



Reinventing risk management for air travel

Skytra Price Indices

Rules and Methodology

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1.0 INTRODUCTION

1.1 Skytra Price Index Rules and Methodology

The body of this document details the Skytra Price Index Rules and Methodology (the “**Rules**”) that Skytra Ltd. (“**Skytra**”) applies consistently to all its indices listed in the Schedule(s). The Schedule(s) also stipulate for each index their specific criteria, as these can vary between indices.

These Rules include details related to:

- a) index construction and management;
- b) index divisor adjustments due to Events & data changes;
- c) the treatment of Events that can affect the indices, and
- d) specific index related details.

Customers using the Skytra Price Indices should familiarise themselves with the Rules and consider taking independent advice before investing in products linked to a Skytra Price Index. Skytra disclaims any liability whether as a result of negligence or otherwise for any direct or indirect losses, damages, claims and expenses, as a result of:

- a) application or reliance on these Rules,
- b) inaccuracies in these Rules, or
- c) inaccuracies or errors in the composition of the Skytra Price Indices or constituent data or their calculated values.

1.2 Skytra Price Indices

Skytra Price Indices are constructed and managed to reflect the wholesale price of air travel per km flown by an individual passenger in identified markets both regional & interregional as well, for economy class tickets (collectively, the “**Skytra Price Indices**” and individually a “**Skytra Price Index**”).

Skytra publishes a set of regional & interregional indices & will consider expanding the index offering with subsets & supersets capturing prices for specific market segments as required by the industry in the coming years. For each market Skytra will calculate and publish a “daily value” and a twenty eight day rolling average of the daily value. The data, methodology are identical in both cases, the average is simply the average of the previous 28 days.

The Skytra Price Indices Series consists of the following indices:

- Skytra - Asia Pacific/Asia Pacific - economy class Price index - daily
- Skytra - Asia Pacific/Asia Pacific - economy class Price index - 28 day moving average
- Skytra - North America/North America - economy class Price index - daily
- Skytra - North America/North America - economy class Price index - 28 day moving average
- Skytra - Europe/Europe - economy class Price index - daily
- Skytra - Europe/Europe - economy class Price index - 28 day moving average
- Skytra - Asia Pacific/Europe - economy class Price index - daily
- Skytra - Asia Pacific/Europe - economy class Price index - 28 day moving average
- Skytra - Asia Pacific/North America - economy class Price index - daily
- Skytra - Asia Pacific/North America - economy class Price index - 28 day moving average
- Skytra - North America/Europe - economy class Price index - daily
- Skytra - North America/Europe - economy class Price index - 28 day moving average
- Skytra - World - economy class Price index - daily
- Skytra - World - economy class Price index - 28 day moving average

2.0 SKYTRA'S RESPONSIBILITIES AS A BENCHMARK ADMINISTRATOR

2.1 Benchmark Administrator

Skytra is registered as a Benchmark Administrator, as defined in the EU Benchmarks Regulation ("BMR") and will, once registered, administer the Skytra Price Indices.

Skytra is responsible for the design and maintenance of the Skytra Price Indices and will manage these indices in accordance with these Rules and will publish, by way of a Notice to its index licensees and its website, any changes to these Rules.

Among its responsibilities as a Benchmark Administrator, Skytra will monitor the performance of its indices to ensure their ongoing accuracy.

Skytra will review the Rules at least twice a year. All changes will be overseen by the Skytra Index Oversight Committee (SIOC). The SIOC's advice will be presented to Skytra's Executive Committee (ExCO) which has responsibility for the performance of Skytra's BA activities. The ExCo forms part of Skytra's governance model, reporting into the Skytra board. All changes that are material will be subject to public consultation.

2.2 Skytra Index Oversight Committee

The SIOC advises Skytra in relation to its indices. Its members will have no access to price sensitive information. The SIOC comprises market users both from the financial markets and the air travel industry. SIOC's purpose is to provide advice and challenge to Skytra with regards to the management of the Indices as per Art 5 BMR.

The Terms of Reference of the SIOC can be found here www.Skytra.com/index/governance.

Following consultation and review by the SIOC, Skytra where appropriate shall publish any changes to its Rules by way of a Notice to its index licensees and on its website, making all reasonable efforts to provide reasonable notice of such changes.

3.0 INDEX CONSTITUENT DATA AND SELECTION CRITERIA

This section defines which data is considered as being eligible for inclusion in Skytra Price Indices. Eligible data must meet the prescribed criteria in this section (§3) before being included in a Skytra Price Index.

The rules and criteria in this section cover foreseen circumstances and seek to avoid ambiguity with regards to data management. In the case of unforeseen circumstances, or specific circumstances that arise on which the Rules are silent or not clear, Skytra would seek the advice of the SIOC (where possible) and the approval of the Skytra ExCo in relation to a proposed course of action. The outcome of any such action would be notified to the market.

Due to the specificities of the available data Skytra Price Indices are constructed through the compilation of data from both transacted (issued) tickets as well as data concerning the prices at which tickets have been offered. Skytra is able to match the offered prices for tickets with the records of transacted tickets, removing the disadvantages inherent in using either type of data alone, as such the indices are based on actual transactions combined with offered prices. Furthermore, this approach provides Skytra with a more robust set of input data as Skytra can use as a waterfall approach in the absence of some of the data required to calculate the indices instead of using a fall-back rate.

The prioritisation of data usage for the Skytra Price Indices is as follows for all of the fields except the price:

1. Ticket settlement transaction data
2. Ticket direct reporting transaction data
3. Offered or searched input data

The prioritisation of data usage for the Skytra Price Indices is as follows for the price field only:

1. Offered or searched input data
2. Ticket settlement transaction data
3. Ticket direct reporting transaction data

There are some circumstances when it may not be appropriate to use the waterfall approach, for example if the loss of data is limited in scope and duration, in these circumstances the data event procedure will be followed as described in section 6.2.

