

ATSLab internship report – draft 1

Subject: Analyzing the factors influencing the opening of direct long-haul flights on the Transatlantic market.

Table of Contents

I) Data used.....	2
II) Analysis of how routes were opened in the past.....	3
II.A) Evolution of the number of routes from 2000 to 2023.....	3
II.B) Waterfall graph detailing the variation of the number of routes.....	4
II.C) Contribution of new routes to seats offer.....	6
II.D) Opening route duration.....	8
II.E) Outcomes for opening routes operating fewer than 3 years.....	9
Appendix 1.....	11

I) Data used

Schedule data: A dataset spanning from 2000 to 2023, organized by year and directional airport pair, including the operating carrier and aircraft information. It contains the number of seats, flights, and flight hours for each route. Note that aircraft data is missing for some flights between 2000 and 2008.

City metrics: Data aggregated at the metropolitan level, covering the years 2010 to 2015. It includes population figures, household income per capita (reported both in local currency and USD 2015), and other relevant city attributes. Some entries may have incomplete information.

Airport metrics: A dataset detailing various characteristics of airports, such as geographical information (time zone, world region, is island), technical specifications (number of runways, elevation in feet, length of the longest runway), and proximity metrics to the nearest major city (distance in kilometers, driving distance, driving time).

Fleet lookup: A reference table listing aircraft by ICAO/IATA codes, including seat capacity estimates, manufacturer, internal size classification, ATI size classification, global model names, payload capacities, and engine types.

Airport lookup: A mapping table that links airport codes to airport names, countries, regions, and geographic coordinates (latitude and longitude).

II) Analysis of how routes were opened in the past

By routes, I mean airport pair regardless of the airline/carrier on it. Routes will be considered directional (i.e., JFK → CDG is not the same as CDG → JFK), unless otherwise specified.

In the following section, all graphs will be divided into three categories (which I will call sub market after): INTER, INTRA_EUR and INTRA_US. INTER refers to international routes between the US and Europe, while INTRA_EUR and INTRA_US refer to domestic routes within Europe and within the US, respectively. I decided to keep these three view in order to check whether trends in the domestic markets may influence the international market.

Note: Some of the graphs may not be directly tied to the main objective of analyzing the factors, but I felt it was worthwhile to look at how routes were opened to spot potential patterns and build some intuition.

II.A) Evolution of the number of routes from 2000 to 2023

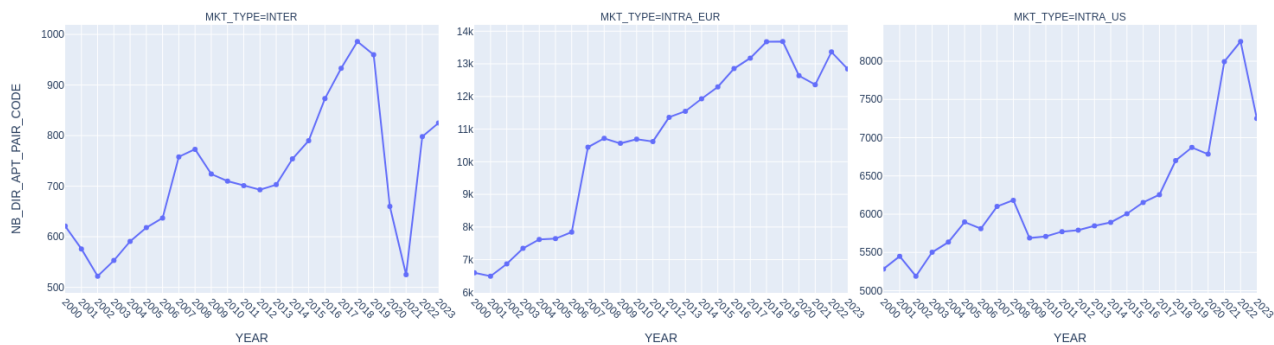


Figure 1: Evolution of the number of routes between 2000 and 2023

The graphs above show the evolution of the number of routes by sub market between 2000 and 2023. Focusing on the international view, we can see that it is quite sensitive to major crisis (9/11, subprime, covid) represented by a decline in the number of routes offered. However, in each case, the market recovered within a few years.

In the absence of crisis, the number of routes increases steadily. For example, the 2012-2019 period seems to be a good period to do more analysis. Between 2006 and 2007, there was a sharp increase in both the international market and the domestic Europe. This increase is likely linked to the Open Skies Agreement (signed in 2007 and in applied in 2008), which allowed airlines more operational freedom. And for Europe specifically, the rise can be also driven by the expansion of low cost carriers during that period.

