2. United Kingdom

AIRLINE DEREGULATION AND PRIVATIZATION
IN THE UK

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1. Introduction

Evaluation of changes in regulatory policy towards airlines in the UK is necessarily different from that appropriate to industries such as telecoms and electricity. Compared with British Telecom and the electricity companies, for example, the UK’s leading airline, British Airways (BA), derives a large proportion of its income from international operations. In order to avoid too narrow a focus, therefore, European Community airline policy will be considered alongside British policy, although wider international issues -- such as multilateral renegotiation of air service agreements -- will not be addressed.

In practice, however, broadening the coverage of the paper to include European Community policy does not have major implications for empirical analysis. Although UK deregulation of airlines has lagged significantly behind developments in the United States, European Community (EC) reforms have lagged behind even more. Thus, whereas substantial deregulation occurred in the UK in the mid 1980s, major European Community reform in airlines is a phenomenon of the 1990s. As a consequence, evidence on the effects of EC policy reforms is still highly limited.

The UK can also be distinguished from most of the other Member States of the EC by virtue of the fact that its major national carrier is fully, privately owned.¹ In many ways the privatization of BA at the beginning of 1987 is the decisive event in the history of the UK industry over the past twenty years, not only because of the direct impacts of the transfer of ownership but also because government policies on issues of deregulation and liberalization have been much influenced by the flotation.²

Arguably, privatization itself is a form of deregulation: although in principle state-owned enterprises can be required to operate as fully commercial operations, in practice they are frequently used as instruments to achieve certain types of political or public policy goals. Privatization therefore typically involves abandonment by the state of some of its very specific policy instruments. It is, of course, open to government to introduce new regulatory instruments to compensate, at least partially, for the loss, and this was the course followed in the UK in newly privatized industries such as electricity, gas, telecoms and water. Where such new regulations are substantial in scope it is, therefore, more accurate to talk of regulatory reform rather than of deregulation. In respect of airlines, however, the flotation of BA did not lead to the creation of

¹ The national carriers of other member states of the EC can be divided into those that are 100% state-owned (egs. Air France, Aer Lingus), those that are majority state-owned (egs. Lufthansa, Alitalia) and those in which there is a substantive but minority state holding (egs. KLM, Luxair).
² The distinction between promoting competition and deregulation is an important one in the European context. In the UK, for example, the new regulatory agencies created during the privatization programme have been given powers and duties to promote competition, so that in some dimensions the degree of regulation has actually increased.
any new agency -- the Civil Aviation Authority (CAA) continued to operate as the industry’s main regulatory body in much the same way as it had previously³ -- and the reduction in the Department of Transport’s control over the industry consequent upon BA’s privatization can therefore properly be viewed as a form of deregulation.

Given these points, it is appropriate to begin an assessment of developments in UK airlines policy with a discussion of the BA privatization, and section 2 will be devoted to this task. Section 3 of the paper then outlines some of the main features of both UK and EC airlines policy. The main empirical part of the paper, section 4, examines evidence on the performance of BA and assesses the factors that have been most influential in determining that performance. Conclusions are summarised in section 5.

2. The Privatization of British Airways

The UK airline industry is dominated by British Airways, which in 1992 was responsible for about 64% of all available tonne kilometres, both scheduled and charter⁴, supplied by UK airlines. BA’s share of scheduled capacity is substantially higher still, standing at over 84% in 1992 (see Table 1). Unlike in the USA and in Japan, therefore, the history of the recent economic performance of the UK industry is largely the history of the performance of one company.

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<th>Leading UK airline’s share of scheduled capacity in 1992 (ATKs).</th>
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<td>Virgin Atlantic</td>
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<td>British Midland</td>
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Source: Civil Aviation Authority.

British Airways was formed in 1972 as a result of the amalgamation of the two major UK airlines British Overseas Airways Corporation (BOAC) and British European Airways (BEA), both of which were state owned. BOAC had been chiefly responsible for long-haul routes while

³ The CAA is the body responsible for both the economic and technical regulation of the industry, including matters such as issuing domestic route licences and deciding which UK airlines to designate on particular routes under bilateral international agreements.

⁴ The charter market is made up chiefly of flights carrying tourist traffic and has been subject to a much lighter regulatory regime than scheduled services.
BEA had operated on the shorter domestic and European routes. Both airlines suffered from poor labour productivity, inefficient fleet structures and low profitability, problems that it was intended that the merger would help address.

Until 1981 BA was operated in fairly traditional ways as a public corporation responsible directly to its sponsoring ministry, the Department of Transport. A number of major changes in performance occurred during this early part of the corporation's history, including substantial reductions in staff numbers, withdrawals from unprofitable routes, and sales of some of BA's assets. Nevertheless, the corporation was in a relatively poor financial position at the beginning of the 1980s, in part as a result of the escalating fuel costs and the slowdown in traffic growth that faced all major airlines at that time. Pre-tax profits fell from £70m in 1978/9 to £20m in 1979/80 and to -£141m in 1980/1, and the burden of net debt had increased to over £1000m by the end of this period.

The underlying market position of the corporation was nevertheless a reasonably strong one. For example, its international route network was one of the best in the world and its centre of operations was London Heathrow, the busiest of the European airports. The potentiality for improved performance was therefore beyond doubt and BA was one of the earliest public corporations identified for privatization.

Although the first plans for privatization were put forward in July 1979 at the very beginning of the first Thatcher administration (which had come to power in the previous month), these initial intentions were rather different from the eventual outcome. What was envisaged in 1979 was a sale of some shares in the enterprise, the model here being British Petroleum which had the legal form of a joint stock company with a majority state shareholding and minority private shareholdings. That is, the idea was to convert BA from a traditional British public corporation -- which had no shareholders and derived all its finance from central government -- to a form of state-ownership with private sector participation that has been much more prevalent in continental western Europe than in Britain.

In 1981 a new management team was established under the chairmanship of Lord King with a brief to run the corporation on more commercial lines, turn around its financial performance, and prepare it for potential privatization (which by this stage was coming to mean a full transfer of ownership to the private sector rather than simply a sale of a minority interest). The new regime sought to re-organize the company in a number of ways, including the following:

i. Substantial reductions in staff numbers through early retirement, redeployment and voluntary redundancies.

ii. Modernisation of BA's fleet of aircraft via the acquisition of new, generally larger aircraft and the accelerated disposal of older craft.

iii. Improvements to control systems and terminal facilities.

BA continued to be a public corporation until April 1984 when it became a public
limited company (plc) in readiness for flotation. From that date, therefore, BA had the same legal form as most large companies in the private sector, although the Government held 100% of the shares.

Although the financial performance of BA improved relatively quickly after 1981 (see section 4) and sale of the company was initially planned for 1985 or 1986, in the event privatization was delayed until early 1987. Late in 1982 the liquidator of Laker Airways -- a small privately owned airline that had managed to gain a license to operate on North Atlantic routes in competition with the major incumbents but which had subsequently gone bankrupt -- brought a triple damages suit for $1 billion in the US courts against BA and other airlines on grounds that they had conspired to drive Laker from the market. The size of the claims and the legal uncertainties surrounding the case led to difficulties in specifying the liabilities of BA in the offer for sale document, and flotation was therefore deferred until the legal claims were settled.

In early 1987 the Government sold the entirety of its stake in the airline (i.e. no minority interest was retained) and realised sales proceeds of £900m. By the end of the first day of trading the market value of the ordinary shares of the company had risen to £1215m, giving an immediate capital gain to investors of 35% (or 68% if calculated on the partly-paid price per share).\(^5\)

Prior to privatization the main UK rival to BA was British Caledonian (BCal) which operated on both domestic and international routes. BCal was much smaller than BA and suffered from having a much less advantageous route structure, but it had received some support from the regulatory authorities and the Government in line with the “multi-airline” policy being pursued at the time (see section 3).\(^6\) In 1986 BCal ran into financial difficulties, among other things as a result of the adverse impacts on traffic volumes of falling oil prices on its Saudi Arabian and Nigerian routes and of events such as the Chernobyl nuclear accident and political conflicts involving Libya. After a reference to the Monopolies and Mergers Commission and a commercial battle with the Scandinavian airline SAS, BA management used its new found commercial freedom to acquire BCal and thereby to enhance its leading position in the UK still further, including by increasing its share of landing slots at London’s second airport, Gatwick, where BCal had a strong base.

Subsequently BA has gone on to consolidate its European and international position by acquiring minority interests in TAT (France), Deutsche BA (Germany), Quantas (Australia), USAir and Air Russia; acquisitions which, together with the BCal merger, add up to a pattern of business conduct that would have been virtually impossible under state ownership.

\(^5\) Shares were offered at £1.25 each in return for an initial payment of £0.65 per share and a deferred payment of £0.60 per share. By selling shares before the second instalment was due, shareholders could limit the size of their investment in the company.

\(^6\) There are some analogies here with the position in telecoms, where Mercury has been promoted as a rival public network operator to British Telecom (the so-called “duopoly policy”).
3. British and European Airlines Policies

3.1 Britain

Until the late 1960s the right to operate scheduled services in or from the UK was largely restricted to the incumbent state-owned air corporations. In 1969, however, a Committee of Enquiry into air transport policy (the Edwards Committee) recommended that competition in the industry be fostered by the creation of a second-force UK airline and that such an airline should be assisted by the transfer of some routes from the state corporations. The proposal was endorsed in a government White Paper of the same year, leading to the creation of the privately owned British Caledonian Airways from the merger of two smaller companies. The White Paper was explicit in stating that the Civil Aviation Authority should give preference to BCal in its licensing policy for international scheduled services. Thus, some African routes were transferred to BCal from BOAC and BCal was given permission to compete with BEA on the London to Paris route. In the event, however, the route transfers actually made were much less significant in scope than had been envisaged by the Edwards Committee.

Throughout the 1970s a policy of giving preference to BA and BCal in the granting of licences for international scheduled services was pursued, and a White Paper in 1976 concluded that there should be no competition between UK carriers on long-haul scheduled services (i.e. BA and BCal should serve distinct long-haul markets). In practice, there was slight erosion of this policy in that Laker Airways was allowed to operate in competition with BA on the London to New York route and BCal managed to achieve significant expansion of its long-haul network. Nevertheless, the general policy stance continued to be relatively restrictive of competition, including on short-haul routes. For example, the CAA was generally reluctant to license new short-haul scheduled services where these were likely to render the operations of existing operators unprofitable.

The first major steps toward a more liberal policy came with the passing of the Civil Aviation Act 1980 which, among other things, amended the duties of the CAA in carrying out its licensing functions. For example, the CAA was now required to pay particular attention to the potential benefits of licensing more than one UK airline on the same route. As the Monopolies and Mergers Commission (1987, paragraph 2.5) noted: “This change coincided with a trend towards liberalisation of some inter-governmental air service agreements .... A number of British airlines other than BA and BCal have thus been able to enter the market for international scheduled services in recent years.”

In 1983 the Government requested that the CAA review the implications for competition and for the development of the UK airline industry of the planned privatization of BA. The CAA's report, published in July 1984, was concerned with the issue of how to prevent BA's market power from inhibiting the development of other UK airlines whilst at the same time maintaining the competitive position of BA in relation to foreign airlines. Despite the latter
concern, the report made a number of relatively radical proposals aimed at weakening the market power of BA. These included:

i. licensing of BCAL in place of BA on routes to Harare, Dhahran and Jeddah;
ii. transfer to other airlines of all BA’s scheduled services from London Gatwick;
iii. transfer of all BA’s European services from provincial airports to other airlines;
iv. creating access to London Heathrow for BA’s competitors on those of BA’s domestic trunk routes where competition did not yet exist, if necessary by reducing BA’s frequencies to make way for new services;
v. various proposals to increase freedom of entry; and
vi. deregulation of prices on domestic routes.

The Government’s response to the CAA report was contained in a major White Paper, published in 1984 and entitled Airline Competition Policy, which established the framework in which a privatized British Airways would be expected to operate. In addition to the maintenance of high safety standards, the White Paper set out four main objectives of policy:

- to encourage a sound and competitive multi-airline industry;
- to promote competition in all markets both internationally and domestically;
- to ensure adequate safeguards against anti-competitive or predatory behaviour by airlines; and
- to privatize BA.

The fourth of these objectives, the privatization of BA, led the Government to reject those of the CAA’s proposals that would have led to a forced reduction in BA’s size. These were principally the CAA’s route transfer recommendations (items (i) - (iii) on the CAA list above). In support of the decision, the White Paper reasoned that, provided that conditions of fair competition prevailed, smaller airlines would continue to be able to grow (as they had in the past). Instead of forced route transfers, a voluntary exchange of routes between BA and British Caledonian was negotiated in which BA gave up its routes to Saudi Arabia in return for British Caledonian routes to South America which were proving unprofitable for the smaller airline.
Table 2. Privatization and deregulation in the UK: chronology of main events.

1969 Edwards Committee recommends the creation of a second-force UK airline to compete with the state-owned BOAC and BEA.

White Paper endorses the Edwards Committee proposals, leading to the formation of BCal and limited route transfers to the new airline.

1972 Formation of BA through a merger between BOAC and BEA.

1976 White Paper concludes that there should be no competition between UK carriers on long haul scheduled services.

1980 Civil Aviation Act is passed, shifting policy to a more pro-competition stance. Among other things, the Act gives the CAA a direct duty to further the interests of users of airlines and to have particular regard to the benefits that might arise from licensing two or more UK airlines on the same route. The Act also gives the Government rights to sell shares in BA.

1981 Lord King becomes chairman of BA.

1982 Launch of an extensive cost cutting programme, including employment reductions, suspension of unprofitable routes and disposal of surplus assets.

1984 Publication of the CAA review of the industry and of the Government White Paper Airlines Competition Policy, leading to further deregulation of domestic markets.

British Airways is converted from a public corporation to a “public limited company” (i.e. a joint stock company) in readiness for privatization.

1985 Privatization is postponed pending settlement of US anti-trust litigation concerning operations on North Atlantic routes.

1986 Anti-trust litigation is settled.

1987 BA is privatized via an offer for sale and shares start trading on 11 February.

Announcement of merger between BA and British Caledonian followed by a Monopolies and Mergers Commission investigation leading to approval of the merger.

1989 BA attempts and fails to acquire 20% of Sabena World Airlines (the Belgian flag carrier).

1992 BA acquires 49.9% of TAT European Airlines (a French domestic carrier) and 49% of Deutsche BA (a renamed German domestic carrier).

1993 BA acquires 25% of Quantas (one of the two major Australian carriers).

Announcement of BA plans to acquire a 19.9% stake in USAir.
BA was allowed to retain its position at London Gatwick and at the various provincial airports. In this case the reasoning was that BA's presence at these airports enhanced their stature and thereby contributed to one of the objectives of government policy for airports. Independent airlines other than British Caledonian were, however, given funds by BA to help them develop up to fifteen new European routes from provincial airports. The CAA's suggestion that BA's service frequencies on major domestic routes might be reduced (item (iv) on the CAA list above) was also not taken up by the Government.

On the other hand, positive responses were given to a number of the CAA's other proposals (see items (v) and (vi)), including:

- that domestic fares should cease to require specific approval by the CAA (domestic deregulation of prices);
- that there should be a two-year experimental period of an area licensing facility which would allow airlines to fly between any two points in the UK (domestic deregulation of route licensing);
- that the CAA should use its licensing powers to increase the range and market penetration of European scheduled services from Gatwick Airport.

As a result of these and other developments, there was considerable deregulation of UK air services in the mid 1980s, accelerating the trend established by the 1980 legislation. By the end of the decade many entry barriers into domestic services had largely been dismantled, albeit with the important exception of access to London Heathrow airport where congestion and the prevailing slot allocation system has made it difficult for new airlines to establish themselves. Indeed, until 1991 the traffic distribution rules specified that no airline that had not been operating from Heathrow before 1977 would be granted access. This ban was, however, lifted in 1991 and new operators have subsequently been granted slots at Heathrow, including the UK carrier Virgin Atlantic. Nevertheless, the allocation procedures continue to afford considerable advantages to incumbent operators.

3.2 European Community Policy

Although a Common Transport Policy has existed since the foundation of the European Community, the airline industry was initially excluded from the full application of this policy. As a result, Member States of the EC controlled their own domestic industries, and international agreements (including between Member States) evolved bilaterally under the Chicago Convention of 1944. Even today there is no single regulatory body governing inter-State air transport.

Policies toward scheduled air services during the 1950s, 1960s and 1970s were generally highly restrictive. Fares, service provision and market entry were all tightly controlled. For example, the bilateral agreements that developed frequently provided for only one airline from each country to operate on a given route, and the great majority of them also featured controlled
capacity and 50:50 revenue pooling. Markets were also characterised by the presence of subsidised airlines, usually national flag carriers.

