benchmarks

DBIQ conducts quarterly reviews of its benchmark universe to maintain accurate and updated records. This process aims to highlight any market data issues, errors, challenges, or concerns about the benchmark, underlying data or security prices. Benchmarks that are highlighted through this review are subject to a thorough methodology review to assess the potential ongoing suitability of the benchmark and if any changes should be made. The results of any such reviews are reviewed by the BICG and when applicable are subject to the Benchmark Change or Retirement policies.

In addition, BICG conducts periodic risk based reviews of benchmarks including methodology reviews, backtesting. The results are discussed with DBIQ and appropriate action is then taken by DBIQ.

4.6 Succession Planning & Knowledge Control

DBIQ ensure business continuity and the integrity of intellectual property with respect to its benchmark universe via its organisational structure, controls and documentation. Each benchmark has a DBIQ Benchmark Owner as the primary contact for the benchmark. A DBIQ Secondary Owner acts as a backup and has an understanding of the methodology and calculations for the benchmark. DBIQ requires minimum documentation for each benchmark that covers benchmark model construction, calculation methodology and daily processes

5 Controls Framework

DBIQ Management has implemented the Controls Framework in order to ensure relevant policies and procedures are implemented. This is achieved by identifying key benchmark lifecycle management areas and then designing control processes to allow effective monitoring of these key areas of benchmark management.

These controls cover system wide processes and functions. Additional benchmark specific controls may also be implemented.

Each control must meet certain measures to ensure its efficiency;

1. Provide clear objective measure of compliance with policy/procedure
2. Performed on a pre-defined periodic basis
3. Suitable escalation path if controls indicate failure or are not completed

Controls are divided between major benchmark lifecycle events, daily and periodic events.

5.1 Major Life Cycle Controls

Major events cover significant actions such as launch, retirements or changes.

- Benchmark design and use
- Benchmark documentation and classification

- Verification of correct configuration for benchmark launch
- Introduction of new data
- Changes or adjustments to benchmark rules
- Appropriate retirement of a benchmark

5.2 Daily Life Cycle Controls

Daily events cover key aspects to ensure the smooth running of the platform.

- Timeliness of benchmark calculation
- Completion of benchmark related tasks as defined in daily procedure trackers
- Access management
- Data change management
- Holiday calendar management
- Data quality

5.3 Periodic Controls

- Benchmark recertification and reviews
- Expert Judgement Error and challenge management

5.4 Record Retention

All data records pertaining to benchmark controls should be retained while a benchmark is in use and post-retirement records should be retained for a minimum of 5 years, including tools used to implement the controls, results of any testing, any correspondence related to escalating a breach of control and subsequent actions taken. Email correspondence should be archived in DB's email system.

6 Benchmark Classification

DBIQ classifies benchmarks based on use, input data and how benchmark data will be distributed. Classifications determine rules on how the benchmark should be managed. Presently, all benchmarks administered by DBIQ are non-significant. DBIQ will conduct a periodic survey of its benchmarks to determine if any of the benchmarks can no longer be considered as non-significant and will notify the regulators in such cases.

The benchmark use classification is based on the type of users and format of products the benchmark is designed to be used by.

Data classifications determine the source and type of data, differentiating between data providers and contributors. Further classifications between exchange and OTC data are made.

6.1 Implications of Ratings

All DBIQ benchmarks are subject to the standard minimum policies and controls. The classification and rating of a benchmark determine the scope of the requirements. Key implications are;

Transparency

The benchmark use rating can trigger transparency requirements. Benchmarks forming the basis of widely used products have core rules and constituent information made available publically.

Private benchmarks that are bespoke in nature or private strategies are restricted to the specific users.

Data quality assurance

The input data rating (for each data source rather than the benchmark) will determine the level of data quality assurance applied. Data is classified as either

- Exchange data and other regulated data which are subject to standard value checks.

Or

- OTC data is subject to standard value checks and verification against alternative sources.

Distribution of selection and rebalancing information

The Selection and Rebalancing Risk Rating levels determines if the selection & rebalancing information should be made public or restricted to certain people.

Restatement

Upon the need for a restatement, the benchmark use rating should be considered when making the notification.

Methodology changes

The benchmark use rating has a direct influence on how a change in methodology is treated. Widely used benchmarks are subject to published notifications whilst private benchmarks are subject to specific user notifications.

7 Input Data Management

DBIQ undertakes a number of processes and controls to ensure the adequacy of data used in benchmark calculations.

