

NETWORK DEVELOPMENTS IN AVIATION

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Summary

The deregulation of aviation markets led to restructuring of airline networks. Hub-and-spoke networks became the dominant network in countries (regions) where aviation markets were deregulated. These developments were primarily cost driven. Because of increasing returns with density, a hub-and-spoke network allows the large carriers to benefit from substantial cost savings compared to a fully connected network. Airlines with other strategies (low-cost carriers) operate different types of networks. In a lot of markets, the number of carriers has not increased or may even have decreased as a result of the deregulation. Again, this may be contributed to cost factors. Despite concerns over reduced competition, average fares have decreased in the US and Europe.

The next step in the deregulation of aviation markets may be the privatization of airports. The airlines may operate efficient networks, but are still confronted with airports where the prices are not determined by market forces. Privatization of airports, however, leads to concerns over abuse of monopoly power and congestion. But then one should also realize that airports are confronted with a small number of “clients” (airlines). Abuse of monopoly power by the airport may weaken the competitive

position of the most important clients (airlines needing large amounts of slots) because the airlines' operating costs will be higher.

1. Introduction

In the last few decades of the twentieth century, aviation markets were in constant turmoil. The deregulation of US aviation markets, which had been relatively stable for decades, had far reaching consequences. For example, the number of airlines increased rapidly just after the deregulation, and then decreased just as rapidly. Airline network design changed drastically, alliances were formed, and frequent flyer programs came to the forefront. Perhaps one of the most visible effects of the deregulation of the US aviation markets in 1978 was the emergence of hub-and-spoke networks. In such networks, the “hub” airport is the only airport with a direct connection to all other airports. All passengers traveling between two “spokes” airports (an indirect market) are channeled through the hub airport. A graphical illustration of a hub-and-spoke network may look somewhat like a wheel; the hub is the airport used in all routes (markets), the spokes are the spoke market. There is no precise definition of a hub airport, but one description of a hub encountered in the literature says that through a hub airport, airlines serve 40 or more cities in three or more banks of flights.

The deregulation of the European aviation market in the 1980s and 1990s, which followed the US example, was far more gradual compared to the shock in the US. But European airlines also restructured their networks, encountered new competitors, and formed alliances. Before the deregulation, many European (flag) carriers were already operating something like a hub-and-spoke network, with the national airport serving as the hub. The benefits of the hub-and-spoke networks, as discussed in Section 3, were, however, not fully exploited.

In the period between deregulation and the turn of the twenty-first century, airline alliances came to the forefront. In the US, cooperation and mergers between carriers already gained importance immediately after the deregulation, but more recently international alliances became a topic of discussion, both in economics literature and in the popular press. Although it was hoped that in the deregulated environment, (the threat of) competition would keep fares low, it was soon realized that in many markets, there was no real threat of entry of direct competitors. Direct competitors (incumbent airlines or new entrants) merged, formed alliances, or went bankrupt. But still, on both sides of the Atlantic, average fares have decreased since the deregulation was complete.

The final consumers in aviation markets are the passengers (disregarding freight). These consumers are faced with different suppliers. First, the passenger travels to the departure airport by car, train, taxi, etc. At the departure airport, the passenger changes mode to air, and the airline(s). Dependent on the airline's network, the passenger may fly directly or through a hub airport (using the same or a different airline) to the destination airport. At the destination airport, the passenger changes mode again and uses a taxi, car, public transport, etc., to proceed to the final destination. The passenger then buys a network product where the different parts of the “composite good” (travel from A to B) are delivered by independent (transport) network operators (airlines, public transport companies) and nodal operators in these individual networks (airports). Airports supply

services directly to the passenger, but also deliver intermediate services to airlines. Government is also an active player. The government may have a role to protect the consumer from abuse of market power by any party, and the population from excessive noise, etc., but also creates an environment in which airlines and airports can operate efficiently.

The essay describes developments up to the turn of the twenty-first century in aviation networks and identifies the underlying economic mechanisms. This essay focuses on developments in airline networks and the interaction with airports. It is true that, on short-haul flights, complementary modes, such as rail, may compete with air. But in general, airlines are more likely to face more competition from each other than from other modes, and any strategy to improve their competitive position towards other airlines can also improve their competitive position towards alternative modes.