Button (1995) has identified four broad pressures that have given rise to slow but definite liberalization of European air transport markets since the early 1980s. First, some national regulatory authorities gradually became less restrictive in the allocation of licences and in the acceptance of at least some degree of price deregulation. The pace of change here has been variable, with countries such as Britain and the Netherlands in the lead but others, such as France, Germany, Italy and Spain being much less keen on domestic liberalization.

Second, there have been moves to liberalize the bilateral agreements between some Member States of the EC, starting with an agreement in 1984 between the UK and the Netherlands that relaxed rules first on market entry and then on fares for routes. The pace of change has again varied considerably from route to route depending upon the attitudes of the relevant governments to liberalization and deregulation.

Third, there has been pressure from the United States on individual EC Member States to develop more liberal bilateral agreements. This has proved partially successful in that the Netherlands and a number of smaller European countries have signed up to new, liberalized agreements. Larger EC Member States have, however, resisted, including Britain where the generally pro-liberalization policy stance has been set aside in favour of retention of a restrictive, but highly favourable (to UK interests) bilateral agreement with the United States. US pressure has also been a factor in leading the EC Commission to seek to negotiate future bilateral agreements for the Community as a whole, rather than leaving matters to individual Member States.

Fourth, the EC institutions themselves came increasingly to the view that a common aviation policy should be developed. Despite calls in the 1950s for a Europe-wide aviation system and despite a 1974 European Court ruling that civil aviation was subject to the general rules of the Treaty of Rome, until relatively recently the European Council and Commission have proved reluctant to apply the Treaty's principles in this area. The position did, however, begin to change gradually in the later 1980s.

The general framework of competition rules in the Community derives chiefly from Articles 85 and 86 of the Treaty and from the much more recently introduced merger regulation. Article 85 prohibits inter-firm agreements, with exemption possibilities for arrangements that can be demonstrated to have economic benefits, while Article 86 prohibits abuse of a dominant position. The merger regulation gives the Community authorities jurisdiction over large amalgamations whose effects are unlikely to be confined to a single Member State. In addition, the Community is much concerned with the problem of state aids and the distorting effects that these might have on competition, an area of considerable importance given the high degree of state ownership in the European airline industry.

An important feature of Community competition policy, and one which distinguishes it from classic antitrust policies, is that it seeks the creation of a “single market”, an objective that
derives from the wider aims of the Community. This means, for example, that EC policy is likely to be particularly directed at practices which have the intention or effect of segmenting markets along national lines. There is also a resulting stress in EC policy on “harmonization” of policies and business practices, and specific regulations often combine liberalization and harmonization goals.

A good illustration of the working of European policy is to be found in the first airline merger to be examined by the European Commission, the merger between BA and BCal in 1987 (see above). Authority to act in this case derived from Article 86 on the basis of the dominant position that would be enjoyed by the enlarged BA in landing slots at London’s main airports (Heathrow and Gatwick). The Commission used its powers to extract undertakings from BA to release a certain number of slots to new entrants wishing to establish services on European routes. A similar approach has been adopted in later airline mergers, including Air France/UTA, KLM/Transavia, Air France/Sabena and BA/TAT (the last two of which were handled via the new Merger Regulation).

In addition to the increasingly important application of the general competition rules and of Community policies on state aids, the development of EC sectoral policy toward airlines has occurred mainly via the introduction of three “packages” of regulations. The Commission published its first memorandum on the subject in July 1979 in an attempt to generate discussion between the interested parties on possible changes to the existing system of regulation. By 1983, the European Council had adopted a Directive for interregional air services which introduced some flexibility on routes outside the main hubs. This was followed by a second memorandum published in 1984 after further studies and consultations with the industry and users. This document set out two main objectives:

i. the creation of a Community framework for aviation to help the industry to reduce tariffs and improve the quality of its services; and

ii. the introduction of competition.

The trend of Community policy was accentuated in 1985/6 by the European Court decision in the Nouvelles Frontieres case, which confirmed that the Treaty rules of competition applied to aviation and therefore that the Commission had significant, hitherto unused powers to act in the sector. In response the European Council requested that the Community take action on tariffs, capacity and access to the market. This request was reflected in the agreement of June 1987 between EC Ministers of Transport on a policy package covering tariffs, capacity, market access and rules of competition. It was this agreement, the culmination of discussions over a three year period, that six months later emerged as the first EC package on aviation policy.

The first package was adopted on 7 December 1987 and came into force on 1 January 1988. A regime was introduced for the approval of fares between Member States’ airports. Discount and deep discount fares (to as low as 45% of economy class fares) were approved on
certain conditions. Allowance was also made for Community airlines to increase their capacity shares on a route, within specified parameters. Changes to access conditions allowed Member States to assign two or more airlines to provide scheduled services between two points (‘multiple designation’), once certain thresholds had been reached. The new access conditions also gave airlines third and fourth freedom rights for services between main airports in a Member State and regional airports in another Member State. Where third or fourth freedom traffic rights existed, limited fifth freedom scheduled air services were also permitted. Two Council Regulations relating to the application of competition rules were also defined: the first set down procedures for the application of Articles 85 and 86 to international air services between Community airports and the second gave permission to the Commission to approve group exemptions for certain categories of agreement. Three implementing regulations laying down the conditions of exemption were adopted in July 1988.

The second aviation package adopted in June 1990 took the ethos of the initial package and, with a commitment to full liberalization by 1 January 1993 in mind, applied it further. This second package allowed more flexible conditions on fares, permitting discount fares as low as 30% of the economy rate without the need for government approval. A limited version of ‘double disapproval’ was also introduced (whereby a fare for a route within the Community is considered approved unless, within 30 days of its submission, both authorities have made their disapproval known to the air carrier in writing). Access to the market was further liberalized by weakening the conditions limiting multiple designation and third, fourth and fifth freedoms. The package also made provision for the gradual elimination of bilateral restrictions on capacity shares.

Between the second and final (third) packages of regulations, the Commission submitted a new proposal for rules on the allocation of slots at EC airports, in recognition of the fact that legal liberalization of entry conditions may not have significant economic effects where capacity is limited. In an attempt to reduce barriers against new entrants at congested airports, the Commission proposed that new entrants be given priority when new slots become available.

In June 1991 the European Council adopted three regulations that constituted the third and final phase in the liberalization of Community aviation. The first regulation sought to create legal and economic standards in the licensing of air carriers, including rules on effective control and majority shareholding.
Table 3. Key features of European Community Third Liberalization Package, effective 1 January 1993.

1. Free pricing regime for fares.

With "ex post double disapproval" for fully flexible fares only (i.e. only business class fares can be controlled in this way).

2. Open market access; i.e. the right to fly between any two points in different community states. But:

   a) some restrictions may be imposed
      - if environmental or congestion problems exist
      - to safeguard island routes
      - to facilitate intermodal coordination
      - to maintain public service obligations on routes vital for economic development.

   b) domestic cabotage only as an extension of "international" service; eg. London-Paris-Nice and only for 50% seats.

3. Common airline operators licence regulations in all Community countries: i.e. criteria for licences (AOCs) are harmonized. For new or renewed licence, carriers must:

   a) show that they are Community based and controlled,
   b) fulfil financial fitness requirements, and
   c) fulfil national technical requirements until European Joint Airworthiness Requirements (JARs) are ready.

4. No distinction between scheduled and non-scheduled services: the same regulations apply to both.

Source: Rigas Doganis (1994).

solvency requirements, periodic financial monitoring and safety fitness. The second regulation, relating to market access, authorised cabotage (a fifth freedom right) and eliminated capacity sharing for airlines on routes between Member States. However, cabotage would be introduced in phases: until April 1997 airlines can only fill up to 50% of seats in a stopover in another
Member State. Provision was also made for the establishment of seventh freedom rights, allowing carriers to commence the transport of goods and passengers between two countries other than the country of establishment, with no requirement to provide other services. The third regulation related to fares, establishing evaluation criteria, defining the double disapproval system and stating the conditions under which it is to be used. From 1 January 1993, airlines have been free to set their own fares on inter-State routes, subject, of course, to normal considerations of competition policy such as the prohibition of predatory pricing.

The European Council has committed itself to full liberalization by the end of the transition period (April 1997). Member States, however, retain powers to regulate competitive conditions in domestic airspace and the right to regulate air traffic to and from non-Community countries. Key features of the third liberalization package are set out in Table 3.

4. Economic Performance

The performance of British and European airlines has been affected by wide range of factors over the last decade or more. Of particular interest here are the impacts of privatization, deregulation and/or regulatory reform, and liberalization. Airlines have, however, also been subject to sometimes sharp variations in market conditions which have had major implications for their performance. It is not therefore straightforward to isolate the impacts of any one factor, and the following outline of some of the major recent developments in airline performance is intended as only a first step in this direction.

4.1 Entry and exit

The early responses to liberalization in Britain and Europe have followed a pattern that is familiar from the earlier experience of deregulation in the US: the number of airlines operating on particular routes first increases as new competitors enter the market and then falls back to some extent as unprofitable operations are closed down. This is illustrated in Table 4, which shows changes in the number of airlines operating on the busiest routes between London and continental European cities. On average there were approximately two carriers per route in 1981 but, as liberalization progressed, that number increased to around three by 1985 and four by 1989 (despite the demise of British Caledonian in 1987). After 1989, however, the average number of operators per route fell back to closer to three in 1993.
Table 4. Number of airlines operating scheduled services on busiest intra-European routes.

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<td>3.18</td>
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Source: Doganis (1994).

The Table indicates that the recent fall in the average number of operators is the result of exit from precisely those routes that had initially attracted new entrants, in particular the routes between London and Paris, Amsterdam, Dublin and Brussels. The first of these are the three busiest of the European routes, whilst the Brussels route -- connecting to the administrative capital of the European Community -- has both a high value customer profile and the potential for considerable growth. It is therefore easy to see why, other things equal, these routes would have been attractive to new entrants.

It is also relevant to note that new entry has been assisted to some extent by deliberate acts of regulatory policy. As in telecoms and other network industries, the UK’s “multi-airline policy” initially sought to provide assistance to newcomers -- although, as noted above, the privatization of BA (and also of the British Airports Authority) led later to an unwillingness to implement policies that might have negative financial implications for BA (and for regional airports). Similarly, the European Commission’s actions to require BA to surrender landing slots to new entrants at the time of the merger with BCal was a policy designed specifically to favour new, smaller airlines.

In the event the UK’s multi-airline policy and EC attempts to reduce market concentration by promoting new entry have partially unravelled. The financial collapse of British Caledonian was a major blow in this respect, and it has not been an isolated incident.
The chief beneficiaries of BA’s release of landing slots -- secured by the European Commission at the time of the BCal merger -- were two small UK airlines, Air Europe and Dan Air. Each subsequently ran into financial difficulties and went out of business, with BA acquiring part of Dan Air’s business (see also Table 11 below).

There are broadly two views of this outcome:

i. entry assistance programmes aimed at encouraging the development of new airlines are largely misguided because they ignore the realities of the marketplace and try to create non-viable industrial structures; and

ii. entry assistance programmes have been too weak in that they have failed to take sufficient measures to offset the market power of large, incumbent carriers, many of which enjoy (or in the past have enjoyed) very substantial state aid.

These views echo similar positions taken in policy debates in other network industries (telecoms, electricity, gas, and rail).

4.2 Prices

BA’s activities cover a wide variety of different routes and markets -- domestic, European and inter-continental; scheduled and non-scheduled -- some of which have become highly competitive and others of which remain highly cartelized. Nevertheless, the historical pattern of average prices is instructive and Figure 1 shows one measure of these, real revenues per passenger traffic kilometre.

As can be seen from the chart, there was a collapse in average revenues at the end of the 1970s which was a major factor in the financial crisis faced by the airline in 1981. The introduction of the new management team and the subsequent shift in the corporation’s business strategy is associated with a recovery in average revenues in the pre-privatization period (and BA prices therefore exhibit a pattern, also to be found in other UK privatizations, in which prices are increased prior to flotation). The mid 1980s represents a turning point in prices, however, and since then average revenues have fallen steadily in real terms.

Table 5 shows estimates of changes in BA’s real prices on scheduled UK and European services, and these are broadly similar to the changes implied by the data in Figure 1 for the airline’s operations as a whole. Thus, following the financial crisis of 1981, there were substantial increases in prices on UK and European routes. However, scheduled domestic fares dropped sharply in 1985 (when other prices were still increasing on average), a fall that can be interpreted as a response to the liberalizing measures then being introduced by the UK Government. And, despite a blip in 1987, the trend in scheduled domestic and European prices has been firmly downwards throughout the period of increasing liberalization.
British Airways’s increases in prices during the early 1980s were not matched by other UK airlines. For example, whereas BA increased its average prices by about 46% between 1980 and 1984, the corresponding increase for BCal over the same period was only about 27.5% (see Table 6). This discrepancy is a reflection of the market positions of the two companies: BA had market power substantial enough to greatly increase revenues in the pre-divestiture period -- enabling it both to finance the considerable restructuring of its operations and to prepare its balance sheet for privatization -- whereas BCal was operating in markets where competitive pressures greatly constrained its ability to get out of difficulties by raising prices. Over the relevant period BA’s average costs rose by about 30%, compared with BCal’s 26%, and BCal’s unit costs were lower throughout.

4.3. Employment and wages

Before privatization, BA’s performance record in relation to its number of employees was...
similar to that in some other state-owned industries such as steel and coal: in response to poor financial performance at the beginning of the decade, the corporation embarked upon a major restructuring of its operations that led to substantial reductions in the size of its workforce. Thus between 1980 and 1984 the workforce of BA was reduced by over a third, from around 56,000 to around 36,000 (see Figure 2).

In the context of UK privatizations, what is more distinctive about the airlines case is that the employment reduction was accomplished without a major contraction in the long-term size of the corporation. Output did fall significantly -- for example, available tonne kilometres (ATKs) decreased from around 8,200 million to 7,200 million between 1980 and 1984 as operations were rationalised -- but on nothing like the scale that occurred in the steel and (later) coal industries. Moreover, after the initial re-adjustment of strategy in the pre-privatization period, BA's output started to grow quickly and steadily (see Figure 3). The take-over of BCal at the end of 1987 gave a major boost to output and, more obviously, to the size of the fleet (see Figure 4). As is clear from the charts, however, there were other major factors driving expansion of activities from the mid 1980s onwards.

Expansion of the size of BA's operations fed through quickly into employment levels, with the result that, almost uniquely for a major privatized UK company, the level of employment rose back towards its level at the beginning of the 1980s, reaching over 54,000 in 1991. More recently, and apparently in response to greater competitive pressures in its markets, BA has engaged in a further phase of employment reduction, although the changes have been much less dramatic than in the early 1980s.

The general downward pressures on costs -- arising first from government pressures to reduce the burden of the airline on central government finances and then, later, from privatization and from the growing competitive pressures on BA in an increasingly liberalized market -- have served to hold back wages and salaries to levels well below those in comparable European airlines. Table 7 shows the position in 1991 and reflects the facts that, at that time, UK deregulation and liberalization had proceeded more quickly than elsewhere in the European Community and that whereas as a privately owned airline BA faced the disciplines imposed by capital markets, the state-owned airlines of continental Europe still faced the less rigorous financial disciplines typically associated with the public sector (notwithstanding attempts by the European Commission to prevent state aids that have the effect of distorting the single market). As the effects of deregulation and liberalization at the EC level begin to be felt, however, and as more European airlines come to be privatized, it can be expected that some of the differences in wage levels shown in Table 7 will start to erode.

---

7 The major employment reduction in coal occurred rather later than in steel and airlines, and only after the power of the mine workers union was broken by defeat of a year-long national strike.
Table 7.  Average annual staff remuneration. European Airlines 1991 (US$000).

<table>
<thead>
<tr>
<th></th>
<th>Pilots &amp; co-pilots</th>
<th>Maintenance personnel</th>
<th>Ticketing &amp; sales staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iberia</td>
<td>209.5</td>
<td>40.8</td>
<td>48.2</td>
</tr>
<tr>
<td>Sabena (1990)</td>
<td>185.7</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Swiss air</td>
<td>191.4</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Austrian</td>
<td>154.0</td>
<td>51.6</td>
<td>47.7</td>
</tr>
<tr>
<td>Lufthansa</td>
<td>152.2</td>
<td>48.3</td>
<td>46.0</td>
</tr>
<tr>
<td>SAS</td>
<td>134.9</td>
<td>61.5</td>
<td>44.7</td>
</tr>
<tr>
<td>KLM (1990)</td>
<td>131.4</td>
<td>39.4</td>
<td>n.a.</td>
</tr>
<tr>
<td>Air Portugal</td>
<td>103.7</td>
<td>25.4</td>
<td>36.4</td>
</tr>
<tr>
<td>Finnair</td>
<td>90.4</td>
<td>33.2</td>
<td>31.0</td>
</tr>
<tr>
<td>BA</td>
<td>87.1</td>
<td>31.1</td>
<td>35.0</td>
</tr>
</tbody>
</table>

Source: Doganis, from ICAO Digest of Statistics.

