

Commercialization and Deregulation - Theoretical Approaches and Lessons from Air Transportation

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ABSTRACT

The network industries began to be deregulated in the late 1960s with the passing of the UK's 1968 Transport Act but the process accelerated from 1978 when the US enacted the Airline Deregulation Act. In the early part of the 21st century we have acquired a relatively large body of evidence of how various forms of liberalized network markets function. Because of the diversity of institutional structures that have emerged, to allow a viable assessment, the focus here is on the transportation, and, in particular on air transportation. Air transportation involves extensive, costly, and complex infrastructure. But while airlines markets throughout the world have gradually gone through a liberalization process over the past 25 years, regulatory changes involving other parts of the air transportation supply chain have globally been less dramatic. In terms of air traffic control systems many elements are still largely publicly owned monopolies although even here there have been gradual reforms to the ways in which air traffic control and navigation services are being provided. In other cases, commercialization has become more extensive with the result that a diversity of ownership and operational models has gradually emerged, ranging from traditional state ownership, through a variety of corporatized structures, to regulated private companies. A structured sample of 11 systems around the world that embraces a diversity of institutional models (e.g. privatized as a non-profit corporation in Canada, partly privatized in the UK, corporatized in Switzerland and state-owned in France and the US) suggests there may, however, in the short term, be no institutional way of providing anything approaching an optimal level of service.

¹ Much of the analysis stems from data collected as part of a large study of air navigation service providers conducted in collaboration with Glen McDougall.

INTRODUCTION

The network industries have changed considerably over the past 30 years. Much of this has been technical change, but there have also been important institutional factors that have acted as facilitators and molders for this change. Technical changes can only be efficiently introduced in the appropriate legal setting, and institutional structures provide the incentive base upon which stimuli for change are set, and the form innovation takes. The aim here is to look at some general issues of the commercialization of network industries that has occurred, but also, and in more detail, to look at what has happened with regard to one particular network industry, that of providing air navigation services infrastructure. In general, while there has been an extensive understanding built up from applied analysis since the 1970s of how the users of network infrastructure react to operating in more commercially driven environments, the empirical analysis of how the suppliers of that infrastructure have responded to changes in their environment is much leaner, despite quite an extensive theoretical literature (Gómez-Ibáñez, 2004).

THE BACKGROUND

Transportation has traditionally for a variety of strategic reasons always been heavily regulated. The trend from the mid-19th century, however, until the latter part of the 20th century was to superimpose economic regulation on regimes that had previously been more concerned with matters such as national security, social cohesion, and safety. The economic arguments advanced differed by industry and embodied a wide range of assumption (including the “public good” nature of many services supplied, the “nature monopoly” of some forms of transport, the large scale “externalities” associated with transportation, and the social requirement to allocate according to “need” rather than through markets.) These were arguments not only applied to transportation, they are found in the debates over the role of government in most of the network industries as well as other enterprises often grouped under the heading of “public utilities”.

The nature of regulation varied considerably between countries and regarding individual transportation modes within countries. Part of the reason for the former was the divergent range of views taken regarding the larger underlying philosophical rationale for regulation. The ideology of countries such as the UK and the US was that there are intrinsic market failures in transportation markets and that intervention is required to correct these (the “Anglo-Saxon” approach). The alternative position, often associated with French policy, was that the market is itself a tool of wider economic policy and that intervention is less designed to correct market failures than to ensure that transportation helps fulfill industrial and regional development goals (the “Continental” philosophy). The early debates in the Europe Union over the form of the Common Transport Policy in many ways epitomize these different positions.

At a more micro-level, the detailed instruments used for regulating network industries varied across countries. In some, such as the US, the emphasis was on retaining as much productive capacity as possible in the private sector but to heavily regulate the output of the industry and the prices charged; hence the establishment of power entities such as the Interstate Commerce Commission to oversee surface freight transportation and the Civil Aeronautics Board to regulate commercial aviation. Some nodes in the transportation system (e.g., sea ports and airports) were, though, state or federally owned, as were many links, notably air space and the road network. In other countries there was more state ownership not only of track (most rail track in Europe was state owned as were national energy grids and telephone systems) but also of operation, including

most railway operations, local bus services, and airlines, but in some countries extending into trucking and long-distance bus operation.

Change came about for a diversity of reasons and, also because of the varying institutional starting points, the resultant institutional structures are equally diverse. Many cases has been pretty well document by those focusing on contemporary economic history and the intent here is not to dwell on these matter for too long. Important from an economic position, however, are both the roles that new economic thinking was involved in causing change and the ways in which it shaped the institutional outcome governing the network industries.

The network transportation industries were at something of a watershed from the late 1960s as emergent technologies added to the general malaise in which many found themselves. The widespread adoption of the automobile was putting increased pressure on the public passenger modes, the changing transportation needs of emergent industries was placing traditional capital intensive and geographical inflexible rail and inland water modes at a disadvantage, and new informatics systems were beginning to affected the overall way logistics was being conducted. The upsurge of macro-economic policy-makers interest in “supply-side economics” as a more viable alternative to alternative to Keynesianism added to the broader thrust for change.

Intellectually, Averch and Johnson (1962) raised early concerns that the most common forms of regulation in the US, “rate-of-return regulation”, has serious adverse effects on the capital-labor ratio of suppliers. Leibenstein’s (1966) work had laid the foundation for looking at economic efficiency, not simply in terms of suppliers try to extract as much rent from users as possible (the “Harberger triangle”), but also whether they had the incentives to do this in the first place (“X-inefficiency”). From Chicago came the work of Posner (1975) and Stigler (1971) that looked at the beneficiaries of regulation and the ability of the regulated to manipulate the system and the incentive structure of regulators to pursue their personal interests, rather than the public interest, in their actions. A diverse range of applied quantitative analysis supported the real-life relevance of these intellectual arguments across a range of network industries, and by deploying a variety of techniques, including powerful tools of flexible econometric functions and data envelopment analysis, quantified many of them. Essentially it was found that the prevailing regulatory structures were not fulfilling many of their stated goals and, they were often proving costly to users and tax payers, as well as distorting, rather than correcting, markets.

Even in its heyday of the 1960s, economic regulation, or at least the form of regulation being practiced, was under scrutiny and the real the issue was what to do about it. Would simply reinterpreting the existing structures, effectively some *de facto* manipulation by the regulator, be sufficient? Would legal changes of a modest kin suffice? Or would a sea change in the way network industries are viewed be required? In terms of institutional economics, Figure 1, borrowed unashamedly from Williamson (2000), illustrates the issue. It is largely self-explanatory with the dark arrows showing constraints that come down from higher levels of analysis and the lighter arrows the direction of feedback. The information in parenthesis is the general frequency in years over which change takes place. The issue in the 1970s was that the economic institutional structures *in situ*, including regulations of network industries, were not bringing about desired resource allocations. *De facto* reforms were possible that would change the governance structure but seemed unlikely to resolve the problem; tinkering in the past had provided no enduring solutions to the underlying problems Hence fundamental institutional reform of systems largely intact for thirty or more years was deemed necessary in many countries. In addition to the economic forces that we look at below, there were wider social pressures in play that were shifting the “embedded” ideas and culture, most notably disenchantment with socialism and communism as a mechanism for resource allocation.

