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<tr>
<td><strong>Authors(s)</strong></td>
<td>Reynolds-Feighan, Aisling J.</td>
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<tr>
<td><strong>Publication date</strong></td>
<td>1989</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>UCD Centre for Economic Research Working Paper Series; WP89/12</td>
</tr>
<tr>
<td><strong>Publisher</strong></td>
<td>University College Dublin. School of Economics</td>
</tr>
<tr>
<td><strong>Item record/more information</strong></td>
<td><a href="http://hdl.handle.net/10197/1467">http://hdl.handle.net/10197/1467</a></td>
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U.S. Airline Deregulation – The Recent Experience and some Lessons for Ireland

by

Aisling J. Reynolds

Working Paper No. WP/8912

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1. INTRODUCTION

The U.S. airline industry was formally deregulated in October 1978, when President Carter signed the Airline Deregulation Act. It was felt that the industry had grown to such an extent that a more competitive environment was required to allow for continued development and expansion of the industry. In this paper, having briefly outlined the reasons for regulating, and then later deregulating the industry, the traffic patterns at U.S. airports in the last two decades are examined and important policy questions are raised. The general patterns of change among air carriers are also discussed; two carrier are focused and their network changes are described in more detail.

The European airline industry is gradually becoming more competitive, though as yet no specific legislation has been drafted to deregulate the industry. For the Irish industry, there are lessons to be learned from the U.S. experience in terms of (i) the network and organisation of Irish air carriers in Ireland and Europe and (ii) the size and spacing of the nation's airports. In the final section of this paper, these lessons are spelt out and future development paths for Irish airports and airlines are suggested.

2. REGULATION AND Deregulation of U.S. COMMERCIAL AVIATION

2.1 The Rationale for Regulation

U.S. commercial aviation was strictly regulated by various parts of the federal government for a period of 40 years. Regulation began in 1938 with the passage of the Civil Aeronautics Act. This Act established and gave authority over routes, entry into the industry and entry into markets to the Civil Aeronautics Authority (CAA) which in 1940 was re-organised into
the Civil Aeronautics Board (CAB). The CAA/CAB of the 1940s may be viewed as a response to a potential market failure at the time. There were 16 airlines in operation before regulation began (the so-called 'trunk lines') and it was felt that in the 1930s and 1940s, few air traffic markets could have supported more than one airline operating on any given route [Panzar (1980)]. Competition was cut-throat and it was suggested that the near bankruptcy of the airlines was caused principally by the competitive bidding system used by the Post Office in allocating airmail subsidies [Keeler (1972), Caves (1962)]. For most routes then, it was economical for only one carrier to transport the mail, and impossible for an airline to be viable carrying passenger traffic alone. Airline markets can be considered to have been joint product natural spatial monopolies. It was considered sound economic policy, under these circumstances to consolidate the responsibility for determining mail rates and passenger fares into a single entity, the CAA/CAB [Panzar (1980)]. While this agency controlled the air carriers in the industry, the Federal Aviation Administration (FAA) operated and controlled the airport system, as well as promulgating and enforcing safety regulations.

Control over routes and network structure was exercised by requiring airlines which provided scheduled interstate air service to hold a CAB certificate. The air carrier's certificate listed all the routes that it was authorised to serve. The CAB was required to apply a test of 'Public Convenience and Necessity' before awarding an interstate route authorisation to a new or existing air carrier. The CAB selected the airline to serve the route from among the applications tendered. The process was long and cumbersome, with the burden of proof falling on the applicant to demonstrate that other incumbent airlines would not be harmed in the process. The CAB made a conscious effort to preserve all existing
U.S. AIRLINE Deregulation - The Recent Experience and Some Lessons

For Ireland

Aisling J. Reynolds

Abstract

In this paper, recent trends in U.S. commercial aviation are examined, so
that an assessment may be made of the impact of the passage of the Airline
deregulation Act of 1978 on the industry and also on the national airways
system. The key planning issues for airlines and airports are highlighted
and placed in an Irish context to aid the planning strategies for a more
competitive European environment.

1 Support for this work was provided in part by a grant from the Ameritech
Foundation. Additional support was provided by the Regional Economics
Applications Laboratory at the University of Illinois. Much of the
preliminary discussion in the paper appears in the authors Ph.D. thesis.

2 Paper presented at the Dublin Economic Workshop Policy Conference,
Kenmare, October 1989.
carriers and to narrow the differences between the stronger and weaker firms.