One important aspect of airline networks is that demand may be continuous, but capacity is not completely flexible. The competitive position of a scheduled airline on a given route is determined by the frequency of service and the fare structure. Although flights are cancelled occasionally, the airline would undermine its own position by cancelling all flights with a relatively low load factor. Moreover, airlines may use aircraft with different capacities on the same route, but the possibilities for substitution are limited: one cannot fly short-range aircraft on long-range routes, and long-range high-density aircraft may be too large to be economical on short routes. For instance, an airline may have excess capacity on a route from A to B. The airline can fill the empty seats with passengers flying from A to C, with a transfer at B. Note that the excess capacity is certainly not a constant, as demand is not constant.

2. Deregulation of Aviation Markets

To understand recent developments in aviation, it is important to understand the sector before deregulation, which occurred in the US in 1978, since this organization carries through in many ways. At the 1944 Chicago convention, three important international aviation topics were discussed: **air traffic rights** (freedoms of the air), control of fares, and control of capacity. The freedoms of the air are the rights to:

1. fly over the territory of a contracting state without landing
2. land on the territory of a contracting state for technical reasons
3. transport passengers, cargo, and mail from the state of registration of the aircraft to another contracting state
4. take on passengers, cargo, and mail in another contracting state, and to transport them to the country of registration of the aircraft
5. transport passengers, cargo, and mail between two states other than the aircraft's state of registration as a continuation of, or a preliminary to, the operation of the third and the fourth freedoms
6. transport passengers, cargo, and mail from one state to a third state after a stop-over in the aircraft's state of registration and vice versa
7. transport passengers, cargo, and mail between two states on a service which does not stop in the aircraft's state of registration

8. transport passengers, cargo, and mail in a state other than the aircraft's state of registration, between airports of that state (cabotage)

The United States, with the largest and best equipped aviation industry, as well as countries with small home markets (including the Netherlands and Sweden), were in favor of “open skies” policies (no tariff or capacity control and maximum exchange of traffic rights). Other European countries, suffering from extensive damage to their aviation sectors due to World War II, favored protection (the above mentioned traffic rights). The participants of the 1944 Conference agreed on the multilateral exchange of the rights to fly over a country without landing and to land for technical reasons without taking on or delivering passengers (the first and second freedoms), but capacity and frequency were to be negotiated in bilateral agreements and fares were to be regulated by the International Air Transport Association (IATA). Airlines were limited in their ability to compete, and on some routes, carriers even had the opportunity to extract monopoly rents.

Together with the control of fares and control of capacity, these freedoms prevented the workings of a market mechanism that would lead to economically efficient prices and frequencies. For example, entry into existing markets and creation of new markets were determined by bilateral agreements (at the government level) rather than market forces. As a result, costs were high and prices did not reflect demand. Customers' preferences, frequencies, and routes operated had become a political issue. Already in 1960, *The Economist* wrote, “The basic trouble remains that the world has too many airlines, most of them inefficient, undercapitalized, and unprofitable.”

In the US, the Civil Aeronautics Authority, later renamed as the Civil Aeronautics Board (CAB), determined routes and regulated fares to protect the carriers from “destructive” competition and protect consumers, while allowing airlines to obtain a reasonable return on ticket sales. The CAB allowed fare increases to compensate for the higher airline operating costs following the oil crisis in the 1970s, but it became more and more clear that government regulations were too restrictive for the airline industry. In 1975, the CAB concluded that the airline industry was naturally competitive and not monopolistic, and in 1978 the Airline Deregulation Act was passed. All restrictions on (domestic) routes, fares, and schedules were removed. Increased airline operating efficiency and the contestability of airline markets (in which airlines supposedly could enter markets or routes quickly and at low costs, especially if the airline serves one or both airports on that route) were expected to benefit both airlines and passengers.

