POLICY RESEARCH WORKING PAPER 2180

Regulating Privatized Infrastructures and Airport Services

A background paper for a course on transport privatization and regulation, organized by the World Bank Institute.

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The World Bank
World Bank Institute
Governance, Regulation, and Finance
September 1999

Policy Research Working Paper 2180

Summary findings

For a World Bank Institute course on transport privatization, Betancor and Rendeiro (of the University of Las Palmas, Spain) cover basic issues associated with the regulation of privatized airport infrastructure and services:

• *Economic characteristics of airports.* Three types of activities are carried out in airports: essential operational services (aeronautical and non-aeronautical), handling services (aeronautical and non-aeronautical), and commercial activities.

Demand for basic airport services is directly influenced by trip purpose. The two types of airline customers (business and leisure travelers) need different levels of flexibility and tend to travel at different times. Analyzing airport capacity (practical and saturation) under peak demand is essential to airport success.

Among other important issues: Runway costs, level and volume of service, pollution, congestion, and air traffic control.

• *Recent trends in the airport industry.* The movement toward privatization may involve public ownership and private operation, including joint ventures; partial or majority divestiture; management contracts; and BOT (build-operate-transfer) schemes and variants, including BOOT (build-own-operate-transfer) schemes and LDO (lease-develop-operate) schemes.

Or it may involve private ownership and operation.

• *Price regulation.* Topics covered include traditional pricing policies; price regulation through an RPI–X formula; charges for congestion, noise, and other externalities; investment plans; and design of the regulatory system.

• *Regulation of quality in the industry.* Topics covered: regulation of services to passengers (as measured by targets for check-in queues, immigration queues, baggage reclaim queues, concourse crowding, shopping, parking, and so on); fault repair times; average levels of passenger boarding and disembarkation and baggage delivery; safety; and investment obligations.

• *Performance indicators in the industry.* Topics covered: strategic indicators and other financial indicators (including revenues), as well as indicators of cost, productivity, and quality of service.

This paper — a product of Governance, Regulation, and Finance, World Bank Institute — was prepared as a background paper for the course on transport privatization organized by the institute. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Gabriela Chenet-Smith, room G2-148, telephone 202-473-6370, fax 202-334-8350, Internet address gchenet@worldbank.org. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/html/dec/Publications/Workpapers/home.html. Ofelia Betancor may be contacted at ofelia@empresariales.ulpgc.es. September 1999. (57 pages)

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Prepared as a background paper for the Course on Transport Privatization and Regulation organized by the World Bank Institute

* We benefited from comments from N. de Castro, G. de Rus, A. Estache and J. Strong . Any remaining mistake is ours only.

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1.1.- The multi-product nature of the activity

Airports are complex and multi-product enterprises. Each airport comprises one or several runways, a set of aprons and taxiways, a terminal building through which passengers and freight are separately processed, and a control tower. Each of these parts develop specific activities that once combined, allow the interchange between air and land transport modes. Nevertheless, an airport is something more beyond a simple interchanger for modes of transport. It is a system that serves a wide range of needs related to the movement of persons and things world-wide. Its development depends upon 4 crucial elements: passengers and goods that circulate through its terminals; its physical, social and economic environment; its nature as a productive and business generator unit; and agents that operate in it, mainly airlines and franchisees of commercial services.

Activities carried out at an airport may be classified into three distinct groups: essential *operational* services and facilities, *handling* services and *commercial* activities (see Table 1.1).[1] Alternatively, the first two are commonly referred to as *aeronautical services*, while the later are considered *non-aeronautical.*

Essential operational services include the air traffic control system, meteorological services, telecommunications, police and security, fire, ambulance and first aid services, and runways, aprons, taxiways, grounds and buildings maintenance. These activities determine the degree of safety in airport operations, and hence, are considered essential and at the core of the airport business. Handling services refer to a great variety of activities. We can distinguish between those that are directly related to the aircraft (ground and ramp handling), such as cleaning, the provision of power and fuel, and the loading and unloading of luggage and freight; and those that are more traffic related (traffic handling), such as the processing of passengers, baggage and freight through the terminal building. Finally, commercial services involve a large variety of different activities that may be located either at the terminal building or around the airport. Duty free shops and other retail shopping, restaurants and bars, leisure services, hotel accommodation, banks, car rental and parking services, and conference and communication facilities, are examples of the myriad of activities that are included in the non-aeronautical set of airport operations.

Airlines are also involved in the commercial side of airport activities. Carriers usually need an office at the airport, a need that should be considered from a regulator's point of view. Under scarce space conditions in terminals, the relevant question is how to ensure a place for every carrier. A transparent, competitive process should ensure that most interested airlines receive space, and in some cases, these airlines may also represent more minor airlines.

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[1] See Doganis (1992).

Table 1.1. Classification of Airport Activities.

Operational	Handling	Commercial
1. Air traffic control	1. Aircraft cleaning	1. Duty free shops
2. Meteorological services	2. Provision of power and fuel	2. Other retailing shopping
3. Telecommunication	3. Luggage and freight loading and unloading	3. Restaurants and bars
4. Police and security	4. Processing of passengers, baggage and freight	4. Leisure services
5. Fire, ambulance and first aid services		5. Hotel accommodation
6. Runway, apron and taxiway maintenance		6. Banks
		7. Car rental and parking
		8. Conference and communication facilities
Aeronautical or airside services		**Non aeronautical or landside services**

Traditionally, airports have been owned and operated by central or local governments, including, in some instances, even through a branch of the army. Airport infrastructure was commonly believed to be a public utility, which supported this type of property arrangement. However, due to public budget constraints and efficiency concerns, a reconsideration of this type of model has occurred, and nowadays the range of possibilities for private sector involvement in airports may be as wide as the range of airport activities themselves.

The classification used in Table 1.1 is not always applicable to all airport activities. Sometimes the criteria that allows a separation of one type of service from another becomes blurred. Aeronautical or airside activities focus on the operation of aircraft, and on the movement of passengers and freight; while the non-aeronautical or landside activities are connected to commercial operations that occur at the terminal and on airport land, usually under a concession contract. Any concession that relates to aircraft or traffic handling would share some features with aeronautical and non-aeronautical services. Fuel concessions and passenger and freight handling, when provided by an airport agent, are examples of activities that would not fit into the above table. Therefore, the classification shown in Table 1.1 should be regarded as tentative.

1.2.- Airport revenues

Assuming that any sorting problems with airport activities are solved, revenues arising from these services are also classified as aeronautical and non-aeronautical. There is a relationship between airport size and revenue generation sources; bigger airports are more capable of exploiting commercial activities and hence, obtain more revenue from this source. In contrast, small airports tend to be almost entirely dependent on aeronautical revenues. Empirical evidence for this type of relationship in regard to Spanish airports is shown in Table 1.2 and corresponding Figure 1.1.

According to Doganis (1992), when an airport reaches the ten million passengers threshold, commercial revenues represent between 50% and 60% of total income. However, US airports are exceptional, and between 70% and 80% of total income is typically due to commercial revenues. Such differences are primarily due to American airports leasing out terminals, hangars and other facilities to airlines.

More relevant is the relationship found between the type of ownership and revenue generation. The arrival of the private sector into airport operations has led to what is called the *commercial airport model*, where the infrastructure is regarded as a business opportunity, and as such, something beyond a traditional airport. Meetings, visitors, employees, local residents, and local businesses and industries would also be important potential customers for airport commercial services. From this point of view, the greater the involvement of the private sector in airport activities, the greater the importance of non-aeronautical sources of revenue. As Table 1.3 shows, this is what is occurring, except at regional airports, which for this sample are mainly located in the US.

Table 1.2. Airports size and revenue sources. The Spanish case (1997)

AIRPORTS	Passengers (thousands)	Aeronautical Revenue/ Total Revenue (%)	Non Aeronautical Revenue[2]/Total Revenue (%)
Madrid/Barajas	23,122	58	42
Palma de Mallorca	16,449	64	36
Barcelona	14,561	60	40
Average for above airports	**18,044**	**61**	**39**
Gran Canaria	7,927	68	32
Tenerife Sur	7,438	71	29
Málaga	7,190	55	45
Alicante	4,398	56	44
Lanzarote	4,005	77	23
Ibiza	3,528	61	39
Fuerteventura	2,440	71	29
Menorca	2,232	62	38
Tenerife Norte	2,042	63	37
Bilbao	1,970	65	35
Valencia	1,912	60	40
Sevilla	1,543	57	43
Santiago	1,283	61	39
Average for above airports	**3,685**	**64**	**36**
Almería	714	68	32
La Palma	696	67	33
Asturias	595	54	46
Vigo	556	67	33
Reus	518	75	25
Gerona	507	66	34
Jerez	453	56	44
Granada	447	59	41
La Coruña	398	62	38
Melilla	352	80	20
Average for above airports	**524**	**65**	**35**
Pamplona	288	71	29
Zaragoza	244	71	29
Santander	204	72	28
Valladolid	191	82	18
San Sebastián	173	70	30
Vitoria	145	77	23
San Javier	108	71	29
El Hierro	97	39	61
Salamanca	44	74	26
Badajoz	18	64	36
Average for above airports	**151**	**69**	**31**
TOTAL AVERAGE		**65**	**35**

Source: AENA

[2] Including handling.

Figure 1.1. Airports size and revenue sources. The Spanish case (1997)

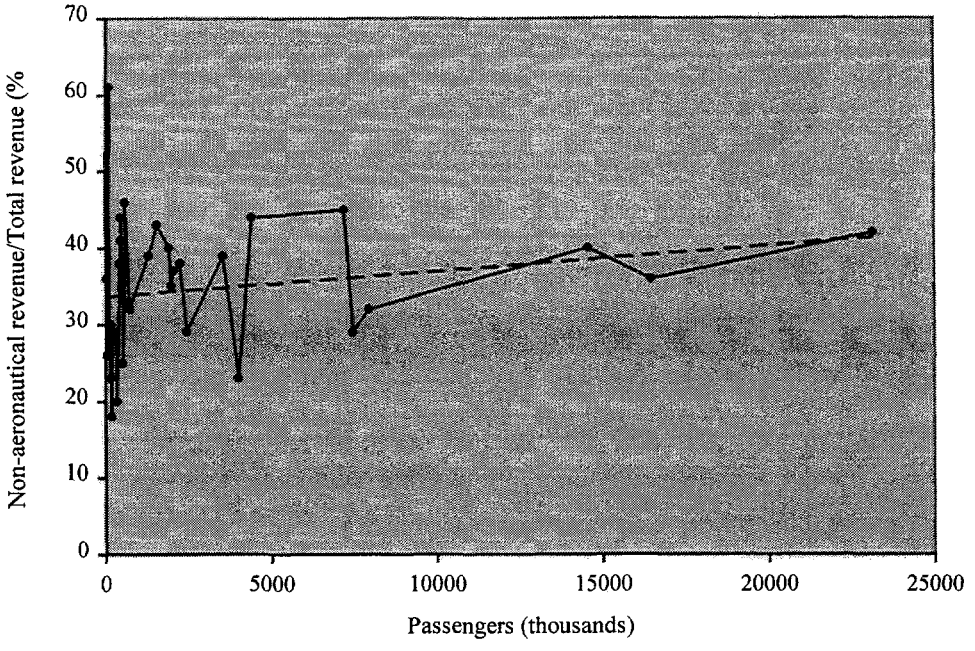


Table 1.3 Traffic and revenue distribution. Selected airports[3]

Average	Government Department	Public Corporation	Regional	Public-Private	Private
Annual aircraft movements (thousands)	78	165	391	169	188
No. of passengers (millions)	6.6	11.9	28.4	12.0	11.1
Airside revenues as percentage of total revenues	70%	50%	36%	62%	43%
Landside revenues as percentage of total revenues	30%	50%	64%	38%	57%

Source: Kapur (1995).