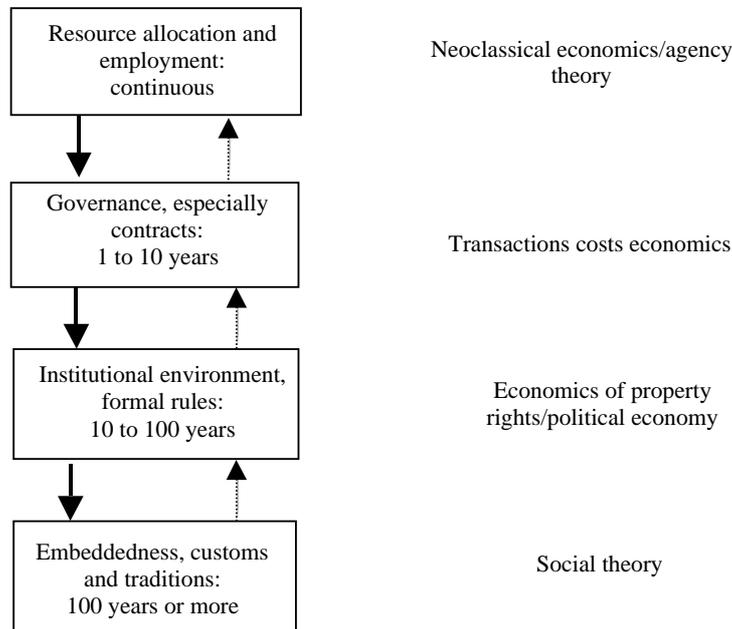


Figure 1.
Linkages between economic institutions

A number of breakthroughs in economic thinking were important in influencing the detailed outcome of the new institutional environment. New understandings of motivation, and the power of rent seeking, played a major role in this, as did some debunking of traditional ideas about the nature of network industries. The idea that the latter were public goods where exclusion was impossible and rivalry absent was seen as patently absurd in most cases as new ways of charging were developed and congestion built up in many networks. The simple idea of scale economies was expanded as economies of scope and density were isolated, and on the revenue side the importance of economies of market presence became appreciated. Baumol (1982) and others resurrected 19th century ideas of the role potential competition as a moderator of the behavior of monopolists, and Demsetz (1968) developed the idea that competition “in the market” can be simulated by “competition for the market”; a vision that led to a massive resurgence of interest in auction theory. A long-held believe that “ownership did not matter” provided the appropriate incentive structures for management were in place was brought into doubt as a better understanding of “principal-agent” issues emerged, and alternative ways of handling this through markets and not-for-profit entities were thought through. But even where there was felt to be a need to regulate an industry, new economic theories often prevailed with the objective not so much of reducing the Harberger triangle but of injecting static and dynamic efficiency in to regulated industries; essentially “price-capping” (Littlechild, 1983)².

² The merits of price-cap regulation have come under some attack recently (Vickers, 2005).

The outcome of all of this has been a massive amount of privatization and regulatory reforms – most noticeable in the former Soviet economies, but also prevalent in most other places – coupled with more liberal and different structures where regulations remain. The literature on this is extensive, and here we simply make some comments germane to developments to air navigation services (ANS).

First, much of the commercialization of network industry infrastructure, including deregulation and privatization, has focused on the user side; airlines, telephone companies, the trucking industry, buses, etc. This has been possible because change has often involved some unbundling of operations from its associated infrastructure, as with telecommunications, but in other instances there was an existing separation. The overall impact, it has generally, been agreed has been a significant increase in economic welfare. There have been problems in some cases because of the detailed nature of the markets created, and there has been corruption, but largely consumers have gained from wider choices, lower prices, and a continual range of new “products” coming on the market. In some cases there are, however, structural problems emerging. Regarding the airlines, for example, although there has been a marked reduction in fares and cargo rates that have benefited consumers, returns have, over the long term, and despite various efforts such as formation of alliances and the initiation of sophisticated price discrimination policies by the carriers, been negative. In essence, there is some indication of the absence of a core in the deregulated market (Button, 1996).

In other cases, the reforms have left vertically integrated infrastructure and operations. The US railroads are the most obvious example with the Class 1 freight carriers retaining their track but freed from most rate controls and with flexibility to adjust capacity under the 1980 Staggers Rail Act. The result in this particular case has been a manifest improvement in short term efficiency – some third of track was quickly abandoned or sold to short-line operators after the Act, and the system has on average carried 17% additional traffic (i.e. a cumulative growth) each year since at largely lower rates. The longer term issue is whether the competition between the railroad companies and from deregulated trucking will allow long term costs to be recovered or whether a core problem exists – short-term returns since the 1980s have been about 5% which is below the full cost recovery level (which would require a return of the order of 10% to 15%).

Where there has been unbundling, the infrastructure has often been left in state hands (if it had previously been nationalized), or privatization and deregulation has come more slowly. In some instances, as with the main UK airports, there has been privatization of the system as a virtually monopoly with price-cap regulation to help ensure efficiency gains are passed on to users. In others, as with some of the air service navigation providers (ASNPs), not-for-profit undertakings have been set up. There have been various auctioning systems devised to introduce competition for the market – broadcasting is an example in some countries. There are also many examples of the infrastructure being left in the public sector but greater efficiency sought through outsourcing or allowing private companies to compete with a former state monopoly (e.g., private mail companies competing with a former state monopoly provider of mail network services). Some have been granted access to private capital markets. These efforts at injecting more commercial incentives for the infrastructure providers have generally been less successful than those for infrastructure users. They often have more attributes of monopolies than their users, and are more capital intensive (posing greater problems with stranded costs), and developing practical methods of regulation, either through direct regulation or auctions, has not proved easy. Analysis is also difficult because changes in infrastructure provision usually takes some time, over which it is difficult to specify a suitable counterfactual for benchmarking.

THE COMMERCIALIZATION AND DEREGULATION OF AIR NAVIGATION SERVICES

Air navigation services

To get a better handle on the implications of various approaches to commercialization of network infrastructure ASNPs are examined. Air transport is a major international industry, and in some cases also a major domestic industry. It serves an important role in facilitating economic network developments in what many see as an increasingly global economy and over longer distances allowing personal movements for social and recreational reasons. It is, by value, a major mode for cargo movements. The air transport industry relies heavily on an integrated system of information, monitoring, and control structures to ensure the provision of efficient and safe services. Unlike the physical infrastructure associated with road and rail transport modes, air transport is provided along a series of virtual corridors that require users to be informed of traffic and other local conditions and where traffic management is deployed to prevent conflicts and to ensure safety.