The European market is inherently different from the US market. The US market is a national market, whereas the European market is a market covering many (smaller) nations. Moreover, due to shorter average travel distances, there is more competition from alternative modes (for example, high-speed rail). European governments were anxious to protect their often inefficient flag carrier (in the US there were no flag carriers and US carriers never received subsidies to offset losses). Flying became more popular and new, nonscheduled carriers entered the market to capture part of the price-elastic section of the aviation market. In 1960, about 50% of airline passengers were business and 50% were leisure travelers. In 1980, roughly 33% of passengers were business and 67% were leisure passengers. But even in the 1970s, unlike in the US,

there was no movement toward deregulation. Flag carriers were seen as national assets to be protected from “destructive competition.” The deregulation of the US aviation markets set the example for the European countries, because everyone could see the benefits in practice. Since the European carriers were inefficient compared to US carriers, European airlines could not compete with US airlines in a deregulated intercontinental market. The dense North Atlantic market is more important to the European aviation sector than it is to the US aviation sector because average travel distances are shorter. The US favored competition and thus deregulation of transatlantic and European markets, so that US carriers could enter the North Atlantic markets and extend the aviation market. If the European carriers were to survive competition from the US carriers in the North Atlantic markets, significant improvements were necessary. Reactive developments led to the gradual deregulation of the European aviation market between 1987 and 1997. Note that bilateral agreements between, for example, the US on the one hand and the UK and the Netherlands on the other (and also between the UK and the Netherlands) already existed at that time. The multilateral deregulation in Europe aimed to create a unified market, resulting in fair competition (to protect travelers from natural monopolies), and a stable and financially viable airline sector. The deregulation of aviation markets, first in the US and later in Europe, had far-reaching effects, especially in the US.

Following US deregulation, there was a large scale entry of new carriers, followed by the departure of almost all of them; the number of major carriers decreased from 40 immediately after deregulation to six or seven in 1994. Based on these figures, it appears that competition did not increase following the deregulation, but still fares have decreased in real terms since deregulation. The decline in fares from 1976 to 1985 represented a savings to passengers of US\$11 billion in 1986, as reported by Kahn in 1988. The “disciplining effect of (potential) competition” was, however, unevenly geographically distributed. Airlines were free to operate their most efficient networks, and most airlines decided to operate the hub-and-spoke network, which are discussed in more detail in Section 3. On routes starting or terminating at a hub, the number of competitors may have actually decreased since deregulation. On routes between hubs and on long-haul connecting flights, there may be fierce competition even when the number of direct competitors is low. Prices on spoke routes are significantly higher than prices on other routes. Hub airlines offer their local passengers better service (more direct flights, greater frequency, better airport facilities, more choice of destinations, and frequent flyer schemes). Because of this service quality, local passengers are more captive (or loyal) to the hub than passengers originating at spoke cities. Airlines are able to charge a hub premium to its local passengers without losing them to competition. The empirical evidence has widely varying estimates of the hub premium, but 15% is probably a reasonable point estimate. But the exploitation of market power can also lead to higher fares; a lack of competition allows airlines to create so-called fortress hubs and raise fares without the threat of entry.

At the turn of the twenty-first century, it remains to be seen whether the European aviation market will replicate the American example in the implementation of similar hub-and-spoke systems. Although government support for inefficient carriers in the deregulated European market will not be by favored by the European Commission, a plausible assumption is that national interests will prevent the emergence of a few single

hubs in Europe. Many European airlines are still state companies, and will likely only be privatized if the government can sell shares at a high price. But the Belgian government allowed Sabena to go bankrupt by not seeking confrontation with the European Commission to save the former flag carrier. But in Europe the number of competitors on individual routes remains low. A survey has shown that roughly two-thirds of the city pairs in Europe are monopolized, and that roughly one-quarter are served by only two carriers.

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Biographical Sketch

Eric Pels graduated from the Vrije Universiteit in Amsterdam in economics in 1994. He was a junior researcher at the Economics and Social Institute, Vrije Universiteit, in 1994, and a junior researcher at the Department of Spatial Economics. From 1996 to 2000, he was an assistant researcher also at the Vrije Universiteit, Department of Spatial Economics, and at the Tinbergen Institute. During that time, he finished his dissertation, *Airport economics and policy: efficiency, competition, and interaction with airlines*. He currently holds a postdoctoral position at the Vrije Universiteit, Department of Spatial Economics, and with Masterpoint. His primary research interests are aviation economics, rail economics, general transport economics, and transport and the environment