14. Network Impacts of Changes in the European Aviation Industry

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1. INTRODUCTION

Air transport plays a vital role in facilitating the movement of goods and people, particularly over long distances. Within Europe, the air transport sector will have an important role in catering to the needs of the internal market as it becomes more integrated and interaction levels over all distances continue to increase. Air transport will also continue to play a pivotal role in linking Europe with the external world, contributing to the growth of traded goods and services. Fostering the growth and development of an efficient air transport system, which caters for the internal and external needs of the European market, requires a flexible and imaginative framework in which existing players and new players may operate to provide differentiated air services to passengers and shippers alike.

The recent European approach to air transport has been one of 'phased liberalization' as opposed to the more dramatic US-style deregulation which took place in the late 1970s. This approach in Europe has given airlines many new opportunities for growth and development. These airlines had until recently been constrained in the development of their networks, which lie at the heart of their operations. These networks represent at once the production plans and products of the carriers. Under the liberalized regime, market forces will influence the evolution of the industry in the expanding single market. The US experience, however, has shown that regulations governing new practices, products and networks need to be in place to ensure that there is a net benefit in this process. In this contribution, changes in Europe's air transport policies will be focused and the important network implications of these changes will be discussed in detail.

The 'third package' of air transport liberalization measures came into effect on January 1st 1993 for the 12 members of the European Union (EU). The main features of the third package are summarized in Section 2 of this

chapter. In Section 3, the theoretical literature examining the implications of deregulation for airline network structure is reviewed. The effects of intensified 'hub and spoke' (HS) airline networks are discussed in this regard. Data on the current state of the European air transport sector are piecemeal and distinctive trends are not yet apparent. Section 4 of this chapter looks at the current state of air transport in Europe and tries to assess the competitive impacts of the third package so far. There are many limitations in the third package and significant barriers to competition remain. These barriers are outlined in this section as well. The impact of these barriers on the development of efficient air transport network structures is highlighted. When subsectors of the air transport industry are examined closely, additional difficulties in the form of constraints and barriers to competition become apparent. To highlight this fact, in Section 5 the air freight industry in Europe is examined and several of the constraints and barriers to competition in this subsector are revealed. In Section 6, the final section of the chapter, some general conclusions are drawn relating to network evolution and structure under the liberalized European regime.

2. THE THIRD PACKAGE OF AIR TRANSPORT LIBERALIZATION MEASURES

The EU took substantial steps towards liberalizing the internal European air transport market in July 1992 with the adoption of Council Regulations No. L240, the so called 'third package' relating to several key aspects of the industry's operation including access for community air carriers to intra-community air routes, licensing, and fares. The previous packages (the first package of 1987 and second package of 1989) represented more modest moves to liberalization and came in the wake of European Court of Justice rulings applying, for the first time, Articles 85 and 86 of the Treaty of Rome (relating to antitrust type restrictions) to air transport.[1] The first two packages were related only to scheduled passenger services. The adoption of the third package came at a time of crisis for the airline industry, with the sector in Europe and elsewhere coming to terms with the effects of the Gulf War and subsequent recession. The third package applied to the twelve member states from January 1st 1993 and also to Norway and Sweden from mid 1993 because of the unusual situation of cooperation between the three Scandinavian countries in international aviation. The second package of air transport liberalization measures (with more limited liberalization of passenger fares, full cargo pricing freedom, capacity restrictions (60/40) and some fifth freedom rights and public service obligations) was adopted in Austria, Finland and Iceland on January 1st 1994 with the third package to be

adopted in 1995. Switzerland is expected to be included in the AEA air transport market from 1997. So by 1997, it is expected that 18 countries will be covered by the third package. This amounts to 20 percent of the global scheduled air transport passenger market in terms of revenue passenger kilometres (RPKs) (21 percent in terms of passengers carried) and 32 percent of global scheduled air freight RTKs (ICAO 1994).

The third package removed the distinction between scheduled and non-scheduled operations in air transport although it has to be noted that the distinctions were becoming more ill-defined over time as scheduled carriers had been offering increasing numbers of charter services or setting up subsidiary charter companies. The charter carriers for their part have been offering scheduled services on a limited number of North-South intra-European routes in recent years. Europe's charter industry accounted for over half of all intra-European passengers and about two-thirds of total intra-European RPKs. These shares have remained relatively constant for the last ten years (*Avmark Aviation Economist*, April 1994; Doganis 1994).

Council Regulations Nos. 2407/92 to 2411/92 cover a wide range of issues in the scheduled and non-scheduled passenger and cargo markets. Council Regulation 2407/92 deals with common licensing arrangements and the rights of community registered carriers to operate aircraft owned anywhere in the Community. The licensing regulation requires that the principal place of business and registered office be located in the state in which the carrier is registered, that the carrier carries insurance and that air transport is the main concern of the licensee. Licensed carriers are not required to own their own aircraft, but they must have at least one at their disposal. These aircraft must be registered in the state's aircraft register, although it is left to the discretion of the member state to issue a license to the carrier if the aircraft at their disposal are registered elsewhere in the EU.

Council Regulation 2408/92 covers access to intra-community air routes. This includes the abolition of capacity restrictions between member states, and the removal of restrictions concerning fifth-freedom[2] and multiple designation[3] rights along with a gradual phasing in of cabotage[4] rights. Full cabotage is not required before April 1997. Consecutive cabotage is permitted where a carrier uses less than 50 percent of its seasonal capacity on a service on which the cabotage segment is an extension or preliminary to an interstate route. This regulation also makes provision for the imposition of public service obligations and permits entry to be restricted on new routes between regional airports (these aspects are discussed in detail in Reynolds-Feighan 1995a and 1995b). Provision is made for member states to establish non-discriminatory rules for distributing air traffic between airports within an airport system (for example, the London or Paris airport systems). These regulations permit carriers to significantly extend their market areas and offer

substantial opportunities for greater efficiency through scale and scope economies. On the demand side, greater product differentiation will have a significant effect on traffic volumes. The network implications of these forces will be discussed in Section 4.