Zoom on the international market depending on the direction (EUR → US or US → EUR)

For the international market, I wanted to assess whether there is any asymmetry depending on the direction of travel. In terms of the number of routes, the graph below suggests that volumes are generally balanced in both directions. However, some differences occurred in 2002 and 2006. The gap in 2002 may be explained by bilateral restrictions combined with the post-9/11 downturn in the U.S., which reduced the number of Americans traveling abroad (I suppose). As for 2006, the difference could be linked to U.S. airlines anticipating the Open Skies agreement, while the sharp increase between 2006 and 2007 likely reflects the response of European airlines to this agreement (not sure about that).

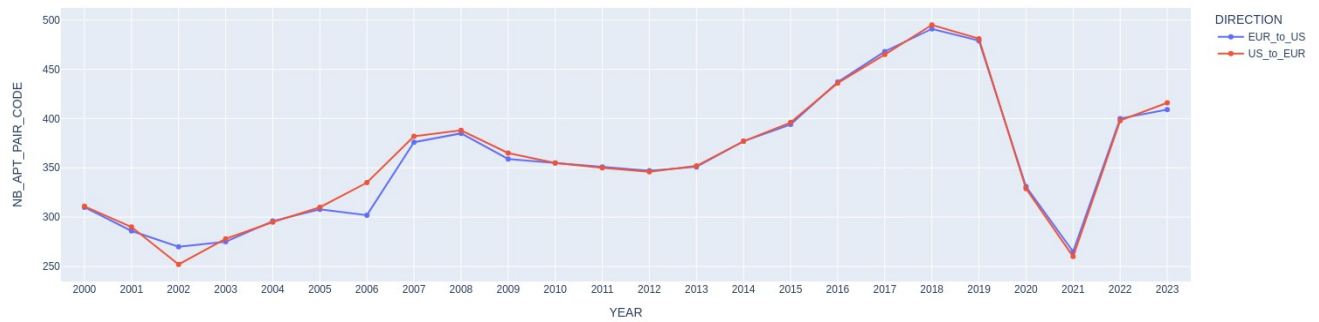


Figure 2: Evolution of the number of routes depending on the direction for the international sub market

Finally, I wanted to check whether, in general, an airport pair is offered in both directions. The graph below shows the number of routes available in only one direction (as indicated by the color). In the past, specifically in 2002, 2006, and 2010, there was some asymmetry, although it was relatively minor compared with the total number of routes. Since 2011, however, the situation appears to have stabilized, with very little asymmetry, indicating that most routes are now offered in both directions (considering only the existence of the service, not its frequency).

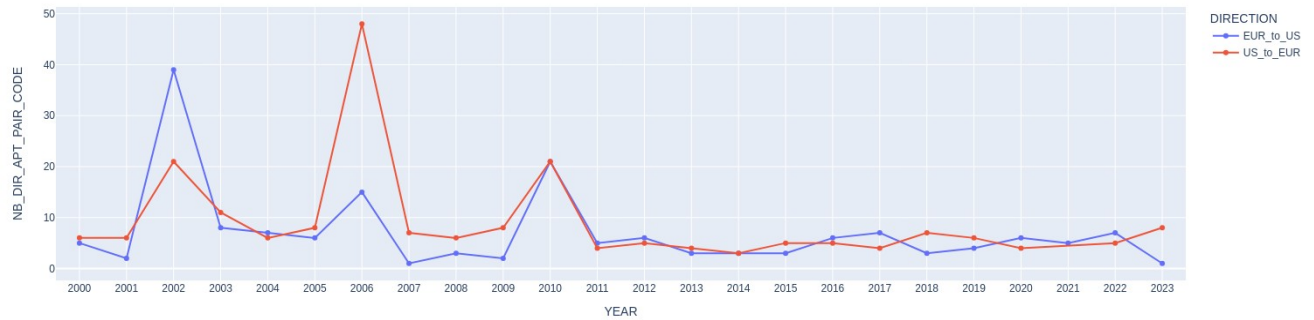


Figure 3: Number of routes existing in one direction only for the international sub market

II.B) Waterfall graph detailing the variation of the number of routes

To analyze changes in the number of routes, I classified them into 4 categories:

- **OPENING_RTE** : routes that have never existed before,
- **REOPENING_RTE** : routes that operated in the past but not in the previous year (or longer),
- **ENDING_RTE** : routes that have closed permanently,
- **BREAK_RTE** : routes that will not operate the following year but will reopen in the future.