4.4 Productivity and costs

Movements in BA’s employment and output before and after privatization are reflected in the enterprise’s labour productivity record, which is shown in Figure 5. The chart shows the logarithm of ATKs per employee over time, and therefore its slope represents the proportionate rate of change of labour productivity. Average productivity growth in various sub-periods is summarised in Table 8, where the impact of the restructuring programme of the early 1980s is clearly visible.

Table 8.  BA’s average productivity growth by period.

<table>
<thead>
<tr>
<th>Period</th>
<th>Productivity Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975 - 1982</td>
<td>5.6%</td>
</tr>
<tr>
<td>1982 - 1985</td>
<td>10.0%</td>
</tr>
<tr>
<td>1985 - 1991</td>
<td>3.0%</td>
</tr>
<tr>
<td>1991 - 1994</td>
<td>11.0%</td>
</tr>
</tbody>
</table>

Source: British Airways.

By the middle of the decade the initial restructuring programme was largely complete.
and average productivity growth subsequently fell to around 3% per annum. Thus labour productivity growth in the immediate post-privatization period was significantly lower than in the late 1970s as well as being lower than in the period of pre-privatization restructuring. More recently, productivity growth has accelerated again, arguably in response to greater competitive and financial pressures on European airlines over the relevant period.

In general, however, there is no very clear break in the labour productivity record that can be confidently linked to either restructuring or privatization or deregulation, as becomes more clear if year to year percentage changes in employment are correlated with changes in BA’s output/capacity (measured in ATKs). Figure 6 indicates, for example, that it is difficult to identify particular periods in which observations tend to lie on one or other side of the average (strongly positive) relationship between employment changes and output/capacity changes.

The lack of a clear break in productivity performance at the time either of BA’s flotation or of UK deregulation/liberalization is matched by data on load factors (see Figure 7). The scheduled passenger load factor moves somewhat erratically on year by year basis, but the trend is steadily upwards and does not change in any obvious way until the 1990s when its growth appears to come to a halt.

It is to be expected that the major swings in labour productivity over the period under examination would have had substantial effects on BA’s unit costs, but the historical record of real unit costs exhibits a rather different pattern from that of labour productivity (see Figure 8) in that movements in real unit costs do show a marked shift in trend at around the time of UK liberalization (i.e. the mid 1980s). Between 1975 and 1985 BA’s real unit costs were declining at a gentle trend rate of around 0.4% per annum; between 1985 and 1994 this trend of cost reduction increased sharply to an average rate of approximately 4.4% per annum.

Despite the sharp break in the unit cost series in 1985, it would probably be wrong to ascribe the emergence of the later trend simply to deregulation and privatization alone. As is clear from the employment data and from the business history of BA, the enterprise’s major strategy shift occurred in 1981 with the arrival of Lord King and the new management team.

On the other hand, the restructuring of BA that occurred in the first half of the 1980s appears capable of providing only a partial account of the first phase of unit cost reductions that occurred after 1985. As Figure 8 shows, the trend in unit costs continued to be strongly downwards through into the 1990s. What then explains the apparent longer term improvement in unit cost performance?

Two major factors that are obvious candidates as explanatory variables are:

- output expansion, and
- increasing competitive pressures as more of BA’s routes came to be deregulated/liberalized.

As is indicated by Figures 3 and 4, the size of BA’s operations increased quickly and
steadily from the mid 1980s onwards and in such circumstances economies of scale will be
translated into falling unit costs. And, given the evidence on labour productivity growth in the
EARLY 1990s, it is possible that deregulation/liberalization effects were becoming more significant
towards the end of the period under study.

Figure 9 shows that changes in real unit costs are indeed negatively correlated with
changes in output/capacity (the greater the increase in output the greater the reduction in unit
costs). It can also be seen, however, that the observations for the periods 1982-4 and 1991-3 tend to
lie below the average relationship. That is, correcting for volume changes, there is evidence of more
rapid cost reduction in these two periods.

In summary, the apparent improvements in BA's unit cost performance can be linked to
three major factors:

- the restructuring of the company in the early 1980s, in response to financial crisis and in
  preparation for privatization;
- economies of scale in operation; and
- competitive pressures linked to deregulation, liberalization and changes in international
  market conditions.

Restructuring likely had its major impact on unit costs in the first part of the 1982-94
period, whereas scale effects can be expected to have been relatively steady throughout. The
intensity of competitive pressures grew over the period, and therefore likely had its greatest effect
toward the end of the period. Thus, as the initial cost effects of restructuring diminished, the
downward pressure on costs was re-established by increasing competitive pressures.

4.5 Investment and profits

The outline of the development of BA's gross capacity in the 1980s and 1990s is clear from
Figures 3 and 4 above which respectively show changes in the airline's available tonne kilometres
and changes in the size of its fleet. These numbers do not, however, necessarily capture the relevant
investment profile in full, since investment in areas such as fleet modernisation and ground
operations may improve performance but not increase overall capacity.

Data on investment are difficult to obtain, but Figure 10 shows estimates of real gross fixed
capital acquisition derived by Galal et al (1994). Together with the capacity data, these indicate that
real investment was falling slightly in the early 1980s, stabilised in the mid 1980s, and then
increased sharply in the post divestiture period. The initial decline corresponds with the period of
financial difficulty and re-organization, during which period BA actually reduced its overall capacity,
while the large hike in investment expenditures came in 1987/8 when BA acquired BCal.

Following the BCal acquisition, real investment fell sharply again but at the end of the
1980s still remained at something like two to three times its level in the mid 1980s. As Figures 3 and 4 show, the airline has continued to grow strongly in the first half of the 1990s, notwithstanding some difficult demand conditions, and further airline acquisitions have accounted for part of this growth.

In contrast, the time pattern of BA's financial performance is much more closely linked to the restructuring exercise of the early 1980s. Table 9 indicates that the major improvement in profit performance occurred in the early 1980s, and this can be ascribed fairly straightforwardly to the policies implemented by the new management in 1981. In particular, as Figures 1 and 8 together indicate, the profit recovery was due much more to price increases than to cost reductions. A further improvement occurs in the immediate post-privatization years (in the late 1980s), but this was a period in which market conditions were relatively favourable and other international airlines were also showing good profit performance. Much more significant is the way in which profitability, although falling somewhat, remained positive in the 1990s during years in which many major airlines made substantial losses.

Table 9. BA's Financial Performance (£ million).

<table>
<thead>
<tr>
<th>Year</th>
<th>Turnover</th>
<th>Pre-tax profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981/2</td>
<td>2,241</td>
<td>-108</td>
</tr>
<tr>
<td>1982/3</td>
<td>2,497</td>
<td>74</td>
</tr>
<tr>
<td>1983/4</td>
<td>2,514</td>
<td>185</td>
</tr>
<tr>
<td>1984/5</td>
<td>2,943</td>
<td>191</td>
</tr>
<tr>
<td>1985/6</td>
<td>3,149</td>
<td>195</td>
</tr>
<tr>
<td>1986/7</td>
<td>3,263</td>
<td>162</td>
</tr>
<tr>
<td>1987/8</td>
<td>3,756</td>
<td>228</td>
</tr>
<tr>
<td>1988/9</td>
<td>4,257</td>
<td>268</td>
</tr>
<tr>
<td>1989/90</td>
<td>4,838</td>
<td>345</td>
</tr>
<tr>
<td>1990/1</td>
<td>4,937</td>
<td>130</td>
</tr>
<tr>
<td>1991/2</td>
<td>5,224</td>
<td>285*</td>
</tr>
<tr>
<td>1992/3</td>
<td>5,566</td>
<td>185</td>
</tr>
</tbody>
</table>

* Excluding profit on disposal of BA's engine overhaul business (= £149 million).

Source: British Airways Annual Reports and Accounts.
4.6 Economic welfare and its distribution

The welfare effects of deregulation/liberalization are exceedingly difficult to estimate because of the problems of distinguishing the effects from those of other changes in the market and in the policy environment that occurred over the period. This in turn is part of the more general difficulty of specifying a convincing counterfactual.

A similar exercise, aimed at evaluating the welfare effects of the divestiture of BA, has, however, been attempted by Galal et al (1994), and their conclusions are summarised in Table 10 (where all numbers are present values of estimated costs and benefits). It can be noted that, although the overall welfare impact of privatization is estimated to be strongly positive, Galal et al believe that the divestiture led to substantial losses of consumers’ surplus. These losses arise because the study estimates, on the basis of comparisons of BA and BCal prices, that privatization of BA had a significant, upward effect on prices.

Table 10. Estimated welfare gains and losses from divestiture of BA (£ million).

<table>
<thead>
<tr>
<th></th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxes</td>
<td>346</td>
</tr>
<tr>
<td>Net quasi rents</td>
<td>-874</td>
</tr>
<tr>
<td>Net sales proceeds (cash)</td>
<td>843</td>
</tr>
<tr>
<td>Total</td>
<td>316</td>
</tr>
<tr>
<td>Employees</td>
<td>0</td>
</tr>
<tr>
<td>Private domestic shareholders</td>
<td>646</td>
</tr>
<tr>
<td>Foreign shareholders</td>
<td>126</td>
</tr>
<tr>
<td>Competitors</td>
<td>-84</td>
</tr>
<tr>
<td>Consumers</td>
<td>-323</td>
</tr>
<tr>
<td><strong>OVERALL TOTAL</strong></td>
<td><strong>680</strong></td>
</tr>
</tbody>
</table>


Attribution of the price increases of the early 1980s entirely to privatization is, however, open to serious challenge. The period was one in which the UK Government was attempting to reduce the burden placed on the national finances by the state-owned sector as a whole, and price
increases aimed at improving financial returns were a common feature of several publicly-owned industries, including industries that were not immediate candidates for privatization (e.g. electricity). Thus, while privatization of BA might have had some positive effect on prices -- because of the higher sales proceeds that a more profitable company could command -- it is likely that much of the observed price adjustment would have occurred even if BA had not been a leading candidate for privatization. Consequently, the Galal et al estimate of the consumers surplus loss from privatization of BA is probably an exaggeration.

Although the results of this type of welfare exercise are highly controversial -- for example, there can also be arguments about whether or not any price increases reflected quality of service improvements -- it can be noted that the results of an equivalent exercise aimed at assessing the effects of deregulation and liberalization would likely differ in at least two major ways:

- there would not be substantial gains to government, and
- consumers' surplus effects associated with price changes might be expected to be positive rather than negative (although there are quality of service issues that would need to be addressed before such a conclusion could be firmly reached).

4.7 Market structure

As noted in section 2, the UK airline industry is dominated by British Airways, particularly in respect of the supply of scheduled services, and the general pattern of market shares has not been substantially changed by privatization and deregulation. As Table 11 shows, BA controlled over 60% of all available capacity (scheduled and charter) at the outset of the period of liberalization. There was then only one major rival in terms of the provision of scheduled services, BCal, although a significant number of niche operators served the charter market. Initially BA's share of capacity fell somewhat as a result of the rapid growth of charter business (in which BA was a much smaller presence) and the development of scheduled competitors, including new entrants such as Virgin Atlantic.
Table 11. Percentage shares of UK airlines’ available tonne kms.

<table>
<thead>
<tr>
<th>airline</th>
<th>1982</th>
<th>1987</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Airways</td>
<td>61.6</td>
<td>53.9</td>
<td>64.0</td>
</tr>
<tr>
<td>British Caledonian</td>
<td>13.3</td>
<td>12.7</td>
<td>-</td>
</tr>
<tr>
<td>Britannia Airlines</td>
<td>6.6</td>
<td>6.9</td>
<td>6.7</td>
</tr>
<tr>
<td>Dan Air</td>
<td>4.1</td>
<td>4.9</td>
<td>-</td>
</tr>
<tr>
<td>British Airtours</td>
<td>2.2</td>
<td>3.7</td>
<td>-</td>
</tr>
<tr>
<td>Air Europe</td>
<td>2.9</td>
<td>2.3</td>
<td>-</td>
</tr>
<tr>
<td>Monarch Airlines</td>
<td>2.1</td>
<td>3.2</td>
<td>3.9</td>
</tr>
<tr>
<td>Orion Airlines</td>
<td>1.7</td>
<td>2.1</td>
<td>-</td>
</tr>
<tr>
<td>British Midland</td>
<td>1.3</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Tradewinds Airlines</td>
<td>1.2</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>Virgin Atlantic</td>
<td>-</td>
<td>2.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Cal Air International</td>
<td>-</td>
<td>1.6</td>
<td>-</td>
</tr>
<tr>
<td>Air 2000</td>
<td>-</td>
<td>-</td>
<td>4.0</td>
</tr>
<tr>
<td>Caledonian Airways</td>
<td>-</td>
<td>-</td>
<td>2.8</td>
</tr>
<tr>
<td>Airtours International</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
</tr>
<tr>
<td>Inter European Airways</td>
<td>-</td>
<td>0.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Air UK Leisure</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Source: Civil Aviation Authority.

In 1987, however, BCal was unable to sustain its competitive challenge and, after running into severe financial difficulties, was taken over by BA. More recently the airline Dan Air has suffered a similar fate. As a consequence, by the early 1990s BA’s share of UK capacity had risen again to significantly in excess of 60% (and to over 80% of capacity for scheduled services). In fact, the position in the early 1990s is remarkably similar to that in the early 1980s with the difference that the main domestic challenger to BA is now Virgin Atlantic rather than Bcal. There continue to be many smaller airlines operating in the charter market and (as niche players) in scheduled services on a limited number of routes, although as Table 11 indicates there have been a significant number of both new entries and exits over the ten year period covered.

4.8 Safety considerations

The general safety record of UK airlines over the past forty years is summarised in Table 12. As can be seen, the safety record improved sharply in the period up to the end of the 1970s, but any subsequent trend is more difficult to detect.
### Table 12. UK airlines safety record (scheduled services).

<table>
<thead>
<tr>
<th>Period</th>
<th>Fatal accidents</th>
<th>Fatal accidents per:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100000 stage flights</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Passengers killed per hundred mill. pass. kms</td>
</tr>
<tr>
<td>1950-54</td>
<td>7</td>
<td>0.93</td>
</tr>
<tr>
<td>1955-59</td>
<td>7</td>
<td>0.63</td>
</tr>
<tr>
<td>1960-64</td>
<td>5</td>
<td>0.33</td>
</tr>
<tr>
<td>1965-69</td>
<td>6</td>
<td>0.35</td>
</tr>
<tr>
<td>1970-74</td>
<td>2</td>
<td>0.11</td>
</tr>
<tr>
<td>1975-79</td>
<td>1</td>
<td>0.06</td>
</tr>
<tr>
<td>1980-84</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>1985-89</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>1990-93</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Source:** Civil Aviation Authority.

Assessment of the possible effects of privatization and deregulation is made difficult by the relatively small number of fatal accidents (itself a reflection of the relatively small size of the overall sample compared with, say, what is available from the United States). For example, the CAA statistics record only 2 fatal air accidents in the period from 1980 to 1993 inclusive. The first of these, in 1986, involved one crew fatality only while the second, in 1989, involved 47 passenger fatalities. Perhaps, therefore, all that can be said at this stage is that deregulation does not appear to have led to any significant deterioration in the safety record.

#### 4.9 Route structures

The geography of the UK is clearly substantially different from that of the US, and even compared with Japan distances between major cities tend to be shorter and traffic densities lower. The high concentration of population in the south east of the country makes the two London airports (Heathrow and Gatwick) much the busiest. The number of domestic trunk routes is very limited (London to Edinburgh and London to Glasgow being the main ones), and competing rail and bus services are generally available and have the advantage that termini are generally in city centres. Direct routes between provincial cities are generally characterised by low traffic volumes.

Liberalization and deregulation do appear to have led to some reduction in domestic routes. This includes loss of routes from some of the smaller airports to London as well as routes
between provincial airports. Illustrative statistics are set out in Table 13 which shows the loss of domestic routes from the two main London airports and from Aberdeen, the most northerly of Britain's major cities, over the period of most rapid domestic deregulation.

At a more general European level, however, the picture is somewhat different. General traffic growth (itself stimulated by deregulation) coupled with capacity constraints at London Heathrow have led to the opening up of more direct routes between major UK provincial airports and cities elsewhere in Europe and in the USA. For example, some US airlines, frustrated by the difficulties of obtaining landing slots at London Heathrow, are developing their transatlantic operations via cities such as Birmingham and Manchester. And the relatively small distances between these airports and London, together with the major concentrations of population in their own areas, mean that such cities offer direct competition to the more traditional, London-based routes.

Table 13. Changes in route structures.