Skytra Price Indices are constructed through the compilation of data covering both ticket prices (offered data) offered by Vendors (airline or GDS) and issued tickets (transacted data). The Skytra Price Indices are created using data for scheduled flights and shall exclude the following:

- Charter flights
- Private flights
- Itineraries with more than six legs
- Bookings that are not ticketed (issued)
- Ticket modifications & associated fees
- Itineraries with non-economy sections
- Itineraries which cannot be assigned to a single Region-Pair index
- Tickets submitted to Skytra too late to include (on or after the date of the first flight)
- Tickets that contain a leg not operated by an airline (e.g. combo tickets airline-train)
- Tickets that contain an airport not recognised by Skytra (Skytra Price Indices List of Indexable Airports)

The reporting of tickets purchased in whole or in part using “air-miles” depends on individual

airlines' reporting policies. Those tickets identified as likely to have been purchased wholly or in a large part using air-miles will be excluded. Skytra in no way decides nor influences if a transaction is reported or not.

Tickets are only included within index calculations if the number of days between the issue date (local to the place of issuance) and the first flight date (local to the place of take-off) is within the "Spot Window" for the region in which the ticket would be categorised. Any tickets issued outside this period are excluded. Refer to schedule A for a list of Spot Windows.

Skytra normally receives (basis 2018), per year globally excluding cancelations/modifications, approximately:

- 2.3 billion transacted flight records
- covering 1.3 billion transactions (each transaction may contain one or several flights)

3.1 Issued Ticket and Offered Price Data Eligibility

For an issued ticket transaction to be eligible for inclusion in the index calculations it must represent a ticket that has been issued to a traveller. Sufficient information must be attached to the transaction to ensure that it is not redundant with data already received and stored. For issued ticket or offered price data to be eligible for inclusion in the index calculations, each data element must represent a transacted or offered Itinerary with sufficient information that enables it to be used in a price match (refer to §5), namely;

- For each Itinerary:
 - Date of issue (if transacted) or of search (if offered),
 - Price offered for the whole Itinerary (if offered).
- For each flight within each Itinerary:
 - Origin & destination airport,
 - Scheduled take off date and time,
 - Cabin class (e.g. economy or business). The inclusion of the "letter class" for each flight of the offer is advantageous but not mandatory.

Where a price is offered for an identified subset of the flights in an Itinerary (a "Package"), this subset is also taken as an independent piece of offered data.

Each issued ticket Itinerary is broken into one or more sections, and each section is assigned both a Region-Pair and cabin class. For the Itinerary to be eligible, Region-Pair and cabin class must match in all sections of the Itinerary.

The price must be the Wholesale price that a travel agent would pay to an airline to purchase the ticket on behalf of a customer, including any applicable taxes & fees but excluding any applicable travel agent commissions, and not have any discounts specific to the agent or a group of agents, it must be a price available generally to agents.

3.2 Matching Offered Ticket Data to Issued Tickets

Eligible transacted data (issued tickets) are matched to eligible offered data (price offers) in order to determine Skytra's price for each issued ticket. The matching price ("**Price**") selected comes from the following predetermined process.

Each offered Itinerary comprises one or more Packages ("offered Package"). All offered Packages in all offered Itineraries on a given search/issue date are identified. On a single day, Skytra may receive offer price data pertaining to the same offered Package several times, potentially at different prices. An offer price is determined for every offered Package, by taking the median of all offered prices that were:

- for the same offered Package (i.e. the exact same sequence of flights, as defined by origin airport, destination airport, date and time of each flight)
- offered on the day of ticket issue

- for the relevant cabin class (economy)
- for the same single-letter class of service code

Each issued Itinerary is, if possible, matched to offered Package(s). The match is attempted in several ways by grouping the sequence of flights in the issued Itinerary into several predetermined combinations (each one an “issued Package”), including a Package which is the full set of all flights in the Itinerary.

For example a two-flight itinerary will be seen as both:

- A single set of two flights within one Package, and
- A set of two individual one-flight Packages.

All issued Packages within an issued Itinerary must be successfully matched in order to consider the Itinerary to be priced using that combination of Packages.

Thus, each issued Itinerary may be priced in several different ways, due to the different grouping of flights. The price that is selected from the various possible matches follows a waterfall:

- For each grouping:
 - For each Package:
 - If the issued Package can be matched to an offered Package including the correct single-letter class of service code, that Package price will be used.
 - Otherwise the average price of issued Packages which are identical to this one, save for the class of service code, and have been matched exactly (as above) will be used.
 - If this is not possible (i.e. there are no issued Packages which are identical to this one, save for the class of service code, which have been exactly matched as above), the median price of the identical Package with the cheapest class of service code will be used.
 - Each issued Package is matched to the best possible offered Package price from the above waterfall, if possible. If each issued Package in an issued Itinerary can be matched to an offered Package price, those prices will be summed to an issued Itinerary price.
- Resulting Itineraries are ranked according to the following waterfall:
 - The greatest proportion of flights in the Itinerary which were exactly matched,
 - The greatest proportion of flights in the Itinerary which were approximately matched (using the average),
 - The lowest price.
- If no full set of Packages sufficient to construct the entire Itinerary could be priced, either with or without the single-letter class, the issued Itinerary cannot be priced.

4.0 METHODOLOGY, TRANSPARENCY AND REVIEW

The Skytra Price Index Rules have been developed in consultation with the target end users of the financial products that will be based on the indices, namely airlines and travel agents. The body governing Skytra Price Index management and production is the Skytra ExCo which reports to the Skytra board, and oversight of Indices' Rules, application of the Rules, and operational performance is provided by the Skytra Index Oversight Committee (SIOC).