Council Regulation No. 2409/92 grants freedom for EU carriers to set air fares and rates for services, except in specific limited circumstances. In Council Regulation 2410/92, the EU competition rules are formally extended to the air transport sector while amendments to certain categories of agreements and concerted practices in the air transport sector are made in Council Regulation No. 2411/92. Several of the negative outcomes associated with deregulation in the US are now subject to safeguard provisions in the European liberalization programme: computer reservation system ownership and bias, predatory pricing practices and slot allocation issues relating to hub airport dominance (see Van De Voorde 1992; Button and Swann 1992; Bjarnadottir 1994). These regulations will impact on the pattern of consumer demand, on carrier profitability and airline industry structure. The empirical and theoretical literature to emerge in the US after deregulation suggests the possible consequences of these forces for carrier network structure. This theoretical literature is reviewed in the next section.

3. AIRLINE DEREGULATION AND THE CHOICE OF NETWORK STRUCTURE: REVIEW OF THEORETICAL EXPLANATIONS

It has long been observed that, following the aviation deregulation in the USA in 1978, airlines have significantly intensified their use of hub and spoke (HS) network structure while increasing frequency of operations (Bailey et al. 1985; McShane and Windle 1989). These observations raise two interesting and interlaced analytical questions. First, what are the possible underlying explanations for the HS phenomenon? Second, why has this phenomenon intensified following the liberalization of aviation markets? In this section, the alternative explanations found in the economic literature are reviewed.

The overall theoretical explanations provided in the literature for airlines' choice of HS network structure can be grouped into three major types: cost side economies; demand side effects and market dominance. Each of these will be examined and then related to the present realities in the European aviation market. For illustrative purposes and in order to provide a common basis for the three interpretations given to the HS network structure, we make use of a simple network structure, composed of three nodes (cities) linked by three routes, as shown in Figure 14.1.[5]

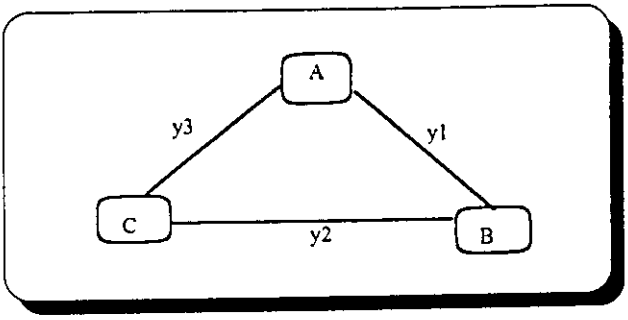

Figure 14.1 An illustrative network

In the layout described in Figure 14.1, if the airline firm provides direct services between each pair of nodes, the network is labelled: fully connected (FC). Alternatively, if the airline uses a given node as its hub, say B, and provides services from A to C via B, we label the network hub and spoke (HS). The airline's output on each route is denoted by y_1, y_2, y_3. In this analysis output is measured in units of number of flights (or number of Aircraft Movements (ACM)) per time unit (say a week).[6] Thus y_1 is the ACM per week between nodes A and B; y_2 is ACM per week between nodes B and C; and y_3 is ACM per week between nodes A and C. Notice that if the airline operates a HS network, so that it does not supply direct service between A and C, then $y_3 = 0$ whereas y_2 contains passengers of two types: those who travel from A to B and those who travel from A to C via the hub in B.

The airline's total cost of providing services on each route, $c(y_i)$, is an increasing function of weekly ACM. Three types of economies are distinguished: size, density and scope. Size economies imply that increasing total output (that is, amount of weekly ACM) by serving more nodes, will lower average cost. The empirical literature does not provide solid support for the existence of significant size economies in aviation (McShane and Windle 1989).

Traffic density economies imply that, given aircraft capacity, the cost per passenger will decrease when traffic density (number of passengers) on routes served increases. In general, more passengers on a route imply greater load factors which normally have a consequential positive effect on profitability through their effect on better fleet utilization. Moreover, higher levels of traffic density enable the use of larger size aircraft thereby reducing associated costs of operations. This effect is labelled in the literature aircraft size

economies. To the extent that improved fleet utilization and aircraft size economies help reduce major cost items such as capital, labour, fuel, maintenance and airport charges traffic, density economies can have a major effect on the choice of a network structure (HS versus FC).

Scope economies imply that the airline's total costs of providing services separately on each individual route,

$$\sum_{i=1}^{3} c(y_i),$$

is greater than the cost of joint production of services,

$$c(y_1, y_2, y_3) < \sum_{i=1}^{3} c(y_1)$$

On the demand side we assume that passengers' demand for flights is a function of fares (p) and of flight frequency (f) which essentially affects total travel time (wait and in-aircraft time), so that demand price elasticity is negative (higher prices reduce demand) while demand frequency elasticity is positive (higher frequency boosts demand).[7] In terms of the above network, let $d_1(p_1, f_1)$, $d_2(p_2, f_2)$, $d_3(p_3, f_3)$ be the demand for travel between the three cities as a function of fare and frequency on the respective routes. In utility terms the demand function can be defined as: $U_i \equiv x_i \cdot \Delta + \mu(y_i)^{\gamma} - p_i > 0$; $y_i > 0$; where x_i has the value of 1 if route i is serviced, and the value 0 otherwise; Δ is the premium passengers are willing to pay to travel directly between cities; μ is value of time; and γ is the elasticity of demand with respect to frequency (ACM per time unit).

Assuming profit maximization, an airline will operate HS network relative to FC network if its total profits under the former will exceed profits under the latter,

$$\pi^{HS}(\vec{p}, \vec{y}, \vec{f}) > \pi^{FC}(\vec{p}, \vec{y}, \vec{f}) \text{ where } (\cdot)$$

define the set of routes operated. Obviously, the set under HS and FC are not the same.