<table>
<thead>
<tr>
<th>Airport:</th>
<th>1984</th>
<th>1990</th>
<th>Destinations lost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>London (Heathrow)</td>
<td>21</td>
<td>19</td>
<td>Blackpool, Carlisle, Dundee.</td>
</tr>
<tr>
<td>London (Gatwick)</td>
<td>19</td>
<td>12</td>
<td>Blackpool, Bristol, Cardiff, East Midlands, Liverpool, Norwich, Plymouth.</td>
</tr>
<tr>
<td>Aberdeen</td>
<td>25</td>
<td>18</td>
<td>Belfast, Carlisle, Isle of Man, Liverpool, Newquay, Plymouth, Prestwick.</td>
</tr>
</tbody>
</table>

Source: Civil Aviation Authority.

5. Conclusions

British and European airlines policies have changed substantially during the 1980s and 1990s. In very broad terms, there is a continuing transition from an industry structure dominated
by state-owned airlines operating in a highly protected market environment to a more competitive market structure which is populated increasingly by private operators. Among European countries, the UK has led the way in both privatization and deregulation/liberalization -- the national airlines of most Member States of the European Community are still state-owned for example -- but policies in all these countries have lagged well behind developments in the US.

In seeking to promote more competitive markets, the UK Government adopted a “multi-airline” policy based upon assisting and encouraging the entry and development of new companies on domestic and international routes. There was, however, always a tension in policy between promoting domestic rivals to BA and promoting BA in its competitive battles with other, major world airlines, and in the event the multi-airline policy was given the lower priority. Although measures were taken to weaken BA’s competitive position vis-a-vis other UK airlines, these were generally of a limited nature and were insufficient to prevent the demise of carriers such as BCAL (the largest domestic rival to BA), Dan Air and Air Europe. Nevertheless, some of the new, smaller UK airlines have survived and even prospered (eg. Virgin Atlantic).

While the Government’s multi-airline policy has been a relative failure, measures aimed at improving BA’s performance have been much more successful. The new management introduced in 1981 quickly turned around the corporation’s financial performance in the early 1980s, gains that were partly motivated by, and later underwritten by, privatization in 1987. As a result of restructuring, BA was in a good commercial position to meet the challenges of the more competitive market conditions that were stimulated by deregulation and liberalization from the mid-1980s onwards, first in Britain and later in the European Community as a whole.

The performance record of BA during this period of deregulation/liberalization has been a good one. Prices have fallen, unit costs have fallen steadily, the airline has expanded considerably, investment has risen and profitability has been maintained in difficult market conditions. And, while the precise attribution of performance improvements to particular aspects of government policy (restructuring, divestiture, deregulation, liberalization, entry assistance) is a difficult exercise, ex post the sequence of financial restructuring followed by privatization and gradual liberalization appears to have worked well.
References


Figure 1. British Airways: real revenue per passenger km (pence).

Figure 2. British Airways: number of employees.
Figure 3. British Airways: available tonne kilometres.

Figure 4. British Airways: number of aircraft.
Figure 5. British Airways: productivity (log ATKs per employee).

Figure 6. British Airways: employment growth vs capacity growth.
Figure 7.  British Airways: scheduled passenger load factor.

Figure 8.  British Airways: real unit costs.
Figure 9. British Airways: unit cost reductions vs capacity growth.

Figure 10. British Airways: gross fixed capital acquisition (£m).
3. Japan

AIR TRANSPORT IN JAPAN:
POLICY CHANGES AND ITS EVALUATION

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1 Introduction

There are presently eight scheduled airline companies in Japan. With respect to passenger transport, the big three - Japan Airlines (JAL), All Nippon Airways (ANA) and Japan Air System (JAS) - account for nearly all of the major markets; together they serve roughly 91% of the passengers on both domestic and international routes. ANA claims about 45% of the domestic market, while JAL about 76% of the international market. The other airlines are for the most part subsidiaries of the big three. The domestic air transport market, with about 70 million passengers annually (55 billion revenue-passenger kilometers), is one-sixth (one-tenth) the size of the United States' markets. Japan's airlines carry about 11 million international passengers a year, about one-quarter of that of the United States' carriers.

Japanese airlines experienced a boom during the second half of the 1980s. From 1985 to 1991, revenue passenger kilometers in the domestic market grew at the rate of 9.3% annually, and in international markets 8.0%. As a result, their operating profits also soared, and they recorded the highest profits in their company histories. These trends reversed from the beginning of 1990. The average growth rate from 1991 to 1993 fell to 3.4% and 4.8% respectively. The declining growth rate influenced the companies' operating performance. JAL, especially, operations in international markets constitute more than half of their business, has suffered huge losses since 1991. It is true that the losses of JAL were caused mainly by changing market conditions, but it should be noticed that the rapid appreciation of yen also made the situation worse.

Air transport markets in Japan have developed in a strictly regulated environment. The Civil Aeronautics Law, which governs the industry, requires that airline companies obtain government licenses to enter the market. Airlines also need government approval for setting and charging their fares, and even for their annual business plans. Naturally, international routes also require government-negotiated bilateral agreements with other countries. In this respect, Japan has been a traditionalist. Its agreements are generally modeled after the old Bermuda Agreement, concluded between the United States and the United Kingdom in 1946.

However, the world-wide policy trend to deregulate the industry reached Japan in the mid-1980s. In 1985, the United States and Japan concluded a provisional agreement on international air transport. This agreement allowed new entry into the market, but required the Japanese government to change their air transport policy, because the government had restricted its carrier in the international market to just one. The government then changed its policy not only in the international market but also in the domestic, intending to promote competition in both markets. But this policy change was not as complete as that of the U.S. government. Since the institutional framework (such as entry licensing and fare approval system) remained unchanged, whether the competition would work effectively depends on how the regulators control markets.

The purpose of this paper is to evaluate the policy changes in the Japanese air transport industry. In sections 2 and 3, we describe the evolution of the policies, and in section 4 we sketch the domestic market structure and performance of the industry. Then, from section 5 to 7, we
examine the effects of the policy change by econometric analysis, focusing on the airlines’ behavior and cost structure.

2 Evolution of Domestic Air Transport Policy

In 1952, Japan Airlines was established as a major private company and started service in domestic markets. The following year, Japan was allowed to operate an international air transport service, and the government decided to reform JAL to a “half public” corporation. The purpose of this reform was to foster the company as a national flag carrier. Around that time, several private airline companies were founded. These companies were small and their business conditions were unstable, so some bankruptcies and consolidations occurred. In 1957, the two biggest of these carriers merged to form All Nippon Airways, which is the second major and purely private carrier. After that, the remaining companies had also undergone integration and consolidation, and in the mid-1960s, four airline companies in Japan existed: JAL, ANA, Japan Domestic Airlines (JDA) and Toa Airways (TA). In the second half of the 1960s, TA developed a cooperative arrangement with ANA, as did JDA with JAL. As a result, it was assumed that they would be consolidated into the big two, JAL and ANA.

However, the government policy changed its course due to the Cabinet Meeting Resolution “Concerning Airline Operations” of November 1970 and the Notice from the Minister of Transport in July 1972. The Cabinet Meeting Resolution of 1970 specified not a two-company system, but rather a three-company system resulting from the consolidation of JDA and TA. This sudden policy change was said to be brought about by strong political pressure from particular corporate groups, and this is clear evidence that Japanese government policy could be moved by influential private bodies at that time. Furthermore, the ministerial notification of 1972 laid out specific rules, etc., pertaining to the business fields of the three firms and increasing transport capabilities. According to this decision and notification, generally referred to as the “Aviation Constitution,” Japan Airlines would be responsible for international routes and domestic trunk routes; ANA would be responsible for domestic trunk routes, local routes and short-distance international charter flights; and Toa Domestic Airlines, the new company resulting from the consolidation of JDA and TA, would be responsible for local routes and a portion of domestic trunk routes. Thus, the so-called 1970-1972 airline regulation system (the old regime, hereafter) was established.

The old regime was intended to secure and nurture transport capacities of all members of the airline industry by establishing a segmented business base for each firm. In actuality, trunk

1 The government invested in JAL the same amount as the capital stock that the company obtained in starting their business. A new bill was passed to make JAL a special organization.
2 In Japan, this is known as the 45-47 regime, standing for Showa 45th year (1970) and 47th year (1972).
3 The segmentation of the market is a common feature of Japanese industrial policy in the 1950s,
route (Sapporo - Tokyo - Osaka - Fukuoka) markets grew much faster than other “local” markets and became a source of internal cross-subsidization. Under this internal cross-subsidization system, each carrier expanded their route network, and at the same time, succeeded in stabilizing their business. In 1970s, the average growth rate of revenue passenger kilometers in the domestic market was 12.2% and that of international market was 42.4% (!!).

However, during the period from the end of the 1970s to the mid-1980s, new trends were witnessed in the field of air transportation. For example, the United States deregulated its domestic air transport market, and the results of this policy change sounded all over the world. In Europe, the Thatcher government started its privatization policy, in which British Airways was the most important objective. Influenced by these policy trends of foreign countries, it was in this period that general opinions in Japan started to change toward a more liberal environment in industrial policy.  

In technological respects, the introduction and spread of wide-body aircraft changed the market structure and competitive strategies. Especially, international air cargo transport grew very fast, and this growth spilled over to the regulation of Japanese domestic air transport. The establishment of Nippon Cargo Airways (NCA), along with its entry into the market was a case in point. The firm was jointly founded in 1978 by ANA and several shipping companies in order to accommodate the rapidly growing field of international air cargo transport. The Ministry of Transport promptly granted NCA a license in 1983 following its application. This decision essentially resulted in the collapse of the single-company system in which JAL handled international routes in the field of air cargo transport.

In 1985, the government of Japan and the United States started negotiations on the entry of NCA and concluded a provisional agreement. The provisional agreement proved to be a decisive factor which voided the significance of the old regime. The contents of the US-Japan provisional agreement allowed both countries to commence operation of three new airline companies each on trans-Pacific routes based on “balanced expansion” of the air transport of both countries. On the basis of the conditions which led to the exchange of this type of agreement, the Minister of Transport consulted the Council for Transport Policy, an official advisory committee of the Minister, about the state of the future operating status of airline corporations in September 1985. The council submitted an interim report in December 1985 followed by a final report in June 1986. Both reports indicated that the old regime needed a change, and that efforts should be made to enhance competition both in domestic and international markets. In particular, the framework of this new aviation policy was outlined as follows:

60s and bigging of the 70s. The airline industry was a typical case.

4 As for transport and aviation fields, the opinions of the Fair Trade Commission calling for relaxation of regulations in all areas of transport administration, including aviation (1982) and administrative inspections of the Administrative Management Agency with respect to aviation administration (1984) were announced.
(1) international routes will be served by multiple carriers;
(2) competition on domestic routes will be promoted by new entry to a particular city-pair market;
(3) Japan Airlines will be 100% privatized.

After receiving the interim report, the government immediately decided to abolish the old regime in a Cabinet Meeting Resolution.

3 New Policy Since 1986

The core of the new policy adopted in 1986 can be summarized as follows. Although we do not necessarily agree with its logic, we will describe its basic features.

With respect to a competitive policy itself, the report states that “an American-style deregulation does not suit the actual circumstances of Japan” based on the limitations of Tokyo International (Haneda) Airport and Osaka International (Itami) Airport and on the problem of differences in competitive strength between airline companies. As such, the report also states that, “For the time being, it is appropriate to proceed with policies which promote competition through the implementation of flexible administrative management as much as possible.” In this report, promotion of competition specifically refers to “the promotion of double tracking and even triple tracking not in accordance with the previous demarcation of trunk routes and local routes, but rather corresponding to the size of the demand of individual routes and status of progress at airport facilities and so on.” On the other hand, the report also points out the difficulty in increasing the number of flights due to restrictions on the capacities of major airports, indicating a manner of thinking which states that, “it is necessary to attempt to further expand air traffic capacity through improvement of air transport facilities and the air traffic control system.”

With respect to domestic aviation, the Ministry of Transport changed over to a policy which promotes competition (such as in the form of double tracking and so on) based on quantitative standards, in 1986. According to these standards, new entries were judged on the number of passengers carried in the previous year. Since that policy change, double and triple tracking routes have increased gradually. In 1993, about 65% of total air transport passenger flew in either double or triple tracking routes, although the number of these routes counts for only 19% of the total.

In addition, a related bill was passed in September 1987 pertaining to the complete privatization of JAL, which led to the realization of its transformation to a private corporation in November of the same year.\(^5\)

However, it should be noted that the new policy did not give enough freedom for airlines to change themselves. This new policy seeks “promotion of competition” within the range of administrative operation without altering the previous systematic framework stipulated by the Civil

\(^5\) At the time of privatization of Japan Airlines, the share of Japanese government was 34.7%. 
Aeronautics Law. In other words, the licensing system for new entry and the approval system for setting fares remained unchanged. On the contrary, some have criticized that the new policy enhanced administrative discretion, and that in some respects the regulation was strengthened, because they have to decide which route would become a double track or a triple track, and which carrier would enter. As is pointed out by the report itself, these conditions greatly differ from the United States, where deregulation was implemented through legal reforms without the discretion of the bureaucracy.

From the consumers’ viewpoint, the new policy did not bring about substantial benefits. This is far from the case of deregulation in the United States. Many researchers showed that the deregulation of domestic air transport markets in the United States increased consumers’ surplus dramatically, and that the main factors of this benefit are price and flight frequency change.\(^6\) Concerning fares, the most important effect of the deregulation was that it made air fares much more diversified and lowered them on average in real terms (“diversify” refers to the availability of many fares with different conditions). Airlines introduced many discount fares for the purpose of their yield management, while the discount fares benefit consumers who otherwise would not use air transport or pay more for the same service. It is reported that now more than 90% of passengers are making use of discount tickets.

Ito [1992] compares fares in Japan and the United States (Table 1). In the table unit fares are passenger’s expenditure per kilometer.\(^7\) The table shows that normal (fare basis Y) fares of the United States are higher than Japan, but that discount fares in the States are much lower than Japan. As noted above, most passengers fly with discount fares. It should be noticed that deregulation brings price diversification and not simple downward pressure on prices. From the beginning of the 1990s, discount fares have been moving toward simplification. However, since discounts rates in the States are much larger than Japan, we can say that the fare level in Japan are still higher than that of the States.

As we saw, the new air transport policy since 1986 has not brought effective competition to the market. As a result, consumers have not obtained any benefit from the policy change. Thus what Japanese government should do urgently is to make competition effective in the air transport markets. At the end of last year, the government revised the Civil Aeronautics Law to relax the conditions for introducing and setting discount fare in domestic markets, but in order to bear fruit for consumers, more drastic relaxation is needed.

\(^6\) For example, see Morrison and Winston [1986]. They estimated that annual improvement in the welfare of travelers by deregulation was at least $ 6 billion (in 1977 dollars), of which the greatest net benefits had gone to business travelers from increased flights frequency.

\(^7\) For details, see the footnotes of the table.
4 The Market Structure and Performance of the Japanese Airline Industry: Descriptive Statistics

In this section we will refer briefly to the domestic market structure and performance of the Japanese airline industry, using the annual data filed in Koku Tokei Yoran (issued annually by Nihon Koku Kyokai) and Koku Yuso Tokei Nempo (by Ministry of Transport), in order to better understand the character of the Japanese airline industry.

4.1 The Market Structure of the Japanese Airline Industry

To begin with, we will survey the cost structure. The three major airlines’ total annual cost, labor, and fuel costs (included in total cost) are shown in Figure 1 (Figure 1-1 is nominal base, and Figure 1-2 real, i.e., deflated by RPI index).

The total cost had been almost unchanged before the regulatory change, but suddenly began to increase after 1986. It is apparent that fuel costs, the share of which was around 30% at the end of 1970s, has been decreasing, and that the labor costs remained constant in real base. And Figure 2 shows that the airport charges, which are said to have been a burden for Japanese airlines, have also been decreasing. So, what have raised the total cost recently are such non-operational costs as sales and administrative costs, and commissions for travel agencies. The reason why the shares of these costs increased is thought to be that airlines’ entry into new routes after the regulatory change caused airlines to spend more to attract demand. According to the context mentioned above, we may say that the ratio of fixed cost has also decreased.

Figure 3 shows changes of the big three’s real average costs (operating cost per available seat kilometer). The cost trend experienced two turning points. One is 1986, the other 1990. All three companies succeeded in cost reduction in the early 1980s. Especially, JAS, the highest-cost carrier, reduced its cost greatly. The average costs remained constant or slightly increased between 1986 to 1990, and they decreased again in 1991 and 1992. As we noted earlier, the second half of 1980s boomed and the air transport policy change occurred in 1986. These are the reasons for the cost trend in that period.