4.1 Validation and review of initial rules and methodology

Indices have been created covering July 2018 to September 2020 on the basis of the Rules and Methodology outlined in this document (and precursor methodologies). These indices and the calculations leading to them have been tested under a test plan covering:

- comparisons of alternative methodologies (upon a change in developing the methodology),
- input data coverage,
- comparison with an alternative metric,
- economic and data events,
- methodology design choices,
- robustness to attempted manipulation, and
- code verification.

The Rules, along with the test program and results, have been reviewed and validated by both Skytra and the SIOC. The test program was based upon demonstrating the historical performance of the indices, their behaviour through Events and in theoretical extreme circumstances, as well as through the theoretical loss of significant amounts of data, before the application of any mitigating change to a divisor. Due to the uniqueness of the Skytra Price Indices, there is no direct equivalent against which the Indices may be tested, however the test program included comparison against a variety of methodologies utilising the input data to ensure the selected methodology is appropriate.

4.2 Validation and review of material changes to the rules and methodology

Changes to the Skytra Price Index Rules and Methodology may be considered; Reviews may be triggered by formal review, R&D projects, customer feedback or the detection of errors. A proposal for the change will be commissioned by the Chief Strategy and Product Officer. Proposals are assessed and signed off by ExCo and reported to the SIOC. These changes could lead to a Material Change in the Skytra Price Indices, a material change would be any change that leads to a different rate being calculated for any of the Skytra Indices from the same data. In order to identify if a change might be material Skytra will develop a plan to test any potential changes covering at least the following areas:

- comparison against prior index methodologies over at least one month
- effect on sensitivities to events
- code validation and verification checks
- other tests deemed necessary by Skytra

Such tests will define:

- the method to employ to enact the change
- the metric(s) to be tested and the nature of the test (correlation etc.)
- the expected result.

Once this analysis is complete Skytra will also perform an analysis as to the potential impacts on any users of the benchmarks. Skytra will then develop a potential implementation plan including a tailored consultation process with users of the benchmarks. All of these elements will

be assembled and the SIOC consulted as to the completeness and appropriateness of the analyses, implementation plan and consultation process.

Should the analyses demonstrate that the change considered is not material and the SIOC consultation yield the same opinion, that the change is not material without any impact on users; Skytra will decide to implement (or not) any change and the associated planning. These changes will be published as a notice on the Skytra website as appropriate.

Should the changes be material and potentially impact users of the benchmarks any advice from the SIOC will be duly considered by Skytra for inclusion in any consultation process or supplemental testing. The consultation process with users will then be executed and all user feedback received considered. As a function of this Skytra will either implement the change or not implement the change. The non-confidential results of the full consultation process with the SIOC and the users will be published on the Skytra website alongside any implementation plan and the supporting rationale for the decision taken by Skytra. A full report will also be made to the SIOC at the next committee meeting.

4.3 Ongoing Validation

The Skytra Price Index production logs and quality control metrics are reviewed at least twice yearly both by the Skytra ExCo and the SIOC. Independently of these planned reviews a review will be triggered if any of the following events occur:

- Divergence of search result volumes by 10% from trend expectations.
- Divergence of issued ticket volumes by 10% from trend expectations in any given index region.
- Divergence of index value by 2% from trend expectations in any given index region.

Skytra evaluates on a daily basis the quality of the input data received, the results of intermediate processing steps while making the indices as well as the final index values produced. This evaluation is based on trends in pricing, volume and type of itinerary on a per airline and per region basis as well as the comparability of the transacted and offered data.

Independent of the above Skytra may decide to review the Rules and the performance of the benchmarks at any time in order to ensure their continued economic relevance.

4.4 Data retention

Complete index production records are maintained by Skytra for at least five years:

- Raw input data from Contributors
- The code and procedures used for each calculation
- The Skytra database of priced Itineraries used to calculate each price index
- The indices themselves
- Test plans and results related to initial testing as described in 4.1 and
- Test plans and results related to Material Changes to the methodology.

4.5 Cessation

Skytra acknowledges that it may become appropriate to cease publication one or more of its benchmarks, for example should they no longer be representative of the underlying market. The same process as for a change to the rules and methodology (as detailed in section 4.2) will be followed.

4.6 Required Quantity and Quality of Data

In order to publish the Skytra Price Index for a given region using the standard methodology, the following quantities of eligible transacted Itineraries, qualifying for an attempted price-match and inclusion in the index (correct region-pair, class, within spot Window etc.), within the 28-day rolling average index period are required (should these metrics not be achievable then waterfall strategies will be activated

Region	Required Number of Itineraries
Asia Pacific/Asia Pacific - economy class Price index	400,000
North America/North America - economy class Price index	400,000
Europe/Europe - economy class Price index	100,000
Asia Pacific/Europe - economy class Price index	30,000
Asia Pacific/North America - economy class Price index	30,000
North America/Europe - economy class Price index	30,000
Skytra World – economy class Price index	990,000

In order to publish the Skytra Price Index for a given region using the standard methodology, the following proportions of eligible transacted Itineraries, qualifying for an attempted price-match and inclusion in the index (correct region-pair, class, within spot Window etc.), within the 28-day rolling average index period are required to be priced:

Region	Required Proportion of Matches
Asia Pacific/Asia Pacific - economy class Price index	50%
North America/North America - economy class Price index	50%
Europe/Europe - economy class Price index	50%
Asia Pacific/Europe - economy class Price index	50%
Asia Pacific/North America - economy class Price index	50%
North America/Europe - economy class Price index	50%
Skytra World – economy class Price index	50%

Should the threshold for the proportion of matches not be met, the waterfall of price priority (as stated in section 3) will be followed.