This visualization is intended to assess whether route openings and closures are dynamics or remain relatively statics over time.

Zoom on the international sub market

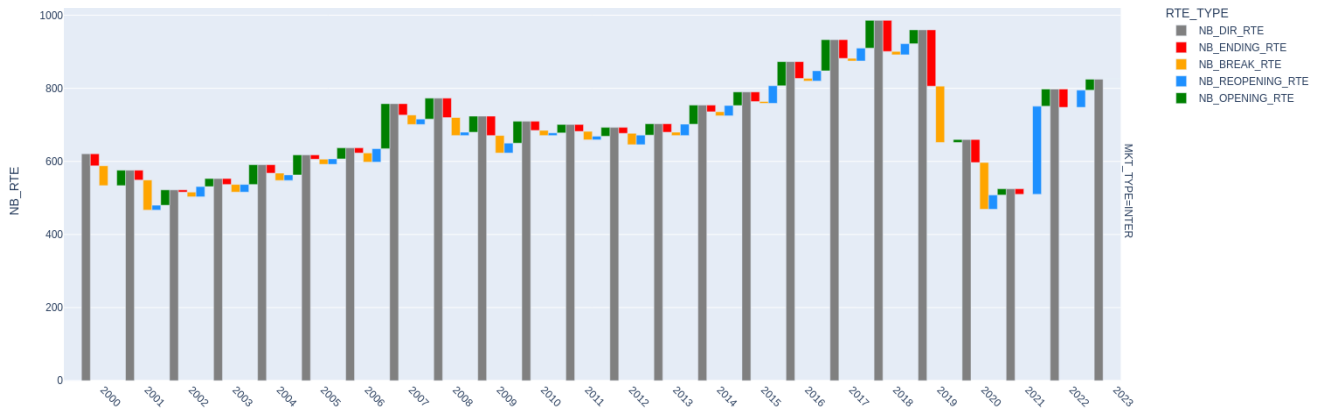


Figure 4 : waterfall chart showing the route count dynamics in the international sub market

Looking at the graph above, we can see that route openings and closures tend to be more dynamic during periods of crisis or major events (such as the 2007 launch), but generally remain fairly stable. Between 2002–2005 and 2012–2019, variations were neither sudden nor particularly significant, representing less than 10% of total routes in most cases. Another pattern is that variation tends to grow over time: right after a crisis, changes are limited, but as time passes, more openings and closures occur. For example, in the 2012–2019 period, the number of changes was low at the start but increased toward the end. Finally, the number of routes taking a temporary break is lower than those ending permanently, suggesting that when a route is discontinued it is generally not reintroduced in the future.