In Figures 4-1, 4-2 and 4-3, the airplane size, the passengers carried by the three airline, and the share of passengers carried are shown respectively. As noted above, Japanese domestic markets can be divided into three groups. One is what is called “triple track routes,” of which the demand in previous year is above 700,000, where JAL, ANA, and JAS operate. Another is “double track routes,” the demand of which is above 400,000 in principle, where JAL and ANA or ANA and JAS operate, and the other is a monopoly.

Among the 179 domestic routes in 1991, the number of triple track ones are 10 (5.6%),

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8 Initially, the MoT put the standard for triple and double track at one million and 700,000 or more a year respectively. Then they relaxed the standard, but some exceptions exist.

9 Commuter routes are included.
double track 24 (13.4%), and monopoly 145 (81.0%). However, the number of passengers carried in triple track was 29,484,000 (42.9%), double track 15,530,000 (22.6%), and monopoly 23,673,000 (34.4%). So the average market size of triple (double) track routes are eighteen times (four times) larger than that of monopoly. In addition, these Japanese routes are also classified into trunk routes and local routes. The definition of the former city-pair routes is that they connect Sapporo (Shin’Chitose), Tokyo (Haneda, Narita), Osaka (Itami10), Fukuoka, and Naha, and the number of the passenger carried in 1991 in the trunk routes was 25,840,000 (38.2%), which happen to include many triple and double track routes.

Before the regulatory change, with regard to the domestic markets, J AL has been in operation only in trunk routes. Under the new policy, J AL was authorized to operate in domestically denser local routes; that is some double and triple track routes. Generally speaking, the denser the market, the wider airplanes employed tend to be. It is clear that J AL always employs the largest type of airplane. However, after the regulatory change J AL’s aircraft size shrunk slightly, whereas ANA and J AS have come to employ the larger aircraft. The reason is that the markets J AL was newly authorized to enter were smaller than those which he had been in operation before the regulatory change, while, roughly speaking, in the case of ANA and J AS, it was vice versa.

On the other hand, ANA has already been in operation both in the trunk routes and in denser local routes (see the passenger share in Figure 4-2), so there has been no room left for ANA to enter the domestic market. The routes ANA has newly entered are both international (for U.S. and Europe) and domestic long haul monopoly routes newly authorized (e.g., Shin’Chitose/Okayama, etc). So the average aircraft size became larger, especially since the regulatory change.

With regard to J AS, it was authorized to enter some domestic trunk and shorter haul international routes, but the extent of entry was less than that of ANA. Figure 4-1 shows that the average aircraft size of J AS became larger in almost the same way as ANA.

Finally, let us investigate the share of departure from each airport by Figure 5. Figure 5-1 shows the situation in 1979, while Figure 5-2 shows that of 1992. As Tokyo and Osaka areas have by far the largest population, so it has been said that departures are concentrated at both Haneda and Itami, and this is as true as ever. However, as the capacity constraint at Itami Airport has been substantial, and has prevented airlines from increasing departures responding to the demand increase, the departure share of Itami has gradually decreased. The construction of Kansai International Airport was expected to relieve traffic, but due to the high landing fees and the lack of the runway, it is said that the new Kansai Airport has not yet played a great role toward solving the problem.

4.2 The Performance

Here we will survey the market performance of the Japanese domestic airline industry after

10 Since 1994, Kansai International Airport has been included in trunk routes.
the regulatory change from the viewpoints of load factor (i.e., the substitution of productivity), yield, and profit rate of each firm.

Figure 6-1 shows that there seems to be little difference of average load factor between 1979-1985 and 1986-1990, so we may say that the regulatory change hardly contributed to airlines’ productivity. The average operating indices of all industries (including the airline industry) are down in that figure. It should be noted that the average load factor has something to do with the average operating rate of all the industries, which means that the load factor cyclically reflects both boom and recession.\textsuperscript{11} In fact, the average load factor of the three airlines during 1986-1992 (67.1%), which includes the boom, is a little higher than during 1979-1985 (64.4%). However, from a statistical viewpoint, the significant difference between them was not recognized as a result of a one-way layout analysis of variance ($F=3.15 < F(1,40,0.05)=4.08$). So neither the regulatory change nor the boom could raise the load factor. On the other hand, from Figure 6-1, we can see that the crash of JAL’s B747SR in 1985 had a substantial effect on its load factor that year.

Figures 7-1 and 7-2 show the yields of Japanese airlines (the international data are also included, because they are not separately published). Note that the real yields of JAL and JAS (shown in Figure 7-2) have been slightly decreasing, except for the boom whereas ANA’s has been slightly increasing, and that even the nominal yield of those two firms (in Figure 7-1) have not necessarily increased. As JAL has been in operation mainly in international markets, so JAL may be suffering from the lack of revenue caused by discount fares in international markets. However, JAL has also been successful in being authorized to enter some domestic routes where discount tickets are less available than in international markets, which is expected to prevent the yield from decreasing. On the contrary, ANA is facing the opposite situation. ANA’s yield may go down as the company goes on entering international markets. So ANA will aim at being authorized to enter domestic longer haul markets, where it can constantly keep more sufficient revenue.

With regard to JAS, after the regulatory change JAS came to operate in domestic major markets where coupon tickets are more available than in minor local routes in which the company used to operate. In addition, JAS was allowed to enter shorter-haul international markets, which may deprive it of its revenue. So JAS may suffer from the situation it faces after the regulatory change.

Finally, according to Figure 8, it seems that the profit rate became higher after the

\textsuperscript{11} The correlation between domestic average load factor and average operation rate of all the industries is shown in the table below.

The correlation between average load factor and average operation rate of all industries

<table>
<thead>
<tr>
<th></th>
<th>J AL ('85 was excluded)</th>
<th>ANA ('85 was excluded)</th>
<th>J AS ('85 was excluded)</th>
<th>J AL ('85 was excluded)</th>
<th>ANA ('85 was excluded)</th>
<th>J AS ('85 was excluded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>all industries</td>
<td>0.556 (2.32*)</td>
<td>0.611 (2.67*)</td>
<td>0.669 (2.99**)</td>
<td>0.626 (2.66*)</td>
<td>0.662 (2.93**)</td>
<td></td>
</tr>
<tr>
<td>service industries</td>
<td>0.744 (3.86****)</td>
<td>0.280 (1.01)</td>
<td>0.110 (0.38)</td>
<td>0.704 (3.29****)</td>
<td>0.296 (1.03)</td>
<td>0.132 (0.44)</td>
</tr>
</tbody>
</table>

Note: N=14(’79-'92). Level of significance: * 5%, **2.5%, ***1%.
regulatory change, but as mentioned in the case of the load factor, we can say that not so much the regulatory change as the boom caused the higher profit rate, because the recession from 1991 apparently lowered the profit. According to the surveys above, where we found that total cost has been increasing while yields decreased, it is said that the profit rate after the regulatory change is quite unstable, and is ruled by cyclical business conditions.

5 Service Competition and Demand Character in Double/Triple Track Routes

In this section we will clarify the effect of authorization of entry on airlines’ competition by econometric analysis. It is generally thought that almost all kinds of competition, e.g., through price, frequency, and service quality, have been forbidden since the introduction of the old regulatory regime. On the other hand, it is pointed out that Japanese airlines have engaged in such competition as employing newer type of airplanes. In addition it is true that the MoT in Japan intended to promote competition among airlines since the abolishment of the old regulatory regime. In effect, with respect to domestic aviation policy, the MoT authorized JAL and JAS to enter the routes where ANA already operated as incumbent, so that 34 double or triple track routes were formed by 1992 (See Table 2).

______________________________

12 As a result of one-way layout analysis of variance, the average profit rate of three firms after ’86 (i.e., after the regulatory change) is significantly higher than during ’79-’85 (i.e., 45-47 system). F=7.06 > F(1,40;0.025)=5.43
13 A famous example is the competition between JAL and ANA to employ B727s in the 1960s.
Table 2. The domestic double and triple track route in 1992, and the number of the firms in operation during the period 1989-92.

<table>
<thead>
<tr>
<th>City Pair Route</th>
<th>92</th>
<th>91</th>
<th>90</th>
<th>89</th>
<th>Firms</th>
<th>City Pair Route</th>
<th>92</th>
<th>91</th>
<th>90</th>
<th>89</th>
<th>Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tokyo/Sapporo</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>17. Tokyo/Nagasaki</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Tokyo/Osaka</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>18. Tokyo/Kumamoto</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3. Tokyo/Fukuoka</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>19. Tokyo/Oita</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, JAS</td>
<td></td>
</tr>
<tr>
<td>4. Tokyo/Naha</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>20. Tokyo/Miyazaki</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, JAS</td>
<td></td>
</tr>
<tr>
<td>5. Osaka/Sapporo</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>21. Tokyo/Kagoshima</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6. Osaka/Fukuoka</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>JAL, ANA</td>
<td></td>
</tr>
<tr>
<td>7. Osaka/Naha</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
<td>23. Osaka/Matsuyama</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>JAL, ANA</td>
</tr>
<tr>
<td>8. Fukuoka/Sapporo</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>JAL, ANA</td>
<td>24. Osaka/Kochi</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, ANK, &amp; JAS</td>
</tr>
<tr>
<td>9. Fukuoka/Naha</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
<td>25. Osaka/Kagoshima</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10. Tokyo/Kushiro</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, JAS</td>
<td>26. Nagoya/Sapporo</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
</tr>
<tr>
<td>11. Tokyo/Hakodate</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
<td>27. Nagoya/Sendai</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, JAS</td>
</tr>
<tr>
<td>12. Tokyo/Akita</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>JAL, ANA</td>
<td>28. Nagoya/Fukuoka</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
</tr>
<tr>
<td>13. Tokyo/Kanazawa</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
<td>29. Nagoya/Nagasaki</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, JAS</td>
</tr>
<tr>
<td>14. Tokyo/Hiroshima</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>JAL, ANA</td>
<td>30. Nagoya/Kagoshima</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>JAL, ANA</td>
</tr>
<tr>
<td>15. Tokyo/Takamatsu</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>ANA, JAS</td>
<td>31. Nagoya/Naha</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>ANA, JAL &amp; JTA</td>
</tr>
<tr>
<td>16. Tokyo/Matsuyama</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>JAL, ANA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: (1) The route where ANA and ANK or JAL and JTA operates is not regarded as double track, because they are horizontally integrated.
(2) Firms which operate for less than 6 months in a year are not included.
(3) JAL, ANA, and JAS operate in all the triple track routes.
(4) The following local routes are excluded, because of their apparently smaller market size.
   Fukuoka / Kagoshima, Kagoshima/Amami, and Naha/Ishigaki

However, it is quite obscure what kind of competition MoT intends to introduce. In the following parts, the regression model referred in Douglas and Miller [1974b] will be constructed in order to verify the null hypothesis that a kind of service competition (like frequency competition) did not exist in double or triple track routes as a result of regulatory change. And through the analysis, we will clarify the demand character in the area.

5.1 Service Competition Model

According to Douglas & Miller [1974b], if the additional demand increase of an individual firm due to the additional increase of frequency $\frac{\partial PAX_i}{\partial FRQ_i}$ is greater than that of the market, i.e., $\frac{\partial PAX_i}{\partial FRQ_i} > \frac{\partial PAX}{\partial FRQ}$, then airlines are supposed to choose the frequency competition as their strategy to increase their passenger share. Indeed one may say it is inappropriate to apply Douglas & Miller’s theory to the Japanese airline industry, where the airport capacity is limited, but
it is possible to think that the knowledge of demand character mentioned above induces Japanese airlines to apply to the Japanese MoT for entry into double or triple track routes in order to increase their traffic share. This will be further accelerated when the capacity limitation in airports is loosened in the future.

In addition, let us suppose the other hypothesis inherent in the case of the Japanese airlines; that is, if \( \frac{\partial \text{PAX}}{\partial \text{EQ}_i} > \frac{\partial \text{PAX}}{\partial \text{EQ}} \), then the airline are supposed to choose the equipment competition. The reason for supposing this hypothesis is that Japanese airlines, especially JAL and ANA, are said to have been in competition to employ the newer type of airplanes than the other since the 1970s.

Here let us construct the log linear regression models (1) and (2) in order to test these two hypothesis.

(1) \[
\ln \left( \frac{\text{PAX}_i}{\sum_{j=1}^{n} \text{PAX}_j} \right) = \alpha_1 + \sum_{k=1}^{n} \beta_{1k} \text{AD}_k + \left( \gamma_1 + \sum_{k=1}^{n} \delta_{1k} \text{AD}_k \right) \ln \left( \frac{\text{FRQ}_i}{\sum_{j=1}^{n} \text{FRQ}_j} \right) + \mu
\]

where \( n \) is the number of firms in operation in a route, \( \text{PAX}_i \) is the total annual traffic carried by the \( i \)th firm in a city pair route, \( \text{FRQ}_i \) is the total annual departures of the \( i \)th firm in a city pair route, and \( \mu \) is the error term.

(2) \[
\ln \left( \frac{\text{PAX}_i}{\sum_{j=1}^{n} \text{PAX}_j} \right) = \alpha_2 + \sum_{k=1}^{n} \beta_{2k} \text{AD}_k + \left( \gamma_2 + \sum_{k=1}^{n} \delta_{2k} \text{AD}_k \right) \ln \left( \frac{\text{FRQ}_i}{\sum_{j=1}^{n} \text{FRQ}_j} \right) + \mu
\]

where \( \text{EQ}_i \) is the number of seats per flight of the \( i \)th firm in a city pair route.

In addition to the models above, we suppose that each firm is to increase its demand share by increasing its total seat supply (i.e., \( S = \text{FRQ} \cdot \text{EQ} \)) share. In this case the carrier is supposed to choose the mixed strategy of increasing departure and widening bodies optimally in order to increase its own demand share under the circumstances or constraints (e.g., slot constraint) the carrier faces.

\[
\frac{\text{PAX}_i}{\text{PAX}} = \alpha_3 \left( \frac{S_i}{S} \right)^r = \alpha_3 \left( \frac{\text{FRQ}_i}{\text{FRQ}} \right)^{\gamma} \left( \frac{\text{EQ}_i}{\text{EQ}} \right)^{\phi}
\]

\( r = \gamma^3 + \phi^3 \) if profit exists for firm \( i \), \( r > 1 \). Here we construct a multiple regression demand share model where the share of departure and that of seats are dependent variables (See equation (3).
In equation (3) if the sum of $\gamma_3$ and $\phi_3$ are larger than unity, we suppose that airlines intend to increase its demand share by increasing its total seat supply share. And in case $\gamma_3$ are larger than $\phi_3$, with both of them statistically significant, we judge that the airline sheds more light on the strategy of increasing the number of departures.

The data in this section is obtained from Koku Yuso Tokē Nempo (this is an annual statistical report published by the MoT), issued between 1989-1992.

5.2 The Regression Results

The results are shown in Tables 3, 4 and 5.

In all cases, we say that the increase of flight share brings about that of passenger share, but each equation shows different results, judging from the result of the Chow test. Each firm might behave in a different manner in this period. In addition, in the case of JAL and JAS, a percent increase of frequency share leads to 1.3-1.4% increase of demand share, whereas with regard to ANA, which had already been in operation in the market of denser traffic and did not enter double or triple track routes during the period of 1989-1992, this phenomenon was no longer seen. From these results, JAL and JAS have the good reason to apply for the entry into the denser routes. And from the viewpoint of demand side, passengers tend to choose the flights of dominant airlines in the market.

