

What Strategy for European Airlines?

The Role of Frequency Distributions on Airline Strategies

Airline networks can be interpreted as systems that express strategic choices made by airlines to serve or not to serve given airports. Research into network strategies of airlines in the past has focused on economies (of density) and on market power. More recent research focuses on managerial decisions related to capacity choices, such as the frequency or scheduling of flights. Effects on the size and evolution of hub-and-spoke networks can be inferred from such choices. Other streams of research within the natural sciences characterize many networks not as random chaotic structures but as efficient complex formations. This paper will interpret European hub-and-spoke networks as complex networks in the sense of statistical physics and classify their structural components into distinctive frequency distributions. From the identified distributions, implications will be drawn for strategic management in air traffic and policy implications with regard to hub-and-spoke airlines.

By Hans Huber

The evolution of airline networks in our modern understanding appears to be driven by market forces, even if these forces are being subjected to regulatory constraints such as safety, traffic control, technical licences, etc. Strategic management has a tendency to prescribe what to do or not do to airline management. Although the role of strategy at a micro-economic (or firm) level is undoubtedly highly relevant, policymakers need to look beyond the limits of the firms and keep in mind the overall direction in which air traffic is expected to evolve in order to advance other goals, such as European integration for example.

Today, many observers agree that the invisible hand is not working very well in the airline industry, partly due to the many remaining structural barriers and to the lack of "objectivity" in measuring network evolution. Finding such a macroscopic, scientifically valid, perspective from inside the industry is not obvious, as policymakers themselves remain divided and nationally biased. To use a term from the natural sciences, one can easily imagine a lot of "noise" before managers or policymakers can draw their conclusions.

A tool that is likely to reduce such "noise" can be found in the natural sciences: in statistical physics to be exact. Airline networks are networks first and foremost - their structure can be graphically depicted and assessed, just as other highly connected networks (the internet, neuronal cells, social networks, etc). Statistical physics allows for looking at many firms that constitute the network at the same time. The constituent firms are allowed to interact in quite a complex way; i.e. the firms do not need to behave independently from one another. Such a physicist's perspective raises universal questions that also pertain to air traffic and that are not truly addressed in management or economics literature: dealing with the growth, robustness or "small world" properties of airline networks in particular.

A Physicist's Perspective

The physicists' macroscopic interpretation of networks often finds power-law, fat-tailed distributions of connections between nodes within networks. The city-pairs that are connected in air traffic would be the variable that can be analyzed in our case. For the data sample of intra-European traffic connections, we plot the number of passengers transported per given airport

(our proxy for the number of connections per airport) along the (descending) ranked order for all airports on a log-log graph. The resulting curve is representative of distributions that are regularly found by physicists in different types of networks.

The problem with such a purely macroscopic view is that it does not tell us how the distribution comes about and to what extent the constituent firms contribute to its formation through their own strategies. When looking at the individual or grouped agents (the firms), the management strategy literature emphasizes three drivers of strategy in airline networks:

Economies of Density

It is argued that larger networks, particularly those that connect larger cities, provide for density advantages: hub-and-spoke networks allow airlines to exploit economies from such higher density. The basic idea is that by combining passengers with various destinations on the same aircraft, the airline can reduce per passenger costs (Brueckner, et al. 1992; Brueckner and Spiller, 1991). By funneling all passengers into a hub, such a system generates high traffic densities on its