Input data covers any information DBIQ obtains for the use of benchmark calculation and is classified in three ways;

- Source - is the person or legal entity who originates the data.
 - Contributor - A contributor is a source contributor if the data provided to DBIQ is exclusively or near exclusively for the use in DBIQ benchmarks.
- Data provider - is a system or legal entity that consolidates and delivers data to DBIQ.
- Data rating – the type of source of data.

New data must go through the onboarding process which is designed to ensure that suitable levels of service are in place and all data used in DBIQ benchmark calculations will be provided consistently in a timely manner. The onboarding process reviews the proposed Source and/or Data provider verses the data quality management requirements to verify that these will be met. Contributors are subject to relevant Contributor Code of Conduct.

7.1 Data Vetting and Verification

The DBIQ Data Vetting and Verification Policy sets out standards which promote the use of accurate high quality data in DB proprietary benchmarks produced by the DBIQ Team. This creates a framework which DBIQ will follow to ensure minimum quality, accuracy and reliability of input data used to produce DBIQ proprietary benchmarks.

Input data is subject to quality controls and the source or provider must be responsive to challenges and queries associated with the data. Data sources should have backup processes to ensure the benchmark can be calculated if data provision from a specific source or provider is to cease.

When considering pricing data, DBIQ has a strong preference to use market data from regulated venues such as exchanges. Where such data is not available (and OTC markets are used for pricing data) efforts are made to ensure that market data is formed in a reliable fashion. When practical the preference is to use Arms-Length transactional data or firm quotes as a second alternative.

Failing this a source is selected that forms data from market information that is built on the competitive forces of supply and demand. This source is typically one that is used in the price discovery process for market participants. DBIQ also uses pricing providers whose business service is to produce price fixings for various markets. In such cases, the services provided are reviewed to ensure the standard of the data.

Data sources and providers are reviewed on a continuous basis. Any degradation of service is noted and where relevant escalated. In the event the quality no longer meets the required standards alternative sources are sought or changes to the benchmark are made.

Price Quality Assurance

Price Quality Assurance tests for each asset class and security group are designed to verify the data quality. These

- OTC Input price data is checked systematically for quality and accuracy daily. The checks vary by asset class but at a minimum compare the price source to alternative market quotes. Prices beyond defined tolerances are verified and when relevant escalated².
- All price data, including exchange traded prices, are subject to a minimum price movement check. Large moves are verified against other data, either by using different data sources or by evaluating versus comparable securities.

Price Quality Assurance testing is applied continuously including during periods of market volatility, turmoil and inactivity. In these cases the DBIQ Team will make best efforts to run daily price checks to the standard specified by DBIQ policy.

Inadequate Quality or Quantity of Input Data

In the event that it may not be possible to determine a benchmark accurately due to quality or quantity of data falling below the standards as required by the methodology of the document, it will be deemed a disruption event and DBIQ will take actions as described in the Disruption Events section of the methodology.

In cases where DBIQ determines that a data source is consistently falling below the required standards, alternative sources will be sought. The Index Change process is followed to make the necessary changes. In some circumstances, DBIQ may cease such benchmarks where no suitable alternative data sources can be determined.

Oversight

DBIQ, Compliance and the IOC are when deemed necessary be involved in monitoring and reviewing corrected Input prices.

During the Data Vetting & Verification process if there is any suspicion regarding potential exceptions, breaches or irregularities on the part of the Source / Contributor, such suspicions are reported to the DBIQ Head and investigated by them in coordination with Compliance. Based on their observations, Compliance, and if needed the IOC, advise on process or policy improvements and ensure these are implemented. Any infringements where DBIQ or BICG suspect any conduct which may involve manipulation or attempted manipulation of benchmark will be reported to the regulator by the DBIQ management team or BICG in a timely manner.

8 Restatement and Calculation Error Management

DBIQ processes and procedures are designed to ensure benchmark calculations are accurate and reliable. On occasion, when calculation errors are made DBIQ follows a defined procedure to analyse the error and if necessary restate the benchmark.

² The following applies only to the bond input universe for DBIQ indices administered in the New York office. Since 5% is the legal threshold to which fund managers and custodians are held when providing valuations, this will also be the DBIQ threshold for these indices. It is also the threshold for which Interactive Data (underlying price source for the bond input data) will open a formal investigation of a provided price. While DBIQ will escalate all outliers to Interactive Data in the interest of an improved pricing, index restatements will only be requested for errors in excess of 5% change in constituent bond levels.