Given the above definitions, we now turn to the three alternative explanations, given in the literature, for the use of a hub and spoke network structure and for its increase use following deregulation. We do not provide an overall model simulating or analysing all types of economies simultaneously. For a treatment, see Berechman and Shy 1994.

I. Cost Economies: A number of authors (for example, Bailey et al. 1985; Morrison and Winston 1986; Keeler 1991; Brueckner and Spiller 1991; Hendricks et al. 1992) argue that cost considerations, mainly economies of aircraft size coupled with scope economies underlie the intensified use of HS networks. What this argument essentially implies is that the use of an HS network has two major effects: (a) it increases traffic density on each route served and, as a consequence, enforces aircraft size economies; (b) the use of a major hub, through which all traffic is funnelled, introduces conditions of joint production which, in turn, intensifies scope economies.

In terms of the above simple network, assuming the profit maximization objective,

$$\pi^{HS}(f_1, f_2) > \pi^{FC} f_1, f_2 f_3)$$

which, in turn, implies:

$$\sum_{i=1}^{2}[(y_i^{HS} * p_i^{HS})] - c(y_1^{HS}, y_2^{HS} > \sum_{i=1}^{3}[(d_i^{FC} * p_i^{FC})] - \sum_{i=1}^{3} c(y_i^{FC})$$

The superscripts HS and FC are used to indicate that output, prices and costs under the HS network are distinct from those under the FC network. Thus, even if total revenue under the two network options are similar, cost savings from aircraft size economies and from scope economies will make the use of HS more profitable than the use of FC networks.

It should be emphasized that, from theoretical as well as empirical viewpoints, traffic density economies do not imply scope or scale economies. In fact, airline costs in some markets (for example, local or feeder services) can be explained on the basis of traffic density economies whereas costs in other markets (for example, trunk services) are strongly affected by scope and scale economies (Caves et al. 1984).

II. Demand Side Effects: Demand side effects is another argument advanced in the literature to explain the intensified use of HS networks following deregulation. Two types of explanations fall under this school of analysis: relative demand elasticity and product differentiation.

In general, passengers' utility from air travel is affected by two main factors, airfare and total travel time. The latter factor is composed of several components, the two main ones being wait time and actual (airborne and transfer) travel time.

Since demand elasticities relative to airfare and travel time components are disproportionate (in particular, for different types of passengers like business

and non-business), then it is conceivable that the adoption of HS networks has a positive effect on demand by reinforcing those demand factors with higher relative elasticities. Specifying demand in utility terms the following expression characterizes air travel demand (see Berechman and Shy 1994):

$$U_i \cong x_i \bullet \Delta + \mu(y_i)^{\gamma} - (p_i)^{\alpha} > 0;\ y_i$$

where U_i is an individual utility function common to each passenger flying route i (only business and non-business passengers are differentiated); x_i is 1 if route i is served and 0 otherwise; Δ is the premium a traveller is willing to pay to fly direct (not via the hub); μ is the (monetary) value of time; γ ($0 < \gamma < 1$) is frequency elasticity (ACM per time unit), and α is fare elasticity.

Beginning with the airfare elasticity factor it has been observed that following the deregulation in the US, on most routes on which effective competition has developed, airfares have substantially declined (Morrison and Winston 1986; Borenstein 1989). A simple explanation might be that competition within markets (for example, within routes) which has evolved after deregulation, has brought down fares by eliminating (or reducing) previous monopolistic rents. In this case the decline in airfare does not in itself explain the HS phenomenon, but the decline in airfares is linked to the use of HS networks through the increase in competition which has ensued (see below). A related explanation is that in deregulated competitive aviation markets the use of HS networks which, in the presence of density and scope economies, result in lower average costs to the airline, will also result in lower airfares. With airfare elasticities of -0.378 and -0.180, for non-business and for business passengers, respectively, one can expect an increase in traffic from airfare decline with positive effects on overall profitability.

A major theoretical and empirical result from the use of HS relative to FC networks, is the significant increase in frequency, that is, in ACM per time unit (Morrison and Winston 1986; Barrett 1990; Oum et al. 1993; Berechman and Shy 1994). This effect, in turn, significantly reduces wait times (time between departures) and produces more favourable multiple departure times. Morrison and Winston report demand elasticity for wait time of –0.047 and –0.206, for non-business and business passengers which, in the case of the latter group, is larger than their travel time demand elasticity (–0.158). Under these conditions, the use of HS can be explained on the basis of increased revenue resulting from increased traffic, given the cost level. Berechman and Shy (1994) have shown that if the premium passengers are willing to pay to travel directly (Δ) is low enough, the airline firm will operate an HS network. One case where this might happen is when the demand elasticity with respect to frequency (γ), is sufficiently large to

outweigh the effect of Δ.[8] Morrison and Winston (1986) estimate that doubling frequency will result in 21 percent demand increase by business travellers compared with 5 percent for non-business travellers.

Product differentiation is another line of argument found in the literature to explain aviation network restructuring. Encaoua et al. 1992, argue that this demand side effect has also a profound effect on network structure. Briefly stated, product differentiation implies that competing airlines have an incentive to make their services as unsubstitutable as possible (thus differentiated products) in order to retain a distinctive share of the market. They do so by having their own departure (frequency) schedules and price structure. In the first stage of the analysis consumers who face these divergent schedules (called network properties) incur extra waiting time costs. In order to capture more demand airline firms will then have an incentive to schedule their departure times closer which, in turn, will weaken their ability to charge differentiated prices. Based on these tradeoffs Encaoua et al. (1992) show that when carriers have the same network structure maximum differentiation in departure times is viable. It is interesting to note that this explanation notwithstanding, carriers tend to use flight amenities and frequent flier programmes to differentiate their services and, at the same time, to price discriminate between classes of passengers.

III. Market Dominance: The empirical literature suggests that airfares on routes which are served by more than one carrier are likely to be significantly lower than comparable routes served by a single carrier or by a carrier with a dominant position in that market (see Borenstein 1992, for a review). This observation raises the question of the potential relationships between competition in the aviation industry and the structure of aviation networks. In particular, if airlines aspire to maintain a dominant market position, can they use HS networks to that end and if so, how?