Zoom on the other sub market

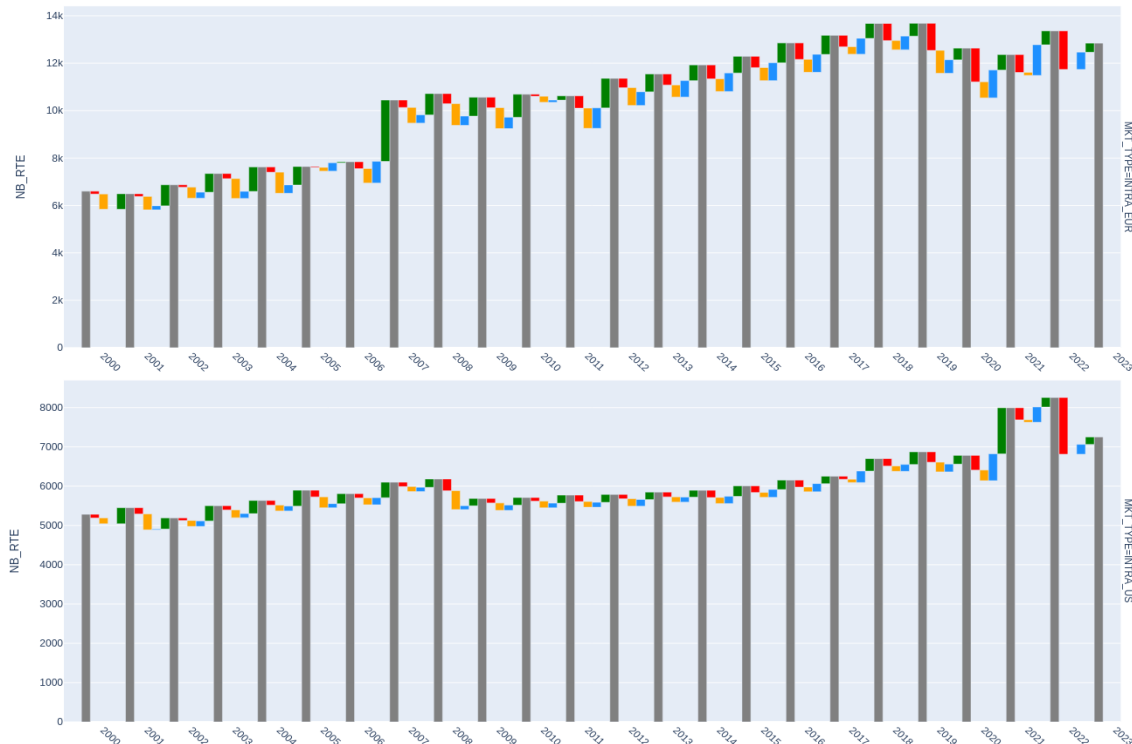


Figure 5 : waterfall chart showing the route count dynamics in the European and the American sub market

For both the European market (first figure) and the American market (second figure), the trends are similar to those observed in the international sub market. Both appear less sensitive to crises, showing little or no change during such periods. In the European market, the impact of low-cost carrier expansion is visible between 2006 and 2007.

In the American market, variations are very steady and consistent over the years, with similar volumes of route openings, closures, reopenings, and breaks. These represent only a small share of the total number of routes, indicating that this market (at least in terms of connectivity, regardless of airline competition) is mature.

The European market shows slightly larger variations, though still far from representing the majority of routes. Unlike the international sub market, route breaks and reopenings are more dynamic here and occur in roughly equal proportions to openings and closures. Moreover, this dynamic has remained stable over time, without the gradual increase seen in the international market.

Note: The sharp increase in route openings in 2020 for the American market is likely due to some data errors, which need further investigation.

II.C) Contribution of new routes to seats offer

From the previous graphs, we saw that, in terms of the number of routes, variations represent only a small share. It is also interesting to examine the market in terms of seats: how many seats do newly introduced routes add over time?

The graphs below show, for each year, the proportion of seats by the route's opening year (grouped), normalized by year (a non-normalized view is provided further below). For example, all seats on routes opened between 2001 and 2005 are shown in orange.

One key observation is that new routes contribute a larger share of seats than they do for number of routes. In the international and European sub markets, 70% of seats are on routes established in 2000 or earlier, while the remaining 30% come from new routes. In contrast, in the American sub market, only about 10% of seats are attributable to new routes. This confirms the previous observation (waterfall one), just as numbers of route openings and closures were relatively stable, the seat capacity associated with these changes is also fairly steady and does not represents a major share.

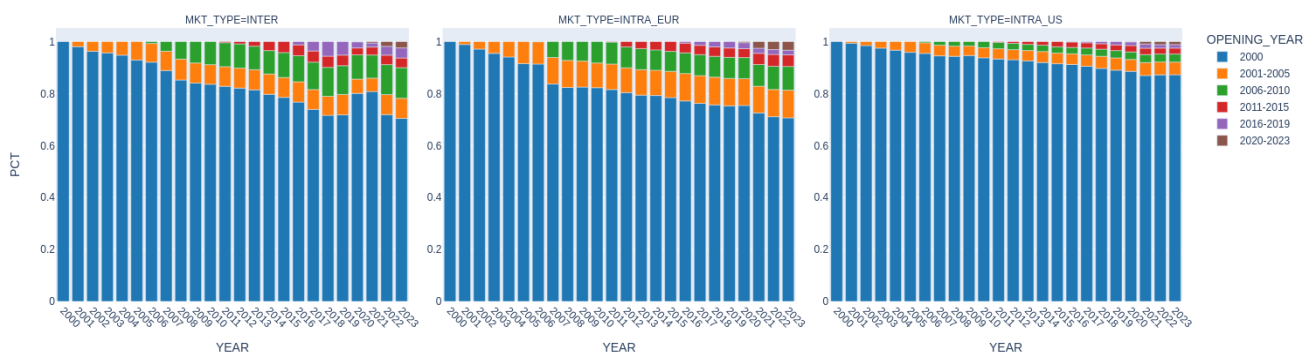


Figure 6: percentage of seats introduced by newly opened routes, grouped by opening year bin

If we focus on newly opened routes only, we observe that their share of total seats remains fairly constant over time. This means that once new seats are introduced, their proportion relative to the total does not change much. Looking at the non-normalized view, we can see a global consolidation or increase in seat numbers over time, but because this growth occurs across all the routes, the relative share stays constant.