Should both the number of eligible transacted Itineraries and the proportion of matches thresholds not be met the fallback strategy of using data from other sources of ticket transactions or offered tickets will be adopted (i.e. Skytra may use its discretion to use other comparable data sources that are readily available to Skytra).

Quality data are those which meet the criteria for eligibility in section 3, except that non-uniform region-pairs or classes of different sections of an issued ticket Itinerary do not prevent the data from being considered quality (such Itineraries may be quality, even if not useful for Skytra's Price Indices). Should the proportion of quality data from a given Contributor drop below 50%, Skytra will assess the impact on the Indices affected and, if time allows, discuss a course of action with the SIOC. Such a course of action could result in any Skytra Price Index affected by the lack of quality data being suspended following consultation with the SIOC.

5.0 SKYTRA PRICE INDEX CALCULATION METHODOLOGY

5.1 Skytra Price Indices

The Skytra Price Indices are a family of Indices which reflect the Wholesale price of air travel per km flown by an individual passenger in identified geographical regions travelling economy class. This measure is known in the air travel industry as “yield” or “revenue per revenue-passenger-kilometre” or “RRPK”. In essence it is the total revenue earned from observed eligible ticket issuances divided by the total number of kilometres to be delivered in the fulfilment of those ticket issuances. Said revenues are calculated according to Skytra’s matching algorithms described in section 3.2.

The Skytra Price Indices are calculated using a three-step process:

First, the input data described in section 3 for both offered tickets and issued tickets are combined in the process of “price matching” as described in section 3.2.

Second, the itineraries are cross referenced to identify tickets where both sources of price information agree and where they disagree (this may be, for example, a result of offered price contributors not having access to all purchasing options). Itineraries with comparable values between the offered and transacted prices are used to parameterise a statistical model (one per index day and Region-Pair) which is then used to create a model price for every Itinerary. Tickets with an offered price which is comparable neither to the transacted price, nor to the model price are discarded.

The third step is to use the remaining priced Itineraries to calculate the average price per passenger per kilometre in each index region for tickets issued within the relevant Spot Window.

- On index day T (UTC) Itineraries where the first flight takes off on T-1 (UTC) are selected.
- Itineraries are allocated to a region based upon the sequence of airports, including connections and stop-overs. For example if an Itinerary starts in Europe at London Heathrow (LHR) and flies via a connection in Munich (MUN) to Bangkok (BKK) the whole Itinerary will be included in the Europe-Asia index.
- Finally, these Itineraries are filtered for those that were issued within the spot window defined for each region (see schedule A.2).

The formulae for Skytra Price Indices are shown in 5.2. The management of Events as described in Rule 6.0, are the same for all indices.

5.2 Index Formula for Skytra Price Indices

For each regional Skytra Price Index a 28-day moving average of single-day RRPK averages is calculated, both of these numbers are published as indices. Each single-day RRPK average, calculated on day T+1, represents Itineraries whose first flight took off on date T. Each single-day RRPK average is itself a weighted average of six RRPK averages, each one representing the average RRPK for spot Itineraries with a specific number of flights (from one to six). The single-day average RRPK of Itineraries containing a given number of flights, L, is calculated using the following formula:

$$RRPK_{L,T} = \frac{\sum_{n=1}^{N_{L,T}} (\text{ticket price}_n * FX_I)}{\sum_{n=1}^{N_{L,T}} (\text{ticket km}_n)}$$

where:

- $N_{L,T}$ is the number of issued eligible tickets:
 - having been booked within the Spot Window appropriate to the region and date T,

- having L flights,
- the first of which takes off on date T,
- ticket price and ticket km refer to tickets which were successfully matched and retained as described in sections 3.2 and 5.1.
- Where necessary ticket prices are converted to USD using FX_i (where i denotes the conversion pair to convert from the original price currency to the index's base currency of USD), the ECB rate for the local date of ticket issuance. Where the ECB rate is unavailable for a given day, the BOE rate will be used. Where neither rate is available, the most recent rate out of either ECB or BOE rates will be used.
 - The ECB rate is the reference rate usually updated around 16:00 CET on every working day, except on TARGET closing days. They are based on a regular daily concertation procedure between central banks across Europe, which normally takes place at 14:15.
 - The BOE rate is the indicative middle market (mean of spot buying and selling) rates as observed by the Bank's Foreign Exchange Desk in the London interbank market around 4pm.

Each region's single-day average RRPK for date T (Daily Index) is then calculated using the following weighted average formula:

$$RRPK_T = \frac{\sum_{L=1}^6 (RRPK_{L,T} * km_{L,T})}{\sum_{L=1}^6 (km_{L,T})}$$

where $km_{L,T}$ is the total RPK to be delivered in fulfilment of all eligible tickets for the region:

- having L flights
- the first of which takes off on date T
- regardless of whether the ticket was successfully priced.

The 28-day moving average (28 day moving average index) is then calculated using the following formula

$$RRPK_{T,28} = \frac{\sum_{n=0}^{27} (RRPK_{T-n})}{28}$$

5.3 Index Divisor Calculation for Skytra Price Indices

Each index has a unique index divisor that is adjusted to maintain the continuity of the index's values across changes due to Events. The index divisors begin at a value of 1.0 on the start date of the index, and are re-valued, when required, as follows:

$$D_T = D_{T-1} \frac{RRPK_{T,28,with\ event}}{RRPK_{T,28,without\ event}}$$

where:

- D_T = divisor at time T
- D_{T-1} = divisor at time T-1
- $RRPK_{T,28,with\ event}$ = the 28-day moving average RRPK for the region at time T, including the event data
- $RRPK_{T,28,without\ event}$ = the 28-day moving average RRPK for the region at time T, excluding the event data

The divisor for each index is then used to create the final daily index as follows:

$$Index_{T,daily} = \frac{RRPK_{T,daily}}{D_T}$$

The 28 day moving average RRPK will continue to be produced as a function of the published daily index.