2.2. Deregulation

It was claimed that regulation allowed for service to a much larger number of cities than would otherwise have been the case, because of the degree of internal cross-subsidisation taking place between the high volume/high profit markets and the thinner markets. In the 1960s and 1970s however, questions began to be raised about the actual level and degree of cross-subsidisation taking place, since empirical evidence suggested that some commuter or air taxi carriers (which were unregulated by the CAB) were managing to provide profitable, unsubsidised service in markets where even the subsidised local carriers had not been able to break even [Keeler (1972)].

In 1978, the U.S. Congress passed the Airline Deregulation Act (ADA). The ADA aimed at creating a more competitive industry and substantially reducing federal involvement. The Act allowed the CAB to grant operating rights to any carrier applying to serve a route on which a minimum level of service was not being provided; in many instances, though other carriers had authorisation to serve the market, they had chosen not to do so. Essential Air Services were provided in the thinner markets by continuing the CAB's subsidy programme for a 10 year period. Without CAB approval, carriers were allowed to decrease fares by up to 50% or raise them 5% above standard industry fares. The CAB's authority over routes ended in December 1981. In 1982, its authority over rates (fares), mergers and acquisitions ended, and the CAB itself was disbanded in December, 1984 [Moore (1986), CAB (1982, 1984), Meyer et al. (1981)].
3. INDUSTRY AND NATIONAL LEVEL TRENDS SINCE 1978

3.1. National trends

Since the early 1960s, U.S. passenger traffic has been growing steadily at an average annual rate of 5.8%, with minor declines in 1973/74 and 1980/81 due to the impact of the oil crises. Decline in 1980/81 must also be attributed to the correction after the temporary but phenomenally high enplanement figures for 1978 and 1979, the deregulation year. Figure 1 shows the traffic trend for the period 1969-87, where traffic is indexed to 1977. International traffic has consistently accounted for between 3 and 5 percent of the total U.S. traffic over this period.

Only those airports/airfields certificated to receive scheduled air services are served by the large U.S. certificated carriers. These airports are known as certificated points. The FAA classify certificated points based on the amount of passenger traffic that they handle in a one year period. The agency developed an 'air traffic hub structure', and use it to measure the concentration of all civil air traffic, in their economic and operations research procedures (CAB, 1983). The FAA air traffic hubs are not airports per se, rather, they are the cities and Standard Metropolitan Statistical Areas (SMSAs) requiring aviation services. These communities fall into a four hub classification scheme, depending on the community's percentage of the total enplaned passengers in all services and operations of U.S. certificated route air carriers within the 50 States and other designated areas. The hub classes are given below in Table 1.
U.S. PASSENGER ENPLANEMENTS
Traffic Index 1969–87

Traffic Index (1977=100)

Year

Figure 1
Airline 'hubs' in comparison, usually refer to those key airports (typically two or three) around which the entire route system is organised. Airline hubs emphasize the transfer of passengers, and accordingly, at these airports, the airlines offer a large number of connecting flights to other areas. The term 'hub' in the context of airline schedules is more loosely applied.

The increase in air traffic has not been equally distributed over the U.S. airport system. The traffic levels at some airports have grown at rates greatly exceeding the national average, while others have declined and indeed a substantial proportion have ceased serving the scheduled traffic market. The changing distribution of traffic can be very simply captured by computing rank correlation coefficients of the top 100 airport's ranks in 1967, with their ranks in 1985, 1981, 1977 and 1973. The vast majority of scheduled air traffic takes place at these top 100 'hubs'. Table 2 shows the percentage of U.S. traffic at these hubs in the four time periods mentioned above, and the proportion of all airports/communities certificated to receive scheduled service that the top 100 represent.
Table 2
Proportion of traffic at top 100 U.S. hubs 1969-87, and correlation coefficients of the top 100 hubs' ranks in 1987 with other years.