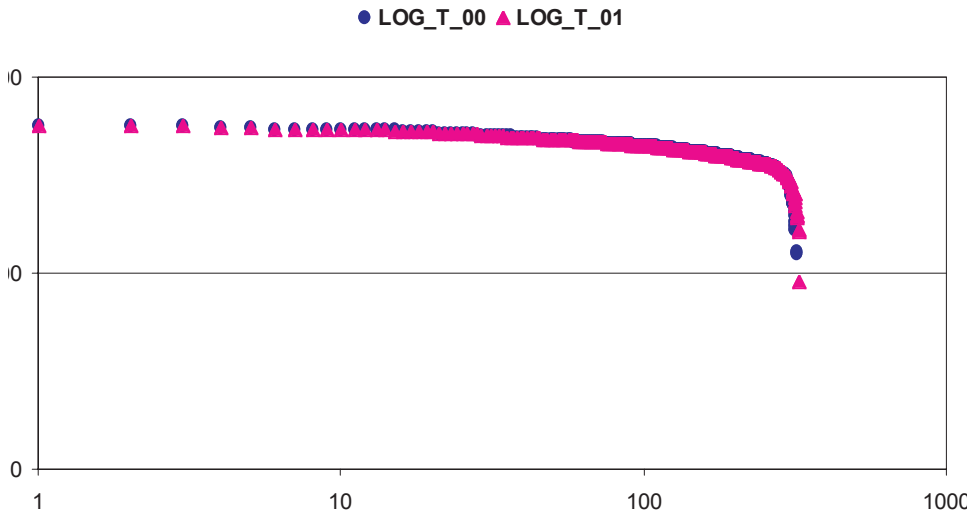


Exhibit 1: A log-log plot for intra-European air traffic connections

"spoke" routes. Bailey, Graham et al. argued that this increases the average number of passengers per flight, letting the carrier take advantage of such economies that arise from employing bigger aircraft. Given such a network form, the size of network (i.e. the number of city origins and city destinations) as well as the size of the connected cities would furthermore increase density within such a system and marginal costs of carrying an extra passenger on a non-stop route would fall as traffic rises. These studies, however, are mostly based on US experiences - the remaining national biases among European airline incumbents question whether such efficiencies can really be reaped.

Market Power

Another issue with hub-and-spoke systems is the market power argument. HS networks can provide an airline with the opportunity to exercise unilateral market power and barriers to entry at dominated airports would further insulate the dominant airline from competitive pressure (Borenstein, 1989 and Levine, 1987). Such research regularly used prices to measure welfare effects (see Panzar (1979), Lederer (1993), Morrison and Winston (1995), and Brueckner and Zhang (2001)). Studies of airline mergers often targeted on ticket prices when determining consumer welfare, suggesting that such mergers would harm consumers (e.g. Borenstein 1990; Kim and Singal, 1993). Such dominance (for example through slot occupation) risks to impact on higher ticket prices.

The market power argument may also explain why airport congestion may actually favor dominant carriers - thus negative externalities along welfare effects seem plausible.

A Focus on Flight Frequency

The most recent research that includes European traffic observes that flight frequency may be a highly strategic variable. For example, Morrison and Winston (1986, 1995) link the increase in flight frequency to the growth of the size of the network. Bruckner and Zhang (2001) show that flight frequency is higher in a hub-and-spoke network than in a fully connected network. They suggest that the downward pressure on fares due to economies of density may be partly or fully offset by the effect of higher flight frequency, so that the net fare impact of such HS networks becomes uncertain. Richard (2003) predicts changes in flight frequency in a merger, but also its relative consequences on consumer welfare.

By comparing the frequency distribution for different strategic groups on a log-linear plot, we can distinguish some striking characteristics on intra-European traffic :

It is noteworthy that incumbent airlines in Europe show, by far, the highest frequencies on very few airports. The absolute degree of flight frequency that they allocate on a small, but significant number of (hub) airports is much higher than with all non-incumbent airlines united (or as compared to our selected two low cost airlines).

Different FRnges of Airports Reached

Whereas the established incumbent networks include some 250 airports, other carriers (as a strategic group) go much further and serve many more airports in Europe: some 380 for our data population (apart from those served by our low-cost group).

Different Slopes for Allocating Frequency

With an incumbent slope starting from a higher Y-intercept and falling rapidly, the "other" airlines allocate their frequencies in a more homogeneous, evenly spread way. The significantly steep slope of our selected U2/RY low-cost network cannot be easily interpreted for two reasons: 1) the network is still growing rapidly from year to year and 2) the selected airlines are only 2 (compared to some 13 incumbent airlines and >100 "others").