REVERSION OF A DIVISOR

If in the subsequent 30 days of a divisor modification as a consequence of a data event, the cause of that event gets reversed the divisor shall return to its original value. Examples of this dynamic are.

- The loss of data for an airline and subsequent inclusion of its data
- The removal of a country

5.4 Specificities of the Skytra World indices

The Skytra World Indices are designed to measure the average economy price across the six other Skytra Index pairs listed in chapter 1.2 either on a daily basis or as a 28 day rolling average. The Skytra - World - economy class Price index – daily is thus calculated as the mean of the other 6 daily economy class daily indices, with each being weighted for the number of observed RPKs delivered in each market. The 28 day rolling average is derived in the same way as for the other indices, the RPK weighted average of the previous 27 days and the current day.

5.5 Measures to deal with corrections to the determination of the benchmark

Skytra has a number of measures in place to deal with corrections to the determination of the benchmark where the benchmark has already been published. The measures used are tailored to the circumstances of the correction required. Skytra will use its discretion with regards to the corrections in accordance with the following rules:

Errors detected on the day of publication:

Where Skytra publishes an index and on the same day detects that the index has been calculated incorrectly (whether due to data or calculation errors), Skytra will always republish if the error has a greater than 0.1% impact on the value of the determined rate. All users will be informed as soon as any republication is made.

Errors detected after the day of publication:

Where Skytra detects an error in the value of the rate on any day post publication, Skytra will not republish the rate for that day, or any other published day. However, Skytra will use the correct rate for the past day in the ongoing calculation of the rates (as they are a 28 day rolling average).

Long term errors:

Where an error has been detected that impacts upon three days or more of the index calculation, Skytra's will decide on how to manage this scenario. Skytra's decision will be reviewed in the next SIOC.

Benchmark determinations based on suspected market abuse:

Irrespective of when an index is published, should Skytra deem that an index value is based upon suspected market abuse, it will take the following actions:

- Assess the materiality of the impact on the value of the benchmark(s) to determine if the suspected market abuse was attempted or actual
 - If attempted, there would be no impact on the rate so no need to republish

- If actual, Skytra may re-evaluate and republish the index
- Skytra submit a STOR to the FCA as per the Surveillance Policy and Procedures

6.0 EVENTS AFFECTING SKYTRA PRICE INDICES AND SKYTRA INDEX DATA

Skytra Price Indices are designed to reflect the wholesale price of air travel per km flown by an individual passenger in identified markets both regional & interregional in economy class (including low cost, very low cost etc), and thus relates to issued Itineraries whose first flight takes off on the given Index Day. As such, Skytra Price Indices' treatment of Events is designed to ensure, where appropriate, that an index's value follows changes in Price due to specific Events that arise beyond the introduction or termination of ticket issue and offered price data. Such an approach allows the value and hence the performance of the index to remain representative and comparable through time.

6.1 Economic Events

Economic Events are those which are driven by a change in the real-world economic activities of airlines and their customers, for reasons either within or outside their control. This is in contrast with Data Events (refer to section 6.2), which are those where Skytra's access to input data (i.e. information about ticketing and prices) changes, without the underlying economy itself changing.

The Skytra Price Indices are intended to follow the Economic Events, and do not require intervention during an Economic Event. The (non-exhaustive) list of Economic Events below describe some possible outcomes:

6.1.1 Seasonal Changes in Prices or Special Offers

Airlines market tickets for different flights at different prices. Normally, daily, weekly and annual cycles are observable. Tickets are often marketed at higher prices for days with higher expected demand. These changes in price may be gradual or abrupt. Skytra's Price Indices will not be adjusted as a result of any such price changes, so any increase in pricing will reflect the higher prices. Likewise an Airline may offer heavily discounted tickets as a special offer and again Skytra's price indices will not be adjusted as a consequence, so the lower prices will be reflected in the indices.

6.1.2 Natural Disaster or Political Event

A natural disaster, such as a volcanic eruption or epidemic may cause consumers to choose not to book or airlines to reallocate capacity. Likewise a conflict or terrorist incident may have similar consequences. In such situations, the indices are intended to reflect the changing balance of supply and demand and thus pricing in the region or regions affected. This means that any changes in the price of air travel will be reflected in the Skytra Price Indices. Any Event that is persistent and particularly disruptive to the industry as deemed by the Skytra Executive Committee will be managed as per §7.

6.1.3 Airline Events

A number of Airline events are also possible, none of these would give rise to a revision or rebasing of the Skytra Price Indices.

- Merger or Acquisition of an airline
- Bankruptcy of an airline
- Closure of Airports
- Strikes affecting airlines

6.1.4 Observation of new airports and new operating carriers

For the purpose of ensuring the comparability of the index, tickets are only considered for indexing if they are between a predetermined list of airports and operated by one of the carriers on a predetermined list. These lists are both contained in the "Skytra Price Indices, Indexable Airports and Airlines lists" available separately from Skytra. Skytra will maintain and update this list on a regular basis considering section 6.2 of this document.

6.2 Data Events

Skytra receives input data from Contributors of both pre- and post- transaction data (also referred to as offered or ticketed data). As these Contributors evolve and grow their businesses, the quantity of data received may grow. The addition over time of further data is generally desirable if such data can be verified and validated. Similarly, should the volume or quality of data received from Contributors no longer meet the minimum requirements outlined in section 4.2, Skytra will consult with its customers and its SIOC on the incorporation of data from further data Contributors.