<table>
<thead>
<tr>
<th>Year</th>
<th>% Traffic</th>
<th>Proportion of CPs</th>
<th>Total no. of CPs</th>
<th>Correlation with 1987 ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>96.9</td>
<td>27.9</td>
<td>524</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>92.5</td>
<td>13.0</td>
<td>772</td>
<td>0.707</td>
</tr>
<tr>
<td>1977</td>
<td>92.3</td>
<td>15.7</td>
<td>633</td>
<td>0.749</td>
</tr>
<tr>
<td>1981</td>
<td>94.7</td>
<td>15.9</td>
<td>627</td>
<td>0.848</td>
</tr>
<tr>
<td>1985</td>
<td>96.0</td>
<td>26.7</td>
<td>374</td>
<td>0.953</td>
</tr>
<tr>
<td>1987</td>
<td>97.7</td>
<td>26.2</td>
<td>477</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Source: CAB/FAA Airport Activity Statistics of the Certified Route Air carriers, Washington D.C.
1 CPs refers to certificated points.
2 The correlation coefficient was not computed for 1969, since it was not possible to determine the ranks of all hubs in that year.

The total number of FAA certificated points has dropped substantially since deregulation, so in effect, a smaller number of airports/communities are handling a substantially greater volume of traffic in the 1980s. Figure 2 shows the total numbers of large, medium and small hubs for the period 1969-87. The number of large and medium hubs in the system has remained relatively constant in the last 12 years, though the number of small hubs has fallen noticeably, and accordingly so has the proportion of traffic at these nodes in a given year. U.S. air traffic has become considerably more concentrated at a smaller number of centers. It is most likely that many of the smaller communities began receiving alternative service when scheduled service ceased, but these data are not as easily or readily available.

Along with the reduction in the number of centres receiving scheduled air services, the spacing of the remaining airports has also changed over the recent decades. In Figure 3, the average distance between large hubs and
U.S. FAA HUBS 1969–87
Number of large, medium
and small hubs

Number of hubs


Year

Figure 2
HUB SPACING 1965–85
Mean distance between hub types

Average distance (miles)

Year

Hub types
- L TO L
- L TO L/M
- L TO L/M/S

Figure 3
other large, medium and small hubs for the period 1965-85 are presented. Since the 1960s, it can be observed that the mean distance separating large hubs has been reducing gradually (L to L in Figure 3). A less stable trend is noted for the large to large or medium hub figures (L to L/M in Figure 3). The average mileage between large and all other hubs has been increasing over the period (L to L/M/S in Figure 3). The relative growth or decline in particular regions has brought about a more efficient spacing of airports in the continental U.S.. CAB fares before deregulation were generally thought to be too low for short distance routes and too high for long distance routes. After 1978 carriers were free to vary fares. In this context, the decline in many small centres would indicate a possible substitution of other transportation services for air transport, in cases where distances are small (i.e. <100 miles).

3.2. Changes at FAA hubs, 1969-87

A random sample of five large, five medium and five small FAA hubs were selected from the 1987 Airport Activity Statistics of the Certificated Route Air Carriers. The total domestic scheduled and nonscheduled passenger enplanements were recorded for each certificated carrier serving the hub, and these traffic distributions were detailed for the years 1969, 1973, 1977, 1981, 1985 and 1987, (five year periods, with 1977 being the last fully regulated year and 1987 being the most recent year for which data were available).

For the five large hubs (serving between 1.65% and 5.30% of total U.S. traffic), the average number of carriers increased from 8.2 in 1969 to 15.2 in 1987. This increase in the number of carriers is quite marked after 1977, since the ADA allowed carriers to enter new markets freely after 1979. There was an average of 17 carriers serving the large hubs in
1985, though this number dropped in 1987, due most likely to the
contraction in the total number of carriers serving the industry, because
of mergers, takeovers/acquisitions or less typically, financial failure.

The Gini index, measuring the difference between actual traffic
distribution and a traffic distribution where all carriers carried the
same proportion of traffic, was computed for each time period and rose
from an average of 0.526 in 1969, to an average of 0.701 in 1987 for FAA
large hubs. A Gini index of 0.5 is quite high under any circumstances, so
it must be stressed that almost a decade before deregulation, traffic
patterns at large U.S. hubs exhibited a high degree of concentration, and
after passage of the Act, this tendency became even more marked.

The Gini index is positively and significantly correlated with the number
of carriers serving each airport (the R-squared is 0.46). The Gini index
is also positively and significantly correlated with the proportion of
traffic at each airport \( R^2 = 0.44 \). Regressing the Gini index on both of
these variables gives an \( R^2 \) of 0.63. The relationship between the
proportion of traffic and the number of carriers is very weak \( R^2 = 0.19 \).
so that the busiest airports do not necessarily have a large number of
carriers serving them, but these airports are likely to have a more
concentrated traffic distribution in comparison to the smaller airports.
Those airports being served by a larger number of carriers are also likely
to have a more concentrated traffic distribution.