Several researchers have hypothesized such relationships by making the structure of the network an endogenous variable as well as a strategic means under the threat of entry (Berechman et al. 1994; Bittilingmayer 1990). To see this, in the above simple network model consider the case where prior to deregulation a monopoly airline decides to operate an HS network, namely routes 1 and 2 with services between cities A and C via the hub at B. Suppose now that following deregulation a potential entrant is threatening to provide direct service on route 3 (between A and C). If he is successful, the incumbent firm will face a decline in demand (thus profits) since the A-to-C passengers can now switch to the new entrant's market. Under what conditions can the incumbent retain his market share by deterring entry? Will he always attempt to deter entry or will he, under certain conditions, accommodate entry?

Berechman et al. (1994) have examined the conditions under which an incumbent airline firm will deter entry attempts by a new entrant following deregulation, or will choose to accommodate entry. The principal result from the analysis is that the HS network can serve as an entry deterrence (or accommodation) mechanism even in cases where the HS is more costly to operate. Key factors in this analysis are the nature of the deregulation policy (partial deregulation – one route only, or global deregulation – all routes); passengers' demand structure as characterized above; the airline's cost structure; and available aircraft capacity. Given the proper conditions relative to these factors, the analysis shows that when faced with the threat of entry the incumbent airline will operate an HS network, thus successfully obstructing entry. Profitable entry accommodation, on the other hand, will transpire if a certain group of passengers of sufficient size have high value of time relative to other groups (the Δ, μ parameters), so that the incumbent will find it profitable to split the market with the entrant, each serving a particular group of passengers.

While it is beyond our scope here to describe in detail the deterrence/accommodation mechanism there are two points worth mentioning regarding these results. First, the entry deterrence or accommodation market arrangements are not due to any possible asymmetry between the incumbent and entrant airlines but rather ensue from the heterogeneity of passengers relative to their value of time. The second point is the decisive effect of the type of aircraft available to the airline, on its market behaviour.[9] The overall results from the analysis are summarized in Table 14.1. Notice that FC operations under deregulation are associated with zero profits whereas HS operations are associated with strictly positive profits.

Obviously, an entrant needs to maintain slots at cities A and C, if he is to actually carry out his entry threat in market 3. Alternatively, if he wants to enter on markets 1 and 2, he needs to hold slots also at hub B. Hence, another useful entry deterrence approach is for the incumbent to exercise grandfather rights at airports thereby hindering new entrants from gaining slots. The importance of hub dominance was highlighted by Borenstein (1989), who showed that airlines which have a dominant position in hubs also charged much higher prices compared with cases where they did not have such a position.

In relating this discussion of the theoretical literature to the European experience, the role of entry barriers and capacity or slot constraints in particular must be emphasized again. The development of US style hub and spoke network systems would require that carriers have the ability to coordinate their schedules to allow for increased volumes of transfer passengers at hub airports. This requires that there is capacity available in the form of terminal and runway slots and that there are efficient ground handling

services and air traffic management systems in place to facilitate reorganization or expansion of flight schedules. The capacity constraints at many of the large EU airports will limit the extent to which existing carriers may experiment with new network schedules and expand the scale of their operations. The scope for cost economies for some carriers may be limited.

Table 14.1 Entry deterrence/accommodation under different deregulation policies and aircraft capacity characteristics

Market Structure	**High Aircraft Capacity**	**LowAircraft Capacity**
Partial Deregulation	Accommodation: HS ($\pi>0$) Deterrence: HS ($\pi>0$) FC ($\pi>0$)	Accommodation ($\pi>0$) Deterrence: FC ($\pi>0$)
Complete Deregulation	Accommodation: HS ($\pi>0$) Deterrence: HS ($\pi>0$)	Deterrence: FC ($\pi>0$)

Note: π is profits.

Effective free entry at all EU hub airports will also impact on the extent to which competition among carriers develops on individual routes and therefore the extent to which demand side effects can impact on network structures. As shown in Table 14.3, it is reported that 6 percent of intra-community routes had three or more carriers. Commentators like Doganis (1994) and Balfour (1994) suggested that so far in Europe, significant competition has not emerged. This situation is not independent of the capacity constraints discussed above, and will impact on carriers' ability to differentiate their services in the form of increased frequency. These factors may conspire to permit some carriers to continue dominating their home markets at least in the short to medium term.

The barriers to competition and to efficient network development discussed above apply to passenger carriers as well as cargo carriers. In the next section, the current state of the European scheduled air transport sector is reviewed.

4. CURRENT STRUCTURE AND COMPETITIVE SITUATION IN EUROPEAN AIR TRANSPORT

The European air transport industry is dominated by the flag carriers of the member states. Table 14.2 shows the proportion of total scheduled air traffic for each EU state carried by the flag carrier. On average, 83 percent of total scheduled traffic (measured in revenue passenger kilometres) or 73 percent of total passenger numbers are carried by the flag carriers. The table also shows the proportion of each flag carrier's passenger and freight traffic carried on intra-European routes. Because of the short or medium haul nature of most European interstate routes the average proportion of revenue passenger kilometres (RPKs) on European routes is 34 percent while the average proportion of total passengers carried on these routes is 55 percent.