As airline industry participants (e.g. airlines and travel agents) undergo change (grow/shrink/start/stop operations), any changes to index values that arise as a result of such changing data volume are considered to reflect the market that Skytra seeks to measure.

Both pre- and post-transaction data Contributors have several data input feeds themselves. Thus, it is possible that portions of data may become available or unavailable for inclusion in the Skytra Price Indices over time. It is conceivable but unlikely that the inclusion or exclusion of new data could influence the value of the Skytra Price Indices, if the data concerned was skewed towards high or low prices and particularly voluminous. These changes will be measured and assessed and, if required, consulted on as per the normal Skytra consultation process.

Should there be any unplanned changes (e.g. should the Contributors add in additional data sources without Skytra's prior knowledge), Skytra would consider these changes to reflect underlying market behaviour. In such circumstances, where the impact on a Skytra Price Index is material (see below), Skytra will use its discretion to apply divisors as described in section 5.3 to manage these Events going forward but not retrospectively. By removing the material influence on Skytra Price Index values resulting from the introduction or termination of such data feeds would retain the benefit of incorporating greater data volume over time and protect the indices from any data loss.

The SIOC will review data events and how they were managed at each committee meeting.

6.2.1 Data Insertion

Any data supplementing the pre- or post-transaction contributions that conforms to the requirements laid out in section 3.1 may be considered eligible for inclusion in the Skytra Price Indices. The impact of the addition of new contributions shall be analysed as described below and, if considered to be a Material Impact, implemented with SIOC oversight.

The inclusion process to be followed prior to consultation is as follows; the relevant indices will be analysed both with and without the new data incorporated over a period of thirteen weeks (91 days) in order to determine whether the inclusion of the new data introduces a Material Impact to index values.

A Material Impact, in respect of a regional Skytra Price Index undergoing a Data Event, is identified by comparing the 91 daily RRPK Index values (not 28 day moving average) produced from data *inclusive* of the Data Event versus the same 91 values produced from data *exclusive* of the Data Event. A change is only considered material if the average values of the daily RRPK Index values deviate by more than 0.1%. Further, a change is only considered material if either:

- more than 48 of the 91 daily RRPK Index values produced from data inclusive of the Data Event are *higher* than the equivalent values produced from data exclusive of the Data Event, or
- more than 48 of the 91 daily RRPK Index values produced from data inclusive of the Data Event are *lower* than the equivalent values produced from data exclusive of the Data Event.

The results of this work will form the basis of the aforementioned recommendation for both the inclusion of the data into the indices and any adjustment to the associated divisor. If the

recommendation is to be implemented then notices will be published on the Skytra website and via direct communication to licensees, describing the addition the analysis and timetable for implementation. The analysis, recommendation and the details of implementation will be reviewed by the SIOC at the next committee meeting.

6.2.2 Data Loss or Exclusion

Skytra monitors daily the volume of data both received and matched in order to ensure that the criteria detailed in section 4.6 are met. The minima are defined for 28 day periods and should over the course of several days it appear that an insufficient volume of data will be captured or other information suggest that insufficient data be captured then a similar process as for the inclusion of data will be followed.

A theoretical retrospective analysis will be performed and a study comparing thirteen weeks of historical index values with and without the data set, that is being lost or excluded, will be performed and again a divisor will be calculated if over this period the exclusion of the data introduces a Material Impact to index values (as described above). The analysis and actions taken as a result of such data loss will be presented to the SIOC for review before any changes are published by way of Notice to licensees and on Skytra's website. Should Skytra discover that it may lose access, or already has lost access, to some data being used to manage or calculate its Indices, without advance notice, the same process will be followed as quickly as reasonably practicable, and any changes following SIOC's review will be made from the date of approval but not retrospectively.

Should the Skytra consider that the data received from a Contributor is of a consistently poor quality, the same analysis will be performed and the same review and approval process adopted for changing the data source or Contributor.

The above sections cover partial changes to data. The following rules cover complete loss of pre- or transacted data for various time periods.

6.2.3 Loss of Data Feed

In the event of a complete (temporary or permanent) loss of a transacted Itinerary or offered price data feed, Skytra Price Indices would be calculated on the basis of the priority of input data as described in section 3.0. Skytra may use its discretion to apply a divisor to the calculation. However, should the priority of input data be insufficient to calculate the Indices according to the quantity and quality thresholds in section 4.6, Skytra may use its discretion to use other comparable data sources that are readily available to Skytra.

If any of the Events described in this section 6 arise, Skytra will issue a Notice to licensees and to the Skytra website that advises of the problem.

6.2.4 Information System Resiliency

The Skytra BA application has been developed on the Google Cloud Platform (GCP) as a serverless solution which is high performing, auto-scaling and resilient by design. The minimal infrastructure foot print is deployed in a redundant primary/secondary configuration and all data is replicated and backed up using Google's Cloud Storage solutions to ensure full geo-redundancy.

6.2.5 Index Representation

Skytra will continually review the performance and behaviour of each Skytra Price Index in order to ensure the index remains representative, and will regularly update the SIOC accordingly.

7.0 EXTREME MARKET EVENTS

If Skytra considers the valuation of its indices, or investability and tradability in associated index based products would be impaired by an Event, Skytra may take whatever action it deems necessary to protect the interests of users of its indices subject to the index or indices remaining representative of the economic interest that they are designed to measure. Skytra will publish a notice to users through the Skytra website, direct communications to licensees. . The SIOC will review the action(s) taken at its next meeting.