Growth and Evolution

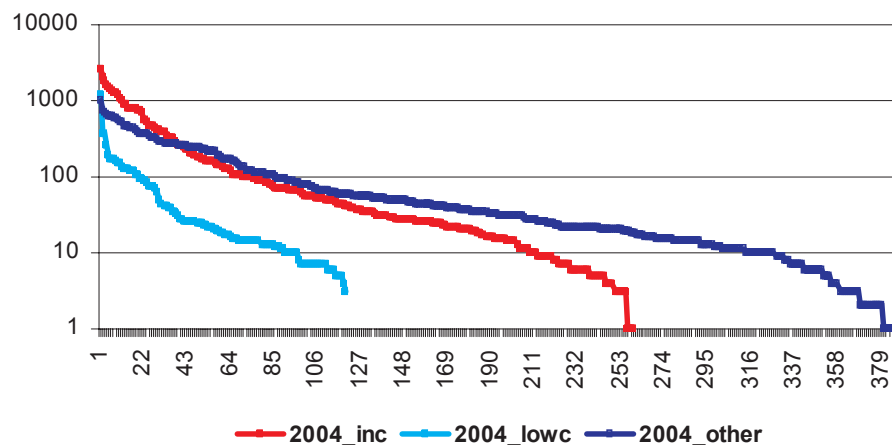


Exhibit 2: A log-linear plot of intra-European frequency distributions

Looking at the evolution of these frequency distributions, we see little variation for the years 2002-2004 in terms of their respective Y-intercepts. As for the incumbents' networks, both their range of airports served and the slope of their collective frequency distribution has changed little. As expected, the most significant change was observed within the combined U2/RY network: important growth flattened the slope and nearly doubled the range of airports served in a two-year time interval only. When looking at all the other (remaining) airlines together, we can observe growth (new service) to some 50+ airports, which is about the same absolute number as the airports that are being added to the U2/RY network. However, for this newly added range, relative growth (as compared to the installed base) and average frequencies appear lower as compared to U2/RY.

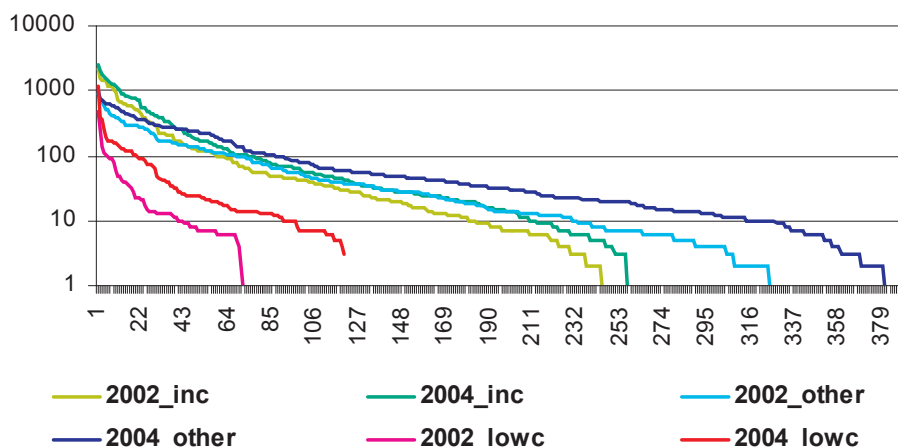


Exhibit 3: The evolution of flight frequencies 2002-2004

Conclusions

Incumbents' hubs-and-spokes networks create the least growth among all strategic groups (as defined) inside the EU.

Capacity constraints and congestion at Europe's biggest hubs may strategically favor incumbents in a defensive way, but do not ensure more airport connections or higher frequencies among European airports.

No support for density argument inside EU.

Airport efficiency inside the EU might be more appropriately addressed by non-incumbent operators (including new entrants): one or several carriers

could operate "bundles of point-to-point" links from a single or a few less densely served airports. This approach is fundamentally different from a nationally biased, over-concentrated HS structure that is dominated by few incumbent carriers, failing to allocate capacity in a more even way across EU airports. Non-incumbent airlines show that less dense city pairs can be operated with adapted business models and technology, but at least 8-9 weekly connections per city-pair appear as a critical threshold. Our analysis suggests opportunities for further decentralized growth within the EU; allowing new entrants to build market power at less frequented airports will not necessarily impede a sound and efficient industry dynamic. We would expect such new entrants to favor intra-EU links rather than domestic ones, thus helping to advance the process of European integration.

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