The current state of competition on European interstate routes was examined by using data from the UK Civil Aviation Authority (CAA) and the Association of European Airlines (AEA). Price data for routes with differing numbers of carriers were not available for assessment of monopoly or collusive behaviour. The number of carriers is used to give a broad indication of the level of competition on routes. These data are presented in Tables 14.2 and 14.3. Table 14.2 shows the twelve EU flag carriers with the total number of intra-EU routes (cross-state, as opposed to domestic routes) being given along with the number of single carrier routes. On average 36 percent of carriers' routes are single carrier routes.[10]

Table 14.3 looks at the breakdown of 'international EU routes' and domestic scheduled city pairs characterized by (i) single carrier routes (ii) routes with two carriers and (iii) routes with three or more carriers. The data from the CAA pertain to all intra-EU routes in 1994; the AEA data pertain to routes operated by AEA members only. According to the CAA data, 65 percent of all routes are single carrier routes, with a further 29 percent having just two carriers operating. The AEA data reflect to a greater degree the competitive situation for the flag carriers. They suggest that 47 percent of the routes are single carrier, while a further 41 percent are two carrier routes. For most of the two carrier routes, the flag carriers would have been subject to capacity and possibly revenue sharing agreements in the past. The extent to which competition has now developed between the carriers on these routes cannot be properly assessed at this stage, given the lack of adequate price data. The AEA data show that an additional 22 routes have been characterized by having three or more carriers competing since passage of the third package.

Table 14.2 Passenger traffic characteristics of European flag carriers, 1993

Carrier	Country	European as % of Total Scheduled		Domestic as % of Total Scheduled		ICAO Traffic per State, 1993		Number of Intra-European	
		RPKs	Pax Carried	RPKs	Pax Carried	RPKs	Pax Carried	Routes	% Single carrier
		1993	1993	1993	1993				
Aer Lingus	Ireland	44.2	80.9	1.4	8.0	4209	4650	28	16
Air France	France	13.2	50.5	16.4	12.0	59201	34472	64	16
Alitalia	Italy	23.2	45.4	7.4	33.5	29759	21803	48	2
Austrian Airlines	Austria	52.8	85.6	0.0	0.0	5629	3297	N/A	N/A
British Airways	UK	15.8	48.9	6.3	20.5	124882	50185	73	22
British Midland	UK	49.3	49.7	50.7	50.3	"	"	N/A	N/A
Finnair	Finland	38.6	52.6	11.4	35.6	5529	3947	N/A	N/A
Iberia	Spain	24.0	34.3	23.1	52.9	27105	22279	45	11
Icelandair	Iceland	39.8	45.0	3.2	31.0	1968	801	N/A	N/A
KLM	Netherlands	11.1	53.2	0.0	0.3	38544	11775	45	24
Lufthansa	Germany	18.9	38.9	9.3	42.8	52941	29363	127	49
Luxair	Luxembourg	100.0	100.0	0.0	0.0	290	471	23	19
Olympic Airways	Greece	34.3	29.8	11.8	58.2	7899	5478	27	10
Sabena	Belgium	34.5	80.5	0.0	0.0	6484	3651	40	16
SAS	Scandinavia	36.5	44.7	23.5	49.8	20583	25126	28	6
Swissair	Switzerland	23.3	65.7	0.6	7.8	17704	9887	N/A	N/A
TAP	Portugal	38.0	54.7	11.4	26.0	7917	4026	41	19

On the domestic routes, the CAA data suggest that 91 percent of routes are single carrier routes. This may reflect the fact that many domestic routes can only sustain one carrier, or that many routes are operated for social or regional development purposes. Only 2 percent of domestic routes have three or more carriers present. These domestic routes will not be subject to free access and price setting until at least 1997.

Table 14.3 State of competition on intra-European routes

(A) UK CAA – 1993 Data

	Intra-European Routes	Domestic Scheduled City Pairs
Total number of routes	636	763
One airline on route	411 (65%)	694 (91%)
Two airlines on route	187 (29%)	53 (7%)
Three or more airlines	38 (6%)	16 (2%)

(B) AEA Carriers Intra-European Routes

	December 1992	April 1994
Total number of routes	410	427
One airline on route	196 (48%)	201 (47%)
Two airlines on route	186 (45%)	176 (41%)
Three or more airlines	28 (7%)	50 (12%)

Source: Association of European Airlines 1994 Yearbook, AEA, Brussels

Some early predictions suggested that Europe's charter airlines would face significant competition from the scheduled sector, once the third package came into force. However the fact that Europe's charters operate in distinctive niche leisure markets and have substantially lower overall costs as well as having higher aircraft utilization rates than the scheduled carriers, means that they are in a strong position to continue as a significant market sector in Europe. The third package afforded the charter carriers the rights to offer new cargo services and to be treated equally on CRSs. The charter airlines are now offering seat only sales alongside inclusive package tours. There is still discrimination against charter carriers according to *Avmark* (April 1994), particularly in relation to ground handling services and facilities and access to airport slots, where scheduled operators have been treated more favourably particularly at congested airports. So far, the charter carriers have not ventured

to compete with the scheduled carriers on non-leisure intra-European routes despite their relatively large presence in the intra-European market.[11] Within the charter sector, carriers have faced a very competitive market in Europe and there continues to be overcapacity in the subsector. As a result, several companies have failed financially and do not have state governments to bail them out. Entering scheduled markets would increase a charter carrier's costs and possibly make the carrier uncompetitive in their base market (*Avmark*, April 1994). Competing with a strong incumbent on a route requires provision of significant capacity and extensive marketing in order to attract customers. Several of Europe's flag carriers have shown a very aggressive response to entry by new carriers (for example, Aer Lingus on the London–Dublin route).

In assessing the current liberalized air transport regime in Europe, several significant barriers to entry and to competition remain in the industry which limit the extent to which a truly competitive market can evolve. Several recent papers detail these problems (Doganis 1994; Balfour 1994); Comité des sages 1994). As has been shown, Europe's air transport markets remain highly concentrated with the majority of routes being single carrier or two carrier routes. Doganis (1994) suggests that three specific factors indicate that the expected benefits and market changes associated with successful liberalization have not emerged in Europe. These are: (i) that no serious competition has emerged within Europe to challenge the dominance of existing flag carriers; (ii) there has been a growing concentration within the European airline industry due to mergers and share purchases among major carriers, along with the collapse of some smaller carriers and failure of new entrants; (iii) while limited competition has increased on some intra-European routes (most notably those out of London), and a wider range of fares has emerged on these routes, on the majority of routes which continue to be operated by two flag carriers, 'fare competition and innovation tend to be limited'. It has already been noted, however, that the European liberalization came at a time of recession in the industry and that comprehensive data which would help assess the short term impact of liberalization in Europe are not available as yet.