The dramatic increase in concentration, particularly at the largest hubs,
reflects the large airlines' consolidation of their "hubs" at these
airports in the deregulated environment. The concentrated nature of the
traffic distribution prior to 1978, indicates that many carriers had
already selected and grown around a small number of key nodes in their systems, and, deregulation allowed this growth to continue in a more streamlined and efficient manner. The air carriers would logically have had a small number of major maintenance facilities at the airports they served, and aircraft rotation schedules would be planned around these nodes. The problem for the airlines with the regulations enforced by the CAB was that the ability to add and cut routes was very limited, and so, traffic flows and aircraft movements could not be channelled through such a narrow subset of nodes. The ADA did allow this streamlining to take place, and the hub-and-spoke networks currently being observed, are the logical progression for the airlines.

For all FAA hubs, it must be remembered that huge growth was taking place in the volume of traffic at these airports, in order for them to maintain their status (i.e. for medium hubs, they consistently needed to carry between 0.25 and 0.99% of total U.S. traffic). As with the large hubs, the increase in the number of carriers serving these airports is quite dramatic after 1977, though for the medium hubs, the increase is at a slower rate, with this trend being consistent for the 10 years since 1977. The Gini index for the medium hubs is consistently lower than for the large hubs. The index began increasing substantially after 1977, rising from 0.361 in that year to 0.567 in 1987. The airlines select these nodes as obvious centres of growth and accordingly, have moved in and in many instances, used them as secondary hubs in their systems. Figure 4 plots the average Gini index for each hub type for the 18 year period, while Figure 5 shows the average number of carriers serving each hub type over the same period.

The number of carriers serving small hubs has increased also in the
U.S. COMMERCIAL AIR TRAFFIC
Average Gini coefficient at each hub type

Mean Gini coefficient

0.8
0.6
0.4
0.2
0

Year

Hub type

← Large ← Medium ← Small

Figure 4
U.S. COMMERCIAL AIR TRAFFIC
Average number of carriers at FAA hubs

Average number of carriers

Year

Hub type

- Large  - Medium  * Small

Figure 5
deregulated period. In 1969, there were an average of 2.4 carriers at the
five small hubs in this sample. There were 2.6 on average in 1977 and 5.6
in 1987. However, looking at the traffic distributions at these airports,
it is noted that only a small change has taken place in the concentration
levels, in the 10 years since deregulation. Generally speaking, the Gini
index continues to reflect a more equitable distribution of traffic among
carriers serving small hubs. This is good for these communities, since if
their traffic load is being relatively evenly spread over an increasing
number of carriers, they are also spreading their risks, giving them
greater stability.

3.5. U.S. Air Carriers 1969-1987
The total number of certificated carriers for the period 1969-87 is
plotted in Figure 6. Between 1969 and 1978, the number of carriers
fluctuated between 33 (1974) and 37 (1970), dramatically rising to 52 in
1979, the first fully deregulated year. The industry continued to expand
in the subsequent years. In 1983, the total count dropped by 7 carriers,
and the general trend recently, has been a gradual fall-off in the number
of carriers in the industry. The decline does not necessarily reflect
financial failure of carriers, but rather the extent of mergers, takeovers
and acquisitions by other airlines in the industry.

Air carriers are allocated to one of four groups: the Majors (with annual
operating revenues of at least $1 billion); the Nationals (operating
revenues of between $100 million and $1 billion); the Large Regionals
operating revenues of between $10 and $100 million); and the Medium
Regionals (with operating revenues of less than $10 million). The number
of majors has remained relatively constant over the period 1969-87. The
greatest changes have occurred in the medium and large regionals
categories. The number of medium regionals fell sharply from 26 in 1982 to
U.S. AIR TRAFFIC 1969–1987
Number of Certified Carriers

Number of Carriers

Year

‡ # Carriers

Figure 6
just 4 in 1987, while the number of large regionals has varied up and down from a high of 23 in 1984, to 15 in 1987. Looking at the trends for the earlier period (1969-80), there were consistent numbers in all categories up until 1979. The categories were different to those listed above, focusing on carriers' certificates rather than traffic volume and so after deregulation the classification scheme broke down. The major carriers served 77.4% of the total U.S. passenger traffic in 1987, and attention is now turned to examining two of these carriers in more detail.