[3] Different airport ownership structures are defined and analyzed at section 3. Selected airports are: **Government Department**: Buenos Aires, Santiago, Mexico City, Quito, Libreville, Nairobi, Budapest, Athens, Gothenburg, New Delhi, Hong Kong, Bangkok and Kuala Lumpur. **Public Corporation**: Sydney, Auckland, Singapore, Rio de Janeiro, Amsterdam, Madrid, Vancouver and Montego Bay. **Regional Government**: Washington, Boston, Chicago, Pittsburgh, Atlanta, Dallas, Miami, Orlando, Paris and Basel-Mulhouse. **Public-Private**: Toronto, Vienna, Rome, Copenhagen, Zurich and Yaounde. **Private**: Heathrow, Gatwick, Stansted, Aberdeen, Edinburgh, Glasgow and Southampton.

1.3.- The nature of airport demand

Demand for basic airport services such as aircraft landings is directly influenced by the air transport market, which in turn depends upon trip purpose. Hence, it is considered a derived demand. A demand for landings is generally quite price inelastic,[4] due to the fact that airports usually do not have a local competitor and that airport charges represent a small proportion of airlines direct operating costs.[5]

As Walters (1978) noted, air transport demand is subject to two motivations - business and leisure. Therefore, we can distinguish at least two distinctly different types of airline consumers: business and leisure travelers. Each group may also be divided into different sub-categories. For instance, for business passengers, we could distinguish between those who need complete flexibility and others that travel according to plans. In regard to leisure customers, there are people travelling to holiday resorts and others that travel to visit relatives and friends.

These groups show different behavior in the market. Leisure travelers are quite price responsive, while business passengers tend to be less sensitive, although not totally price inelastic. Business travelers are also more influenced by the convenience of schedules, as they usually book their ticket at the last minute and might need to alter the booking frequently. Business trips are concentrated in the early morning and late evening hours, while the leisure traffic principally appears in the weekends and holiday periods.

Consequently, airport service demand is characterized by peak and off-peak fluctuations, which can be found by day, by week and by seasonal periods. Such a peak nature of demand would strain airport capacity. Furthermore, if the spectacular growth in the air transport sector is also taken into account, the analysis of airport capacity becomes an essential element of airport features.

1.4.- Capacity constraints

The term capacity refers to the ability of a component of the airfield to accommodate aircraft movements. It is expressed in terms of operations per unit of time, usually per hour. For instance, the hourly capacity of the runway system will be the maximum number of aircraft's that can be processed in an hour according to a set of specified operating conditions.[6] Therefore, when evaluating airport capacity, terminal building and runway system capacities should be individually studied, although the latter is usually considered the main determinant of total system capacity.[7] There are four main factors affecting runway capacity: air traffic control, demand, meteorological conditions around the airport, and the design and configuration of runways.

Two basic concepts of runway capacity may be applied: *practical* capacity and *saturation* capacity. Practical capacity relates to the number of operations that can be done

[4] See, for instance, Morrison (1982).

[5] Doganis (1991) for ICAO airlines reports a percentage around 5% for airport and en route fees.

[6] The concept of runway capacity applied here is that of saturation as presented below.

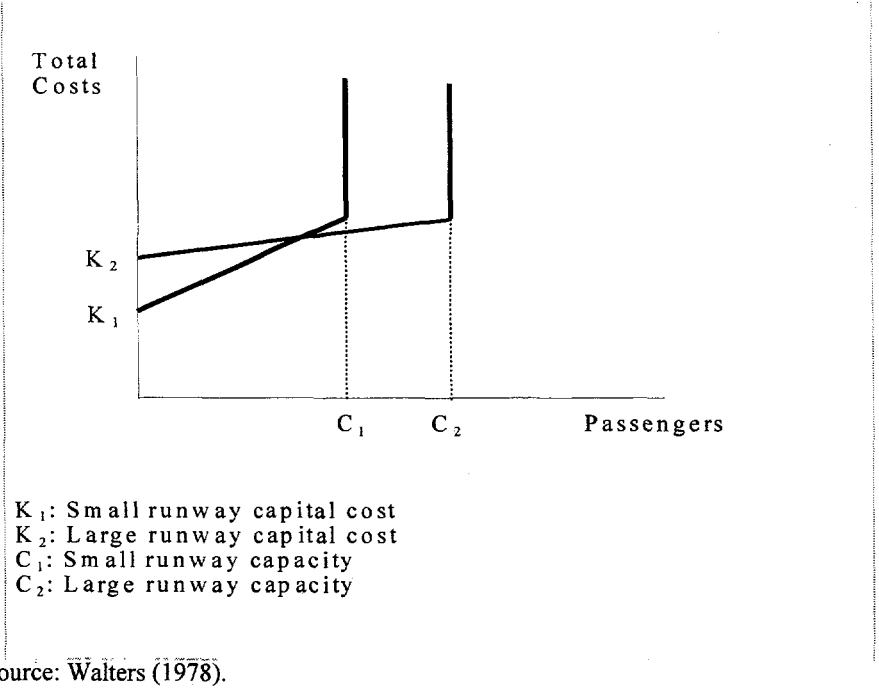
[7] See Ashford and Wright (1992).

in a period of time without imposing an average delay that exceeds a pre-established or reasonable level, for instance delays to departing flights average four minutes at peak hours. On the other hand, saturation capacity refers to the maximum number of aircraft that can be served in a given period of time under continuous demand conditions.

Airports are productive units whose capacities can only be increased through the incorporation of large and indivisible units. If runway capacity at a given airport is equivalent to a maximum number of "n" airplanes per period, and the airport operates below that level, the cost of operating an additional plane would be equal or close to zero. However, if such an airport operates at full capacity, to increase traffic would require the construction of a new runway. Therefore, if traffic volume at peak periods increases sharply, obliging the construction of another runway, this would imply capacity under-utilization at off-peak hours. Fluctuations in demand for airport services and investment indivisibilities, leads inevitably to excess capacity, with important repercussions on the cost structure of the airport industry. Peak period pricing, however, may help to lessen that problem and allow for more efficient capacity allocation.

The shape of the cost curve for runways exhibits a positive slope for traffic volumes below available capacity. Instead, once capacity is surpassed, the cost grows asymptotically. This cost is known as capacity cost and its behavior is shown at Figure 1.2.

Figure 1.2. Runways Costs Functions



Source: Walters (1978).

Terminal building capacity is becoming more important as non-aeronautical airport services are given a greater weight as a result of the emerging role of the private sector. Commercial and other activities carried out in the terminal building require large spaces. This capacity can be evaluated by considering two important variables: *level of service* and *volume of service*.

Level of service is closely linked to quality. Space, waiting time, comfort experienced by users or treatment provided by airport staff, are all determinants of quality.

The evaluation of these factors implies subjective elements. For this reason, most studies utilize time of service and level of congestion as proxies for this variable. Volume of service, the second parameter to be considered, refers to the number of users that can be served given a selected level of service.

From the airport point of view, the importance of establishing an adequate level of service stems from the fact that the time wasted by passengers waiting in line renders a large amount of resources useless. For instance, the greater the time required for the check-in procedures, the less time available to engage in last minute shopping in the commercial area of the airport.

A shortage of capacity at airports translates into increasing congestion and delays. The immediate consequences for users are increasing costs, and decreasing quality of services and safety. However, providing additional capacity in order to meet demand requirements has important implications for the airport costs structure.

An alternative mechanism to meeting demand is to allocate flight and gate slots. While flight slots refer to landing and departure times, gate slots concern terminal utilization. When allocated, both types have to be jointly considered, otherwise delays occur as recently landed aircraft wait until a gate becomes available. Traditionally, incumbent airlines have been the *de facto* proprietors of slots. These airlines have been using them for such a long time that almost any national law recognizes their property right or *grandfather right* based on regular utilization. This is the criterion recommended and accepted by IATA members.

In a deregulated air transport environment aimed at increasing competition, the support of grandfather rights makes little sense. In fact, it constitutes a very efficient market entry barrier. Nevertheless, airport slots may be allocated according to other methods. Hence, a second possibility is a slot auction, in which airlines bid for a slot or a combination of slots. This mechanism ensures that the airport authority gets the highest possible price. However, the implementation of the auction is complicated when grandfather rights are in place. Airlines that have such rights would not submit to an auction unless they are legally obliged to. Typically, in such situations only newly created slots or those lost under a *use it or loose it* principle would be available for the auction.[8] Furthermore, the allocation process requires that access to other airports be considered. Slots are so vital for airlines that they even trigger important international alliances, such as the one intended by British Airways and American Airlines, which recently became subject to the scrutiny of the European Commission. The EC has demanded the disposal of 267 slots at Heathrow and Gatwick airports as a price for approving the alliance. The prospective partners, in turn, have requested that they be allowed to sell them.

1.5.- Airport costs

Airport costs may fall into two categories: those related to the terminal building and those associated with the runways system. The first group depends on passenger flows at the terminal building, while the second is determined by the number of processed aircraft.

[8] This is the method selected by the European Union, and perhaps one of the main reasons that may explain why competition has not flourished across Europe.

Empirical evidence points out the existence of economies of scale in landing operations, which means that as an airport increases its traffic, the cost per unit of traffic declines. On the other hand, there are decreasing returns to scale when handling passengers inside the terminal. The required time to process a passenger through a terminal increases with airport size. Hence, the optimal dimension of an airport would depend upon a delicate equilibrium between both elements (Walters, 1978).

Airport costs are compound by labor, capital and other operational costs. Among western European airports, staff or labor cost is the largest item, representing on average around 42% of total cost.[9] In a few cases, where airport authorities are involved in activities usually undertaken by concessionaires, such as handling services, the percentage may rise to 65%. The second major heading is given by capital charges (interest and depreciation). For most European airports this figure varies between 20 and 35 per cent. In contrast, the cost structure of US airports appears to be quite different. Staff costs have a weight that on average may reach 22%, with capital charges increasing to 44% of total costs. These differences can be explained by the different way both groups operate. For instance, labor cost contrasts may be explained by the common practice at many US airports of renting terminals and other facilities to airlines, which sometimes may even own the facility. The fact that handling activities are usually carried out by concessionaires also contributes to labor cost contrasts. Regarding differences in capital charges, it should be noted that capital bond markets have been frequently utilized by US airports to finance their development. Europeans, however, have been more dependent on government budget allocations.

1.6.- The problem of externalities at airports

When users of airport infrastructures impose a cost/benefit upon non-users (or even upon other users on the system), it is said that there is an externality. In other words, airport users are not bearing all the costs generated by the services they require. Regarding negatives or bad externalities, it is noise to which most airport externalities studies have been devoted (see Walters, 1978; Nelson, 1980; Levesque, 1994). However, pollution and congestion are also bad externalities that cannot be neglected from a regulator's point of view.

The main economic problem of externalities is quantification and subsequent valuation. For example, a highly sophisticated technology is required to measure aircraft pollutants emissions. Regarding noise, measurement is not an easy matter either. However, accousticians have devised ordinal scales constructed as weighted averages of the high frequency peak noise and the number of times at which the noise of an aircraft is heard.[10] In order to measure congestion,[11] this has to be linked to airport capacity (see above). Taking capacity as a given, there is an international standard for aircraft movements of an average delay not exceeding four minutes. Longer aircraft waiting times would indicate congestion problems, which may be also measured by using weighted averages.

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[9] See Doganis (1992).

[10] For example: The Noise Number Index in the UK, the Composite Noise Rating and the Noise Exposure Forecast in the US, and the Isosophique in France.

[11] Congestion is a type of negative externality imposed upon other users in the system.

Once the measurement task is completed, the emerging question is that of valuation. Since we are considering costs imposed by users upon non-users we would have to take into account people's own judgement about suffered damage. Although the subjective nature of such a judgement makes valuation very difficult, economists have developed several tools that would allow for a more or less accurate valuation.[12]

It has been argued that almost all the problems caused by noise around airports are reflected by lower property values. Hence, *ceteris paribus* comparisons between noisy and quiet houses would provide a market valuation of quiet. According to Walter (1975), the price of noisy houses near an airport may be 30% less than equivalent homes in quiet areas. Nevertheless, this has been the subject of considerable controversy for the reasons explained above.

Aiming to solve or lessen the noise externality, which is perhaps the most dominant negative externality, some airport authorities have restricted the number of night operations or even established landing charges according to the amount of noise emissions. This last option constitutes an alternative for internalization of the bad externality. By paying for the disturbance incurred, airlines are bearing the true social costs. Of course, the problems of quantification and valuation remain.