Table 3. Regression results of demand share function (1) and the 95% confidence limit of parameter $\gamma_1$ with regard to each firm.

| Firm | $\alpha_1 + \beta_1k$ | $\gamma_1 + \delta_1k$ | $\text{adj}R^2$ | SE | Pr($|\gamma_1| \leq x$) = 0.95 |
|------|----------------------|----------------------|-----------------|----|--------------------------|
| JAL  | 1.616 (12.31a)       | 1.343 (46.27a)       | 0.966           | 0.121 | 1.285 $\leq \gamma_1$ $\leq$ 1.401 |
|      | -1.845+1.099AD89+0.793AD90 (12.30a)(2.96a)(2.67a) | 1.426-0.253AD89-0.190AD90 (39.55a)(3.00a)(2.78a) | 0.970 | 0.114 | 1.353 $\leq \gamma_1$ $\leq$ 1.498 |
| ANA  | 0.019 (0.15)         | 0.995 (36.71a)       | 0.918           | 0.096 | 0.942 $\leq \gamma_1$ $\leq$ 1.048 |
| N=122 |                     |                      |                 |     |                          |
| JAS  | -1.291 (7.65a)       | 1.266 (33.56a)       | 0.944           | 0.186 | 1.191 $\leq \gamma_1$ $\leq$ 1.341 |
| N=68 |                     |                      |                 |     |                          |

Note: (1) t-statistics are in parentheses ; Level of Significance: $a=1\%$
(2) estimated by OLS.
(3) The confidence limit of JAL(2) is the value of '92.
(4) The equations in the upper row of each firm's empirical results were estimated without any annual dummy variables.
(5) the results of the Chow test between firms are:
  JAL/ANA : $F=13.92 > F(2,194:0.01) = 4.71$
  JAL/JAS : $F=14.01 > F(2,140:0.01) = 4.76$
  ANA/JAS : $F=28.00 > F(2,186:0.01) = 4.71$
Next, we can compare the estimated results of equation (2) with those of (1), in Table 4.

| Firm   | \( \alpha_2 + \beta_2 k \)          | \( \gamma_2 + \delta_2 k \)          | adjR² | SE   | Pr(\( | \gamma_2 | \leq x \))=0.95 |
|--------|------------------------------------|------------------------------------|------|------|-------------------------|
| J AL   | \(-1.101\) (12.49a)                | 1.233 (63.16a)                     | 0.982 | 0.089 | 1.194 \( \leq \gamma_2 \leq 1.272 \) |
|        | \(-1.200+0.684\)AD89+0.340\)AD90   | 1.266-0.152\)AD89-0.077\)AD90      | 0.983 | 0.087 | 1.217 \( \leq \gamma_2 \leq 1.315 \) |
|        | (11.77a)(2.56b) (1.59d)            | (51.92a)(2.52b) (1.58d)            |      |      |                          |
| ANA    | \(-0.420\) (5.68a)                | 1.090 (67.27a)                     | 0.974 | 0.054 | 1.058 \( \leq \gamma_2 \leq 1.122 \) |
|        | \(-0.600+0.253\)AD90             | 1.124-0.053\)AD89-0.054\)AD90      | 0.975 | 0.053 | 1.076 \( \leq \gamma_2 \leq 1.171 \) |
|        | (5.10a)(1.33d)                    | (46.12a)(1.38d) (1.39d)            |      |      |                          |
| J AS   | \(-0.404\) (4.29a)                | 1.082 (50.85a)                     | 0.975 | 0.125 | 1.039 \( \leq \gamma_2 \leq 1.125 \) |

Note: (1) t-statistics are in parentheses ; the level of significance : a=1%, b=5%, c=10%, d=20%
(2) estimated by OLS
(3) The confidence limit of J AL(2) & ANA(2) are the value of 92
(4) The equations in the upper row of each firm’s empirical results were estimated without any annual dummy variables.
(5) The results of the Chow test between firms are :
   J AL/ANA : F =23.62 > F (2,194:0.01)=4.71
   J AL/J AS : F =23.68 > F (2,140:0.01)=4.76
   ANA/J AS : F =4.57 > F (2,186:0.05)=3.04

What is apparently different from the results in Table 3 is that all the regression coefficients are larger than unity in this case, whereas the results of the Chow test are almost the same as those in Table 3. So it can be said from this viewpoint that all the Japanese airlines have room for choosing the strategy of expanding the equipment size, but their behavior may be different from one another. Especially in the case of ANA, there may be no choice but competing through the expansion of equipment, because it already operates as an incumbent in almost all the domestic denser markets.

Let’s then look into the regression results of equation (3). Judging by the results shown in Table 5, we can recognize three notable findings:

(1) In all the cases \( r = \gamma_3 + \phi_3 > 1 \) is recognized. This means that the more each airline increase the total seat supply share, the more it can increase demand share.

(2) The Japanese airlines except for ANA may have the incentive of choosing these two strategies:
   1) increasing frequency in double or triple track routes, 2) expanding equipment size in these routes.

(3) However, J AL and J AS seem to choose not so much frequency competition as equipment competition.

The reasons for these results may be that the lack of airport capacity makes it difficult for the airlines to depend heavily on frequency competition. The values of ANA - which has the biggest fleet in the domestic air network - gives us the evidence.
Table 5. Regression results of demand share function 3

<table>
<thead>
<tr>
<th></th>
<th>$\alpha_3 + \beta_3 k$</th>
<th>$\gamma_3 + \delta_3 k$</th>
<th>$\phi_3 + \lambda_3 k$</th>
<th>adjR$^2$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAL</td>
<td>$-1.252$ (12.21a)</td>
<td>$0.319$ (2.63b)</td>
<td>$0.947$ (8.58a)</td>
<td>0.983</td>
<td>0.086</td>
</tr>
<tr>
<td></td>
<td>$-1.481+0.880AD89+0.563AD90$ (12.63a)(3.49a) (2.74a)</td>
<td>$0.282+0.427AD91$ (2.16b)(2.04b)</td>
<td>$1.053-0.200AD89$ (8.61a)(3.51a)</td>
<td>0.987</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>$0.947$ (8.58a)</td>
<td>$1.053-0.200AD89$ (8.61a)(3.51a)</td>
<td>$0.987$ (0.080)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANA</td>
<td>$-0.435$ (5.85a)</td>
<td>$-0.018$ (0.28)</td>
<td>$1.112$ (16.31a)</td>
<td>0.974</td>
<td>0.054</td>
</tr>
<tr>
<td></td>
<td>$-0.608+0.271AD89$ (5.16a)(1.43d)</td>
<td>$-0.063+0.247AD89$ (0.89)(1.56d)</td>
<td>$1.189-0.306AD89$ (15.47a)(1.84c)</td>
<td>0.987</td>
<td>0.080</td>
</tr>
<tr>
<td>JAS</td>
<td>$-0.778$ (7.60a)</td>
<td>$0.410$ (5.62a)</td>
<td>$0.751$ (12.24a)</td>
<td>0.983</td>
<td>0.103</td>
</tr>
<tr>
<td></td>
<td>$-0.739$ (7.95a)</td>
<td>$0.513-0.277AD89$ (6.50a)(2.73a)</td>
<td>$0.646+0.284AD89$ (9.19a)(2.66a)</td>
<td>0.984</td>
<td>0.098</td>
</tr>
</tbody>
</table>

Note: (1) t-statistics are in parentheses; the level of significance: a=1%, b=5%, c=10%
(2) estimated by OLS
(3) The equations in the upper row of each firm’s empirical results were estimated without any annual dummy variables.
(4) The results of the Chow test between firms are:
   - JAL/ANA : F =20.15 > F(3,192:0.01) =3.88
   - JAL/JAS : F =6.66 > F(3,138:0.01) =3.93
   - ANA/JAS : F =8.29 > F(3,184:0.01) =3.89

5.3 Summary of Findings

Here we will sum up the findings in this section and briefly comment on them. According to the empirical results, passengers seemed to choose the airlines that had high frequency and seat-per-flight share (equipment). On the other hand, from the viewpoint of airlines, JAL and JAS were able to increase their demand share by increasing the frequency and seat-per-flight share. In addition, the strategy of increasing equipment share was probably of comparative importance for these carriers because of the airport capacity constraints. However, in the case of ANA, the strategy of increasing equipment share - that is, employing wider bodied airplanes - was important.

If we take into account these results, the regulatory change that authorized the entry into double or triple track routes was favorable not to ANA but to JAL and JAS. However, as in the case that once the frequency competition led to the waste of profit in the U.S. airline industry under regulation, it is necessary for the regulator (MoT) to pay attention to whether or not the service competition including frequency and/or equipment competition in double or triple track routes causes the waste of scarce resources.

In the following section, it will be clarified whether this competition has brought about excess capacity or not.
6 Does the Demand Meet Supply in Double/Triple Track Routes? : The Models and Regression Results

6.1 The Models and Data

According to the empirical results in section 5.2, something like service competition in double and/or triple track routes may bring about excess capacity. On the other hand the capacity constraints in Haneda (Tokyo) and Itami (Osaka) Airports may be a crucial factor to prevent airlines from increasing their supply. In this section we will focus on the load factor of the routes where entry was newly authorized after the regulatory change in 1986 and investigate whether or not supply meets demand in these routes. To begin with, we will construct two kinds of load factor functions. The definitions of the variables used in the models are shown in Table 6.

The data in this section is the same as in section 5, i.e., the panel data of 31 routes between 1989-1992; the sample number is 124.

In treating the load factor we have to take into consideration that the average load factor changes according to boom and slump. So we restored to the analysis of variance (one-way layout) in order to make sure the existence of load factor’s difference between 1989-92. The result goes as follows.

\[ F = 10.84 > F(4,120; 0.01) = 3.48 \]

From the result, the null hypothesis that the average load factor in each year is equal is rejected at 1% level. So we introduced the annual dummy variable \( AD_x \) (see Table 6).

Both demand and supply factors are to influence the load factor directly; demand factors, e.g., the number of passengers (PAX), and supply factors, e.g., the number of departures (FRQ), the number of seats per flight (EQ), and the stage length (DIST), and the factor of the market structure, e.g., the concentration (HERF). On the other hand, among these variables, PAX and EQ are endogenous variables in demand and supply function, so the load factor function may compose the simultaneous equations together with demand and supply functions.

In addition, we have to pay attention to the multicollinearity between variables. The partial correlation coefficients between variables are shown in Table 7.
Table 6. Variables and their definitions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition and data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF</td>
<td>the average annual load factor of each market, reported in “A”</td>
</tr>
<tr>
<td>PAX</td>
<td>the number of O&amp;D passengers in each market that traveled in a year, reported in “A”</td>
</tr>
<tr>
<td>DIST</td>
<td>each route’s nonstop distance between O&amp;D, reported in “A”</td>
</tr>
<tr>
<td>HERF</td>
<td>the Herfindahl index, the sum of the squares of the shares of each firm in the market, calculated by us. The data source is “A”</td>
</tr>
<tr>
<td>EQ</td>
<td>the average annual number of seats per flight in the market, which was calculated by the authors. The data source is “A”</td>
</tr>
<tr>
<td>FARE</td>
<td>the round trip ticket price of the market, filed in “B”</td>
</tr>
<tr>
<td>INC</td>
<td>the product of the per capita incomes of the two main cities served by each market, i.e., $\sqrt{(Income\ of\ Origin) \times (Income\ of\ Destination)}$. The data source is “C”</td>
</tr>
<tr>
<td>POP</td>
<td>the product of the population of the two areas served by each market, i.e., $\sqrt{(Population\ of\ Origin\ Area) \times (Population\ of\ Destination\ Area)}$, where “area” is both main city and its commuting zone. The data source is “C”</td>
</tr>
<tr>
<td>ADx</td>
<td>annual dummy variable (x=89,90,91)</td>
</tr>
<tr>
<td>DS</td>
<td>single track dummy variable (1 for single track route and 0 otherwise)</td>
</tr>
<tr>
<td>DT</td>
<td>triple track dummy variable (1 for triple track route and 0 otherwise)</td>
</tr>
<tr>
<td>DTR</td>
<td>trunk route dummy variable (1 for trunk route and 0 otherwise)</td>
</tr>
</tbody>
</table>

Note: Data Source “A” is Koku Yuso Tokei Nempo (issued between ’89-’92), “B” is Jikokuhyou (the timetable, published by JTB), and “C” is Chiiki-keizai-souran, issued between 1991-94 (which reports regional annual data of population, income, etc., annually published by Toyo Keizai Shimposha)

Table 7. The partial correlation coefficients between variables

<table>
<thead>
<tr>
<th></th>
<th>LF</th>
<th>PAX</th>
<th>DIST</th>
<th>FRQ</th>
<th>EQ</th>
<th>HERF</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAX</td>
<td>0.253</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRQ</td>
<td>0.240</td>
<td>0.880*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIST</td>
<td>-0.355*</td>
<td>0.014</td>
<td>-0.238</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ</td>
<td>-0.048</td>
<td>0.667*</td>
<td>0.244</td>
<td>0.457*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HERF</td>
<td>0.162</td>
<td>-0.581*</td>
<td>-0.514*</td>
<td>-0.251</td>
<td>-0.445*</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: * significant at 0.1 % level

Among these coefficients the correlation between PAX and FRQ is strong (coefficient is 0.88). So in the construction of the load factor function, we chose not to include these two variables simultaneously but to build two type of load factor equations (Load factor function [1] and [2]) each of which includes PAX or FRQ as independent variable. Each equation in log-linear form and its expected sign of coefficients are as follows;
(1) Load factor function (x=89, 90, 91)

\[
\ln(\text{LF}) = a_1 + \sum_{x=89}^{91} b_{x, \text{AD}_{x}} + \left( c_1 + \sum_{x=89}^{91} d_{x, \text{AD}_{x}} \right) \ln(\text{PAX}) + \left( e_1 + \sum_{x=89}^{91} f_{x, \text{AD}_{x}} \right) \ln(\text{DIST}) \\
+ \left( g_1 + \sum_{x=89}^{91} h_{x, \text{AD}_{x}} \right) \ln(\text{HERF}) + \left( i_1 + \sum_{x=89}^{91} j_{x, \text{AD}_{x}} \right) \ln(\text{EQ}) + \mu_1
\]

The coefficient of \( \ln(\text{PAX}) \) is expected to be \( c_1 > 0 \), because, other things being equal, the more the traffic increases, the higher the load factor becomes. In addition, the value of the coefficient is thought to be \( 0 < c_1 < 1 \). And if at once \( c_1 > 0 \) and the null hypothesis that \( c_1 = 1 \) cannot be rejected, airlines are thought to have enough capacity for demand.

According to Douglas & Miller [1974b], the longer the stage length is, the lower the actual load factor.\(^{15}\) We accept this hypothesis and expect \(-1 < e_1 < 0\).

On the other hand, against our expectation, if \( e_1 > 0 \), then airlines are expected to make a profit in routes of longer distance. However, according to Murakami [1994], airlines do not necessarily make profits in longer routes other than monopoly ones, so in this paper we expect the coefficient of stage length to be \(-1 < e_1 < 0\). The signs of the coefficient of \( \ln(\text{HERF}) \) are expected to be \( 0 < g_1 < 1 \), because each airline will increase the number of departures until zero rent if it knows that the more the frequency share increases, the more does its traffic share. So the departures in oligopoly markets will be more numerous than those in monopoly ones, and the load factor in the former type of markets will be lower, with traffic being constant. The coefficient of \( \ln(\text{EQ}) \) is expected to be \( 0 < i_1 < 1 \), if airlines can induce those passengers who would not take airplane if airlines did not offer attractive service through, e.g., equipment competition. However, in case airlines fail to attract passengers, \(-1 < i_1 < 0\) will be expected and excess capacity may be brought about.

Then we will examine the sign of coefficients of the demand function.

(2) Demand function (x=89, 90, 91)

\[
\ln(\text{PAX}) = a_2 + \sum_{x=89}^{91} b_{x, \text{AD}_{x}} + \left( c_2 + \sum_{x=89}^{91} d_{x, \text{AD}_{x}} \right) \ln(\text{LF}) + \left( e_2 + \sum_{x=89}^{91} f_{x, \text{AD}_{x}} \right) \ln(\text{EQ}) \\
+ \left( g_2 + \sum_{x=89}^{91} h_{x, \text{AD}_{x}} \right) \ln(\text{PP}) + \left( i_2 + \sum_{x=89}^{91} j_{x, \text{AD}_{x}} \right) \ln(\text{FARE}) + \left( k_2 + \sum_{x=89}^{91} l_{x, \text{AD}_{x}} \right) \ln(\text{INC}) + \mu_2
\]

To begin with, the sign of the coefficient of \( \ln(\text{LF}) \) will be \( c_2 > 0 \), because the higher load

\(^{14}\) \( \frac{\partial \text{LF}}{\partial \text{PAX}} > 0, \quad \frac{\partial^2 \text{LF}}{\partial \text{PAX}^2} < 0 \)

\(^{15}\) According to Douglas & Miller [1974a], pp.50-51, the change of productivity caused by technological development or the revision of fares makes the break-even load factor lower. This also causes a lower real load factor.
factor of the double or triple track routes means that the OD cities of these routes are attractive for business passengers because of many business opportunities.\footnote{On the other hand, there have been some studies where the load factor is regarded as representative of service quality (e.g., Graham, Kaplan and Sibley [1983], p.126, or Borenstein [1989], pp.349-350). In these studies it was defined that the higher the load factor, the lower the service quality, so the sign of the load factor variables in the demand function is supposed to be negative. But this is true only in the case of the tourists on holiday who may avoid congested times. Business travelers are supposed to gather in the denser markets in the OD cities in which there are many business opportunities. So here we expect the sign to be positive.} With regard to the coefficients of $\ln(\text{EQ})$ and $\ln(\text{PP})$, $e_2 > 0$ and $g_2 > 0$ will be expected because both the variables reflect market structure. The coefficient of $\ln(\text{FARE})$ will be $i_2 < 0$ according to the law of demand, and $k_2$ of $\ln(\text{INC})$ will be $k_2 > 0$, if we assume that the air transport service is normal goods.