Another point is that, although new routes contribute around 30% of total seats, not all years contribute equally. For instance, in the international and European markets, routes opened between 2001 and 2010 account for about 20% of seats. Over time, the share of seats offered by newly opened routes gradually decreases. This likely reflects market maturity, where route openings are no longer the main driver of growth. This pattern is even more pronounced in the American market.

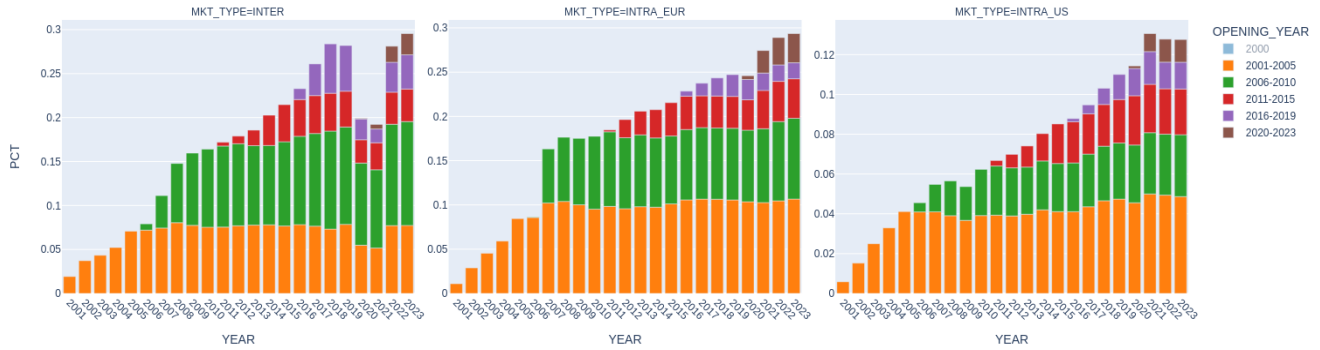


Figure 7: zoom of figure 6

View non-normalized

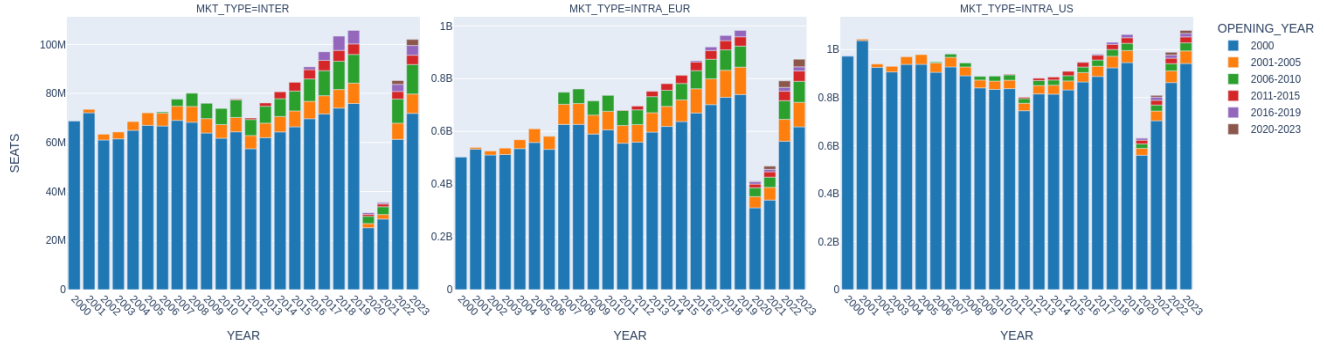


Figure 8: seats introduced by newly opened routes, grouped by opening year bin

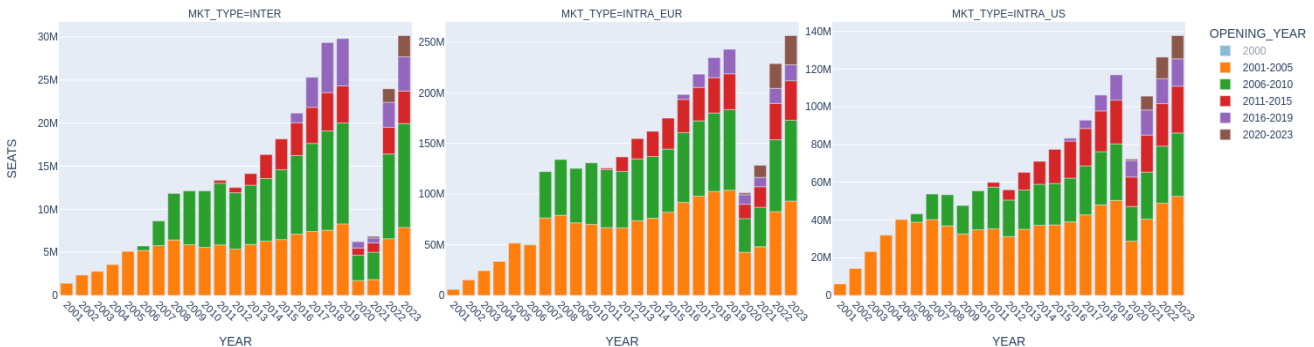


Figure 9: zoom of figure 8

II.D) Opening route duration

One important aspect to consider is the duration of newly opened routes. In some cases, airports or countries offer temporary price-reduction (for example, in the UK or Norway) lasting one, two, or three years. These measures aim to stimulate the market and encourage the launch of new routes. However, some of these routes may not remain in operation in the long term.

The graph below shows the distribution of the number of routes according to the number of consecutive years they remain open after their initial launch. By “number of years for the first opening,” I mean the count of consecutive years during which a newly opened route stays active.