1.7.- The air traffic control

The air traffic control (ATC) has usually remained under government control and outside of privatization schemes. Nevertheless, this trend is changing. For instance, the ATC in New Zealand (see Box 1.1.) has been corporatized, and is operated by a limited liability company with two shareholders, the Ministry of Finance and the Ministry of State-Owned Enterprises. Canada went even further (see Box 1.2). In 1996, the Canadian Government sold its ATC to a private operator, Nav Canada, which is subject to an economic regulatory regime. Most ATC systems, however, have not been privatized because of a fear that safety standards could be compromised by commercial pressures. This was also the same fear expressed by opponents of airline deregulation. In this context, there are two possible views;[13] the *market-failure* view and the *market-response* view. According to the former, privatized airlines or ATC private operators would face negative financial and safety incentives, suggesting that they would be inclined to reduce their safety expenses in order to increase profits. The second view suggests that given that outputs of reduced safety can be perfectly observed in the form of accidents, consumers will use them as good indicators of an operators' level of safety, and hence would penalize negligent firms, which might even be obliged to leave the industry. For the airline industry, there is enough evidence to support both views.[14] The actual industry safety levels are influenced by both the market-failure and market-response views, indicating that safety regulation is necessary, although in practice, it has been imperfect and complemented by market mechanisms. These considerations should be taken into account when privatizing ATC systems.

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[12] Christensen et al. (1998) is a very good review for those interested in externalities.

[13] See Chalk (1993).

[14] See for instance, Rose (1990) and Borenstein and Zimmerman (1988).

Box 1.1. ATC: The case of New Zealand

During the 80s, the public provision of services in New Zealand experienced a radical reform. The air traffic control service, which was operated by the Civil Aviation Department, was transformed into a commercially oriented corporation. The new organization, Airways Corporation, had to assume responsibility for its management. The cost coverage and the provision of services required by users were two of the proposed objectives.

The need to be financially autonomous compelled the Airways Corporation to adopt a new performance philosophy. Previous to the introduction of the new commercial orientation, service managers tried to please politicians, since they controlled funding. However, the change in approach resulted in more attention focused upon users. Frequently, users were consulted regarding areas such as fare structure, the introduction of new technologies, and safety measures. The new approach permitted a greater flexibility in decision making regarding the services users needed.

Detractors of the ATC corporatization program were concerned about safety, assuming that standards would decrease as result of profitability pressures to reduce costs. In other words, they detected a conflict between safety and commercial goals. Nevertheless, in New Zealand, it appears that the market may discipline such behavior. Conforming to certain standards is necessary, otherwise consumers would switch to other transport modes, avoiding airports and air carriers reputed to be unsafe.

Among the main achievements of the ATC corporatization in New Zealand are the provision of services at a substantially lower cost, a reduction of fares, service improvements that allow users to obtain cost savings, and the adoption of new technologies and services. An important element that may help to explain the success of this approach is the inclusion in the board of directors of people with experience in both the public and private sectors. Another relevant aspect was that politicians and the government were resolute in their commitment to change. The government recognition that a commercial approach can provide a more efficient service was a key element in the transition process. Indeed, Airways Corporation is accepted by the private sector in New Zealand as one of the best managed public enterprises in the country.

Box 1.2. ATC: The case of Canada

In the Canadian case, the process of establishing a commercial approach to air traffic control was the result of users demands, which required the provision of a more efficient service. At the same time, corporatization of the ATC was also part of a governmental initiative that aimed to promote the modernization of transport infrastructures and a more rational use of resources in Canada.

Problems associated with the service included; users not paying the true value, and managers subject to rigid public rules and, hence, they lacked the flexibility required by market conditions. In addition, the labor force was over-dimensioned with regard to service needs. Finally, the slow and bureaucratic investments approval process made it very difficult to incorporate new technologies into the system in accordance with market needs.

For all of these reasons, in 1995 the Canadian government announced the commercialization of the air navigation system. The government established a set of principles to be assumed by the new operator. Among these were: preserve and promote aviation safety, improve efficiency of the system, allow access to all users, provide service to remote regions, comply with international obligations and operate the service under a commercial approach with the aim of recouping all costs.

In turn, the government committed itself to developing regulations that would not affect the commercial interest of the company. Nevertheless, some regulatory measures were adopted to prevent the firm from exploiting its monopoly power. The aim was to promote efficiency through the application of self-regulatory mechanisms that would give consumers enough protection at the lowest regulation costs. A consultation procedure was also established in order to maintain equilibrium among participants and minimize disputes requiring third party intervention. Finally, non-interference between the social and financial objectives was ensured. Such a regulatory structure aimed to protect users' interests, while guaranteeing enough flexibility for the firm to maneuver in a commercial environment.

A report carried out by Corporate Services of Canada regarding the commercialization of the air navigation system noted that the experience was a great success for all parties involved. The industry maintained its safety level, while at the same time, the system was improved to respond more efficiently to demand and technology changes. Travelers and users benefited from a more efficient service. The government also gained from efficiency improvements while preserving the public interest through its regulatory duties.

2.1.- The traditional model and regulation of the industry

Traditionally, airports and airlines have been regarded as integrated and important parts of the national air transport system. Both were considered public utilities. In welfare terms, the benefits to society stemming from the operation of these services would always compensate for eventual financial losses, and would thus justify corresponding subsidies.

Under this airport model, operational and handling activities are considered essential to the airport business, while commercial activities play a secondary role. Airports are aimed at facilitating the interchange of transport modes, and not at exploiting passengers' willingness to pay for things they might buy at other and more adequate places. Conveniently, airport assets, property and management are always in public hands, and only commercial activities may sometimes be awarded to private operators. Concessionaires usually pay a high canon because they are guaranteed exclusiveness and monopoly power. This pattern of concessioning commercial activities may lead to prices being at least double than what they are outside of the airport.

Individual government regulation in this context is almost absent. Being airports, and as such, a public monopoly, means that there is already enough interference, and as a result, economic regulations that search for efficiency are regarded as unnecessary. Nevertheless, due to the international nature of air transport and the required coordination of activities, the International Civil Aviation Organization (ICAO)[15] has established some regulatory principles regarding airports' pricing mechanisms (see section 3) and non-discriminatory practices due to aircraft nationality. Other rules concern recognition of aircraft certificates and the need to facilitate custom procedures. However, ICAO is much more concerned about safety and security matters, both at the operators level and at the air traffic control system.

2.2.- The movement toward privatization

When governments starts worrying about the burden of airport financing and the lack of efficiency, the traditional model appears unsustainable. Nevertheless, most airports around the world might still fit inside this model, and it is only since the 1980s that things have started to change. In Europe, for instance, the privatization wave has mainly taken the form of corporatization or partial or full divestitures (only BAA). Lack of public funds and underdeveloped capital markets have made it very difficult to apply a similar model to developing economies, such as those in Latin America, Asia or Africa, where the selected privatization patterns have been in the form of concessions or management contracts.

If public monopolies are being turned into private monopolies, and if consumers' interest are to be protected, some regulatory provisions are required. In this sense, there is an important question to bear in mind. Are airport infrastructures genuine natural monopolies, or due to its multi-product nature should we distinguish those activities where

[15] ICAO is an intergovernmental institution that was created at the Chicago Convention in 1944.

the exertion of monopoly power is very likely from others where the forces of competition are feasible and desirable? This takes us to the matter of unbundling of airport activities.

In the strict sense, one airport would not be subject to competition until another nearby airport begins to compete for traffic. However, if one considers that the services carried out at airports are quite numerous, and also different in nature, perhaps there is some other scope for the introduction of competitive forces. This is competition for the right to serve the market.

As can be seen in Table 2.1, most airport activities, with the exception of operational services, may be subject to competitive forces, at least in the form of competition for the market. Hence, if this subcontracting takes place, any concern regarding the exploitation of monopoly power should mainly regard the operational part of airport activities. This is the reason why most regulatory provisions affecting airport charges concentrate on the operational side of activities. In fact, most cases of airport pricing regulation, which occurs through either discretionary or contract regulation, principally aim to control operational charges (see section 3).[16]

Table 2.1. Scope for competition at airport services

	Competition for the market	
	Feasible	**Desirable**
Operational		
Air traffic control*	YES	?
Meteorological services	NO	NO
Telecommunication	NO	NO
Police and security	YES	?
Fire, ambulance and first aid	YES	?
Runway, apron and taxiway maintenance	YES	YES
Handling		
Aircraft cleaning	YES	YES
Provision of power and fuel	YES	YES
Luggage and freight loading and unloading	YES	YES
Processing of passengers, baggage and freight	YES	YES
Commercial		
Duty free shops	YES	YES
Other retailing shopping	YES	YES
Restaurants and bars	YES	YES
Leisure services	YES	YES
Hotel accommodation	YES	YES
Banks	YES	YES
Car rental and parking	YES	YES
Conference and communication facilities	YES	YES

*:The ATC may be subject to other forms of private participation. A more detailed analysis is presented at section 1.7.

[16] An example of discretionary regulation is the one exerted over BAA airports. The term discretionary or commissioned regulation are applied in the literature as synonymous.

In spite of this, a closer look at handling and commercial activities may be useful. Will the introduction of competition for the market be sufficient to reduce monopoly power, or should some regulatory mechanism be in place? Let us assume that an airport authority concerned with maximizing profit decides to concession a given facility or service.[17] It may award the concession to one or several competitive operators. For instance, it may allow only one handling agent to operate the whole airport, in which case the monopoly reproduces itself; or on the contrary, it may allow several competing agents to serve the airport. Alternatively, it may allow only one or several restaurant operators to cater the whole airport. Therefore, a regulator should also worry about these aspects of airport operations, even if they represent only a small part of airport revenues. Table 2.2 illustrates this idea.

Table 2.2. Monopoly power at airport handling and commercial activities

Handling and commercial		
Concessioned		Not concessioned
One operator	Several operators	YES
YES	NO	

Once a regulator decides to fix prices it should also be concerned about the consequences of the measures adopted. To what extent should airport quality be affected? How could it measure and control airport performance in order to establish the degree of regulation accomplishment? As these questions are essential in any regulatory framework, they are considered in detail in sections 4 and 5.

2.3.- Experiences in airport privatization

The traditional model of airports began to be reconsidered in 1987 when the British Government decided to take the British Airport Authority (BAA) under full flotation, except for a single *Golden Share* that was retained. Nevertheless, when other governments also chose to privatize their airports, they did not follow the same privatization path. The British case has been unique so far. Therefore, in regard to airport privatization, it should be kept in mind that a great variety of privatization forms may fit into the airport infrastructure case.

Different models of airport ownership and management can be categorized as follows:[18]

- Public ownership and public operations
- Public ownership and public operations with commercial orientation
- Regional ownership and operations

[17] Of course, it might decide just the opposite. In such a case the exertion of monopoly right is clear.
[18] These section relies on Kapur (1995).

- Public ownership with private operations: joint ventures, partial/majority divestitures, management contracts, BOT and similar concession schemes, etc.

- Private ownership and private operations.

2.3.1.- Public ownership and public operations

This is the model that traditionally has been utilized to operate airports around the world. Usually, a Civil Aviation Department, under the supervision of the Ministry of Transport or even the Ministry of Defense, operates and owns most airports. The Comando de Regiones Aéreas (an arm of the Air Force) that owned, administered and operated a total of 400 airports in Argentina, has constituted, until recently, an extreme case of this type of model. In general, most countries start airport services operation with the participation of the army, although afterwards they tend to distinguish between the control and operation of military and civil air traffic services.

2.3.2.- Public ownership and public operations with commercial orientation

Also known as public corporations, this model aims to improve management and airport finance autonomy, facilitating access to private capital markets. The British Airport Authority, established in 1966 was the first authority operated according to such criteria. The Israeli Airports Authority, Aeropuertos Españoles y Navegación Aérea (AENA) in Spain, and INFRAERO in Brazil are other instances that fit into this model.

The Spanish model of airports may illustrate the evolution from pure State ownership to public corporations combined with a bit of private sector involvement. Until 1977, the provision of airport and air traffic services was the responsibility of the Air Force; afterwards, activities were transferred to the Government, so airport related activities were operated by Organismo Autónomo de Aeropuertos, while air traffic services were managed by another department of the Civil Aviation Authority. Finally, in 1990 both were merged to form AENA, a public company with autonomous status and under the tutorship of the Department of Transport. Nevertheless, AENA introduced some private participation in the financing and construction of new infrastructure. For instance, they have applied BOOT schemes (see below) for the construction of a new terminal at Palma de Mallorca in which the selected developer was a joint venture company made up of a private promoter and AENA itself. They have also constructed a new cargo terminal at Barcelona airport.