The Comité des sages report of 1994 showed great concern about capacity constraints at European airports and argued that 'slots will again become the crucial issue for achieving real liberalization of the market' (page 20). The Comité called for an increase in overall airport capacity as a matter of urgency. Balfour (1994) argues that in relation to the slot allocation rules which were adopted by the Commission in 1993 (Commission Regulation 95/93, OJ L141, 22.1.93) 'the Regulation as eventually adopted by the Council departs little from normal practice and creates few opportunities for new entrants, except by extending the "use it or lose it" rule to a certain

degree'. Because of this, 'new entry, and hence competition, on many major routes remain virtually impossible'.

The Comité comprehensively reviewed the main problems facing the European industry. They demanded that state aid to national carriers be permitted only in limited circumstances and that carrier restructuring plans should ultimately lead to privatization. The Comité called, for the most part (there were two dissentions), for complete liberalization of ground handling services as soon as possible. With regard to external policy, the Comité felt that in order to reduce competitive imbalances currently existing between member states, a common external policy was vital. Without it, the process of improving the competitive position of the European industry was undermined. The slow pace with which problems were being addressed in the area of air traffic control came in for criticism as did the lack of development of a European airport system serving the internal market, rather than being left to local planning agencies. Removal of VAT on internal air transport was called for along with rejection of any carbon tax proposals. In relation to the environment, the Comité called for harmonization of the legal basis and procedures for planning and construction of airport facilities so as to reduce delays and costs associated with lengthy hearings on such cases. In summary, several key barriers to competition remain in the industry despite the significant liberalization in the third package.

These barriers to entry and to effective competition will have a significant impact on the extent to which carriers (both new and incumbents) will be able to reorganize and optimize their networks. Reynolds-Feighan (1994) has shown that the European flag carriers in 1990 organized their traffic flows around a single hub network. The extent to which schedules can be optimally coordinated in time and space is constrained by such factors as air traffic control delays and other difficulties and by airport slot availability. One of the most dramatic effects of US deregulation was the move by carriers to concentrate traffic and coordinate its flows through multiple interactive hub and spoke network systems. The reasons why this network system developed were discussed in the previous section. Empirical evidence for the US can be found in Borenstein (1992) and Hansen and Kanafani (1990). For the air cargo sector, these barriers to competition will constrain its development and its ability to organize carrier networks in an efficient manner. However in addition to many of the practical difficulties outlined above, the air cargo sector faces several additional constrains which restrain the development of an efficient and competitive air cargo sector in Europe. These issues will be explored in the next section.

5. COMPETITION AND NETWORK STRUCTURE IN THE EUROPEAN AIR FREIGHT SECTOR

In this section, the nature of network organization in the air freight sector is highlighted and several constraints on this subsector's development are presented. The outcomes of US deregulation of air cargo in 1977 and 1978 are briefly reviewed particularly in relation to carrier network structure. The main characteristics of Europe's air freight industry are then described for 1993, before the prospects for European air freight markets are examined.

US air cargo deregulation impacts: The major trends to emerge in global air freight have been influenced to a significant degree by the outcome of deregulation in the US domestic cargo market in 1977 and 1978. The impacts are discussed in Reynolds-Feighan (1994) and in terms of industry structure and organization can be summarized as follows:

(i) The number of all-cargo operators increased from 3 in 1977 to 19 in 1993 (including non-scheduled and express operators).

(ii) The market share of the total US domestic freight market carried by all-cargo operators increased from less than 17 percent in 1977 to 56.7 percent in 1993. (International traffic statistics were not available from the FAA for 1993).

(iii) The express or integrated carrier emerged as a significant new player in the deregulated market. Express carriers freight tons accounted for 80 percent of the all-cargo tonnage and for 45 percent of total US domestic freight in 1993. Federal Express, the largest of the express carriers, accounted for 72.6 percent of the all-cargo share of traffic and for 41 percent of total domestic freight tons in 1993. Federal Express merged in 1989 with Flying Tiger which at the time was the second largest US all-cargo carrier. The market is highly concentrated.

(iv) All-cargo carrier air networks are organized typically as single hub systems (unlike passenger carriers, where networks are typically multiple interactive hub and spoke networks). In the case of express carriers, the substantial surface transport operation is combined with these air networks to produce multimodal interactive hub and spoke networks.

(v) Express carriers have sought to significantly expand their networks internationally and develop new products such as warehousing/stock control, shipment tracking and logistics management which they package with their door to door freight services.

(vi) Express carriers have sought to have federal deregulation of certain aspects of surface transport, which until 1994 remained regulated at the state level. This constrained efficient operation of local level operations in many instances.

Table 14.4 Characteristics of Europe's air freight markets

Carrier	Country	% of State's RTKs	% Freight carried on Freight services		Total Europe freight as % of total scheduled		Total Nth Atlantic freight as % of total scheduled		Total Long Haul freight as % of total scheduled	
			RTKs	Tonnes	RTKs	Tonnes	RTKs	Tonnes	RTKs	Tonnes
Aer Lingus	Ireland	100.0	50.5	45.9	11.9	52.1	88.0	42.6	88.0	42.6
Air France	France	97.4	52.8	46.9	1.3	9.2	30.9	29.0	93.9	82.6
Alitalia	Italy	99.4	41.4	35.3	3.6	17.8	49.3	37.9	93.4	68.9
Austrian Airlines	Austria	66.9	0.0	0.0	22.8	63.7	46.7	18.7	66.9	26.0
British Airways	UK	50.6	5.0	2.6	2.9	17.3	44.7	42.2	90.3	73.6
Finnair	Finland	99.7	3.6	11.9	12.7	40.6	44.0	27.3	86.4	51.8
Iberia	Spain	98.2	19.1	24.3	8.1	22.7	30.0	17.4	80.4	41.3
Icelandair	Iceland	100.0	14.6	17.7	38.7	49.1	60.3	41.0	60.3	41.0
KLM	Netherlands	110.8	18.6	15.3	2.7	19.4	37.6	37.0	94.2	76.0
Lufthansa	Germany	99.9	49.8	43.8	3.1	17.5	37.6	30.6	90.0	65.7
Luxair	Luxembourg	90.0	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0
Olympic Airways	Greece	100.0	0.0	0.0	31.9	36.5	22.8	5.8	56.7	14.1
Sabena	Belgium	100.0	0.0	0.0	4.6	24.2	50.4	40.8	92.9	71.8
SAS	Scandinavia	95.4	0.0	0.0	11.1	40.4	49.9	23.8	84.5	38.3
Swissair	Switzerland	99.6	0.0	0.0	5.4	30.6	43.6	32.2	90.6	59.6
TAP	Portugal	99.8	0.8	1.6	18.8	40.4	23.7	14.5	73.4	38.8