Both Continental and American existed before regulation was first imposed in 1938, and as was pointed out above, airlines in this position were given special attention and protection under CAB regulation. The economic status of air carriers in the current period was, to a large extent, predetermined by their status under regulation. The trunk carriers emerged in the late 1970s with by far the largest share of the air passenger traffic market, the most extensive aircraft fleet and gate ownership levels and with long standing public reputations. In the ten years since 1978 however, three of the 11 trunks of 1978 have declared bankruptcy and two were acquired by other trunks. In 1988/89, 9 of the 11 trunks were flying, many under different management and corporate frameworks.

Table 3 shows a traffic index for Continental and American from 1969 to 1987 (1977, the base year, =100) and also the share of total domestic traffic handled by these airlines over the same period. American's volume of traffic has increased 240% since 1977, though its share of the passenger market is almost exactly the same in 1987 as it was in 1969. This airline's market share dropped in the 1970s and continued to decline initially under deregulation. American has managed to recapture its earlier share of the market via extension of its network and purchase of
smaller feeder airlines (e.g. Air California Inc., and American Eagle). Continental Airlines was a smaller trunk, and its market share varied from 3.0% of total traffic in 1969 to 3.4% of traffic in 1973. The volume of traffic handled by Continental rose slowly after 1978. Continental was acquired by Texas Air (formerly Texas International) in 1981, and declared bankruptcy in 1983. After re-organisation in 1984 and 1985, the company purchased People Express (and its subsidiary, Frontier), New York Air and Rocky Mountain Airways Inc., from its parent company. Continental rapidly increased its volume of traffic, 530% over the 1977 volume. Its share of the U.S. market grew from 3.04% in 1981 to 9.1% in 1987.

<table>
<thead>
<tr>
<th>Year</th>
<th>Continental Airlines traffic index</th>
<th>share of U.S. market</th>
<th>American Airlines traffic index</th>
<th>share of U.S. market</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>63.68</td>
<td>3.009</td>
<td>86.99</td>
<td>12.642</td>
</tr>
<tr>
<td>1973</td>
<td>90.03</td>
<td>3.443</td>
<td>92.48</td>
<td>10.874</td>
</tr>
<tr>
<td>1977</td>
<td>100.00</td>
<td>3.293</td>
<td>100.00</td>
<td>10.125</td>
</tr>
<tr>
<td>1981</td>
<td>111.49</td>
<td>3.048</td>
<td>107.92</td>
<td>9.071</td>
</tr>
<tr>
<td>1985</td>
<td>208.50</td>
<td>4.153</td>
<td>181.98</td>
<td>11.145</td>
</tr>
<tr>
<td>1987</td>
<td>534.82</td>
<td>9.099</td>
<td>242.29</td>
<td>12.675</td>
</tr>
</tbody>
</table>


Both airlines have greatly expanded the size of their domestic networks since 1977, Continental increased its numbers from 33 airports in 1977 to 122 in 1987, while American increased its numbers from 50 in 1977 to 119 in 1987. Looking at the emphasis within the networks, American Airlines has consistently focused their operations on the FAA large hubs. The proportion of traffic at these large hubs increased in the deregulated period, when all FAA large hubs were served by this airline.

Continental Airlines has significantly increased its traffic proportion at
the large hubs it serves. In 1977, 67.8% of its traffic passed through FAA
large hubs, while in 1987, 78.8% of its traffic was channelled through
these communities, when all but one of the FAA large hubs were served. As
with American, the proportion of traffic at medium hubs has declined,
along with a decline in the proportion of traffic at small hubs' also. In
1987 however, this airline dramatically increased the number of small hubs
and nonhubs that it served: much of this increase in the network size is
explained by the mergers and acquisitions mentioned above.

The traffic distributions over the airlines' systems were examined for
each of the time periods selected. Scheduled and nonscheduled domestic
passenger enplanements for each airport in the system were recorded for
the six years. The Gini index was computed for these traffic distributions
for both carriers, and these are detailed in Table 4.