As with other sectors the last three decades have seen considerable changes in the airline industry following initial moves in 1978 by the US. Now not only are major domestic markets like the US and Canada largely deregulated, but international services, most notably those within the European Union and in markets where there exist US Open Skies bilateral air service agreements, are also open to competition and fare flexibility. In many countries these have been accompanied privatization of formerly state owned airlines to stimulate their greater efficiency. None of these arrangements have, however, strictly, resulted in the creation of classic free markets – for example in the US foreign ownership of airlines is still limited and markets are distorted bankruptcy protection laws – but they have significantly changed the environment in which air carriers offer their services.

Air navigation services are one of the key components of the infrastructure serving the air transport sector; it prevents collisions between aircraft in the air and obstructions on the ground. It also seeks to expedite and maintain an orderly flow of air traffic and, within the broader notion of air traffic navigation, to provide services involving meteorology, search and rescue, charts, and telecommunications to those flying. There has always been strong government intervention in the supply of ANSs and this was more solidly institutionalized at the *Convention on International Civil Aviation*, held in Chicago in 1944, that made national governments ultimately responsible for ensuring ANSs are available. Until recently ANS were generally provided by state agencies.

Air traffic control is one element in a longer value chain that ultimately provides air transportation services to consumers. One reason for pressures to review the nature of ANSs is that many airlines markets have been found to be financially unstable, whereas the overall air transportation industry, including navigation services has enjoyed relatively high returns. Some indication of the situation is seen in Figure 2 based upon a study by McKinsey's, but supported by subsequent analysis, using variety of data sets and measures of return³. This provides details of the returns on capital invested for different actors in the air transport supply chain even before the September 11th attacks in the US.

As can be seen, whereas the airlines have performed poorly, in contrast, most of the other components of the value chain with elements of either institutional or natural monopoly not only fully recovered costs but also had the potential to earn rents. There are for example, only four

³ Similar results, for example, have emerged from a range of studies covering different periods from the mid-1990s, different markets, and using a variety of financial performance indicators (Button, 2004).

global distribution systems and two, probably subsidized, manufacturers of large aircraft and three of large jet engines. Airports are local monopolies in most cases while ANSPs, the subjects of this study but not shown in Figure 2, are institutional state monopolies. This, coupled in many cases with labor market monopolies even further back in the value chain, has led to serious vertical distortions in the overall air transport market.

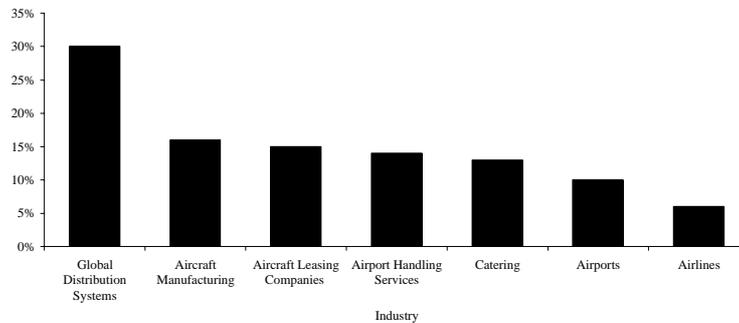


Figure 2
Economic margins of industries within the air transportation sector (1992-1996)

The focus here is on the changes that have occurred in ANSPs in a variety of countries around the world. Whilst airline markets were in the vanguard of the deregulation movement, the institutional structures surrounding ANSPs have been the subject of less attention, and certainly not the object of major change in many countries. One reason for this is that ANSPs are largely seen as natural monopolies whereby economies of scale, scale, and density make effective competition untenable, and competition for the market would entail high transactions costs. A second reason is that ANSPs have tended to become the domain of a fairly tight community of aviation customers and users, and technicians concerned with the hardware and software of the infrastructure and are thus less in the public eye. The issue has, therefore, becomes not one of stimulating a competitive market for efficiency reasons but rather the more engineering driven one of exploiting the various forms of scale to minimize the costs of providing an externally determined quality of service. Nevertheless, changes have taken place.

Commercializing air service navigation networks

Commercialization is a catchall term that includes a variety of different approaches with regard to ANSs provision and in most cases it does not mean privatization; it more to do with changing the ways in which an enterprise is financed, regulated, and managed⁴. In this context it means introducing stimuli that causes the enterprise to act more like a private company. Among the variants available are the formation of public/private partnerships with both parties having a share in the ownership of the enterprise – a model that has been adopted by the UK for its ANSP (Goodliffe, 2002), the formation of government owned corporations that can take a variety of forms as can be seen from the models found in Australia, New Zealand, Switzerland, etc., and the

⁴ The United Nation’s the International Civil Aviation Organization (ICAO) talks of commercialization in terms of the ability of a provider to act like a commercial business irrespective of ownership, allowing it to act independently of government in financial matters and funding although the subject of normal business taxes. This does not mean, however, that safety and other social considerations should not be the subject of government regulation.

use by a public entity of private finance, as with the French ANSP. Canada has established a not-for-profit private corporation where the government appoints part of the board of directors.

A number of countries have been feeling their way regarding supplying ANSPs in ways other than through the traditional state agency. The analysis here makes use of consistent time series data collected from ANSPs in 11 diverse countries⁵ covering the period 1997 to 2004, and over 200 interviews of those involved in the sector – including providers, policy makers, airlines, labor, equipment suppliers, international agencies, such as Eurocontrol, the International Air Transport Association, and the ICAO – as well as published sources.⁶

Table 1 shows there are significant institutional differences between the various ANSPs. The UK NATS provider is a public-private partnership with 7 airlines holding 41.94% of the capital, the UK government, 48.87%, the main UK airport operator, BAA, 4.19%, and employees, 5%. It is regulated in line with many UK monopolies under a five-yearly price-cap regime whereby average rates may increase by the retail price index less a stipulated amount. Safety is under the supervision of a separate agency. The French provider is a state entity that, with parliamentary approval, may seek funds from the private market and raise revenues from user fees. NAV CANADA, the Canadian provider, is a private non-profit entity that has total flexibility in rate setting provided it observes pricing principles in legislation and is 100% debt funded with the ability to raise finance on the open market.