I have excluded data from 2020 onwards due to the strong impact of COVID-19, which could bias the results. I did not exclude other crises (maybe I should).

It’s important to be aware of edge effects. For instance, a route opened in 2019 would appear to have only one year of consecutive operation, simply because of the time window considered. However, since such cases represent a small share of total routes, I chose (very arbitrarily) to keep them in the analysis.

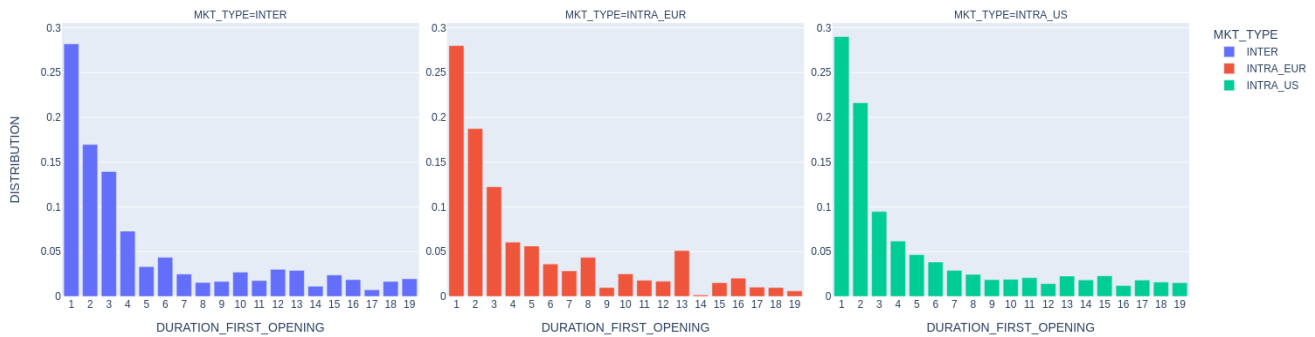


Figure 10: distribution of newly opened routes by the duration of their first launch

The distributions are similar across all sub markets. They show a decreasing trend, partly influenced by the edge effect. However, the strong concentration on the left indicates that most first openings last only one, two, or three years, and it becomes increasingly rare for routes to remain open longer. This pattern may be linked to the temporary price-reduction mentioned earlier, or to airlines testing new routes and evaluating their long-term viability.

One surprising observation concerns long-haul routes, particularly in the international market. I initially assumed these were more complex to launch, leading airlines to think twice before committing. The presence of a noticeable trial-and-error effect in this segment was therefore unexpected (if it is a trial-and-error effect).

From a cumulative perspective (graph below), we see that around 60% of routes remain active for no more than three years during their first opening, regardless of the sub market.