Amsterdam Schiphol Airport in Holland is an interesting variant of this type of model. The government holds 76% of participation, the city of Amsterdam holds 22%, and Rotterdam has the remaining. The airport follows a business oriented approach and has financial independence, although the government may finance infrastructure investments. In spite of its public nature, the airport has managed to sell bonds in the Euromarket, getting a triple "A" rating, the highest possible bond qualification.

2.3.3.- Regional ownership and operations

This is an alternative to public ownership and operation by a national body. It seeks to promote development for the airport region, and as a result, property is found either in the hands of one or several local or regional entities. This approach has been used at airports in the US (except for airports in Washington),[19] the United Kingdom (but for BAA airports) and France. Some local governments may operate several airports, such as Aèroports de Paris which has four, but generally, it is normal to control just one.

At US airports, in spite of being under local, regional or even state supervision, a great deal of activities are contracted out to the private sector, which may assume 90% of total airport activity. It is also interesting to point out that debt financing for the funding of infrastructure projects has been commonplace at US airports. In order to guarantee this debt, US airports used to keep long term *residual agreements* with the airlines that committed themselves to covering airport operating costs and debt service. The usual procedure was the following: each year the airport would calculate what part of the costs could not be covered by non-airline revenues, with the subsequent amount being the payment required to air carriers. In turn, airlines would keep a great deal of operational control at the airport, including exclusive gate use and the right to approve all capital improvement programs. The changes experienced in the air transport market after the passage of the Deregulation Act in 1978 reduced the value of such guarantees, and since then, airports have been shifting to *compensatory agreements*, which give airport authorities greater control over operations and investment plans, allowing them to charge airlines for the space used. US airports may also benefit from the Airport Improvement Program (AIP) implemented by the federal government. Funds for the AIP come from taxes and users fees.

2.3.4.- Public ownership with private operations

Privatization policies are undertaken to promote efficiency in a public budget constraint environment, and are often driven by disenchantment with public sector performance. However, there is not a single model for airport privatization. The range of possible options is wide, and includes: joint ventures, partial/majority divestitures, management contracts, BOT and similar concession schemes, etc.

- *Joint Ventures*. This was applied to Kansai International Airport (Japan), which has a unique ownership structure. The Japanese Government owns β of the shareholdings, with the rest belonging to 12 different local governments and more than 800 private companies and individuals. The total project cost exceeded more than US$20 billion, which included the construction of an artificial island. The airport is administered as a private company, although with limited managerial and financial autonomy, and is under the supervision of the Ministry of Transport.

[19] Washington National and Dulles Airports remain federally owned. In 1987 the Federal Government established the Metropolitan Washington Airport Authority (MWAA), that was given a 50 year lease to operate both airports.

- *Partial/Majority divestitures*. The government reduces its equity participation either in part or to one single share (or even to zero shares). Shares divested could be sold directly to local or regional governments or to private individuals, or they could go under public flotation. Divestitures are mainly used as a means of obtaining private equity funding for future airport expansion. The only instance of majority divestment is BAA, as mentioned earlier. Other instances of partial divestitures are Zurich, Vienna and Copenhagen airports. Zurich airport in Switzerland is a very interesting case because, although property is retained by the Canton of Zurich, the airport is operated by a private company (Flughafen Immobilien Gessellschaft), which in turn belongs to the Canton, with 50% of shares, and a group of private individuals. Vienna airport in Austria, originally a public corporation, is today, after a partial divestiture, 48% in public hands, which includes the participation of Amsterdam Schiphol airport. After BAA, it was the second airport quoted at the stock exchange. Copenhagen airport put 25% of shares under flotation in 1994.

- *Management contracts*. The management of all or part of the airport is contracted out to a specialized operator for a given period of time and under certain conditions regarding performance, maintenance, incentives and infrastructure investment. For instance, Aèroports du Cameroon is a company created by the government of Cameroon to operate 7 of the 14 airports in the country for a 15 year period. This company is participated by Aèroports de Paris, with 34% of shares, followed by the Cameroon Government with 24%. The remaining shares are distributed among carriers and a major bank. Aèroports du Cameroon is required to re-invest part of its profits, although it can establish airport charges after consulting the government and airport users.

- *BOT schemes and its variants*. A BOT (Build Operate Transfer) scheme occurs when the government grants a concession or franchise to a private firm in order to finance and build or modernize a facility that will also be operated by the firm for a certain period of time (20 to 50 years is a common period for airports). The private operator will get corresponding revenues and in turn it will assume all commercial risk. When the concession period expires, the facility will return to the government. The concession contract may include some regulatory provisions regarding the prices charged or the quality provided. This scheme and all its variants has been widely used for infrastructure development. For example, a BOT scheme was utilized by the Colombian Government in 1995 for the construction and maintenance of a second runway, as well as for the maintenance of an existing runway at El Dorado Airport in Bogotá. The US$100 million would be recovered by the landing fee revenues collected during the 20 year concession period. In this case, the government assumed a great part of the risk, granting a minimum level of revenues. The Colombian Civil Aviation would continue to provide air traffic control. However, the governments' absorption of commercial risk may represent a difficult blueprint barrier for future privatization projects in Colombia. Indeed, it seems plans to concession the Cali airport have failed because bidders were expecting the same sort of downside protection.

Concession contracts are perhaps the most recent and innovative arrangement for airports that allow for the benefits of private sector involvement. Another recent example is given by the Argentine Government, which in February 1998 subscribed

to a concession contract with the consortium Aeropuertos Argentina 2000 regarding a set of 33 airports, which were all awarded to the same concessionaire. The concession period length was established at 30 years, with a 10 year possible extension included in the contract. Aeropuertos Argentina 2000 has the right to collect some aeronautical charges[20] that are subject to economic regulation and that were initially established for a five year period. Non aeronautical charges could be set freely. The corresponding total annual payment to the Argentine Government reaches US$171.121 million, an amount that will periodically be adjusted according to the Producer Price Index. In addition, the consortium is required to invest a minimum of US$2.1 billion. The group has already taken control of Buenos Aires two airports, Eisesa and Aeroparque. The regulatory body specially created at the time is the Organismo Regulador del Sistema Nacional de Aeropuertos (ORSNA), which among other tasks, will supervise airport fees and investment requirements fulfillment. Another interesting example of an airport concession is provided by Australia.[21] Twenty two of the nation's airports, which were previously under control of the Federal Airports Corporation,[22] have been or are currently being leased for 50 year terms with an option for another 49 years. According to the Australian Government each airport should, whenever possible, be sold separately and remain subject to a regulatory framework. The government decided against the use of an industry specific regulator, so the Australian Competition and Consumer Commission will undertake regulatory duties.

Slightly different is a *BOOT (Build Own Operate Transfer)* scheme. Under this system, the private operator also retains ownership of the facility during the concession period, usually in order to guarantee bank loans. Toronto's Lester B. Pearson Airport's third terminal, with a capacity for 10 to 12 million passengers, was developed under this type of arrangement. The deal included a 40 year land lease, with an option to renew for a further 20 year period, a lump sum payment to the government of Cdn$30million, and an annual lease payment based on developers gross revenues. Toronto's airport represents a rare combination of public and private ownership and operations. Terminals one and two are owned and operated by the governmental body Transport Canada. Terminal three, however, is privately owned, although it is operated under a management contract by Lockheed Air terminal of Canada Inc. Transport Canada coordinates activities and provides air traffic control. It is also the proprietor of runways and taxiways. Since charges at terminal three are twice as high as those at other terminals, the market seems to be segmented, with the more prestigious international carriers tending to utilize terminal three, while the other terminals are mainly used by low-cost and regional carriers. However, at the moment, the Canadian Government is reconsidering the position of this airport and trying to re-nationalize it again.

The *LDO (Lease Develop Operate)* scheme constitutes another alternative for introducing private participation at airports. It consists of a long term concession on

[20] Other aeronautical charges will correspond to Comando de Regiones Aéreas that will be in charge of air traffic control.

[21] To date, apart from Australia, privatization of airports in the Asia/Pacific region is pretty much an unknown.

[22] Established in 1988 as a Government Business Enterprise.

an existing facility. A private firm operates and upgrades or expands the facility, obtaining revenues from operations, and pays rents back to the government, which retains the property throughout the concession period. This type of arrangement was planned for La Chinita Airport in Maracaibo (Venezuela) in 1993, although it was unsuccessful due to a consortium breach of contract and changes in the political situation.

2.3.5.- Private ownership and private operations

This is exemplified by airports operated by the British Airports Authority.[23] BAA used to be a public corporation until 1987, when the government, applying the Airports Act, decided to take 500 million shares under full flotation at a subscription price of £2.40 each. As mentioned earlier, the government kept a single share (*golden share*), and 25% of equity was reserved for employees. In order to avoid capital concentration, individual participation was limited to 15%. Initially, foreign capital participation was also limited, although it reaches some 10%. Finally, private participation amounts to 95% of total shareholdings. The Airports Act also provided for the regulation of BAA in order to avoid any monopoly power exploitation. The government appointed the UK Civil Aviation Authority as regulator, although the Monopolies and Mergers Commission and the Office of Fair Trading could review BAA activities as well.

Another example of full divestiture is provided by Belfast International Airport, although the mechanism selected by the government was a public tender. The winning bid of US$72 was presented by a group of managers and employees, and in contrast to BAA, it was not subject to CAA scrutiny.

It is worth mentioning that occasionally a private sector company has chosen to build and operate an airport by itself. London City Airport, developed by Mowlen, is an example in Europe.

As we have seen, the range of possibilities for private sector involvement in airports is quite wide, and no one best practice model has emerged. The BAA case provides enough evidence to support full divestiture allowing for an improvement in market efficiency. Poole (1990) reports that the number of passengers handled per employee increased after privatization, while at the same time operating expenses declined. Nevertheless, the procedure used to privatize BAA may not always be applicable. First of all, it requires developed capital markets, which is quite rare in developing economies. It also needs a new regulatory framework, which is costly and not easy to implement. Furthermore, when governments wish for political reasons to retain property, such an option is not feasible. These are the main reasons undermining the appearance of alternative privatization procedures. Nevertheless, a dominant model that falls in the middle of the privatization spectrum seems to be emerging, at least in Latin American countries, as shown in Table 2.4. This is the concession model in any of its variants. It seems to adequately provide governments with much needed funds for airport infrastructure expansion. At the same

[23] BAA manages the following seven airports: Heathrow, Gatwick, Stansted, Glasgow, Edinburgh, Aberdeen and Southampton.

time, it allows the government to keep property and get back facilities at the end of the concession period. Furthermore, it provides a financial windfall for governments with restricted budgets.

Any concession process, however, is very complex and costly. The whole process, beginning with the initiation of economic and technical studies until the concession contract is ready, may take several years. In addition, transparency when awarding private concessions is essential, otherwise, political corruption or lawsuits may be the likely final outcomes.

Table 2.3 Inventory of airport ownership structures in selected countries *(Source: Kapur 1995)*

	PUBLIC PARTICIPATION			PRIVATE PARTICIPATION	
	Government Department	**Public Corporation**	**Regional Government Ownership**	**Joint Public-Private Venture**	**Private Ownership**
EUROPE AND NORTH AMERICA	Czech Republic Greece Hungary Romania Russia Sweden	Austria Canada Germany Ireland Israel Netherlands Norway Spain	United Kingdom France United States	• **Share Flotation** Brussels (Belgium) Liverpool (UK) East Midlands (UK) Copenhagen (Denmark) Italy Vienna (Austria) Zurich (Switzerland) • **BOT** Birmingham (UK) • **BOOT** Toronto (T3) (Canada)	• **Share Flotation** BAA (UK) • **BBO** London City (UK) • **MEBO** Belfast (UK)
ASIA AND PACIFIC	China Hong Kong Malaysia India Japan Thailand	New Zealand Singapore	None	• **Joint Venture** Kansai (Japan) • **BOT** Australia	None
LATIN AMERICA AND THE CARIBBEAN	Venezuela Haiti	Jamaica Brazil	None	• **LDO** Maracaibo (Venezuela) • **BOT** Mexico City Argentina Bogota (Colombia)	• **BOO** Punta Cana (Dominican Rep.) Freeport (Bahamas)
MIDDLE EAST AND AFRICA	Angola Gabon Kenya Saudi Arabia	Nigeria South Africa	None	• **BOT** Istanbul (Turkey) • **Management Contract** Cameroon	None
FINANCING		**FINANCING SOURCES**		**FINANCING SOURCES**	
• Direct Government Subsidies • Multilateral Lending • Bilateral Lending		• Debt with Government Guarantees • Municipal Bonds		• Debt with Government Guarantess • BOT, BTO, Leases • Quasi-Equity Instruments • Equity Instruments	
PUBLIC RISK				SHARED RISK	PRIVATE RISK

Table 2.4. Privatization processes in Latin America airports .