The Australian provider is a federally owned authority with payment to the government of a fee for guaranteeing debt obtained on the financial markets. The regulator has recently approved a 5-year path of rate changes worked out in consultation with customers. The FAA in the US is responsible for providing ATC services and has recently internally separated operations from oversight of safety. It is funded through appropriations and a variety of taxes. Skyguide, the Swiss ANSP, is a joint-stock, not-for-profit corporation financed by private banks with no debt guarantee from the government. The Federal Office for Civil Administration provides safety oversight while with economic regulation of approach charges is the responsibility of the Swiss ministry and en route charges of Eurocontrol.⁷ The German provider Deutsche Flugsicherung GmbH (DFS) is federally owned company that slated to be privatized in 2006. Its remit is full cost recovery from fees set by the federal government.

⁵ The ANSPs in the study are of a variety of sizes, in descending order in terms of millions of instrument rule movements they handled in 2004; FAA, 18.5; NAV Canada, 3.6, Airservices Australia, 2.7; DFS, 2.7; DSNA; 2.6; NATS UK, 2.3; SkyGuide, 1.1; Irish Aviation Authority, 0.5; South Africa, 0.5; LVNL, 0.5; and Airways New Zealand, 0.3.

⁶ Whilst there is no intension of providing a full literature review in the paper, some contextual comments are warranted as to how it differs from a small number of other studies on related issues. The US General Accounting Office (1995) conducted a study of possible corporatization of the FAA, that was a fore runner to a series of subsequent analyses, the most recent of which is US Government Accountability Office's (2005b) comparative analysis of commercialization of the Australian, Canadian, German, New Zealand, and UK ANSPs that highlights the nature of the various reforms and some of the outcomes. Lewis's (2004) analysis is of a similar type although focusing on governance issues covering six systems (Australia, Canada, New Zealand, Switzerland, the UK and the US) and focuses on issues similar to those addressed here. However, it develops no original database. Poole (2005) considered 16 corporatized ANSPs looking mainly the flexibility of the institutional structures. In addition there have been studies of the impacts of commercialization of individual ANSPs – e.g., by Golaszewski (2002) on the US, Poole and Butler (2001) on Canada, and Goodliffe (2002) and Majundar and Ochieng (2003) on the UK – or on super-national regions – e.g., Eurocontrol Performance Review Commission (2003; 2005).

⁷ EUROCONTROL is responsible for regulating the safety of air navigation in Europe, overseeing the air traffic management systems, and developing a seamless ATM system.

Table 1
Basic features of the air navigation service providers in the study

Country	ANSP Name	Ownership	Rate Regulation [#]	Safety
Australia	Airservices Australia	Government corporation	Commission oversight	Separate agency
Canada*	NAV CANADA	Not-for-profit private corporation	Legislated principles/appeals	Separate agency
France**	Direction des services de la navigation aérienne	State department	Approved by transport ministry	Internal but separate
Germany [‡]	Deutsche Flugsicherung GmbH	Government corporation	Approved by transport ministry	Internal
Ireland [§]	Irish Aviation Authority	Government corporation	Regulatory commission	Internal but separate
Netherlands [¶]	Luchtverkeersleiding Nederland	Government agency	Approved by transport ministry	Transport ministry/separate
New Zealand	Airways Corporation of New Zealand	Government corporation	Self-regulating	Separate agency
South Africa	Air Traffic and Navigation Services Ltd.	Not-for-profit joint-stock corporation	Transport ministry committee	Separate agency
Switzerland [¥]	SkyGuide	Not-for-profit joint-stock corporation	Approved by transport ministry	Separate agency
United Kingdom	National Air Traffic System, Ltd.	Public/private partnership	Price capping	Separate agency
United States [°]	FAA's Air Traffic Organization	State department	Financing from taxation	Internal but separate

Notes

- Established in 1995
- * Corporatized in 1996
- ** Consolidated in 2003
- [‡] Established in 1993 and to be privatized in 2006
- [§] Corporatized in 1993
- [¶] Corporatized in 1993
- Corporatized in 1987
- [¥] Incorporated in 2001, predecessor established in 1921
- Public/private partnership in 2001
- [°] Air Traffic Organisation established in 2004.
- [#] Excluding national, generic anti-trust and similar regulations. All ANSPs are financed by user fees except the US Federal Aviation Administration that is funded by taxation.

The time frame covered is in part selected for practical purposes; the long-term data on ANSPs are often not complete and frequently inconsistent. Definitions also change over time and data series change in their character as institutional reforms take place. Eight years is also a suitable period over which to conduct the expert opinion analysis; memories distort with the years, and it is a time frame over which, while technological advances have been made, they have not represented sea-changes. It is also a period that covers a large part of an economic trade-cycle. Set against this, although many of the commercialization took place before 1997, other initiatives have taken place only comparatively recently, and the effects of institutional changes take time to fully work their way through. Inevitably a trade-off was made in selecting the period studied.

The quantitative assessment of commercialization relies heavily on trend analysis; essentially looking at how key parameters varied over the period 1997 to 2004 for the various providers. These are internal measures seeking insights into how conduct and performance have changed relative to a base year. This has the clear advantage over narrower benchmark analyses used, for example, by Eurocontrol Performance Review Commission (2005b) that involve static comparisons across what amount to quite heterogeneous entities; the ANSPs vary considerably in their size, types of traffic handled, stages in the corporatization process and the data that they have historically collected. Trend analysis is particularly useful for indicating the dynamic response of an ANSP to institutional reform.

IMPACTS OF COMMERCIALIZATION AND INFRASTRUCTURE

There were a variety of reasons why network infrastructure was highly regulated in the 1970s, and any successful deregulation and commercialization should, ideally be capable of meeting the challenges that were posed at that time least as well as a regulated structure, and preferable better.

Safety

Safety has always been of paramount concern in the provision of ANSP and other forms of transportation and, in the past, has been one reason for economic regulation; the fear being that profit motivated enterprises would in particular try to save money on safety at times of financial difficulty. Evidence for other sectors indicates that, with appropriate, separate safety regulation, commercialization has not increased the number of accidents; airline deregulation being a particularly relevant example. Major incidents are extremely rare in air transportation, and hence there is a tendency to make use of proxies. Indeed over the study period there were only two accidents attributed in whole or part to the ANSPs under review. In particular, measures of near-misses or air-misses (airproxes) are widely used. The problem is a lack of a standard definition and variations in the methods of reporting make even these proxies a rather poor guide. In many countries information is provided or verified by an independent airprox board, or safety organization, but in others it is collected by the ANSP.

The airprox trends seen in Figure 3 indicate a general decrease in serious potential safety incidents for some more commercially driven ANSPs, including the UK and Canada, but an increase in others; although in some of these latter cases this may be from an improvement in the level of voluntary reporting; this would seem to explain the Swiss case. Additionally, since the data is on trends from a base year, that year itself may have been atypical. There is no evidence,

however, to question the overall conclusion of a US General Accountability Office (2005a) study that “At a minimum, safety has not eroded since commercialization.”⁸



Note: All data based on 1997 except for Airservices Australia, 2000=100 and LVNL, 2002=100.