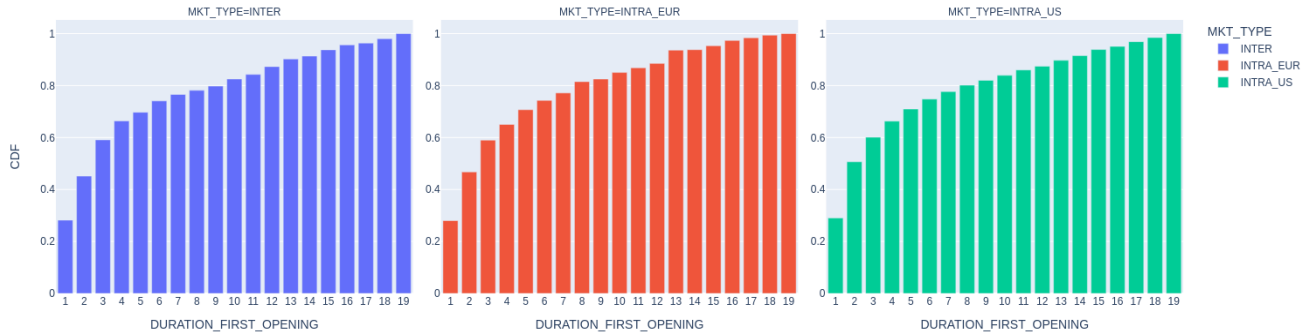


Figure 11: cumulative distribution of newly opened routes by the duration of their first launch

Some links:

- <https://avinor.no/contentassets/75e2fbe873a14ebba0bbbffd771f1088/avinor-guidelines-startup-aid.pdf>
→ aid from Avinor airports in Norway
- <https://assets.publishing.service.gov.uk/media/5a7e37bbe5274a2e8ab469a3/draft-protocol-start-up-aid.pdf> → aid in the UK

II.E) Outcomes for opening routes operating fewer than 3 years

As previously explained, we know that 60% of new routes close within their first three years of operation. The next question is: when these short-lived routes close, do they reopen later, or do they close permanently?

The graph below focuses on routes whose first operating period lasted up to three years. For these, we distinguish between two cases: the route was permanently closed and the route was paused and later reopened.

To avoid bias, the analysis uses only data from 2000 to 2019, excluding the COVID period. We also exclude this time the last three years of the dataset (2017–2019) so as not to misclassify routes whose status is still uncertain (not consistent with the previous part I need to check that).

Looking at the normalized results, in both the international and American sub markets, just over 60% of routes that lasted up to three years for their first opening were discontinued permanently afterward. In contrast, in the European sub market, the share is roughly balanced between permanent closures and later reopenings.

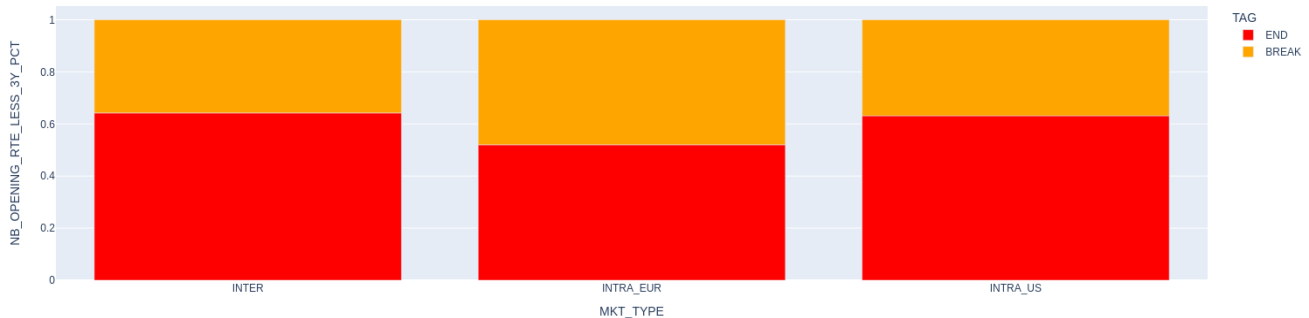


Figure 12: outcome (end/pause) of newly opened routes lasting up to 3 years

This suggests that the European market is more flexible in adjusting its route network, with a greater tendency to pause and later reopen routes compared with other sub markets.