<table>
<thead>
<tr>
<th>Year</th>
<th>Continental Gini index</th>
<th>American Gini index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>0.565</td>
<td>0.589</td>
</tr>
<tr>
<td>1973</td>
<td>0.553</td>
<td>0.603</td>
</tr>
<tr>
<td>1977</td>
<td>0.555</td>
<td>0.618</td>
</tr>
<tr>
<td>1981</td>
<td>0.674</td>
<td>0.705</td>
</tr>
<tr>
<td>1985</td>
<td>0.659</td>
<td>0.713</td>
</tr>
<tr>
<td>1987</td>
<td>0.741</td>
<td>0.718</td>
</tr>
</tbody>
</table>

The Gini index shows gradual increases in both American and Continental
Airlines' traffic distributions between 1969 and 1987. The Gini index is
proposed as a superior measure to those previously used in the economic
literature, because it takes account of the entire distribution, makes
unit free comparisons and it satisfies the axioms proposed by Sen (1976)
which capture several, intuitive properties of a good measure of
concentration [Reynolds (1989)]. The Gini index is also easily illustrated, and it is used now to highlight changes in both Continental and American's traffic patterns in the last c.20 years.

Figures 7 and 8 illustrate the changing nature of Continental and American Airlines' traffic distributions between 1969 and 1987. The high level of concentration in both airlines' traffic patterns in 1969 and 1977 indicate that the recent phenomenon of hub-and-spoke networking is not so drastic a change in organisation, but rather a refinement of a general trend among larger carriers, to concentrate flows from an increasing number of nodes in their system, through a small number of key airports or carrier hubs. The same comments were made earlier when airport patterns were examined. These trends have become exaggerated since 1977, but were very definitely in place prior to deregulation.

To summarise then, the major U.S. carriers examined here, have greatly expanded their networks (be it through natural growth or merger with/acquisition of other carriers) since 1977, and have maintained or increased their market shares by serving a very high proportion of the large and medium FAA hubs, and by streamlining their services through a small number of key hub-airports. The size of the national airways system serving the scheduled traffic market has contracted considerably since deregulation. This smaller national network which is handling a tremendously increased volume of traffic, is now being served by a greater proportion of the major carriers. The 11 trunk carriers in 1977 accounted for 77.86% of all U.S. traffic in that year. In 1987, the 12 major carriers accounted for 77.40% of U.S. traffic: change in the industry structure has occurred among the smaller carriers: the large and medium regionals were the classes of scheduled carriers experiencing the greatest change, in terms of new entrants and subsequent exits.
CONTINENTAL AIRLINES
Traffic distribution 1969–87

% Enplanements

0 20 40 60 80 100

% Airports

Year

1969 1977 1987

Figure 7
AMERICAN AIRLINES
Traffic Distribution 1985–85

% enplanements

% airports

— 1985  — 1986

Figure 8
4. LESSONS FOR IRISH COMMERCIAL AVIATION

4.1. Irish airlines

For the U.S. carriers, their status and organisation before deregulation greatly influenced their position in the market after 1978. The large carriers had well established hubs before deregulation, and as was discussed in the last section, growth, development and expansion was focused around these key nodes in the deregulated environment. Aer Lingus has established Dublin as its major hub, but it is important that the airline develop secondary and tertiary hubs elsewhere in Europe. The hubs operate as regional centers of activity in an airline's network, gathering passengers from a substantial hinterland of smaller airports. The secondary hubs are also passenger gathering centres and successful interaction between hubs depends on the size of the connecting passenger traffic generated, since from the airline's standpoint, the most important function of the hub is that it be a point of transfer for passengers. Thus it is important that at each hub, the airline offers a large number of connecting flights to other areas. The U.S. airlines construct what they call 'complexes' which are blocks of flights arriving at the hub airport within a very short period of time, and this is followed by an equally large number of departures, when passengers have made their connections. Major airlines will have between 3 and 5 complexes in operation every day at their hub airports. Hubs that are too close together will end up competing with one another for passengers rather than being regional specialists in the airline's operation.