The US express carriers have sought to expand their US operations into Europe in the last decade. These efforts will be reviewed because they help to highlight several difficulties constraining the development of these kinds of operation in Europe.

European Developments: The third package relates to air freight carriers as well as passenger and combination carriers. Cargo services had not been dealt with in EU regulations until 1991, when third and fourth freedom rights were specified along with authorization of fifth freedom rights for carriage of freight by EU registered carriers within the EU and full pricing freedom (Bjarnadottir 1994; *Official Journal of the European Communities* L036/91). The data in Table 14.4 describe the main characteristics of European carriers' air freight traffic.

As with scheduled passenger services, air cargo is dominated by the national or flag carriers. Table 14.4 shows that on average, 94 percent of total revenue tonne kilometres (RTKs) are performed by the flag carrier. The main exception is the UK where BA perform about 51 percent of total RTKs. Europe's air freight is carried by passenger carriers and by combination passenger cargo carriers (such as Lufthansa and Air France). In Table 14.4, the proportion of freight carried on freight only services by the flag carriers is given. For Lufthansa, Air France, Aer Lingus and Alitalia only, over 40 percent of RTKs are performed on dedicated freighter services.

Air freight within Europe tends to account for a small proportion of carriers' total RTKs and tonnes carried. For the AEA carriers covered by the third package, intra-European traffic accounts for 17 percent of RTKs on average, and for 36 percent of freight tonnes. For many of the carriers, the North Atlantic is the most important market sector for freight, averaging 41 percent of total RTKs and 27.5 percent of freight tonnes carried. This reflects the significantly larger stage length on these long haul routes compared with intra-European routes. Long haul routes more generally (i.e. North, mid- and South Atlantic, sub-Saharan Africa, Far East/Australasia and other routes) account for an average of 78 percent of RTKs and 50 percent of freight tonnes. The breakdown for individual carriers is given in Table 14.4.

The proportion of freight carried on freighter only services is greater for the long haul routes than for short/medium haul routes, for those carriers offering freight only services. This reflects the fact that on longer haul routes, as distance increases, the cargo capacity of passenger aircraft becomes increasingly constrained by the weight of passengers, baggage and fuel (this is not the case for the B747-400 and B777 aircraft). Within Europe, competition from surface modes has a negative impact on air freight potential. The fact that passenger airlines have traditionally looked on cargo as a byproduct of their passenger operations (with the marginal cost of cargo

considered close to zero) and priced accordingly, means that rates have been low relative to the economic costs of the services. Domestic markets account for a small share of the total RTKs (averaging less than 2 percent of RTKs) but a more substantial 10 percent of total freight tonnes.

Earlier it was stated that there has been air cargo pricing freedom in Europe since 1991, and access to intra-European routes. Because of the small geographical size of the European internal market (compared with the US domestic market), significant developments and growth in European carriers' air cargo traffic are expected to emerge in the long haul markets. The North Atlantic and Europe–Asia markets are expected to record 6.5–7 percent annual growth rates in RTKs according to Boeing. The forecast for intra-Europe growth is a more modest 2–3 percent per annum for the same period (1993–2013).

Policy implications for network development: The fact that the European Commission has not been able to adopt and implement a common external policy limits access on long haul international routes typically to the flag carrier designated in the bilaterals. This impediment to competition is much more significant in air cargo markets than in passenger markets because of the heavier reliance on long haul routes. European, US and other governments have shown less resistance to air cargo deregulation than to passenger deregulation in the past and perhaps this area will be first to experience more widespread liberalization beyond Europe.

In relation to slot allocations, particularly at congested airports, scheduled passenger operations have been prioritized until recently. While charter passenger carriers can expect more favourable treatment under the new regulations, cargo carriers will still face disadvantages. One alleviating factor arises because of the different preferences which cargo carriers face compared to passenger carriers – where passengers have a preference for daytime direct routings, shippers have a preference for early morning delivery with the elapsed business time between pickup and delivery being minimized. The carrier's routing is less important. However, noise regulations and airport curfews restrict the choice of airports for the cargo operators and in many instances will force cargo developments to be centred on secondary European hubs rather than the main hubs. This may impact to a significant degree on the development of dedicated all-cargo carrier networks and on the cost efficiencies which may be gained through network reorganization.

The aircraft noise legislation agreed by European ministers of transport related to two areas. These are (i) non-addition of 'Chapter 2' aircraft to EU aircraft registers after 1992, and (ii) a ban on Chapter 2 aircraft and engines after 1997. For some all-cargo operators, particularly express operators, low utilization rates make newer aircraft uneconomic. New entrants after 1997

will be competing for aircraft equipment purchases/leases as well as trying to compete in offering air services. Europe's air freight industry will rely on developments in the EU's external aviation policy in order to open up greater opportunities to competition. Europe's passenger carriers already offer low cost competition because of their cargo pricing procedures along with their advantages in having substantial access to the main European airports.