The key takeaway is that most newly opened routes do not last long on their first attempt, and in the international market, more than half of them will never reopen afterward. This analysis is based on the number of routes, not their seats offer. Maybe that different perspective could show different patterns, as we've seen before.

View non-normalized

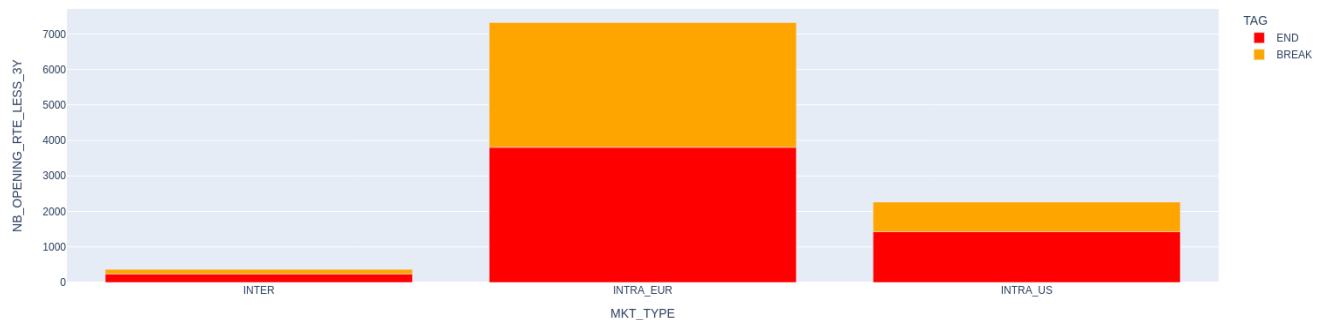
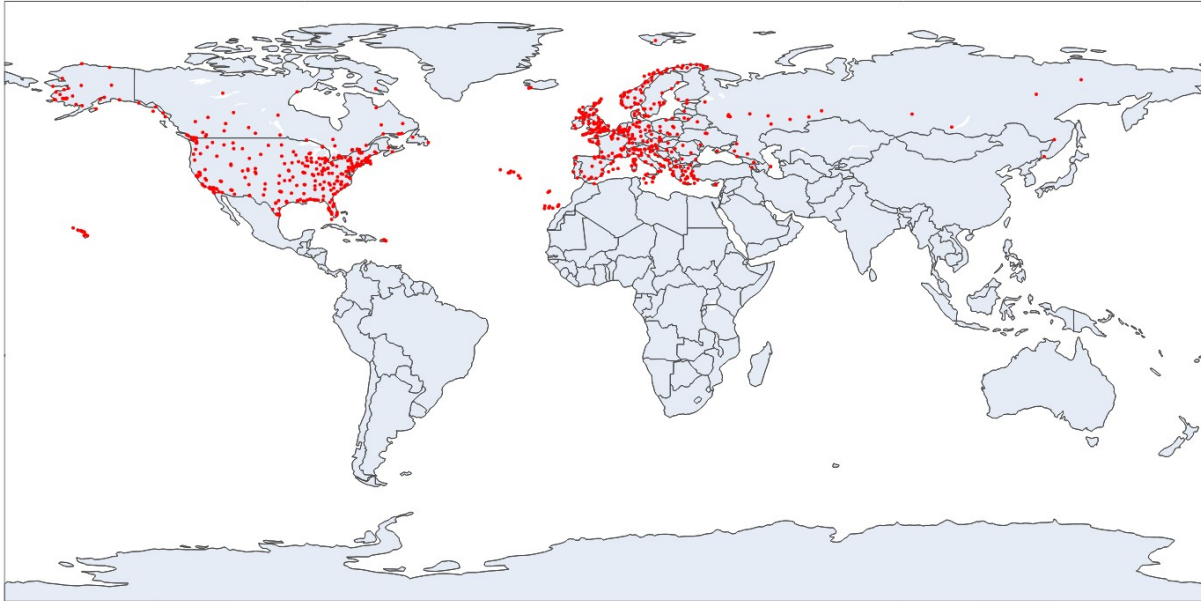


Figure 13: outcome (end/pause) of newly opened routes lasting up to 3 years, non-normalized view

In short:

- Mature markets see relatively few new route openings.
- The share of seats introduced by newly opened routes decrease over time.
- When they do open, they often don't last, especially for the international sub market.

Appendix 1



Just a world map with the airports I'm working with, in order to identify what is included in the European and American (more precisely North American) sub markets.