8.0 SKYTRA PRICE INDICES - OPERATIONAL ELEMENTS

8.1 Changes to Skytra Price Index Rules and Methodology

Skytra will present any Material Changes to its Rules to the SIOC for discussion. Material Changes will be consulted more widely on the proposed change(s), as detailed in section 4.2 of this document.

8.2 Recalculation of Skytra Price Indices

Refer to section 5.4 for rules regarding the recalculation of indices due to errors.

8.3 Index Opening and Closing Hours

Skytra Price Indices will be calculated for every day of the year and published on London Business Days (Monday to Friday excluding UK public holidays), unless specified in the relevant Schedule(s). The Skytra Price Index values, including any values calculated on preceding non business days e.g. weekends and public holidays, will be published to the market at 1400 local London time (UTC+1 when the UK is on BST & UTC otherwise).

If for any reason Skytra is not able to calculate an index or indices for publication at the planned time a Notice will be issued and placed on the Skytra website detailing when indices will be published and the reason behind the non publication.

8.4 Raising Objections

Complaints in relation to Skytra Indices are handled in accordance with Skytra Complaints Policy.

8.5 Further Information

For further information see <http://www.skytra.com> or contact Skytra Price Index client services at IndexInfo@Skytra.com.

9.0 SKYTRA PRICE INDICES – GLOSSARY OF TERMS

9.1 Skytra Price Indices

Skytra Price Indices use, where appropriate, standard airline industry terminology to define the criteria and parameters used in these Rules. These together with other terms are defined in this section.

Term	Definition
AIR MILES	Air miles are points that a passenger can collect when they buy certain goods or services and which can be used to pay for air travel and other goods and services.
BMR	EU Benchmarks Regulation
EVENT, DATA	Data Events are those where Skytra’s visibility on the underlying economy (i.e. information about ticketing and prices) changes, without the underlying economy itself changing.
EVENT, ECONOMIC	Economic Events are those which are driven by a change in the real-world economic activities of airlines and their customers, for reasons either within or outside their control.
EXCO	Skytra’s Executive Committee, which has responsibility for the performance of Skytra’s BA activities. The ExCo forms part fo Skytra’s governance model, reporting into the Skytra board.
FIRST FLIGHT DATE	First flight date is the date on which the first flight of an itinerary is due to take off.
GDS	Global Distribution System. A third-party commercial service which acts as a marketplace, making airline tickets available to travel agents, specifically acting as a conduit between airlines and travel agents, for marketing and booking purposes. There are 4 main GDSs globally: Amadeus, Sabre, Travelport and Travelsky.
INDEX DAY/DATE	Index date is the date referenced by an index in order to index a single day. An Itinerary must have a first flight date (UTC) equal to the index date in order to be included in the index for that index date.
ISSUED	When an airline receives the payment or a passenger redeems miles/points, a ticket is issued which is linked to the reservation which allows the passenger to travel. Traditionally reservation/booking and issuance were separate steps but it is now more common to require immediate payment at the time of reservation.
ITINERARY	The full sequence of flights including, for each flight, origin and destination airport codes, departure date and time, included within a transaction for one person. Applies to actual issued transactions and offered transactions. An itinerary can be broken down into one or more packages.
MATERIAL CHANGE	A change to the Rules and Methodology described in this document which would lead to a different rate being calculated from the same input data for any of the Skytra Price Indices
MATERIAL IMPACT	With regards to a change in the values of a Skytra Price Index, a Material Impact has the definition as given in section 6.2.1. A Data Event causes a Material Impact if the deviation of the average of index values (across the 91-day test period) is greater than +/-0.1% and either the number of index values impacted positively by the Data Event exceeds 48 out of 91

	or the number of index values impacted negatively by the Data Event exceeds 48 out of 91.
PACKAGE	For offered data, a package is a bundle of flights within an offered Itinerary which could be purchased separately from the rest of the itinerary, in that a price is identified for that bundle. An offered Itinerary will contain one or more packages. For issued data, no packages are pre-identified but the matching algorithm breaks Itineraries into possible packages in order to enhance matching.
REGION	Africa, Asia/Pacific, CIS, Europe, Middle East, Latin America, North America
REGION-PAIR	The combination of two regions, which are dictated by the regions of the origins and destinations of flights in an itinerary. There can be inter-region (e.g. EU-NA) and intra-region pairs (e.g. EU-EU).
RPK	Revenue-passenger-kilometre. One RPK is the delivery of one km of air travel to one paying customer.
RRPK	Revenue earned per RPK. The revenue earned by an airline in return for the delivery of one RPK. Also called Yield. In the order of 2cents to 20cents per km.
RULES	The Rules governing the calculation and operation of the Skytra Price Indices as stated in the Rules and Methodology document.
SIOC	Skytra Index Oversight Committee. SIOC's purpose is to provide advice and challenge to Skytra with regards to the management of the Indices.
SPOT WINDOW	The spot window is defined by "lead time", which is the number of days between ticket issuance (local to place of issue) and flight date (local to place of take-off) of the first flight in the Itinerary. Spot windows are designed to capture a large part of the sales by number and by revenue, whilst representing "prompt" purchases and eliminating erratic immediate pricing. A ticket's lead-time must be within the Spot Window appropriate to the region-pair in order to be included in the index calculation.
VENDOR, DATA	Companies that specialise in selling data aggregated by various means and from various providers, which cover particular industries & markets and offer data on certain factors evolution, trends, customer insights, etc.
VENDOR, TICKET	Entities that can offer tickets for sale, which could either be airlines that offer tickets for sale directly or GDSs that facilitate tickets for sale offering for airlines.
WHOLESALE PRICE	Wholesale price is the price that an Agent pays to an airline for a ticket on behalf of a customer. Based on offered prices, inclusive of fees and taxes to the airline but exclusive of Agent fees/margins, not subject to any specific Agent discount.