Policy issues for air courier operations: As was reported earlier, the US market saw very significant growth in the express carriers in the 1980s. Federal Express, UPS and DHL set up significant European operations during the 1980s. UPS continues to operate in Europe but has suffered losses in this segment. Federal Express suffered very substantial losses in their attempt to clone their US operation in Europe, eventually pulling out of Europe in 1992.[12] TNT (the Australian owned carrier) and DHL continue to operate in Europe but like UPS they have sought to ally themselves with European local distribution networks or European postal services. The failure of Federal Express in Europe suggests several further constraints on the development of courier operations and other air freight developments despite liberalization.

The size of the European express market is small relative to the US with US interstate express packages averaging three million per day while in Europe, the average daily traffic is estimated to be of the order of 120000 to 140000 per day (*Economist* 1993). Establishing a presence in the express market requires a significant air network and surface distribution system at local levels, with strong marketing of services. The entry costs are high. In Europe, the postal services have moved to compete with the private operators, unlike the US where it is estimated that the Post Office now carries about 10 percent of overnight mail. Some of Europe's post offices have sought to form alliances with air carriers (for example, TNT) in order to compete in the express market. Links with the national airlines and rail companies, which have been put in place on a small scale so far, may present formidable market presence and keep out new entrants as they expand. Rail-air links particularly may offer a significant advantage in meeting city centre to city centre time-definite delivery requirements. As in the US, regulations governing other surface transport modes as well as other activities (for example, postal services, telecommunications etc.) must be considered in parallel with air transport regulations.

6. CONCLUSIONS

In this chapter, European air transport policy has been reviewed in some detail, with recent evidence suggesting that the market still faces significant

barriers to competition. Entry to intra-European routes has been slow, and no significant new competitor has emerged. Because of capacity constraints at several major European airports, and state ownership of (and often state aid to) flag carriers, entry will continue to be difficult for new carriers in the short to medium term at least.

The theoretical literature on network structure in deregulated markets was reviewed and it was shown that three main sets of factors could explain the intensified use of hub and spoke networks after deregulation. These were (i) cost economies (of scale, scope and density) impacting on firms' operations; (ii) demand side effects (such as fare reductions or frequency increases); and (iii) market dominance, where hub and spoke network structures permitted carriers to achieve or maintain dominant positions. These factors were related to the European experience in terms of how barriers to competition could hinder the development of more efficient network structures.

This chapter then looked at the air freight sector where several additional constraints were identified which may significantly hinder network growth and development. In this sector globally, the forecasts suggest that growth will continue at a rate of 1–2 percent higher than that for passenger services. In Europe however, the air freight sector is faced with several constraints limiting its growth and development. Environmental constraints limiting airport operating hours and requiring fleet replacement for many carriers reduce the ability of the air freight sector to gain from liberalization. Slot constraints at several key hub airports (which will impact on all classes of carriers) will force some carriers to develop cargo hubs at secondary centres. For integrators, where city centre to city centre elapsed times are crucial, the further development of multimodal networks may be problematic. Rail-air links together with alliances with Europe's postal services are likely to continue offering formidable competition to private integrated or express carriers.

The European 'liberalization' rather than 'deregulation' approach attempts to dismantle a complex series of national, bilateral and multilateral regulations within a single European market context. Network structure under EU liberalization was to become a matter solely for carriers to determine. The liberalization should in theory lead to net benefits because of improved efficiency in the industry, lower fares and greater choice for consumers via flight frequency and product variety. At present, a vision of how the industry is to evolve at different scales or in different subsectors does not emerge. The major phases of EU air transport liberalization will be achieved by 1997. What is required at this juncture is a fine tuning of these and other policies in order to facilitate the efficient development of this key component of the EU's transport networks.

ABBREVIATIONS

AEA: Association of European Airlines
CAA: UK Civil Aviation Authority
CRS: Computer Reservation System
EU: European Union
ICAO: International Civil Aviation Organization
RPK: Revenue Passenger Kilometre (one paying passenger carried one kilometre)
RTK: Revenue Tonne Kilometre (one revenue tonne carried one kilometre)

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NOTES

1. For a review of the legal and political progress towards the third package, see Button and Swann (1992); McGowan (1994).

2. A fifth-freedom right is the right to carry passengers and/or freight between two foreign countries on a route originating in or destined for the country of registration or ownership of the carrier.

3. Multiple designation is where multiple carriers are permitted to offer air services on an international route.

4. Cabotage is the right of a carrier of one state to carry traffic exclusively between two points within another state. Consecutive cabotage occurs when a carrier flies between two points within another state as a preliminary or continuation of a service to the home state.

5. The use of such a simplified network is a standard approach in the germane literature since the use of a more elaborate network with many nodes introduces mathematical complexity without any significant theoretical gains (see, for example, Morrison and Winston, 1986; Bittilingmayer, 1990; Berechman and Shy 1994).

6. Some authors (for example, Morrison and Winston 1986) have used 'number of passengers' to measure output. Yet, airlines actually provide capacity or number of flights per time unit which, given the demand, may or may not be fully utilized (load factors less than 100 percent). Furthermore, the use of ACM per time unit as a measure of output enables us to investigate the effect of deregulation on frequency of service.

7. In a more elaborate model we should have considered classes of passengers, e.g., business and non-business passengers. See Berechman and Shy (1994).

8. More specifically, for this result to hold it is necessary that the extra markup from passengers who are willing to pay the premium to fly directly is less than the extra markup from all other passengers. In most cases, the size of the former population is significantly smaller than that of the latter. In addition to frequency, the price that the airline firm can charge on each route is a critical factor. See the discussion below on entry deterrence.

9. It is certainly true that in the long run aircraft capacity is an endogenous choice variable. Here we treat it as an exogenous one mainly because entry attempts are essentially short run phenomena.

10. Many short haul low density routes are included in this total.

11. *Avmark* (April 1994) suggests that the charter carriers account for about 50 percent of total intra-European passengers and almost two-thirds of RPKs.

12. Recently they have established a small scale distribution network in Europe focusing on the main centres of population only.