Figure 3
Number of serious air traffic management safety incidents (approxes)

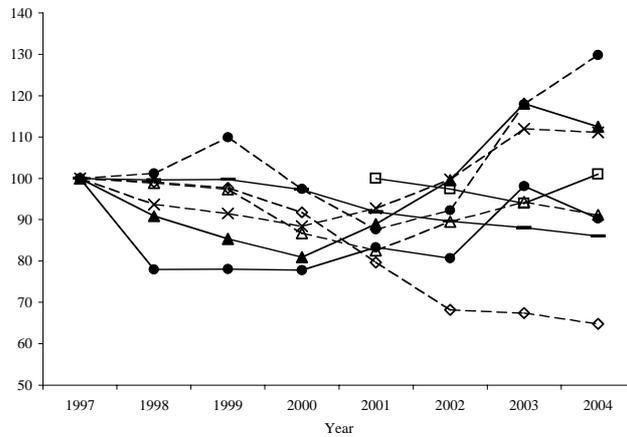
Charges

Many component of infrastructure are seen to involve monopoly situations leading to rent seeking by suppliers. Global experiences across a range of industries, however, show that in the long-term, and usually after an adjustment period, commercialization can lead to reductions in the charges levied on customers. Markets structured with some form of competition may bring charges down, but failing that, regulatory structures, have been designed to ensure that monopoly powers are not exploited.

Unfortunately not all the ANSPs provided data on unit rates, and especially not terminal rates, but what there are indicates that prior to the crisis following the events of 2001, rates were generally moving down for most of the ANSPs (Figure 4). Immediately after the attacks on the US and the SARS outbreak, demand for ANSPs services shrank, and en route and terminal service rates rose as providers modified their conduct to confront mounting financial problems. Detailed comparisons over different commercialization regimes, however, are difficult. Full sets of rates for NATS UK, the only price capped undertaking, are not available, while of those subjected to rate-of-return regulation through their not-for-profit constraints provide ambiguous results, SkyGuide shows significant increases in both terminal and en route rates but Airways NZ shows declines.

In the absence of full data sets on charges, cost data provides some indication of the potential for rate reductions, even if they are not always passed on. Eurocontrol Performance Review Commission’s (2004) cost effectiveness benchmarking studies, for example, analyses underlying cost factors such as support cost ratios, productivity and employment costs, as well as service quality indicators, rather than relying on unit rates.

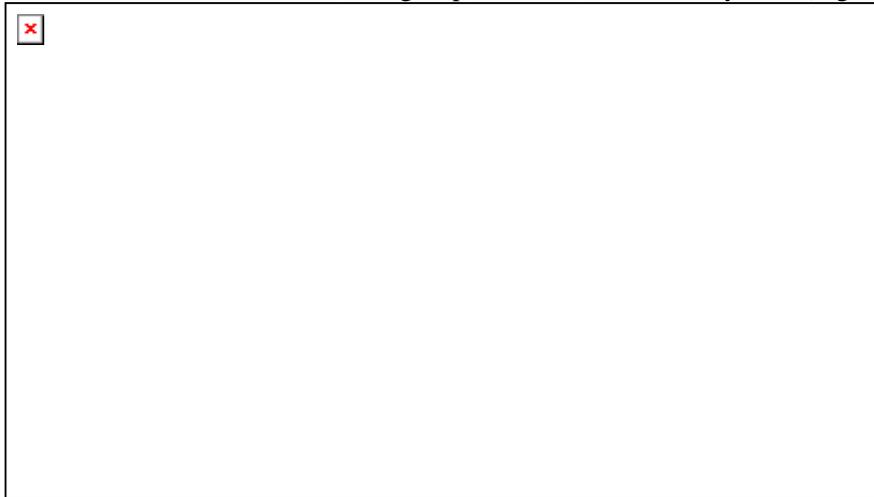
⁸ Where there have been increases in airproxies, there is evidence that the ANSP is cognizant of the situation and reacting; e.g., “The increase in the incident rate is of concern and a range of safety measures have been implemented to improve safety performance. En route ATS incident rates continued to be lower than targets.” (Airservices Australia, 2004).



Note: All data based on 1997 except for NATS UK 2001=100.

Figure 4
Charges for en route services as unit rates at constant 2004 prices⁹.

The picture for the ASNPs in the sample is a little mixed, and not helped by the fact that data for NATS UK is only available for a relatively short time that covers a major restructuring of the enterprise. The commercialized ANSPs, as a group, however, do relatively well (Figure 5).



Note: All data based on 1997 except for Airservices Australia, 1999=100, NATS UK, 2001=100, SkyGuide, 2000=100, and FAA, 1998=100.

Figure 5
Annual air navigation service provider costs by instrument flight rules movements (2004 prices)

⁹ Unit rates, as defined by the ICAO, are used in a formula as the basis for user fees that the ANSPs charge their customers. There are separate rates for different services. En-route rates consider weight and distance in the formula and terminal rates are weight and number of landings. The ICAO defines the unit rate as determined by dividing the total ANSP costs for that service by the forecast traffic units. In the following year, when actual traffic units are known, any loss or profit is carried forward for calculation of the next year's unit rate.

The state owned FAA increased cost per instrument flight rules movement by 23% in real terms between 1997 and 2004, whilst the five largest commercialised ANSPs (NAV Canada, DSN, Airservices Australia, NATS UK, and DFS) reduced their instrument flight rules movement on average by about 15%. Of the smaller commercial ANSPs, Airways NZ reduced per instrument flight rules movement costs by 5% while Skyguide, LVNL, the Irish Aviation Authority and South Africa had increased costs of between 4% and 38%.

Cost reductions have been achieved in a number of ways. Removal of excess physical capacity, for example, has also been practiced in many instances¹⁰. In the UK, for example, NATS estimate a savings of some \$13 million in 2002-2003 from consolidating two operations into its new Swanwick Center, although this was planned prior to the formation of the public-private partnership. New Zealand consolidated four radar centers into two, and DFS moved its Dusseldorf control center to the Langen control center where it also relocated its corporate headquarters. NAV Canada whilst retaining a significant number of control centers, has, nevertheless, physically consolidated its administration.

Service Quality

Much early regulation of infrastructure was concerned with providing a level of service commensurate with the public interest and which it was felt the market would not always do. Defining this service level always proved problematic and inevitably quantifiable surrogates were developed. Delays are costly to airlines and their passengers and freight customers and thus became a standard quality indicator; airlines also have the ability to exercise “voice” in public debate. They have also been long-standing concerns in Europe (Eurocontrol Performance Review Commission, 2005) and the US (US Government Accountability Office, 2005c), especially regarding airport delays, and their impacts on local development.