(3) Equipment (Supply per flight) function (x=89, 90, 91)

$$
\ln(\text{EQ}) = a_3 + \sum_{x=89}^{91} b_{3x} \text{AD}_x + \left( c_3 + \sum_{x=89}^{91} d_{3x} \text{AD}_x \right) \ln(\text{PAX}) + \left( e_3 + \sum_{x=89}^{91} f_{3x} \text{AD}_x \right) \ln(\text{FARE}) \\
+ \left( g_3 + \sum_{x=89}^{91} h_{3x} \text{AD}_x \right) \ln(\text{DIST}) + \mu_4
$$

Airlines are expected to employ wide-bodied airplanes to meet demand, so $C_3 > 0$. And according to the condition of the sign of the price in a supply function, $e_3 > 0$. In respect of the relation between the equipment and stage length, the longer the distance of a route is, the bigger the size of airplane employed, so $g_3 > 0$ will be expected.

(4) Fare determination function (x=89, 90, 91)

$$
\ln(\text{FARE}) = a_4 + \sum_{x=89}^{91} b_{4x} \text{AD}_x + \left( c_4 + \sum_{x=89}^{91} d_{4x} \text{AD}_x \right) \ln(\text{DIST}) + \left( e_4 + \sum_{x=89}^{91} f_{4x} \text{AD}_x \right) \ln(\text{LF}) \\
+ \left( g_4 + \sum_{x=89}^{91} h_{4x} \text{AD}_x \right) \ln(\text{HERF}) + \left( i_4 + \sum_{x=89}^{91} j_{4x} \text{AD}_x \right) \ln(\text{INC}) + \mu_4
$$

In the fare determination function, we are to verify the hypothesis that the domestic air fares are determined according to the full-cost principle. The determinants of fares are supposed to be (1) stage length which reflects the operating cost, (2) the load factor, (3) concentration measured by Herfindal Index, and (4) income of the OD area of the market. The factors (2), (3), and (4) are supposed to determine the mark-up ratio. As regards the parameter $c_4$, $0 < c_4 < 1$ will be expected, because the fares are set higher, but the extent to which they increase decreases as the distance grows. The sign of coefficient of $\ln(\text{LF})$ is expected to be $e_4 < 0$, because in a route where the load factor is lower, airlines are expected to set higher fares in order to compensate for the loss of...
revenue. The higher the concentration, and the higher the income of the OD areas a market serves, the easier it may be for an airline to set more substantial margin on the operational cost, so \( g_{4} > 0 \) and \( i_{4} > 0 \) may be expected.

In addition, another Load factor function [2] will be shown, where we substituted \( \ln(\text{FRQ}) \) for \( \ln(\text{PAX}) \) in Load factor function [1].

(5) Load factor function [2] \( (x=89, 90, 91) \)

\[
\ln(\text{LF}) = a_{5} + \sum_{x=89}^{91} b_{x5} \text{AD}_{x} + \left( c_{5} + \sum_{x=89}^{91} d_{x5} \text{AD}_{x} \right) \ln(\text{FRQ}) + \left( e_{5} + \sum_{x=89}^{91} f_{x5} \text{AD}_{x} \right) \ln(\text{DIST})
\]

\[
+ \left( g_{5} + \sum_{x=89}^{91} h_{x5} \text{AD}_{x} \right) \ln(\text{HERF}) + \left( i_{5} + \sum_{x=89}^{91} j_{x5} \text{AD}_{x} \right) \ln(\text{EQ}) + \mu_{5}
\]

If a unit of increase of frequency causes one or more unit of increase of demand (e.g., the increase of frequency newly cultivates demand), \( c_{5} < 0 \) will be expected (for the sign of the other coefficients, see Load factor function [1]).

6.2 Regression Results

In this subsection both the regression results of simultaneous equations (see Table 8) and the Load factor function [2] (See Table 9) will be shown. The former equations were estimated by 2SLS, the latter by OLS.

Prior to the appreciation of both the load factor functions by which we will judge whether supply meets demand, we are to appreciate the results of the other equations. With respect to the demand and the supply per flight function, all the signs of estimated values meet the required conditions. The price elasticity of demand is about -0.7. In addition, as to the method of estimation, we substituted single track dummy variable \( DS \) and triple track dummy DT for \( \ln(\text{PP}) \) in demand function, and the dummy variable DT which can be regarded as the variable reflecting distance for \( \ln(\text{DIST}) \) in supply per flight function. All of them were introduced in the intercept of each equation, so that the values of adj \( R^{2} \) and standard error were improved with the sign of coefficients of the other variables meeting the conditions.
Judging from the results of the fare determination function, we may say that air fares are determined according to the full-cost principle, and that the ratio of the increase of fares decreases with distance. As regards the other variables, all the estimated signs meet the expected conditions.

According to the results of Load factor equation [1], the value of the estimated parameter of Ln(PAX) and Ln(EQ) is considerably small, to the extent that the hypothesis of c₁ = 0 and d₁ = 0 are barely rejected at 10% level, although both signs are expected ones. So in the markets which we chose as samples, it may be pointed out that not so much excess capacity as the equilibrium of demand/supply or excess demand is brought about. In addition, the sign of estimated parameter of Ln(HERF) meets the expected condition at 1% level. From this result, e.g., especially in those single track routes the tracking number of which was once increased, the excess demand might occur, or it can be said that in the routes where the number of tracking is large it is less easy for airlines to control the load factor.

Then let us check up whether the same results were obtained from the Load factor equation [2].

The difference between equation [1] and [2] is that in the latter equation we canceled the variable of Ln(EQ), which was relatively insignificant, and added the ‘Shinkansen Express’

\[ \text{Ln}(\text{LF}) = 0.257 - 0.019\text{Ln}(\text{DIST}) + 0.073\text{Ln}(\text{PAX}) - 1.460\text{Ln}(\text{the number of firms}) \]

(1.8c) (7.1a) (5.5a)

---

Note: t-statistics are in parentheses : the level of significance is a=1%, b=5%, c=10%. d.v means "dependent variable."
dummy variable DH which may reflect the competition between airways and railways in the markets the stage length of which is about 500km. Then the values of statistics were improved.

The results shows that an additional flight brings about a bit increase of average load factor. In addition, it is true the estimated parameter of Ln(FRQ) is more stable than that of Ln(PAX) in the Load factor function[1]. But we can draw from this result the same appreciation as the Load factor function[1], i.e., in the sample markets the demand/supply equilibrium or the excess demand may exist. And judged by the result that the estimated coefficient of trunk dummy variable DTR completely cancels out that of Ln(FRQ), the inclination of the excess demand may be strong. On the other hand, both the estimated parameters of Ln(HERF) are less stable than in the load factor function[1]. In order to investigate why this result was brought about, we looked up the annual round-trip average load factors of all the markets chosen as samples, and then verified the null hypothesis that all the average load factors of single, double and triple track routes were equal (See Table 10).

Table 9. Regression results of the load factor function[2]

<table>
<thead>
<tr>
<th></th>
<th>INTERCEPT</th>
<th>LnFRQ</th>
<th>LnDIST</th>
<th>LnEQ</th>
<th>LnHERF</th>
<th>Statistics</th>
<th>adjR²</th>
<th>SE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.201+0.346DTR+0.074AD89 (19.80a) (3.88a) (4.52a) +0.105AD90+0.070AD91 (6.46a) (4.38a)</td>
<td>0.074 (4.47a)</td>
<td>-0.074DTR (3.70a)</td>
<td>-0.071 (3.72a)</td>
<td>0.027</td>
<td>0.047 (1.74c)</td>
<td>adjR²=0.437</td>
<td>SE=0.063</td>
<td>F=11.62</td>
</tr>
<tr>
<td>2</td>
<td>4.504+0.348DTR+0.073AD89 (20.87a) (4.02a) (4.56a) +0.105AD90+0.069AD91-0.080DH (6.60a) (4.45a) (2.80a)</td>
<td>0.066 (4.05a)</td>
<td>-0.067DTR (3.43a)</td>
<td>-0.090 (4.46a)</td>
<td>0.032</td>
<td>0.047 (1.20)</td>
<td>adjR²=0.464</td>
<td>SE=0.061</td>
<td>F=12.83</td>
</tr>
</tbody>
</table>

Table 10. The two-tailed test of the null hypothesis that all the average load factors of single, double and triple track routes were equal

<table>
<thead>
<tr>
<th>the kind of routes dealt with</th>
<th>the difference of sample mean</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>double track/triple track</td>
<td>2.04</td>
<td>2.06 (significant at 5% level)</td>
</tr>
<tr>
<td>double track/single track</td>
<td>1.70</td>
<td>2.34 (significant at 5% level)</td>
</tr>
<tr>
<td>single track/triple track</td>
<td>0.34</td>
<td>1.21</td>
</tr>
</tbody>
</table>

Note: The sample number of single track routes is 14 (the sample mean is 73.71, standard deviation is 4.97), double track 78 (70.35, 5.37), triple track 32 (72.39, 2.84). And the null hypothesis that the variance of each sample is equal cannot be rejected at 5% level (the result of Bartlett test is $X^2 = 5.983 < X^2(2,0.05)=5.991$).

The results show that the average load factor of the double track routes are substantially lower than that of the triple track routes, and also lower than that of the single track routes, although the t-value is insignificant. The reason why both the estimated parameter of Ln(HERF) in the load factor function[2] were not stable may be that we can recognize the phenomenon that the higher concentration leads to the higher load factor with regard to single and double track routes, whereas the inverse situation exists with regard to double and triple track routes. So in the
triple and single track routes we chose as samples demand may meet or exceed supply. Regarding this point, we did a further investigation: we tried to reveal whether the average load factor in triple track routes mean the congestion level or not. In judging whether congestion occurs, we selected a criteria of 75% level of load factor above which it is difficult for passengers to reserve the seat. Then we verified the null hypothesis that the annual round-trip average load factor of triple track routes is 75% (See Table 11). For the purpose of the comparison with the case of the triple track routes, we also dealt with the double track routes.

According to the results, as regards both triple and double track routes, the null hypothesis cannot be rejected except in 1992, the slump year. So congestion may occur, or be on the verge of occurrence in both types of routes, but it is clear that the value of standard deviation of double track routes is larger than that of triple track routes. This may mean that a variety of routes are included in double track routes and some of them cause the destruction of the causal chain that the higher concentration leads to the higher load factor. So we classified the double track routes into two groups: (1) Haneda or Itami are at least included in the origin or destination, (2) Nagoya is included in either of the endpoint, and verified the null hypothesis that there is no significant difference between two groups (See Table 12).

<table>
<thead>
<tr>
<th>Group</th>
<th>load factor ('89-'92)</th>
<th>standard deviation</th>
<th>sample number</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (1)</td>
<td>70.57</td>
<td>5.73</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Group (2)</td>
<td>66.02</td>
<td>5.32</td>
<td>19</td>
<td>3.18 (significant 1% level)</td>
</tr>
</tbody>
</table>

The findings are that the average load factor of group (2), i.e., the routes either of which endpoint is at least Nagoya, is significantly lower than that of category (1), and that we can reject the null hypothesis that the average load factor of category (2) is 75% at 10% level (t-value is 1.70). So in the category (2) type double track routes, excess capacity may exist. The reasons behind these results are that the market size is relatively smaller in these routes, and that routes such as Nagoya/Sendai and Nagoya/Nagasaki, (of which the number of passengers is less than 400,000, the benchmark above which double track is authorized), have been included for some reason.18

6.3 Summary of Findings

In this section we revealed that the traffic may be congested or be on the point of congestion in the triple track routes, in the double track routes the endpoint of which is Haneda or Itami Airport, (in which the trunk routes are also included), and in single track routes where the

18 The numbers of passengers of these routes in '90, the boom year, are 218,005 (Nagoya/Sendai), and 161,525 (Nagoya / Nagasaki). And even in the boom, the average load factor of the former route is 72.6%, and the latter 69.2%.
entry was newly authorized between 1989-1992. With regard to these routes the authorization of new entry has been unable to solve the problem of excess demand. An expansion of airport capacities is required to relieve the traffic.

However, in some of the double track routes excess capacity may exist. This is thought to be brought about by the re-allocation of the routes for the purpose of adjusting the vested rights among airlines or by some intention which has little to do with the viewpoint of economic regulation. In these routes the rationalization of supply is desired.

7 The Regulatory Change and Cost Structure

In this section we will investigate how the regulatory change affected the cost structure of three Japanese airlines, JAL, ANA, and JAS.

7.1 Models and Regression Results

As already mentioned, Japanese airlines were authorized to enter new domestic and international routes after the regulatory change in 1985. For example, the average stage length of ANA and JAS became longer because they were authorized to enter both international routes and domestic routes of longer distance, and to exit the shorter haul local routes and hand them to their subsidiaries. These regulatory changes caused them to employ wider-bodied airplanes, which lower the operating cost per passenger or output. On the other hand, JAL entered domestic local routes that were comparatively shorter but denser. This may have led to higher cost per output.

In order to measure the effect of these entries and exits on airlines’ cost, we constructed two kind of cost functions of the Cobb & Douglas type. The variables will be shown in Table 13.

The first one is the average cost function where the input price variables were excluded. Before the estimation of the cost function, we investigated the partial correlation matrix to check whether multicolinearity existed (See Table 14). Taking into account the results in Table 14, we constructed the average cost function in the following manner: (1) as the permit of entry and exit is the most remarkable point in the regulatory change, we included the network variable NET in the average cost function. (2) we then chose to include those variables which had little correlation with the variable NET.$^{19}$ The reason for selecting average cost function of this type is to keep as numerous degree of freedom as possible, as well as to avoid multicolinearity. The regulatory change dummy DRC (1 for 1986-1992) and the firm dummy variables (ANA ; 1 for ANA, and JAS ; 1 for J AS) were introduced in each intercept and all the coefficients, but those which were not significant even at 20% level were excluded (See Table 15).

$^{19}$ As the exception we introduced the variable DIST that correlated with NET at 0.1% level, because it is thought to have much effect on the average cost.
Table 13 Variables of cost function

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>total operating cost deflated by RPI index</td>
</tr>
<tr>
<td>AC</td>
<td>average operating cost (=TC/ATK)</td>
</tr>
<tr>
<td>EQ</td>
<td>the average annual number of seats per flight</td>
</tr>
<tr>
<td>FRQ</td>
<td>the total departure in the year</td>
</tr>
<tr>
<td>DIST</td>
<td>the average annual distance per flight</td>
</tr>
<tr>
<td>NET</td>
<td>the total number of entrance and withdrawal to/from routes since '79</td>
</tr>
<tr>
<td>PAX</td>
<td>the total passenger in the year</td>
</tr>
<tr>
<td>ATK</td>
<td>the total available ton kilo in the year</td>
</tr>
<tr>
<td>LP</td>
<td>Labor price (labor cost/the number of employees) deflated by RPI index.</td>
</tr>
<tr>
<td>FP</td>
<td>Fuel price (fuel cost/ATK)</td>
</tr>
<tr>
<td>CP</td>
<td>Capital cost deflated by RPI index (the sum of depreciation cost, maintenance cost, cost of using airport facilities, insurance cost, divided by the number of airplane really owned)</td>
</tr>
</tbody>
</table>

Note: All the data were obtained from Koku Toukei Yoran, published annually by Nihon Koku Kyokai.