Country	Privatization Plans
ARGENTINA	Privatization in progress • 33 airports concessioned as a group to Argentina 2000. • Concession to 30 years with a 10 year possible extension. • Bidding variable: annual payment. • Total investment: Aprox. US$ 2000 m. • Excluded: Ramp services, cargo and duty free shops. • ATC: Fuerza Aérea Argentina.
BOLIVIA	The three largest airports have been already privatized • El Alto, Viru Viru and Cochabamba concessioned to Airport Group International. • Concession to 25 years, started March 1997. • Bidding variable: % of revenues – minimum: 14%. • A fund is created for maintenance and operation of 34 remaining airports. • Adaptation to FAA II rules and IATA level B.
BRAZIL	Strategy under consideration.
CHILE	Privatization in progress • Concepción, Punta Arena, Temuco and Copiacó to be concessioned in 1998. • Investment requirements: US$ 150 m. • Concession to 15 years. • Bidding variable: lowest charge per epax. Minimum revenues guaranteed. • Excluded: Aircraft fuel services. • ATC: DGAC. Airports already concessioned: Iquique, Calama, La Serena, Puerto Montt, Santiago.
COLOMBIA	• Bogotá: El Dorado second runway concession to Ogden-Dragados-Conconcreto. • Cartagena: Awarded to Schiphol (30%) to 15 years. Fixed annual payment US$ 24.5 million. • Barranquilla: Awarded to AENA (50%) to 15 years. Fixed annual payment US$ 9 million. • Medellin and Cali: next in line.
COSTA RICA	Privatization in progress. OD contract for San Jose International Airport is being prepared.
ECUADOR	Privatization in progress. BOOT contract for new airport development at Quito and Guayaquil. Required investment of US$ 700 m.
EL SALVADOR	Privatization under study.
GUATEMALA	Privatization under study for La Aurora and Tikal.
HONDURAS	Privatization under study for Tegucigalpa, San Pedro Sula, La Ceiba and Roatan.
JAMAICA	Privatization for Montego Bay-Sangster • BOO for passengers terminal. • 49 years term. • The concessionaire will also operate actual terminal and airside activities.
PANAMA	Privatization under study.
PERU	Privatization plans for five national airports in the first half of 1999 under a master concession.
MEXICO	Privatization at initial stage. • 58 airports to be concessioned grouped in three sets. Mexico D.F. excluded. • Southeast Airport Group (Cancun) awarded to the consortium formed by Copenhagen airport, GTM, Cintra and Tribasa.
REPÚBLICA DOMINICANA	Privatization in progress. OD contract for Las Américas, Puerto Plata, Samana and Barahona.
URUGUAY	Concessions plans: • Laguna del Sauce, Punta del Este. • Carrasco, Montevideo
VENEZUELA	Privatization under study for Simon Bolivar airport at Caracas.

Source: Anuario del Transporte 1997 (adapted).

Table 2.5. Structure of some European airports

		Type of Ownership	Market Structure		Pricing Principles/Subsidies
Spain	Airport	Publicly owned (AENA - the state-owned national airport authority of Spain)	**Handling:** Monopoly for third party passenger handling	**Operating services:** Monopoly	Landing fee based on weight, different passenger fees based on destination. Yearly regulation, no discrimination
	ATC	Publicly owned by AENA	Monopoly		Based on aircraft type and dist. flown over own airspace
France	Airport	Publicly owned (Paris airports are owned and operated by Aéroports des Paris, which is owned by the state)	**Handling:** Self handling is allowed but not third party	**Operating services:** Monopoly	Aeronautical charges regulated by the state. Landing fees are based on weight. Passengers charge on departure
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over own airspace
Germany	Airport	Publicly owned except Dusseldorf and Berlin airports	**Handling:** Monopoly/Oligopoly	**Operating services**: Monopoly	Take off and landing fees are regulated by air transport authorities.
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over own airspace
Sweden	Airport	Publicly owned (state), municipality/mixed and one private. (Sweden Civil Aviation Administration runs all major airports)	**Handling:** Monopoly. Except for SAS and passengers, not allowed	**Operating services**: Monopoly	Charges regulated by the state. Landing, terminal navigation and security charges. Landing fee is based on weight (different rates for international/domestic flights)
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over own airspace
Switzerland	Airport	Mixed ownership between a public agency and private	**Handling**: Monopoly (by Swissair)	**Operating services**: Monopoly (by Swissair)	Charges for landing, passenger and aircraft parking. Noise charge (often combined with landing charge)
	ATC	Publicly/Privately owned	Monopoly. Non-profit company.		Based on aircraft type and dist. flown over own airspace
Netherlands	Airport	Publicly owned	**Handling:** Competitive. 3 ground handling	**Operating services:** Monopoly	No subsidy for international airport, regional airport are subsidized in 60% of their operating costs
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over own airspace
Italy	Airport	Publicly owned except Rome and Naples airports	**Handling:** Monopoly (in course of liberalization)	**Operating services:** Monopoly	Subsidies/Market. Subsidies mainly for operations and infrastructures
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over own airspace
Belgium	Airport	Publicly owned	**Handling:** 3 ground handling operators	**Operating services:** Monopoly (local)	Landing, passenger, parking, air bridge and airport fuel throughput fees
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over own airspace
Portugal	Airport	Publicly owned by ANA. Privatization plans for ANA has been announced	**Handling:** Passenger – Monopoly (TAP). Freight – some competition	**Operating services:** Monopoly (ANA)	Aeronautical charges are set by government. Landing fee based on weight, not discount or surcharge for noise
	ATC	Publicly owned	Monopoly		Based on aircraft type and dist. flown over on airspace
United Kingdom	Airport	Most of major airports are privately owned by one company (BAA), with Manchester and smaller airports owned by local authorities.	**Handling**: Competition	**Operating services**: Monopoly but, commercially run	BAA and Manchester: RPI-X constrained, fixed charge per aircraft (including surcharge of 50% for noise) and a per passenger tax, with surcharges for parking
	ATC	Publicly owned (plans have been announced to privatize)	Monopoly but, commercially run		Based on aircraft type and dist. flown over own airspace

Source: Viegas and Fernández, (1997).

3.- PRICE REGULATION

3.1.- Introduction

The trend toward privatizing the airport industry stems from a governments' view that airports ought to be financially self-sufficient. However, some regulatory provisions must be in place in order to control the substantial monopoly power that airports may exploit. A clear instance is found at privatized British airports. The Monopolies and Merger Commission (1996) reports that in certain cases airports in London have observed a course of conduct that was against the public interest. As Forsyth (1984) points out, the main question is determining whether regulation limiting monopoly power could be a means for improving airport efficiency, and in particular, how would regulation influence the equilibrium between productive and allocative efficiency? In turn, the answers to these questions depend upon the features of the airport industry and the applicable regulatory system.

First of all, in order to establish what airport activities could be exploited through monopoly power, we should clearly distinguish among them. The classification that separates aeronautical from non-aeronautical services is adequate for our purposes.[24] A great variety of commercial activities carried out at an airport, such as tax-free shops, retail shopping, restaurants or hotel and bank services, are considered non-aeronautical. For these types of activities, the introduction of competition would be feasible and desirable. Hence, the unbundling of activities could be useful for reducing the exertion of monopoly power to a small set of aeronautical services related to aircraft movements, such as the provision of runways, aprons and taxiways. Therefore, if an airport is to be privatized, there will be a clear need for establishing controlling rules that would allow for the regulation of private sector involvement. Regulation could take several forms. The most important is competition for the right to serve the market (concessions or leasing), as well as fares or profit controls. Nevertheless, the most common regulation tool used for limiting monopoly power is price regulation. Before we go onto describing the sort of mechanisms that might permit the control of airport charges, we will point out some features related to airport pricing structure.

An airport pricing system has to deal with several features, including costs covering, congestion, environmental impacts, standard level of services, investment plans and cross-subsidies. Not only is the treatment of such features complex, but because of their interdependence, it is very difficult to conciliate all elements under a common pricing policy. For example, the financial goal of costs covering must be in accordance with the necessity of investing in additional capacity. The pricing structure not only must ensure the allocative efficiency of actual resources, but it must also reflect the need for new capacity and its efficient assignment. Hence, the optimal level of capacity (and therefore of congestion) at the airport must be determined. We should also add that the multi-product nature of airport activities implies the presence of joint costs that are common to the operation of several services. For instance, common areas at the terminal building allow the

[24] See section 1.

processing of passengers (handling), while at the same time these areas are also utilized for commercial purposes. This makes it very difficult to determine the correct cost allocation for different airport services. Furthermore, the airport industry shows increasing returns to scale at aeronautical operations due to capital investment indivisibilities. These characteristics clearly influence the airport pricing structure. At this point, the important question is; how might these peculiarities be incorporated into the pricing structure and connected to the design of a regulatory framework?

3.2.- Traditional pricing policy

The recommendations of international organizations (ICAO and IATA) for airport costs covering include the application of average costs as the basic price. In addition, these organizations sought to establish a uniform fare structure for the whole industry. The division of incurred costs between a number of processed traffic units provides a unitary tariff. This procedure can be separated by distinguishing among different components of total cost, in which case several fares for each service could be obtained. Given that all users pay the same for utilization of same services, most airlines support this mechanism as objective and fair. However, the reality is that different operators impose different costs, and therefore they should face different charges. For example, an airline that operates at peak periods imposes a cost (capacity cost) that is higher than others operating at off-peak periods. Hence, there is a need to find a way to incorporate this and other industry particularities into the actual fare system within the context of regulation. Otherwise, we would have to consider other alternative pricing mechanisms.

The similarity of fare structures found at the majority of airports rests on the fact that most countries follow ICAO and IATA guidelines. Both organizations seek a uniform pricing system, recommending the utilization of aircraft weight as the basis for the estimation of applicable charges. Table 3.1, where the pricing structure of several countries is shown, verifies that such a structure basically corresponds to a landing fee, calculated according to aircraft weight, plus a departure fee for passengers.

With the increasing involvement of the private sector into airport activities, the uniformity of pricing structures around the world might break. Hence, privatized airports could evolve toward a more efficient pricing system. For a private firm, actual costs covering, as well as those costs generated by future investments in additional capacity, are of critical importance. The actual pricing structure, upon which regulatory devices would be applied, must be consistent with additional capacity investment, which would allow corresponding costs to be covered. As the required time to recover the investment is quite long, the regulator should permit price variations during the investment period with the aim of adjusting costs and revenue generation. However, among the various problems that a regulator might encounter, is the difficulty of establishing credible commitments, and the need to develop a deep knowledge of the operations and opportunities that a privatized airport might face.

Table 3.1: Airport charges at selected airports (1998)

Charges	Rio de Janeiro	Manchester	Sidney	Madrid
Landing fee:				
Basic unit	MTOW[1]	MAW[2]	MTOW	MTOW
Charge per:	Ton.	Ton.	Ton.	Ton.
Increases with weight	No	No	No	Yes
Free parking	3 hrs.	4 hrs.	2 hrs.	3 hrs.
Surcharges/rebates:				
Night lighting	No	No	No	No
Noise	No	Yes	Yes*	No
Passengers charge:				
Paid by:	Passenger	Company	*	Company
Distance related	No	No	No	No
Other charges:				
Security	No	Yes	Yes	Yes
Rescue/fire service	No	No	Yes	No
Airbridge	No	No	No	Yes
Terminal (General)	No	No	No	No

Source: Doganis (1992) adapted and actualized.
[1]MTOW: Maximum take off weight.
[2]MAW: Maximum aircraft weight.
*It is not an airport charge. It is collected at ticketing point as Government levy.