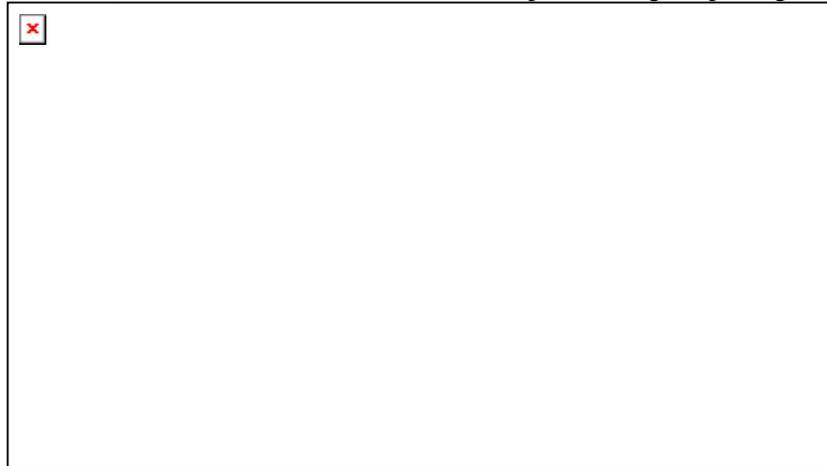
Delays may be attributable to a number of factors including weather, airport construction, availability of loading gates, environmental constraints, scheduling difficulties, and the variability in arrival times of long haul flights. ANSPs may contribute to delays if they are short-staffed, are afflicted with labor action, have equipment outages, do not have appropriate technology, or operate inadequately designed air space. Figure 6 provides data on delays induced by ANSPs’ inadequacies; unfortunately only a small number of countries keep systematic data of their overall delays. There is clearly a high degree of volatility for those represented, but in general the trend has been down, even allowing for the reduced pressures on ATC capacity after 2001. The FAA is seen as the main exception, where delays were rising before the attacks on the US and began to rise again relatively soon after the event.

Investment

One of the original reasons for taking much infrastructure in to public hands in the past was a concern that the private market would not be able to finance large investments and that, even if it was, there would be inadequate planning. In more recent time, the concern has changed completely with the public sector proving incapable of enthusing tax payers sufficiently to contribute to infrastructure expansion and modernization. The result is that governments have

¹⁰ One factor limiting cost reduction in doing this has been when government has established legal levels of service to regional communities without due recompense. LVNL, for example has to conform to levels of service stipulated the Ministries of Transport and Defense that often mean opening towers when there is little traffic. Such constraints, and resulting cross-subsidies, inevitably affect overall systems costs.

hoped that commercialization would make capital financing more tractable. The non-commercialized environment also offered little incentive for the ANSPs to make the best use of their investment funds, and later this raised concerns over potential “gold-plating” of investments.



Note: All data based on 1997 except for SkyGuide, 1998=100, and DFS, 1999=100.

Figure 6

Air traffic management induced delays (measures in terms of minutes per flight)

The commercialized ANSPs use a variety of approaches to meeting their investment requirements to confront the challenges of different revenue mixes, regulatory constraints, competitive conditions, and market conditions (Magdalena, 2005). Government guarantees, however, do affect the cost of borrowing and ANSPs such as DFS and Airservice Australia where there are various debt guarantees enjoy the highest rankings. Even so, NAV Canada with no such guarantee enjoys a 22 basis points advantage on three-year debt over similar Canadian companies (Bell Canada, Greater Toronto Airport Authority etc).

Magdalena’s analysis also highlights the strong liquidity positions in 2004 of the larger commercialized ANSPs he examined; Airservice Australia, for example, had access to at least A\$70 million in standby/money market facilities, and a \$4 million overdraft arrangement together with the ability to draw on the government at short notice, NATS UK has access to \$38.6 million as a liquidity reserve and a six month debt-service reserve account to mitigate any short term down turn in revenues as far ahead as 2012, and NAV Canada has a \$170 million operations and maintenance reserve, a debt-service reserve account with some \$125 million in it, and an unallocated credit facility balance of \$520 million.¹¹

¹¹ This liquidity position, however, should be put in the context of the event immediately after the attacks of September 11, 2001. The reserves of commercial undertakings are conventionally based on anticipated fluctuations in cash flow and maintenance needs, with a, largely subjective, allowance for contingencies. The events of 2001 demonstrated problems that can be encountered in extreme circumstances. With the not-for-profits, once reserves are depleted then rates must be increased, costs reduced, or money borrowed. In the case of NAV Canada, its rate stabilization fund was depleted by the post September 11th slowdown in traffic and the subsequent effects of SARS in 2003 and had reached a cumulative deficit of some \$100 million. It was placed on credit watch while it responded to the crisis. Subsequently, rate increases were initiated. The newly formed public-private NATS UK was limited by price-capping from increasing rates despite the market downturn and, with a debt gearing of 115%, faced severe financial difficulties. A “composite solution” was found that allowed prices to increase slightly, required relaxation of some

The data on capital expenditures do not show any discernable pattern for the smaller ANSPs over the period probably because their investments tend to be discrete and irregular. Focusing only on the larger providers, Figure 7 shows annual capital expenditures in constant prices for those ANSPs with annual instrument flight rules movements greater than 2.0 million. The state owned FAA increased its annual capital expenditure by 38% in real terms between 1997 and 2004 while NAV Canada has decreased its expenditure by 42% and Airservices Australia by 50%. The five commercial ANSPs shown are spending on average 24% less in real terms on annual capital expenditure in 2004.

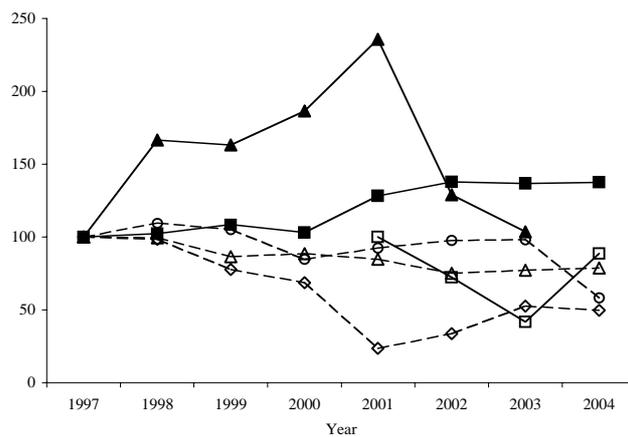


Figure 7
Annual capital expenditure of the larger ANSPs (in 2004 prices).