SCHEDULE A – SKYTRA PRICE INDEX SERIES

A.1 Skytra Price Index Series Coverage

Skytra Price Index Series comprises the following twelve inter- and intra-regional indices

Skytra - Asia Pacific/Asia Pacific - economy class Price index - daily

Skytra - Asia Pacific/Asia Pacific - economy class Price index - 28 day moving average

Skytra - North America/North America - economy class Price index - daily

Skytra - North America/North America - economy class Price index - 28 day moving average

Skytra - Europe/Europe - economy class Price index - daily

Skytra - Europe/Europe - economy class Price index - 28 day moving average

Skytra - Asia Pacific/Europe - economy class Price index - daily

Skytra - Asia Pacific/Europe - economy class Price index - 28 day moving average

Skytra - Asia Pacific/North America - economy class Price index - daily

Skytra - Asia Pacific/North America - economy class Price index - 28 day moving average

Skytra - North America/Europe - economy class Price index - daily

Skytra - North America/Europe - economy class Price index - 28 day moving average

A.2 Specific Skytra Index Qualification Criteria

Skytra Price Index

Each Skytra Price Index listed in section A1 is created and managed under these Rules. The individual index values are calculated using an identical method for each region the only difference is that the origin & destination Airports deemed eligible for the relevant series.

The Skytra Price Indices are non directional so, for example, both an Itinerary originating from an Airport in Europe with a final destination in North America and an Itinerary originating from an airport in North America with a final destination in Europe will contribute to the North America/Europe Index.

The Skytra Price Indices are calculated using only those Itineraries which fall within the Spot Window for the appropriate region pair. The Spot Window is a period of 28 days preceding (but not immediately preceding) the first flight date (UTC) of the Itinerary (the Index Date), during which the ticket must have been issued in order to qualify. For Itineraries whose Region-Pair excludes North America (i.e. Asia Pacific/Asia Pacific, Asia Pacific/Europe and Europe/Europe), the Spot Window begins 30 prior to the Index Date, and ends 3 days prior to the Index Date.

The table below illustrates the weekly schedule of the last day of the Spot Windows, the Index Date & the Index Publication Days for non-North America markets.

Week Day							Legend
TU	W	TH	F	SA	SU	M	Index Day (first flight date of Itinerary)
W	TH	F	SA	SU	M		Index Publication Day
TH	F	SA	SU	M			Last Day of Spot Window
F	SA	SU	M	TU			
SA	SU	M	TU	W			
SU	M	TU	W	TH			
M	TU	W	TH	F			

For Itineraries whose Region-Pair includes North America (i.e. North America/North America, Asia Pacific/North America and Europe/North America), the Spot Window is also 28 days long (inclusive) but the position varies according to the day of the week (due to the speed of data availability).

The table below illustrates the weekly schedule of the last few days of the Spot Window, the Index Days & the Index Publication Days for regions-pairs which include North America.

Week Day								Legend	
SU	M	TU	W	TH	F	SA	SU	M	Index Day (first flight date of Itinerary)
M	TU	W	TH	F	SA	SU	M		Index Publication Day
TU	W	TH	F	SA	SU	M			Last Day(s) of Spot Window
W	TH	F	SA	SU	M	TU			
TH	F	SA	SU	M	TU	W			
F	SA	SU	M	TU	W	TH			
SA	SU	M	TU	W	TH	F			

Skytra will follow the same Index publication approach for holidays, meaning that if a Skytra Price

Index Index Publication Day coincides with a Bank Holiday, the index will be published on the next working day. The first table below illustrates the bank holiday schedule for 2020 & 2021, while the second table depicts an example of the index publication schedule based on the North America on the occasion of one UK Bank Holiday day, which can be extended to more than one consecutive bank holidays.

Bank Holidays										
2020	01-Jan	10-Apr	13-Apr	08-May	25-May	31-Aug	25-Dec	26-Dec	27-Dec	28-Dec
2021	01-Jan	02-Apr	05-Apr	03-May	31-May	30-Aug	25-Dec	26-Dec	27-Dec	28-Dec

Week Day									Legend
SU	M	TU	W	TH	F	SA	SU	M	Index Day
M	TU	W	TH	F	SA	SU	M		Index Publication Day
TU	W	TH	F	SA	SU	M	TU		Last Day(s) of Spot Window
W	TH	F	SA	SU	M	TU			Bank Holiday
TH	F	SA	SU	M	TU	W			
F	SA	SU	M	TU	W	TH			
SA	SU	M	TU	W	TH	F			

APPENDIX I – CHRONOLOGY OF CHANGES TO RULES

Since first published in February 2020, the following changes have been made to Skytra Price Index Rules and Methodology.

Rule Changes - applied 22/10/2020 v2.0

- **Section 3.0, Index constituent data updated to capture further exclusions.**
- **Section 3.2, ticket matching approach and prioritisations updated**
- **Section 4.6 minimum number of itineraries updated to lower levels following observation of traffic during the COVID19 crisis.**
- **Section 5.1 implementation of a cross referencing mechanism between data sources, validating prices to be used in indices.**
- **Section 5.2 update to divisor implementation mechanism**
- **Section 6.1.4 addition referring to Skytra Price Indices Indexed Airports and Operating Carrier lists**

Formalism Changes – applied 12/11/2021 v2.2

- **Section 2.1, Skytra IS a regulated benchmark administrator**
- **Section 4.3, Ongoing validation, partial redraft to capture data validation controls at input, intermediate and output levels.**
- **Section 3.0, There are some circumstances when it may not be appropriate to use the waterfall approach, for example if the loss of data is limited in scope and duration, in these circumstances the data event procedure will be followed as described in section 6.2.**