The selection of the initial price structure will be the basis for the application of the regulatory mechanism. It should be an adequate guideline for future investment and also ensure an efficient allocation of resources. Economic theory states that if the price is established according to the service marginal cost, an efficient allocation of resources among users would be obtained. The paid fare would reflect the true service value, with those not willing to pay not being served. However, those airports that generally operate below available capacity present a very small marginal cost, not being able to produce enough revenues for the covering of total costs. In the airport industry, a great deal of costs are sunk, or there are historical costs that do not conform to the service marginal cost. Therefore, the strict application of a charging policy that follows the marginal cost criterion, would inevitably lead to financial losses for those airports operating below available capacity.

Given that price-demand elasticity of airport services is lower than one,[25] there might be another possibility for the generation of extra revenues through the application of an *ad-hoc* rule known as Ramsey pricing. This policy suggests that when the marginal cost rule does not allow enough revenue generation to cover costs, it would be more efficient to charge users according to their willingness to pay. Costs covering would then be ensured without getting far away from the efficient allocation principle. Hence, this would be a means for deficit reduction that avoids the utilization of cross-subsidies. Nevertheless, airport monopoly power would be substantially exploited.

3.3.- The British Airports: price regulation through an RPI – X formula

The British Airport Authority (BAA) today enjoys a considerable degree of market power. The majority of air traffic arriving or departing the United Kingdom goes through two of the most important BAA airports, Heathrow and Gatwick. The chance for competition from other airports in the UK and the European continent, such as Paris or Amsterdam, is remote. The possible appearance of a competitor would be frustrated through an occasional and adequate fare cut at London airports. Hence, monopoly power exerted by BAA airports is real, and may have clear repercussions upon service users and society as a whole.

The Civil Aviation Authority (CAA) of the United Kingdom is responsible for the provision of air traffic control services and the regulation of safety and economic aspects at airports in the country. Among its objectives as an airport regulator are the protection of consumers interests, the promotion of economic efficiency, the financial viability of airport services and the encouragement of additional capacity investments in order to meet future air transport demand growth. However, the most known function of the CAA relates to the establishment of a maximum level of charges for large airports. The Airports Act (1986) does not specify anything regarding the regulation of BAA's commercial activities. The only charges subject to regulation are the landing, passengers and aircraft parking fees. Profits generated by commercial activities are usually utilized as compensation for less regulated aeronautical fares. There is, therefore, a cross subsidy for aeronautical services with revenues arising from commercial activities. Such a mechanism is known as the *single till principle*. Obviously, the application of this principle leaves aeronautical service prices below provision costs, which generally represents a problem when it is a congested airport. Consequently, the application of this method leads to economic inefficiency. Nevertheless, the abandonment of it would imply that aeronautical service charges should reflect the higher provision costs, which would lead to airports increasing their profits since they would no longer need to cross subsidize and hence, they could make bigger profits at non-regulated commercial activities. In turn, under the single till principle, air carriers would also enjoy a part of airport commercial revenues through cross subsidizing by keeping reasonable aeronautical charges. It also ensures that the private airport operator would not obtain excessively high profits. This is the rationale behind the behavior of the British airports regulatory authority. Of course, the application of the principle does not help airport congestion problems.

[25] See section 1.

Pricing regulation takes the form of a *price–cap* applied to revenues deriving from airport charges per passenger, also called revenue yield (see Box 3.1). Price caps regulation according to the RPI-X formula have been a key element in the field of regulatory reform in Great Britain. Approximately 50 firms in the United Kingdom are under this sort of regulation. This system encompasses a pricing structure that is subject to specified maximum fare increases, expressed in terms of percentages that can not exceed the difference between the Retail Price Index and a given factor "X". This index is preferred to an industry specific one because it can not be manipulated by the regulated firm. A term period is established, usually five years, after which prices and limits are revised. Regarding the "X" factor, as this is exogenous to the firm, it may vary and be different for each year of the regulatory period.

BOX 3.1. The RPI-X formula for BAA airports

Regulation of fares through an RPI-X mechanism and applied to revenues coming from airport charges (landing, passengers and aircraft parking fees) implies that revenue per passenger should not exceed a given maximum value determined by the following expression:

$$M_t = [1 + (RPI_t - X_t)/100]\, Y_{t-1} - K_t$$

Where:

M_t : maximum allowable revenue per passenger for year t.

RPI_t : percentage of change for the Retail Price Index between years t and t-1

X_t : factor "X" (%) in year t.

Y_{t-1} : revenue per passenger in the year t-1 calculated according to the following formula:

$$Y_{t-1} = [1 + (RPI_{t-1} - X_{t-1})/100]\, Y_{t-2} + S_{t-1}$$

Where S_{t-1} is the allowable security cost per passenger in the year t-1. It corresponds to 95% of the annual equivalent.

K_t : correction factor per passenger applied in year t (whether of a positive or negative value). It can be obtained trough the formula:

$$K_t = [1 + I/100]^2\, [T_{t-2} - (Q_{t-2} \times M_{t-2})]/Q_{t-2}$$

Where:

T_{t-2} : is total revenue coming from airport charges in year t-2.

Q_{t-2} : passenger volume in year t-2.

M_{t-2} : maximum allowable revenue per passenger for year t-2.

I : if $K_t > 0 \Rightarrow I = SR + 3\%$

if $K_t < 0 \Rightarrow I = SR$

"SR" (Specified Rate) is the average of discount rate for public funds expressed as a percentage. This value is published weekly by the Bank of England during the twelve month period starting at the beginning of October of year t-2 till the end of September year t-1..

It should be pointed out that processed passengers are not the only output at airports, consequently, aircraft that carry cargo and mail are not considered by this type of regulatory system (*revenue yield*). An alternative for the application of regulation is given by the *tariff basket* approach, according to which the regulatory mechanism is applied upon a weighted average of each component of the fare structure. Such an approach takes into account the different airport outputs since it weighs each element of the fare structure by its generated revenue. However, the British Civil Aviation Authority recommends the utilization of the approach based on passengers revenue. There is not yet any evidence pointing to the existence of serious problems relating to the application of this method.

The application of a price-cup formula may also allow part of the costs to be passed directly to users. For instance, at BAA London airports and at Manchester airport, a passing through of 95% of the additional security costs imposed by the Ministry of Transport is permitted with a one year lag period. The regulator may opt for allowing a high price in order to compensate for the risk of losses, or it may reduce the period of regulation as a means for minimizing risk. This last alternative aims to protect airports against unexpected cost changes.

At Table 3.2 an example of the application of the price-cup formula at the Manchester airport for a five year period is shown.

Table 3.2. Application of a price-cup at Manchester airport (93/94 to 97/98)

	1993/94	1994/95	1995/96	1996/97	1997/98
X (%)	3.0	3.0	3.0	3.0	3.0
RPI (%)	1.8	2.2	3.9	2.1	3.5
RPI – X	-1.2	-0.8	0.9	-0.9	0.5
£ per passenger based on RPI – 3 (M_t without including S_t and K_t)	7.675	7.614	7.683	7.614	7.652
Security costs adjustments (S_t in £)	-	-	-	0.172	0.173
Correction factor (K_t in £)			0.265	0.379	0.911
Maximum allowable revenue per passenger (M_t in £)	7.675	7.614	7.948	8.165	8.736*
Revenue per passenger obtained (£)	7.435	7.278	7.136	7.192	7.505*
Difference	-0.240	-0.336	-0.812	-0.973	-1.231*
Revenue losses (million £)	3.1	4.8	12.0	14.2	19.0

Source: Monopolies and Mergers Commission (1997).
* Estimated values.

The formula is adjusted to allow for 95% of security costs to be passed on to users. There is also a correction factor based on passenger traffic forecasts that permits the adjustment of forecasting errors that might give rise to differences between allowable and truly obtained revenues. A detailed explanation of the calculations and terms utilized to construct Table 3.2 is given in Box 3.2.

When limits on prices are imposed, there is the possibility that profitability could be increased at the expense of quality of service. For instance, an airport may reduce costs by not cleaning the terminal building regularly or by allowing congestion and delays. Hence, when prices are regulated through a price-cup there is always the need for monitoring quality by establishing reasonable standards. This was a crucial element when airlines evaluated the quality of service at BAA airports. Carriers argued that an absence of standards might provide an incentive for BAA to increase profits through a deterioration of service quality.

A regulator also has to consider that airports may try to cross subsidize aeronautical activities when subject to regulation. The presence of joint costs represents a temptation to allocate a great part of those to the regulated activity, or monopolistic prices may be charged for commercial unregulated services, for which price controlling is more difficult. In this sense, BAA has argued that regulated aeronautical fares were quite low as a result of the strict control, making cross subsidization from commercial services necessary. The main consequence of this procedure was the diversification of services provided and the emphasis on commercial activities.

Another element to be taken into account is that an efficient fare structure requires great flexibility in its application due to the changing nature of airport service demand. According to BAA, price controlling clearly affected the efficiency of their services. BAA also asserted that severe regulation may result in financial difficulties for the airport operator, bringing unforeseeable consequences in regard to profits.

Finally, according to the Civil Aviation Authority, the main benefit derived from regulation was that it obliged airports to keep costs low. In other words, airports were minimizing costs in order to get higher profits. Other important conclusions were: (i) the regulator must clearly know what its goals and responsibilities are; and (ii) the regulator must have direct access to all the information needed, including confidential material, in order to carry out its work properly.

Box 3.2. Details of application of the price-cup at Manchester airport

Application of formulas at Box 3.1 permits to generate values of Table 3.2. Figures have been obtained for a reference value at the base year of the variable revenue per passenger of £ 7.768. According to the formula of the correction factor K_t this only makes sense from year three onwards. The period considered goes from years 1993/94 to 1997/98.

Year 1993/94

$Y_{t-1} = 7.768$
$K_t = 0$
$M_{93/94} = [1 + (1.8 - 3.0)/100] \times 7.768 = 0.988 \times 7.768 = 7.675$

Year 1994/95

$Y_{t-1} = 7.675$
$K_t = 0$
$M_{94/95} = [1 + (2.2 - 3.0)/100] \times 7.675 = 7.614$

Year 1995/96

$Y_{t-1} = 7.614$
$K_t = 0.265$
$M_{95/96} = [1 + (3.9 - 3.0)/100] \times 7.614 = 7.683$

Year 1996/97

$Y_{t-1} = 7.683$
$K_t = 0.379$
$S_{t-1} = 0.172$
$M_{96/97} = [1 + (2.1 - 3.0)/100] \times 7.683 = 7.614$

Year 1997/98

$Y_{t-1} = 7.614$
$K_t = 0.911$
$S_{t-1} = 0.173$
$M_{97/98} = [1 + (3.5 - 3.0)/100] \times 7.614 = 7.652$

Note: M_t values do not include S_t and K_t. It corresponds to 4th row on Table 3.2.

3.4.- Relevant aspects when regulating airport charges[26]

As we have pointed out above, there are certain aspects of the airport industry that are very difficult to incorporate into the regulatory structure. Nevertheless, if regulation through an RPI-X formula is to be efficiently applied, such elements ought to be taken into account. Factors that may cause larger troubles when regulating airport charges are, among others, congestion, externalities such as noise,[27] investment indivisibilities and service quality. Below we consider each of these aspects individually.

3.4.1.- Congestion

Costs that arise when processing an additional passenger or aircraft at an airport that operates below available capacity at any time are close to zero. Under these conditions, additional passenger or aircraft charges should be established according to the airport short run marginal cost. However, if demand increases, giving rise to a large traffic concentration at peak hours, the corresponding marginal cost would be much higher than the one applicable at off-peak periods. Hence, in such a case there would be a reason for price discrimination, specifically, the charged price for peak periods could be much higher than the one applied at off-peak intervals. If investment aims to increase capacity, fares should also incorporate this fact. In summary, an optimal fare structure that allows congestion problems to be considered needs to be quite flexible. However, if price controls take the form of price cups, this implies rigidities that do not permit changes in prices over time. Hence, in practice, such a regulatory mechanism limits the utilization of prices as a tool to manage the problem of congested airports.