These investment programs need to be taken in the context of the capacity provided to gain a full indication of their efficiency. Certainly there is evidence that ANSPs are handling more traffic; Figure 8 provides details of the number of instrument flight rule flights controlled by the various ANSPs.¹² The data show significant growth before 2000 with a major decrease in traffic in most countries after September 11, 2001 and the SARS outbreak. South Africa was an exception due to the special circumstances of opening the country to international traffic after sanctions were lifted. Irish Aviation's growth in 2004 was partly accounted for by its taking over of NATS UK's Northern Oceanic Transition Area airspace. The indications in general, however, is that commercialization has helped improve the efficiency with which capital is used.

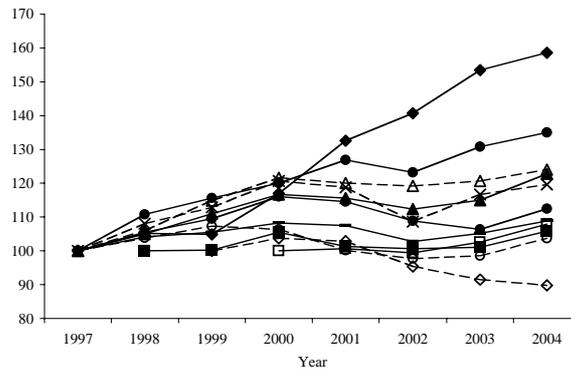
Labor protection

A major concern in the early part of the twentieth century was that commercially-oriented institutions in monopoly situations providing infrastructure would exploit their labor to keep costs down. Unionization of labor was thus normally encouraged for collective bargaining. The situations has changed somewhat. Although using large amounts of capital, some 60% to 70% of a typical ANSPs' operating costs are labor costs, and ANSPs are heavily reliant on their air traffic controllers that take many years to train and there is a high attrition rate in the process. Given

covenants by lending institutions, and arranged a cash injection from a new equity partner matched by government. The new equity diluted the share of the private partner, the Airline Group.

¹² Instrument flight rule movements include all commercial airline movements and the majority of business aviation flights.

their training and particular characteristic set, controllers have become highly paid and have the ability to exercise monopoly power themselves. Strikes and other forms of disruption by air traffic controllers have been a feature of many ANSP markets over the years, the most notably confrontation resulting in the sacking of controllers in the US in 1981. The issue of commercialization, therefore, is more to do with whether market forces would temper the power of the air traffic controllers.



Note: All data based on 1997 except for Airservices Australia, 1999=100, NATS UK, 2000=100, and FAA, 1998=100.

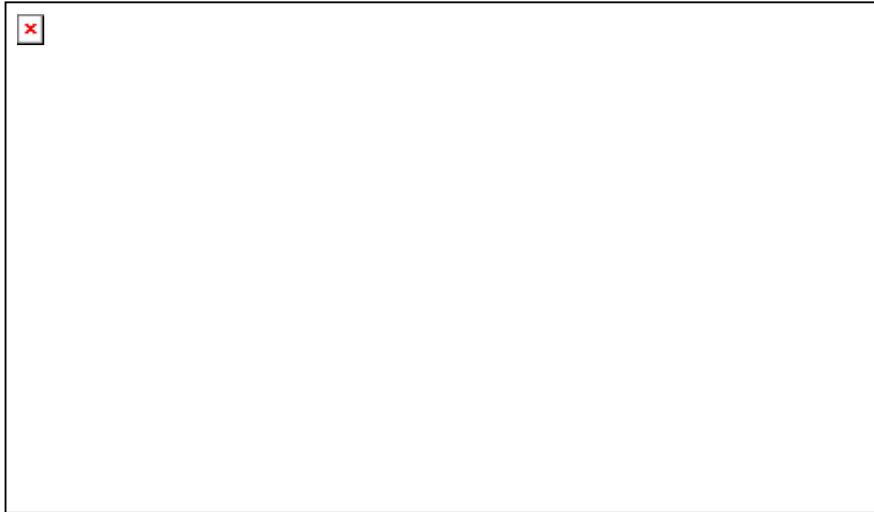
Figure 8
Flights controlled under instrument flight rules

Figure 9 provides details of aggregate controller's remuneration, including overtime payments for eight ANSPs, and Figure 10 provides details of the number of controllers employed¹³. The data presented are not, however, entirely consistent; some countries, for example, included benefits, others have not, but broad trends can be discerned.

The overall money going to controllers has risen sharply in real terms over the period, with the number of controllers largely remaining constant or rising slightly. The non-commercialized FAA's payments increased 40% in real terms from 1998, while the commercial ANSPs, with the exception of the Dutch provider where the trend has essentially been flat, have seen gains in outlays of 20% or less. There have been decreases in the number of air traffic controllers in Australia and New Zealand, and increases elsewhere with NATS and the FAA being fairly flat, giving a good impression of average remuneration. These figures may also be set against general trends in overall national labor markets. NAV Canada employees, for example, have received higher wage increases than their counterparts in the public and private sectors since privatization; e.g., air traffic controllers have received increases in excess of 37% whilst other public sector groups received on average, 22%.¹⁴

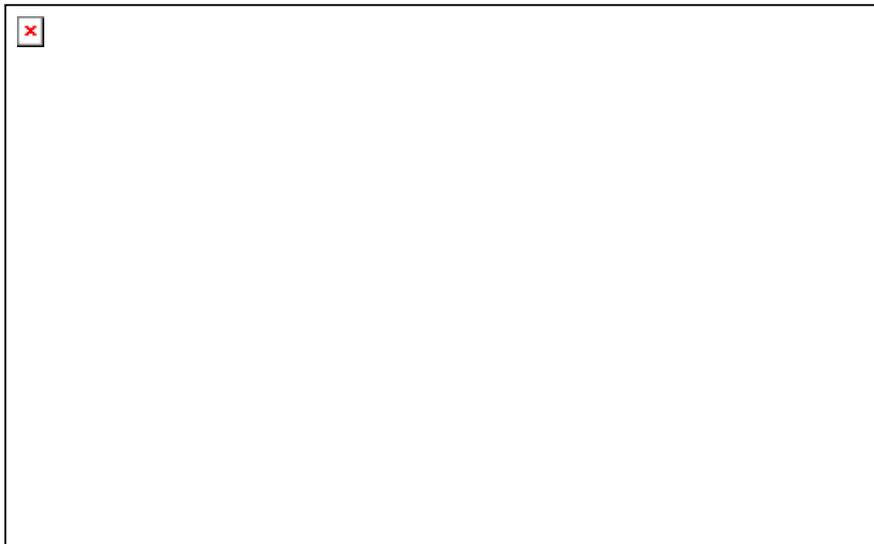
¹³ In general the commercialized ANSPs have been shedding non air-traffic control workers since the mid-1990s; for example, NAV Canada has reduced management and administrative staff by nearly 50% from 1997,

¹⁴ South Africa faced exceptional circumstances after the end of apartheid followed by democratic elections in 1994; the amount of traffic increased significantly but air navigation infrastructure was run down and controller salaries had to be brought to international levels to prevent attrition by controllers leaving for attractive salaries in other countries.