An error can be discovered by either DBIQ internal verification procedures or a user challenge. Each error is logged, along with the underlying reason. The process is reviewed and when possible the system or process that caused the error is rectified. Overviews of errors are reported to the IOC.

Each error is analysed and a restatement decision is informed on predefined thresholds and the scope of the error. The thresholds are defined based on the volatility³ of the benchmark and time since the error occurred, and are applicable to all DBIQ benchmarks irrespective of their risk classification or benchmark use classification.

Factors determining the restatement based on the scope of the error are;

- Benchmark specific documentation may override the restatement thresholds
- Benchmarks of the same family and/or dependent benchmarks are treated consistently
- Errors that will impact future calculations are considered on a case by case basis
- Pricing errors associated with exchange traded products

The following table outlines standards for restating to ensure the integrity of the benchmark determination process is maintained.

Benchmark Category	Error occurring within 7 days	Error occurring between 7 days and 3 months	Error occurring between 3 months and 1 year	Error occurring older than 1 year
Low Vol ($\leq 3\%$)	Always restate	Restate if $> 0.01\%$	Restate if $> 0.03\%$	Do no restate
Medium Vol ($> 3\% \ \& \ \leq 10\%$)	Always restate	Restate if $> 0.025\%$	Restate if $> 0.05\%$	Do no restate
High Vol ($> 10\%$)	Always restate	Restate if $> 0.05\%$	Restate if $> 0.15\%$	Do no restate

For benchmarks that are the basis for Exchange Traded Products, only calculation based errors will be corrected according to the re-statement table. Errors due to incorrect prices on the underlying instruments will only be restated as follows:

- If found before the open of the next trading session: Always restate
- If found within 7 days, restate if the implied change in the benchmark level is greater the 0.03%
- If found after 7 days and less than a year, restate if the implied change in the benchmark level is greater than 0.10%

The volatility band for each benchmark is based on the historic daily volatility from inception until the last calculation date of the current year. If this period is less than 1 year, the volatility should be estimated based on similar assets and benchmarks.

Benchmark calculation and publication will continue to schedule during the review period. If a decision to restate is made, benchmark levels will be corrected, restated and users notified.

DBIQ will aim to fix benchmark errors within one business day of discovery. In the event of a major error that may take longer to fix, it may be deemed necessary to put benchmark calculations on hold. In this case, benchmark users, and if required, Compliance and the IOC must be notified. The notification will typically be made via an announcement on the DBIQ web site.

³ Volatility is defined as annualized volatility over the lifetime of the index.

When practical, DBIQ aims to inform users of restatement events via the DBIQ website or specific user notices. Users may register their interest in receiving restatement notices for specific benchmarks with DBIQ.

8.1 Restatement of Benchmark Groups

Benchmark groups are groups of benchmarks with similar calculation methodology – they may be different currency versions, return versions (price, total, net gross), or other such augmentations of a “primary” benchmark.

For groups of benchmarks, an error in one benchmark may or may not lead to a restatement in all the benchmarks in the group. The impact of the error on each benchmark in the group and consequent restatement, or not, will be assessed individually based on the rules above. From a practical view, if systems do not allow individual assessment then all the benchmarks in a group will be corrected (and restated). This is likely to also be the case for dependent benchmarks.

8.2 Restatement of Benchmarks with Memory

Benchmarks with memory are benchmarks where the current benchmark level depends in some systematic and well defined way on previous benchmark levels. Current benchmark levels for benchmarks with memory may depend on a rolling window of past benchmark levels (e.g. moving average or momentum benchmarks) or may depend on the entire past history of benchmark levels (e.g. where the exponential moving average of the benchmark level is an input).

Restatement decision for benchmarks with memory will need to be evaluated on a case-by case-basis depending on the type of error, such as:

When a security fixing is wrong but this did not lead to any benchmark levels breaching thresholds specified above. This would have the risk of ongoing benchmark levels breaching thresholds.

- When an array of past benchmark levels is used in ongoing benchmark calculations where the past benchmark levels did not ‘qualify’ for a restatement based on the thresholds above.
- If the security fixing is wrong, it is likely the current level is wrong and so this should trigger a restatement.

In such cases a restatement decision will be made by DBIQ Research Analysts or Head and if no restatement occurs, the previously published figures for the benchmark levels will be used in benchmark calculations going forward.