The hubs must also have a sizeable local demand: all of the U.S. airlines have selected FAA large or medium hubs as the key nodes in their networks, since these communities have relatively large local populations. In many
instances in the U.S., the volume of traffic handled by an airport may not accurately reflect the size of the hinterland population. Atlanta, Georgia, for example, was the busiest commercial airport in 1983 and 1984. All of the large hubs however are characterised by relatively large urban populations, and it is the connecting passenger volume which then distorts the degree of association between urban population hierarchies and air traffic hierarchies. The essential points to be made in an Irish context in this regard are that Irish airlines, Aer Lingus particularly, will need to establish secondary hubs elsewhere in Europe, but in such areas that they will control a substantial regional submarket. The hub airports need to be well spaced, so as to maximise the air traffic potential for the airline's route system. The hubs are typically large centers in and of themselves, and the traffic gathering mechanisms requires that 'spoke' routes be established between the hub and other surrounding airports. Currently the major U.S. air carriers serve most, if not all of the large and medium FAA hubs: while the frequency of service may be low, the inclusion of all of these large population centers in the airline's system offers them greater direct and indirect connecting passenger potentials. Irish airports are limited in the local passenger potential that they offer the airlines. Shannon, for example, has good facilities and the advantage of the U.S. Immigration Service on this side of the Atlantic. However the small local demand makes this airport an unlikely possibility in terms of substantial future expansion. One possible way to increase the local demand level would be for an airline like Aer Lingus to offer bus services from a number of centres to Shannon, and take the responsibility for passengers from the time they board the buses. By using alternative modes as passenger gathering services for regional airports, the continued expansion by the airline in Ireland would be sensible and justified. Minimum distances, in terms of where the comparative advantage of air
travel exceeds other modes, must be examined and used to help measure future traffic potential.

The major U.S. carriers of today have developed extensive routing systems in one of two ways: (i) for some, like American Airlines, a strong planning department has set out long term growth paths for the airline, and the gradual movement into new markets is carefully monitored and articulated (ii) for an airline like Continental, the development of secondary hubs was achieved by take-over of other carriers: Continental's Newark hub was formally the main center of the People Express airline firm. The process of integrating two or more systems of routes is a slow and difficult one, and Continental has encountered a number of problems in undertaking such a project, but in the long run, the regional specialisation which each hub enjoys, gives the airline a strong base from which to expand. Figure 9 shows Continentals traffic patterns at airports in the Continental U.S., and this regional effect is clearly seen. Aer Lingus has rapidly expanded the size of its network in Europe and in Ireland, but as was mentioned above, the airline must now build up a secondary hub elsewhere in Europe, or alternatively, form an alliance with another carrier which is currently acting as a regional centre in west-central/south-central Europe.

In selecting routes, the airline must trade off load factors with connection rates: In the U.S., the routes directly linked to the airlines hubs generally have higher load factor because the markets are denser. The thinner markets have lower load factors (between 5 and 15 percent lower, on average), but the connection rates are considerably higher than the dense markets, with at least 70% connection rates or higher. Thus in evaluating the addition of new routes, account must be taken of both
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Figure 9
direct passenger potential and connecting passenger potential. The joint product nature of the production process becomes very important in these kinds of assessments. Having selected which routes to fly, the matching of equipment type to the route characteristics, given potential passenger traffic is a key determinant of technical efficiency.

4.2. Irish airports

For Irish airports, two main points need to be made with regards entering a more competitive environment in Europe. First, it is clear that investment in groundside facilities was more risky after deregulation in the U.S. While some airports experienced considerable growth in traffic volume, others declined significantly. At the smaller airports in particular, expensive expansion plans depended heavily on whether or not airlines decide to service the community: in cases where airlines withdrew service, the community often found that the land was more productive when put to other use, and accordingly, a large number of airports were closed down. The other extreme occurred in situations where small airports experienced a high growth in demand for their facilities, but were unable to satisfy this demand. While deregulation allowed airlines to determine their own routes, rates and service frequency, no mechanism was left for determining which airlines should get access when an airport has limited facilities (Quinones, 1986). Thus for European and Irish airport planners, it is important that procedures for allocation of facilities and terminal space be clearly set out and enforced.

As was mentioned in the last section, Ireland's small land area and small potential passenger demand suggest that the development of alternative modes of transport, like bus or less likely, rail services, would present a way of gathering the dispersed population and generating greater local
demand for the airports which have been constructed and maintained to
date. The greater direct passenger potential would make the facilities
more attractive to air carriers as spoke routes, and increased frequency
of service would raise airport revenues.

In summary, Ireland's peripheral location in Europe requires that Irish
airport authorities will need to rationalise the number of centres from
which air transport services will be offered, and improve the
attractiveness of these centres by generating greater local demand. For
Irish airlines, there is a need to focus heavily outside of the island, if
they are to expand and compete in a freer market. Alternatively, if they
continue to focus on the small regional Irish market, they will seriously
need to consider merger or joint venture agreements with other regional or
European national carriers. Air traffic markets exhibit decreasing returns
to scale in markets where passenger demand is limited. The utility of
these markets lies in the indirect passenger potential that they generate
for the more substantial airports. These small markets need to be part of
a larger system however, if their economic sustainability is to realised.

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