Note: All data based on 1997 except for NATS UK 2000=100, DFS, 2002=100, LVNL, 2000=100, South Africa, 2000=100, FAA, 1998=100, NAV Canada, 1998=100.

Figure 9
Air traffic controllers pay including overtime (2004 prices)



Note: All data based on 1997 except for SkyGuide, 1999=100, NATS UK 2000=100, LVNL, 2000=100, South Africa, 1998=100.

Figure 10
Trends in the number of air traffic control staff

The labor contracts, however, are not always part of the commercialization and ASNPs are not always free to negotiate labor pay and conditions although there are changes taking place. For example, the law on civil servants had governed LVNL, however, since 1994 it has agreed its own collective agreement separate from the national collective agreement for civil servants. In some countries there are also national wage rounds in which the ANSP participates. Since 1987

Ireland has had a system of national wage rounds with wage bill maxima and limited local bargaining based on productivity improvements. The Irish Aviation Authority participates in the private sector round (there is also a public sector round), and must accept the national settlements. Nevertheless, the evidence is that their performance in tempering the power of some labor groups has hardly been stellar.

CONCLUSIONS

The latter part of the 20th century may rightly be called the “Age of Regulatory” reform. Significant changes occurred in the way economic regulation was viewed and this extended across infrastructure networks as well as their access and use. The changes that have taken place have varied by sector and that makes generalizing difficult. The developments in the ANS sector, while not entirely typical, do highlight some of the challenges that have to be confronted in bring about change.

Air navigation service providers take diverse forms, and their have significant changes in the way they are viewed and in their institutional structures. The commercialization of this important infrastructure, however, has been fractious and many have resisted change. Certainly the reforms that have taken place may appear “revolutionary” to the administrators formerly engaged in states agencies, but in comparison with reforms in other sectors, but they still leave them well short of the types of market fully commercial undertakings operate in. The impacts on their performances have been comparatively limp as a result. There are clear efficiency gains in terms of cutting overhead labor and in gaining access to more diverse capital sources, and this has been done with no loss in safety. But the nature of the changes has barely scratched the surface of the principle agent problem. The jury is still out on the public-private, price-capped regime in the UK, there has not been time to examine its working in “normal circumstances” to make a real assessment. The not-for-profit institutional structure has merit and many of the most obvious, but also most easily tackled, issues have been addressed. The motivation for confronting monopoly unions is, however, lacking and ease of access to investment funding has reduced any major incentives to trim any capital that may meet with serious resistance. There is some evidence, not discussed here, of greater openness in negotiations with airlines as part of normal commercial dialogue that is often missing with state-owned undertakings, but it is unclear whether this leads to genuine efficiency gains.

Overall, commercialization of sectors making use of infrastructure has been hugely beneficial for society with considerable static and dynamic efficiency gains. Getting a structure that allows these types of benefit to be released from infrastructure, however, is proving more difficult. A variety of institutional structures have been tried in different sectors and within sectors as illustrated here, but there seems to be no single, ideal way of moving forward. The changes that have occurred in the regulation of infrastructure have largely been beneficial but have often not produced the levels of productivity gains that many had hoped for.

REFERENCES

- Airservices Australia (2004) *Annual Report: 2002-2003*, Airservices Australia, Canberra.
- Averch, H. and Johnson, L.L. (1962) Behavior of the firm under regulatory constraint, *American Economic Review*, 52: 1052-1069.
- Button, K.J. (1996) Liberalising European aviation: is there an empty core problem, *Journal of Transport Economics and Policy*, 30: 275-291.

- Button, K.J. (2004) *Wings Across Europe: Towards an Efficient European Air transport System*, Aldershot, Ashgate.
- Demsetz, H. (1968) Why regulate utilities? *Journal of Law and Economics*, 11: 55-66.
- Eurocontrol Performance Review Commission (2003) *A Comparison of the Performance in Selected US and European En-route Centres*, Eurocontrol, Brussels.
- Eurocontrol Performance Review Commission (2005) *ATM Cost-effectiveness (ACE) – 2003 Benchmarking Report*, Brussels, Eurocontrol, Brussels.
- Golaszewski, R. (2002) Reforming air traffic control: an assessment from the American perspective, *Journal of Air Transport and Management*, 8:3-11.
- Gómez-Ibáñez, J.A. (2003) *Regulating Infrastructure: Monopoly, Contracts, and Discretion*, Cambridge Mass., Harvard University Press.
- Goodliffe, M (2002) The new UK model for air traffic services – a public private partnership under economic regulation, *Journal of Air Transport and Management*, 8: 13-8.
- Leibenstein, H. (1966) Allocative efficiency vs “X-efficiency”, *American Economic Review*, 56: 392-415.
- Lewis, I. (2004) Analysis of alternative institutional arrangements for reform of US air traffic control, *International Public Management Journal*, 7: 385-414.
- Littlechild, S. (1983) *Regulation of British Telecommunication's Profitability*, Department of Industry, London.
- Magdalena, R. (2005) *Peer Comparison: Global: Air Traffic Controllers*, Standard and Poors, New York.
- Majundar, A. and Ochieng, W. (2003) The part privatization of NATS: the experience one year after, *Journal of Air Traffic Control*, June: 28-34.
- Poole, R. and Bulter, V. (2001b) *Nav Canada: A Model for Commercializing Public Enterprises*, Frontier Centre for Public Policy, Policy Series No. 11, Winnipeg.
- Posner, R.A. (1975) The social costs of monopoly and regulation, *Journal of political Economy*, 83: 807-27.
- Stigler, G.J. (1971) The theory of economic regulation, *Bell Journal of Economics and Management Science*, 2: 3-19.
- US General Accounting Office (1995) *Air Traffic Control: Issues Presented by Proposal to Create a Government Corporation*, GAO/T-RCED-95-114, Washington DC.
- US Government Accountability Office (2005a) *Air Traffic Control: Preliminary Observations on Commercialized Air Navigation Service Providers*, Washington DC, GAO-05-542T.
- US Government Accountability Office (2005b) *National Airspace System: Initiatives to Reduce Flight Delays and Enhance Capacity are Ongoing but Challenges Remain*, GAO-05-775T, Washington DC.
- Vickers, J. (2005) Abuse of monopoly power, *Economic Journal*, 115:F244-F261.
- Williamson, O.E. (2000) The new institutional economics: taking stock, looking ahead, *Journal of Economics Literature*, 38: 595-613.