8.3 Restatement of Benchmarks Impacted by Historical Calendar Changes

Historical changes in holiday calendars (addition or removal of a holiday) may impact benchmark weights, participation factors, benchmark levels and future selection and rebalancing dates. DBIQ will restate impacted benchmarks if the change to a holiday calendar is discovered within one calendar week. The impact of historical changes to a holiday calendar that come to light outside of the one calendar week window will be treated on a case-by-case basis and a determination will be made by DBIQ Research Analysts or Head on whether to restate or not.

9 Changes to and Retiring a Benchmark

9.1 Material Change

A material change will constitute a change in one or more of the following where disclosed in publicly available documents:

- index identifier(s)
- methodology – for e.g. change in algorithm used for calculation of the index,
- input data – for e.g. if a rate or a curve is proposed to be used for the calculation of an index which is different from the one mentioned in the index documentation,
- selection & rebalancing rules
- reduction in transparency of index

9.2 Change to a Benchmark

Prior to making a change or retiring a benchmark, DBIQ follows a process to consider the proposal and its impact. Prior to making a change, at a minimum this proposal is ratified by DBIQ management and for any major change by the IOC. The impact of the proposal to both the benchmark and known users is considered.

Prior to the announcement of any change, DBIQ aims to provide a feedback period on the proposals and or current benchmark methodology for the benchmark users. DBIQ aims to make a notice of the change at least 1 month prior to a change. This period maybe shortened if market events necessitate an immediate change. Where a benchmark is designed for a single client, changes may be made based on a mutual agreement with the client.

The process for considering a change is based on the following steps;

1. Check Framework for Changes – Review benchmark rules, documentation and known benchmark users to identify the capacity DBIQ to make a change⁴.
2. Prepare proposal – Complete analysis of reasons and impact of change. Consider likely impact on benchmark and if it will result in change in suitability for known users. Document proposal and when applicable request feedback on proposal. Feedback should be considered and if appropriate the proposal amended. Where possible and applicable, the feedback received will be provided in any relevant change notice (typically on an anonymous basis).
3. Ratify change – DBIQ Management and BICG approve all material changes to a benchmark⁵.
4. Initiate change of benchmark – Finalise documentation provide relevant notices.

9.3 Benchmark Retirement

The Benchmark Retirement Process sets out standards which promote the required practices for retirement or cessation of benchmarks within the DBIQ platform. Careful consideration is given as to the reasons to retire a benchmark and potential client implications of this. Factors including benchmark usage, data inputs and future potential use are included in the process. All retirements are approved by a member of the DBIQ Management Team.

During the review process DBIQ will attempt to identify known benchmark users. Depending on the results of the analysis different procedures are followed.

Unused Benchmark Retirement

In the event DBIQ fails to identify any users DBIQ will initiate the retirement process. DBIQ will provide a notice on its website where appropriate. In the event a user or users are identified the “In Use” process below will be followed.

In Use Benchmark Retirement

An in-use benchmark can be defined as a benchmark which if retired will cause the disruption of the index product linked to it. Typically, in use benchmarks may only be considered for retirement when;

- Underlying market data is unavailable or the quality is considered insufficient for use in a benchmark
- The effective maintenance of the benchmark is no longer possible
- Commercial reasons make the cost of maintaining the benchmark economically unsustainable compared to the uses

⁴ DBIQ does not retrospectively make changes to index methodology or restate index levels. If a change in methodology is required for any reason then the due consultation process with the client and legal will be undertaken before making the change.

⁵ Non-material changes, such as correction of typos in the documentation or changes in internal procedures, can be made with the approval of DBIQ management.

Known users are consulted about the proposed retirement. Their views are consolidated and considered. A final decision is dependent on the DBIQ Management Team and/or the IOC being satisfied that all relevant benchmark users can, within reason be transferred to another benchmark or the relevant products may be cancelled.

If a decision is made to retire the benchmark a notice period of 3 months will be given before calculations are ceased if the cessation of the benchmark will lead to a disruption event. In other cases, the duration of the notice period will depend on the nature of benchmark and the extent of its usage.

Market Disruption or Data Issues and Retirement

In the event a market undergoes a rapid change or a data source is cancelled it may be necessary to retire (or change) a benchmark with short notice. DBIQ undertakes retirement as a last resort and is only undertaken if the benchmark data sources or methodology cannot be modified or adapted to be accurate and reflective of the underlying benchmark principles.

For a benchmark to be retired in these cases all known stakeholders are informed as soon as practical after the underlying issue has arisen. Their views should be sought and discussed with the IOC who take the final decision on if the benchmark should be retired or how the benchmark should be calculated on an ongoing basis.

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