There are two important aspects related to congestion at airports: (i) determining optimal capacity and (ii) its efficient allocation. Regarding the former, the existence of a price-cup implies that the airport has no incentive for optimizing available capacity given that it faces a fixed fare structure for which revenues increase only if traffic flow also increases. Hence, this type of price regulation breaks the link between congestion reduction and revenue generation. In other words, the airport gets no gains from reducing congestion. A possible solution to this problem may come through the incorporation of congestion costs into the price regulatory formula. Nevertheless, finding an adequate indicator of congestion is not an easy task, and even more difficult, would be the inclusion of the variable in the price-cup. An alternative way around the problem could be provided by a regulator that establishes the optimal level of capacity through a cost-benefit analysis that compares congestion costs against benefits arising from the availability of larger capacity.

Once optimal capacity has been determined, it has to be efficiently allocated. Usually, this consists of determining a price that equilibrates market supply and demand. Those airports with traffic volumes exceeding capacity at certain times should apply

[26] See Forsyth (1997).
[27] See section 1.

different charges at peak and off-peak periods. Price discrimination is justified by the high level of traffic verified at peak periods. If the level is high enough, this may give rise to the need for additional capacity investments. However, the conflict mentioned above remains. Price-cups regulation limits such a possibility since its goal is to keep fares low, which is incompatible with peak pricing as a peak fare would be necessarily higher in order to allocate capacity more efficiently.

A possible way to reconcile the application of the price cup regulatory formula with an efficient allocation of capacity at congested airports consists of applying, jointly with the price formula, a mechanism for the allocation of slots and/or establishing a slots market. For instance, available capacity as determined by the regulator could be allocated through a public auction, after which resale would be permitted. The main problem caused by this procedure is determining who is going to obtain rents arising from sales. If the regulator allows the airport to take the money in, then it would have an incentive for keeping capacity scarce and prices high. However, this experience has been implemented at airports in London and it seems to have worked relatively well.

3.4.2.- Externalities

Noise is one of the most important negative externalities generated at airports. As aircraft noise affects a large number of people, there is a need for the internalization and incorporation of its effects as part of total airport costs. In order to proceed, the external marginal costs must by estimated, followed by the establishment of a fare structure. However, the main question is how to consider the external effects jointly with the regulatory framework. In this sense, there are two main problems. First, how to incorporate noise control devices, for instance, through a special fare mitigating excess noise into the regulatory formula, and secondly, how to reconcile permissible noise levels and airport capacity.

In general there are three alternatives to regulate noise level that are consistent with the RPI-X formula: (i) incorporation of a noise index into the formula, (ii) charging a special fare paid by the airport or its users and, (iii) establishing quantitative limits. The idea behind the first procedure is that it would allow airports to charge higher fares the lower the level of noise, in a way that airlines would be penalized if they succeed in reducing its noise. Hence, airlines would have the incentive to collude and operate in the opposite direction. The second entails airports being penalized according to the noise generated by its customers. However, given that it is not the airport itself that generates noise, but its users, the airport should be in the position to pass through such costs to the users. Alternatively, air transport carriers could be charged directly. Finally, the establishment of quantitative limits, such as restrictions on certain types of airplanes or banning air traffic operations for a given period of the day, are instances of solutions that fit into the third alternative. These may be complemented by a charge aimed at reducing noise at peak hours. For example, night restrictions might be complemented by another charge that would limit noise during the day. Such a combination can be found at Sidney airport, for which a noise charge is combined with the application of quantitative limits.

Capacity may be augmented by choosing different aircraft approach routes, which would also lead to increases in noise levels. This trade off could be studied through a cost benefit analysis. The regulator would have to get information regarding the costs of noise on different routes, and then compare them with the benefits arising from the availability of additional capacity. The regulator would then be in the position to select the most efficient combination. However, this would be possible only if it is also able to control other aspects, including environmental impacts, at airports.

3.4.3.- Quality of service

Quality of service is an important aspect that must be controlled when price regulation is implemented. An airport that faces a regulated price will try to reduce its costs in order to get a higher profit margin. Hence, elements related to quality of service must be closely supervised. There are four mechanisms that allow for the control of quality. First, the regulatory agency might ask the airport to publish certain quality standards. Second, a quality index might be incorporated inside the RPI-X formula. A third option would consist in establishing compensation for users of poor quality services. Finally, a fourth possibility would be given by the fixing of minimum quality standards. Airports that do not comply would be fined or subject to a revision of regulatory conditions.

Usually *ad hoc* methods are applied for controlling quality. For instance, in the telecommunication industry of Great Britain and Australia, the regulator collects information through quality indexes. Those airports with quality indicators below required levels would be subject to regulatory pressure. However, in regard to airports, development of good quality indicators is not an easy task. Nevertheless, within the context of regulation, it is crucial to take steps for evaluating service quality and hence, ensure that these do not deteriorate. Fixing minimum quality standards and enforcing compliance might be the most effective means, since it implicates airports in the attainment of quality aims. However, air carriers, as the main airport users, also have a large role in airport quality, as frequently, services are jointly provided by the airport and the air carrier. Concessionaires of airport services, such as passenger and luggage handling, are in many cases the airlines themselves or other outside companies. Consequently, the attainment of service standards and quality controls must be the responsibility of both the airports and the main operators.

Another aspect related to quality has to do with the existence of enough airport capacity to offer services at an acceptable level of quality. As has already been mentioned, there is lack of incentive to invest in new capacity at those airports subject to price regulation. Uncertainty regarding additional capacity costs coverage implies that certain adjustments should be allowed in order to charge higher prices when investment takes place. However, this means that the regulator must provide *ad hoc* solutions and therefore, move away from the simplicity of the single application of a price cup.

3.4.4.- Investment plans

The provision of airport infrastructure is subject to the existence of significant indivisibilities, meaning that capacity can be augmented only by adding large and indivisible units. In this context, an important element is given by the relationship between airport charges and the need to amplify capacity. This leads to another problem for the regulatory framework.

When an airport disposes of excess capacity, the optimum price is given by the short run marginal cost. If demand increases, the use of capacity would need to be rationalized through a significant price increase, which could be equal to the long run marginal cost. This would be the efficient way to proceed when capacity is scarce. In other words, users demanding more capacity might pay the marginal cost of obtaining it. Nevertheless, once additional capacity investments have been carried out, and considering that indivisibilities would again give rise to excess capacity, the efficient use of resources would indicate a need to charge lower fares. Hence, an efficient price system would lead to low revenue levels most of the time. This aspect of capacity is troublesome for the design of an RPI-X formula, since this system of regulation imposes rigidities that do not allow necessary fluctuations in order to efficiently charge. Nor does it permit the airport to break even.

It is important to point out that privatized airports forecast future investments by taking into account the actual price system upon which regulation is applied. Therefore, such a price system has to be consistent with coverage of additional investment costs. There is a need to establish a regulatory system that would permit private airport operators to cover actual costs, as well as those generated by future investments. The British experience in regulation was such that the regulator was unable to design a regulatory mechanism that allowed investment decisions to rest entirely in the hands of private concessionaires. The regulator had to intervene in order to evaluate the impact of price regulation upon investment plans. In this sense, the regulator adopted a managerial role.

3.5.- Design of the regulatory mechanism

The British experience in regulation indicates that price cup regulation may impose certain risks upon the regulated firm, making profits more volatile. This implies that regulated prices have to be frequently revised. Therefore, the regulator can not establish a unique limit that would be binding over a substantial period of time, and consequently, the main advantage of this regulatory procedure can not be properly exploited. Apart from congestion and externality problems, there are also complications relating to the implicit incentives to degrade the quality of services provided in order to increase profit margins. Regulatory prospects are further complicated by the lack of incentives to invest in new capacity.

In the United Kingdom, the regulator has frequently had to intervene in order to compensate for the effects of the price cup formula. For example, adjustments in capital expenditures are often needed, or additional security costs need to be passed through to users. Other adjustments due to inaccurate traffic forecasts, which affect factor X, are also common. If traffic increases are markedly above predicted levels, it might be necessary to

provide investment expenditures incrementally in order to avoid likely congestion problems. This would have clear repercussions upon financial airport results. In other word, the regulator is often compelled to apply an *ad hoc* regulatory price mechanism.

An *ad hoc* regulatory mechanism might partially allow for a solution to the troubles that arise from the pure application of a price cup. In this sense, Forsyth (1997) proposes to use a mixed system, designed in such a way that would combine regulation through the RPI-X formula with the rate of return. Fares would be established with reference to the price cup formula and real airport costs. Weights given to each of these elements would depend upon the importance of different inefficiency sources. For example, if quality is a serious problem, more emphasis would have to be put on airport costs. Airports would be allowed to recover a great deal of the costs incurred by the provision of better service quality. This mixed rule would open up the possibility of adjusting in an *ad hoc* manner airport gains or losses. Furthermore, it would soften the critical aspects that arise when establishing an initial price upon which the regulatory mechanism would be applied.

Hence, the application of such a mixed regulatory system to the airport industry might be desirable. However, this would mean a more active role for the regulator, as it would not be possible to simply establish price regulation, while leaving the airport itself to make the rest of the decisions. The regulator would need to establish the necessary capacity at congested airports and, perhaps, the creation of a slot market. It should also estimate noise costs, establish charges for internalization of such effects, and try to reconcile allowable noise levels with airport capacity. Finally, as a result of the importance of quality related aspects and the presence of externalities at airports, the regulator would have to decide directly upon industry investment plans.

4.- QUALITY REGULATION IN THE AIRPORT INDUSTRY

4.1.- The need for regulation

The main reason for regulating quality is market failure. Consumers are imperfectly informed about the quality of products at the time of purchase, and are therefore unable to distinguish a bad quality provider from a good quality one. In general, regulation is needed in order to overcome such informational asymmetry. Nevertheless, the quality outcome may differ with the type of market and the temporal dimension. In competitive markets, firms that produce low quality products and sell them at high quality prices will acquire a bad reputation and will be excluded from the market (Klein and Leffler, 1981). In monopolistic situations, the quality of the product is always lower than under a perfect information setting. Imperfect information causes quality deterioration (Shapiro, 1982). Regulators, however, face similar asymmetric information problems regarding product quality.

As we have seen in section 3, privatized airports are usually subject to some sort of pricing regulatory mechanism. Less common is quality regulation, in spite of the likely exploitation of monopoly power in some airport operations. For instance, the British Airports Authority (BAA), although subject to price-capping,[28] does not have to comply with a level of quality specified by the regulator. Rather, BAA itself keeps track of their quality records by periodically carrying out quality survey monitoring. It seems that being subject to Civil Aviation Authority (CAA) scrutiny acts as a sufficient incentive to keep high quality standards without any specific regulatory provision. Nevertheless, BAA and the airlines actually agree upon the level of service to be provided. Areas such as check-in, security queues, jetty availability, stand availability and cleaning, project development, and departure and transfer baggage, are usually the main matters under discussion. Performance measures, services standards and compensation payments in case of non-fulfillment, are included in the final service level agreement.

4.2.- Monitoring quality: the case of BAA self-regulation

In order to evaluate quality performance at airports it is necessary to distinguish between the different recipients of airport services and also between the various ways of assessing quality. The main airport customers are the airlines, which in turn depend upon paying passengers. For this reason, any performance measure standards should distinguish between services directly provided to passengers and those intended for airlines. At the same time, there are two main approaches for the assessment of quality. First, there is a subjective approach that bases its analysis on quality surveys that capture the quality perceptions of passengers and airlines. On the other hand, there are also more objective approaches involving the measurement of performance against measurable standards (see Table 4.1).

[28] Price-caps might induce quality costs cutting, as operators choose to reduce quality and hence costs, rather than increase efficiency.