Table 14 Partial correlation coefficients between independent variables of average cost function (N=42)

<table>
<thead>
<tr>
<th></th>
<th>EQ</th>
<th>FRQ</th>
<th>DIST</th>
<th>NET</th>
<th>PAX</th>
<th>ATK</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRQ</td>
<td>0.202</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIST</td>
<td>0.615*</td>
<td>-0.722*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NET</td>
<td>0.299</td>
<td>-0.704*</td>
<td>-0.841*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAX</td>
<td>0.792*</td>
<td>0.277</td>
<td>-0.406</td>
<td>-0.117</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ATK</td>
<td>-0.343</td>
<td>0.578*</td>
<td>0.915*</td>
<td>0.874*</td>
<td>0.339</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: *: significant at 0.1% level

The findings are that (1) the economies of network rationalization were substantial in all the equations and especially so with regard to ANA and JAS, (2) the economies of traffic did not existed (see 1), (3) the economy of aircraft size is observed with regard to ANA and JAS, and especially strengthened after regulatory change, but in the case of JAL, (4) the economy of distance had not existed, but was improved after the regulatory change (See 4).
Table 15 Regression results of the Cobb-Douglas average cost function

<table>
<thead>
<tr>
<th></th>
<th>INTERCEPT</th>
<th>LnPAX</th>
<th>LnNET</th>
<th>LnEQ</th>
<th>LnDIST</th>
<th>adjR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.796+0.136ANA (9.70a)(2.54b) +1.248JAS (8.88a)</td>
<td>0.242 (2.55b)</td>
<td>-0.123-0.152JAS (5.36a)(5.47a) -0.022DRC (2.94a)</td>
<td>0.967</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.859+2.208ANA (3.36a)(2.54b) +1.720JAS (5.62a)</td>
<td>-0.096-0.216JAS (3.72a)(4.89a)</td>
<td>0.387-0.399JAS (2.14a)(2.55b) -0.020DRC (2.94a)</td>
<td>0.967</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-1.720+7.246ANA (0.89)(3.58a) +6.429JAS (3.49a)(2.88a)</td>
<td>0.992-1.373ANA (3.39a)(3.60a) -0.972JAS (2.43b) 0.384-0.146DRC (0.89)(3.19a)(3.28a)</td>
<td>0.973</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note (1) t-statistics are in parentheses: a=1%, b=5%, c=10%, d=20%

(2) estimated by OLS, using annually aggregated firm data of '79-92, N=42

The other cost function is the total cost function that included the input price variables AP, FP, and LP, in which multicollinearity was not taken into account. The empirical model of log linear form which includes the dummy variables is as follows;

$$\ln(TC) = a_1 + \sum_{a=1}^{2} a_{a1}(DF_a) + a_3(DRC) + \left[ a_4 + \sum_{a=1}^{2} a_{a4}(DF_a) + a_6(DRC) \right] \ln(DIST)$$

$$+ \left[ a_7 + \sum_{a=1}^{2} a_{a7}(DF_a) + a_9(DRC) \right] \ln(NET) + \left[ a_{10} + \sum_{a=1}^{2} a_{a10}(DF_a) + a_{12}(DRC) \right] \ln(FRQ)$$

$$+ \left[ a_{13} + \sum_{a=1}^{2} a_{a13}(DF_a) + a_{15}(DRC) \right] \ln(EQ) + \left[ a_{16} + \sum_{a=1}^{2} a_{a16}(DF_a) + a_{18}(DRC) \right] \ln(LF)$$

$$+ \left[ a_{19} + \sum_{a=1}^{2} a_{a19}(DF_a) + a_{21}(DRC) \right] \ln(LP) + \left[ a_{22} + \sum_{a=1}^{2} a_{a22}(DF_a) + a_{24}(DRC) \right] \ln(FP)$$

$$+ \left[ a_{25} + \sum_{a=1}^{2} a_{a25}(DF_a) + a_{27}(DRC) \right] \ln(CP) + \mu$$

$$a_{26} = 1 - a_{22} - a_{25}$$

$$a_{26} + a_{22} = 1 - (a_{22} + a_{23}) - (a_{25} + a_{26})$$

$$a_{19} + a_{21} = 1 - (a_{22} + a_{24}) - (a_{25} + a_{27})$$

where (1) the variable of output was divided into DIST, FRQ, and EQ, (2) µ is the error term, and (3) DF α is the firm dummy (DF1 represents ANA, and DF2 : JAS).

The procedure of estimation is that (1) we estimated with the dummy variable DRC and DF α included in the intercept and each coefficient, (2) then excluded both independent variables and the dummy variables insignificant, even at the 20% level, in order to keep the degree of
freedom and improve the statistics.\textsuperscript{20} And the parameter constraint that “total cost is homogeneous to input price” was added in the equation in the upper row, while no constraint was added in the other (See Table 16).

### Table 16: Total cost function of Cobb-Douglas form

<table>
<thead>
<tr>
<th>INTERCEPT</th>
<th>LnDIST</th>
<th>LnNET</th>
<th>LnFRO</th>
<th>LnEQ</th>
<th>LnLF</th>
<th>LnLP</th>
<th>LnFP</th>
<th>LnCP</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-2.472-4.340)DRC</td>
<td>0.471</td>
<td>(0.050+0.125)DRC</td>
<td>(0.514)</td>
<td>(-0.162)DRC</td>
<td>(0.708)DRC</td>
<td>0.388</td>
<td>0.206</td>
<td>0.406</td>
<td>adj(R^2) =0.9991</td>
</tr>
<tr>
<td>((1.25))</td>
<td>((2.46))</td>
<td>((1.68))</td>
<td>((2.09))</td>
<td>((2.27))</td>
<td>((3.86))</td>
<td>((2.82))</td>
<td>((3.67))</td>
<td>((3.39))</td>
<td>SE=0.017</td>
</tr>
<tr>
<td>(-3.737)ANA</td>
<td>0.316</td>
<td>(-0.097)ANA</td>
<td>(0.316)</td>
<td>(-0.109)DRC</td>
<td>(-0.306)</td>
<td>0.214</td>
<td>0.338</td>
<td>\text{SE}=0.013</td>
<td></td>
</tr>
<tr>
<td>((3.01a))</td>
<td>((2.04))</td>
<td>((1.71))</td>
<td>((2.04))</td>
<td>((2.33))</td>
<td>((1.98))</td>
<td>\text{}</td>
<td>\text{}</td>
<td>\text{}</td>
<td></td>
</tr>
<tr>
<td>(-4.684)JAS</td>
<td>(+0.586)ANA</td>
<td>(-0.199)ANA</td>
<td>(+0.196)DRC</td>
<td>(+0.721)ANA</td>
<td>(-0.306)</td>
<td>0.214</td>
<td>0.338</td>
<td>\text{SE}=0.013</td>
<td></td>
</tr>
<tr>
<td>((7.64a))</td>
<td>((4.40a))</td>
<td>((3.59a))</td>
<td>((3.45a))</td>
<td>((3.98a))</td>
<td>((1.92a))</td>
<td>\text{}</td>
<td>\text{}</td>
<td>\text{}</td>
<td></td>
</tr>
<tr>
<td>(-5.945)JAS</td>
<td>(+0.842)AS</td>
<td>(-0.051)JAS</td>
<td>(+0.797)ANA</td>
<td>(+0.386)JAS</td>
<td>(+0.752)DRC</td>
<td>\text{}</td>
<td>\text{}</td>
<td>\text{}</td>
<td></td>
</tr>
<tr>
<td>((10.05a))</td>
<td>((3.29a))</td>
<td>((1.40d))</td>
<td>((2.37b))</td>
<td>((1.92a))</td>
<td>((3.87a))</td>
<td>\text{}</td>
<td>\text{}</td>
<td>\text{}</td>
<td></td>
</tr>
</tbody>
</table>

Note: N=42, estimated by OLS, and t-statistics are in parentheses.

Findings: Looking at the coefficient of Ln(NET), we can recognize that the entry and exit after the regulatory change deteriorated the cost efficiency. This is different from the result in Table 15. But in addition to this result, if we take it into consideration that the t-value of DRC is unstable, we can conclude that the cost inefficiency of JAL that entered the shorter haul routes represents the whole effect and made the sign of DRC positive. And one reason for the unsuitability of t-value of DRC is that some domestic routes of ANA and JAS had already been rationalized before the regulatory change. Especially with regard to ANA, which was more successful in entering longer haul routes than JAS, it can be said that the rationalization of these routes had led to slightly lowering the total cost before the regulatory change if we exclude the effect of unstable dummy variable DRC. So at least with regard to ANA, it would be natural to think that the economies caused by the entry into the international markets and exit from domestic local markets arose around or after the regulatory change.

Looking at the coefficient of Ln(FRO), the regulatory change accelerated the cost inefficiency. But if we look at this result from the opposite viewpoint, we may say the reason why this phenomenon arose is that, as regards ANA and JAS, cost efficiency was achieved by the

\textsuperscript{20} In addition, in advance of the estimation of Cobb-Douglas total cost functions, we estimated the total cost function of the translog form, using the same independent variables as in Table 16. As a result, the t-value of all the second order terms were not significant even at 20% level, so we decided on excluding all of them and selecting the Cobb-Douglas form with the constraint that all the coefficients of the second order term is zero. Consequently, the value of statistics was improved.
rationalization of frequency caused by the exit from domestic short-haul routes and entry into international routes. With regard to ANA, this inclination can be clearly observed in the equation in the lower row.

Next we look at the coefficient of $\ln(EQ)$. As the sign of the coefficient of DRC is negative, it is said that the regulatory change improved the economies of aircraft size. However, it is also observed that the coefficient of JAL is unstable (so not shown). JAL had already employed the jumbo (B747 series) by the time of the regulatory change, so the economy of aircraft size was comparatively obscure. As regards the coefficients of input price variables, the values of labor price and fuel price are a little greater than the results of Caves et al. [1984] (labor price: 0.356, fuel price: 0.166, material-capital: 0.478) and Gillen et al. [1985] (0.330, 0.177, 0.500). It may be inappropriate to compare our empirical results with theirs because we introduced a different form of the cost function, but our results probably reflect the higher labor cost structure inherent in the Japanese airline industry.

7.2 The Summary of Findings

Summing up the results of Table 15 and Table 16, we can see that not only the cost structure of Japanese airlines but the effects of regulatory change on them are different from one another. Regarding cost structure, ANA may have benefited most by the regulatory change that authorized the company to enter the long-haul international markets and exit from some domestic shorter-haul ones. This can be observed in the regression coefficients of either network or aircraft size. Similar results were obtained in the case of JAS, but JAS probably did not benefit as much as ANA.

On the other hand, it is not clear whether JAL benefited by the regulatory change. Authorization for JAL to enter the domestic denser routes may have brought more revenue to the company, but worsened the cost efficiency, because it made the average stage length shorter with average aircraft size constant or larger. So we have to say that these noncommittal policies to JAL caused to obscure its operational performance.

8 Summary and Conclusions

The air transport market in Japan was strictly regulated until 1986. In that year, the government changed its air transport policy to promote competition in the market. This competition policy, however, was far from the deregulation policies adopted in other developed countries, especially in the United States. The characteristic feature of Japanese competition policy is that the competition is controlled through the administrative process. It is true that an airport capacity shortage exists and that this prevents free entry into the market, but the government does not want to revise the law and to clarify entry conditions. It is not clear how effectively the air transport markets work. Comparing fares in Japan with those in the States, we can conclude that

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21 See Caves, Christensen and Tretheway [1984], p.485 and Gillen, Oum and Tretheway [1985], p.112.
the consumers in Japan hardly benefited from the new policy. We think that the government should urgently adopt a more effective competition policy.

In section 5 to 7, we investigated the effects of the policy change on the airlines’ behavior, supply and demand conditions in markets and airlines’ cost structure by econometric analysis. As noted above, the policy change brought about “controlled competition,” in which price competition is effectively ruled out. In this case, the possibility exists that airlines engage in service competition such as frequency and in seat-per-flight share competition. Our analysis shows that JAL and JAS, which expanded their route network by the new policy, were able to obtain a large share by increasing the frequency and seat-per-flight share. From the experience in the States, especially during the era under the Civil Aeronautics Board’s regulation, it is said that service competition of this type lead to over-capacity. But in Japan, airport capacity constraints are so severe that such effects were not recognized, with the exception of some routs. Finally, we can conclude that by the relaxation of entry regulations, carriers that started long-haul operations benefited in improving their cost structure.

APPENDIX

In this appendix we will investigate in what kind of markets the fares are set higher or lower, and how these fares will change in case fares be set approximately at the average cost level, and clarify what kind of consumer will benefit or lose by the revision of the way of setting fares.

Regarding the fares of the U.S. domestic markets under CAB’s regulation, as was already mentioned, fares were set higher (lower) in longer-haul (shorter-haul) markets judged by the fact that the longer the stage length was, the lower the average load factor. However, the similar phenomena are not observed in the Japanese case, i.e., there is no correlation between distance and load factor (see Figure 9). Although the Japanese domestic air fares are regulated, the way of setting fares (or the demand character) is quite different from what was observed in USA. The following part is to investigate the way of setting air fares in the Japanese domestic market.

To begin with, we will construct the fare determination function as follows:

\[ \text{FARE} = f(+\text{DIST}, +\text{PAX}, +\text{LFsd}) \]

‘FARE’ is the normal round-trip fare filed in the time table. ‘DIST (=the stage length of a market)’ is the variable that represents the operational cost at a market, and both ‘PAX (the total number of passengers in a year)’ and ‘LFsd (the standard deviation of the monthly-average load factors in a year)’ are the variables that represent the mark-up ratio. It is expected that the larger the number of passenger is, and the larger the value of standard deviation of the monthly-average load factors is, the higher the mark up ratio.\(^{22}\)

\(^{22}\) The large value of standard deviation means that there is/are month(s) in which the average load factor is substantially low. So the airline has to set higher fares so as to cover the loss which arises in these months.
The estimated result of the fare determination function of log-linear form is shown in table 17. The sample number is 164, and they are obtained from the cross-section data of 1991.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>INTERCEPT</th>
<th>Ln(DIST)</th>
<th>Ln(LFsd)</th>
<th>Ln(PAX)</th>
<th>adjR²</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(FARE)</td>
<td>1.083</td>
<td>0.740</td>
<td>0.055</td>
<td>-0.028</td>
<td>0.926</td>
<td>0.137</td>
</tr>
<tr>
<td></td>
<td>(8.18a)</td>
<td>(38.82a)</td>
<td>(1.86c)</td>
<td>(3.16a)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: t-statistics are in parenthesis; level of significance; a=1%, c=10%.

Except for Ln(PAX), the signs of the coefficients meet the expected conditions. The negative sign of the coefficient of Ln(PAX) means that the regulator (MoT) refrains from setting “too high” fares at larger markets.

Then comparing the obtained estimated fares (i.e., close to average cost based fares) with the real ones filed in the time table (i.e., residual between estimated value and real one), we will specify the markets where the fares are set higher or lower. If the estimated fare of a market is lower than the real one, we judge that the passengers of the market lose the mutual consumer surplus. Those which are classified as “high fare markets” are, for example, short haul markets in Hokkaido (where the standard deviation of the monthly average load factor is large) or long haul markets without any substitutional (competitive) mode (e.g., Shin Kansen). Speaking of the former type of markets, the real fares are 20-30% higher than the estimated ones. On the other hand, those which can be classified as “lower fare markets” are the ones to/from isolated islands. With regard to these markets, the real fares are 40-50% lower than the estimated ones.

In order to classify the markets more strictly, we will introduce the hierarchical cluster analysis. Using the same variables already introduced (i.e., DIST, PAX, LFsd, which can be regarded as market structure variables) and the same dataset, we will classify 160 markets into 5 clusters by Ward method that is most frequently used. Then multiplying the residual (converted into ¥) of each market by the total annual passengers of the market, we intend to obtain the total gain or loss of consumer surplus after the current method of pricing (i.e., price discrimination) is abolished and the method approximate to the average cost pricing is achieved.

The results of cluster analysis is shown in table 18.
Table 18. Results of cluster analysis

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Cluster.1</th>
<th>Cluster.2</th>
<th>Cluster.3</th>
<th>Cluster.4</th>
<th>Cluster.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>the attribute of the markets</td>
<td>long haul &amp; very large (double or triple track)</td>
<td>long-medium haul &amp; large (single or double track)</td>
<td>long haul &amp; medium (single track, including a few double track)</td>
<td>short haul from/to/in Hokkaido and Kyusyu district</td>
<td>short haul other than the markets in Cluster.4</td>
</tr>
<tr>
<td>total gain(+), or loss(-) of consumer surplus (1991 Million yen)</td>
<td>+65,797.4</td>
<td>+2,748.5</td>
<td>+789.7</td>
<td>+1,865.8</td>
<td>-1,309.8</td>
</tr>
</tbody>
</table>

Note: It depends considerably on author’s subjective judgment to determine how many clusters are introduced. In this case, “the error sum of square” is 0.0296, at which level 160 data are classified into 5 clusters.

Judging by the results, we can point out:
(a) that the nominal total gain of consumer surplus is about 70,000 million yen,
(b) that in most of the markets the consumer surplus will increase,
(c) that from the viewpoint of the expected change of consumer surplus, shorter haul markets can be classified into 2 types.

With regard to Cluster. 4, we can classify them into more detailed 3 clusters. One is (4-1) the markets to/from in Hokkaido, another is (4-2) to/from in Kyusyu, and the other is (4-3) to/from/between isolated islands. And after the re-calculation, we got the following results: as to (4-1) type markets, the gain of consumer surplus will amount to 1,550.1 million yen, and (4-2) type 629.0 million yen, whereas as to (4-3) the loss of consumer surplus will be about 313.3 million yen.

In addition, regardless of the size or type of the markets, the loss of consumer surplus is recognized as to the markets to/from Naha, which will amount to 11,041.6 million yen, while the consumer surplus of Cluster.1 will increase to be 72,152.4, Cluster.2 to be 3,945, and Cluster.3 to be 3,879.8 million yen, excluding the effect of the markets to/from Naha. Taking into consideration this result and the result of (4-3) type cluster, the fares to/from in Okinawa prefecture are set lower, partly because of the lower income level, or partly because of the higher ratio of tourists the price elasticity of whom is thought to be larger.

However, even though we take it into consideration that the discount air tickets have already been available in the Japanese domestic markets, we can expect the consumer surplus to increase in most of the markets after the abolishment of the price discrimination.
References