Table 4.1. Elements for quality assessment at airports

	Recipients of airport services		
	Passengers	**Airlines**	**Others**
Alternatives for quality assessment	*Subjective approach*: Quality surveys monitoring *Objective approach*: Establishment of standards and measurement of performance		

4.2.1.- Services to passengers

As mentioned above, BAA controls the level of quality in passenger services through quality survey monitoring. This constitutes an application of the subjective approach. The survey measures passengers' perception of the service they receive in departures, arrivals and retail areas. Over 250,000 passengers are interviewed each year. The interview takes 8 to 12 minutes, and passengers are asked to assess services on a five-point scale from "extremely poor"(1) through "average"(3) to "excellent"(5). At Heathrow, Gatwick and Stansted, information has been collected throughout a six-year period on customers perception of twelve basic aspects of services in the departures area, and seven basic aspects of services in the arrivals area. Departing passengers are interviewed as they enter the gateroom, and arriving passengers as they exit the terminal. In a similar way, perceptions about various aspects of service and value for money provided by retail outlets, car parks and restaurants, are also collected.

Scores for BAA airports are presented at Tables 4.2 and 4.3. However, these are results only for those areas that are common to all three airports. Each table shows the constituent factors for each airport ranked according to the quality survey monitoring. Results show that, on average, passengers perceive most areas to be at least "average." Many areas are ranked between "good" and "excellent," and no area is assessed as "extremely poor." Overall, Stansted scores consistently well, and Gatwick still scores slightly better than Heathrow, although Heathrow has shown more improvement than Gatwick since 1991.

In addition to recording subjective measures about passengers' perceptions, various performance standards have also been established by BAA . An example of check-in queue targets is presented at Table 4.4.

Table 4.2. Quality survey monitoring scores. Departure and arrival areas at selected BAA airports. 1995/96

	HEATHROW	GATWICK	STANSTED
Departures			
Security queue	4.1	4.2	4.4
Telephones	4.0	4.0	4.1
Check-in queue	4.0	4.0	4.3
Departure lounge cleanliness	4.0	4.1	4.5
Flight information	3.9	4.0	4.0
Toilets	3.9	4.0	4.4
Trolleys	3.9	3.9	4.2
Airside seating	3.7	3.9	4.2
Announcements	3.7	3.7	4.0
Check-in crowding	3.6	3.8	4.1
Landside seating	3.5	3.8	4.1
Departure lounge crowding	3.5	3.8	4.3
Average	***3.82***	***3.93***	***4.22***
Arrivals			
Immigration queue	4.2	4.3	4.5
Disembarkation	4.0	4.0	4.1
Trolleys	3.9	3.8	4.2
Telephones	3.9	4.0	4.2
Baggage reclaim queue	3.8	3.9	4.0
Toilets	3.8	3.9	4.4
Concourse crowding	3.5	3.8	4.3
Average	***3.87***	***3.96***	***4.24***

Note: A score 1 is "extremely poor", 2 is "poor", 3 is "average", 4 is "good" and 5 is "excellent".
Source: Monopolies and Mergers Commission (1996).

Table 4.3. Quality survey monitoring scores. Retail value for money areas at selected BAA airports. 1995/96

	HEATHROW	GATWICK	STANSTED
Duty-free shopping	3.8	4.1	4.1
Tax-free shopping	3.7	3.8	3.8
Other shopping	3.6	3.7	3.7
Catering	3.4	3.5	3.5
Bureaux de change	3.3	3.5	3.4
Long term parking	3.3	3.6	3.4
Short term parking	2.7	3.1	3.5
Average	***3.4***	***3.61***	***3.63***

Note: A score 1 is "extremely poor", 2 is "poor", 3 is "average", 4 is "good" and 5 is "excellent".
Source: Monopolies and Mergers Commission (1996).

Table 4.4. BAA check-in queue targets

Maximum waiting times (minutes)			Length (persons queuing)		
Heathrow	**Gatwick**	**Stansted**	**Gatwick**		
20	20	15	Scheduled		Charter
			Short-haul	Long-haul	18
			10	18	

Services provided to passengers may sometimes be perceived as inadequate. Airports usually devise a mechanism for tending to passenger complaints. However, the sensitivity of airport authorities to such complaints is dependent on the degree of monopoly power and regulatory provisions.[29]

Complaints and suggestions from passengers may arrive in a variety of forms: comment cards, letters, telephone calls, e-mail or in person. The processing and treatment of those may be subject to regulation. Usually a customer services department handles complaints, but the regulator may be the ultimate arbitrator. In addition, there may be fixed targets regarding prompt responses.

[29] Here monopoly power refers to the existence of competing airports.

4.2.2.- Services to airlines

Service directly provided to airlines also has to be taken into account in order to reach a complete quality assessment. Although BAA is not subject to quality standards, some airlines have already requested the Monopolies and Mergers Commission to establish standards regarding the availability of key operational equipment such as baggage belts, jetties, stands, moving walkways and lifts.

In spite of a lack of quality regulation, BAA makes direct measurements of its service delivery by recording objective data on the availability of critical equipment. Table 4.5 shows the 24 hour availability data for passenger–sensitive equipment from April 1995 to March 1996. Other performance indicators developed by BAA are: number of faults per unit (as a measure of the effectiveness of preventive maintenance), and time to site and time to repair (as measures of reactive maintenance). A target of repairing 95% of faults within four hours was set. Table 4.6. shows average fault repair time for passenger sensitive equipment. Other aspects considered are: percentage of passengers boarding /disembarking via jetty, coach or steps (see Table 4.7), planned and unplanned stand outage (in terms of hours per month) and maximum baggage handling delivery times (see Table 4.8).

Table 4.5. Percentage availability of critical equipment at selected BAA airports. April 1995 to March 1996

	Departure baggage systems	Passengers lifts	Loading bridges	Passenger conveyors	Escalators
Heathrow					
Terminal 1	97.8	99.2	99.0	99.1	98.9
Terminal 2	98.8	99.5	99.3	n.a.	99.3
Terminal 3	98.4	99.4	98.7	98.5	99.3
Terminal 4	98.6	99.5	99.4	99.7	99.8
Gatwick					
North Terminal	98.1	99.4	98.5	99.2	99.5
South Terminal	97.5	99.2	97.9	98.8	99.2
Stansted	99.4	99.4	99.5	n.a,.	99.9

n.a.: Not available.
Source: Monopolies and Mergers Commission (1996).

Table 4.6. Average fault repair times for critical equipment (hours) at selected BAA airports. April 1995 to March 1996

	Departure baggage systems	Passengers lifts	Loading bridges	Passenger conveyors	Escalators
Heathrow					
Terminal 1	1.52	3.18	2.31	1.92	1.79
Terminal 2	0.14	2.35	1.31	n.a.	3.24
Terminal 3	0.55	4.53	4.24	4.45	1.82
Terminal 4	0.63	3.75	0.83	0.68	1.09
Gatwick					
North Terminal	0.92	2.04	1.25	1.49	1.29
South Terminal	1.60	1.97	6.27	1.57	1.81
Stansted	0.12	1.64	0.46	n.a.	0.31

n.a.: Not available.
Source: Monopolies and Mergers Commission (1996).

Table 4.7. Average levels of pier service at selected BAA airports. 1995/96

		Percentage of passengers boarding/disembarking via		
	Arrival/ Departure	Jetty	Coach	Steps
Heathrow				
Terminal 1 Domestic*	Arrival	87	9	4
	Departure	89	7	4
Terminal 1 International	Arrival	79	17	4
	Departure	81	15	4
Terminal 2	Arrival	95	2	3
	Departure	94	2	4
Terminal 3	Arrival	89	7	4
	Departure	90	4	6
Terminal 4	Arrival	94	3	3
	Departure	93	4	3
Gatwick				
North Terminal	Arrival	83	13	4
	Departure	75	21	4
South Terminal	Arrival	83	3	14
	Departure	83	3	14

* Including Channel Islands and Ireland.
Source: Monopolies and Mergers Commission (1996).

Table 4.8. Standards for maximum baggage delivery times at selected BAA airports (minutes)

	First bag	Last bag
Heathrow		
Terminal 1	16-20	30-34
Terminal 2	21	25
Terminal 3	24-28	49-53
Terminal 4	11-20	22-41
Gatwick		
North Terminal	20	35
South Terminal	20	35
Stansted	15	33

Source: Monopolies and Mergers Commission (1996).

Airlines may feel disappointed regarding airport services. Hence a mechanism to register their complaints also has to be in place. This aspect will have to be considered by a regulator concerned about the exploitation of monopoly power. For instance, in the case of BAA, it is the Civil Aviation Authority which is responsible for addressing complaints. This procedure applies not only to airlines but to other agents such as tour-operators or concessionaires as well. Other airports that might feel damaged by anti-competitive practices may also refer to such authorities or even to the Monopolies and Mergers Commission.

Many of the most crucial aspects of airport operations are not always the direct responsibility of the airport authority. Aircraft landings and take-off punctuality would also be determined by visual and approach air traffic services. So in order to keep with published time tables both the airport authority and the Air Traffic Control must be closely coordinated, particularly when they belong to different organizational bodies.

All the variables mentioned above, even in terms of scores or standards, constitute instances of possible regulatory quality targets. Standards might be applied either when a full divestiture has been applied or when a concession contract is intended. The convenience of intervening in order to fix quality levels should be studied by the regulator. A scrutiny mechanism and agreements with air transport carriers regarding prices and corresponding quality levels might be adequate in order to ensure good quality standards.

4.3.- Regulation of safety and externalities

Airport safety would also play an important role in determining quality. Its objective is to ensure that passengers will have a normal waiting time and flight, and that the possibilities of suffering a terrorist or criminal attack are minimal. The procedures required to comply with safety standards impose some costs on passengers and airlines. Different components of the airport security system are shown at Table 4.9.

Security queues are considered an important determinant of airport quality. BAA reports that among the three airports mentioned above, 90% of passengers waited less than five minutes and 95%, less than 10 minutes. Airlines have suggested that a maximum waiting period of five minutes at London airports for a security search would be desirable.

In economic jargon, externalities are considered a market failure, hence wherever they appear intervention is regarded as necessary. The main negative externalities at airports are noise, congestion and pollution.[30] Traditionally, airport operators or even corresponding regulators, have left externalities aside, and only recently have they started worrying about their environmental impact. Today, it is common to find airports where night operations have been banned or restricted to less noisy aircraft's. Higher fares for noisier planes is another technique that aims to reduce the social cost of noise. Peak-pricing is also spreading as a practice for relieving congestion. Air pollution, however, has not been given much importance.

The increasing sensitivity toward environmental concerns has led to special treatment for externalities in most infrastructure project contracts. Usually an environmental impact study is required as a pre-requisite for airport infrastructure construction. Such a study should also consider the monitoring of possible negative impacts during the operation phase. In general, the environmental impact study will reflect environmental law.

4.4.- Regulation of investment obligations

As was shown in section 2, the possibilities for private sector participation in airports are numerous. However, if involvement in the activity does not comprise long term objectives such as maintenance of facilities and future investments, airports would end up obsolete and highly deteriorated. This could be the case when a concession contract does not consider investment obligations. Fortunately, this is not often the case in most airport infrastructure concession contracts.

On the contrary, investment plans are usually an essential part of the contract. For instance, the concession contract that was recently prepared for the operation of Argentine airports required the operator to present a detailed investment plan. The concessionaire is obliged to invest a minimum amount of something more than US$2 billion, in addition to

[30] See section 1.

the rest of the planned investments. Such a plan has to be clearly stated, specifying in physical and monetary terms, the works that will be carried out during the concession period. These works include a new airport for Buenos Aires.

BAA also has its investment plans subject to CAA scrutiny. Projected investments are presented periodically, and the regulator expects these to be broadly in line with reality. Additionally, BAA is required to consult airlines on future development plans.

Table 4.9. Components of the airport security system

Security component	Functions
Pre-departure gate screening	Screening passengers, body search, screening airport and airline personnel, X-ray inspection of carry-on luggage.
Parked aircraft control	Screening airport and airline personnel, alarm systems for parked aircraft, aircraft security survey.
Aircraft movement	Screening airport and airline personnel, alarm systems for parked aircraft's, aircraft security survey.
Crew screening	Background checks, training, pre-departure screening.
Ramp security	Surveillance of jetway access, ramp doors, alarm systems, fire sensors and protection, screening personnel.
Perimeter security	Posting, fencing, gates and other opening, lights placement and protection.
Terminal security	Surveillance of jetway access, ramp doors, alarm systems, fire sensors and protection, screening personnel.
Passenger screening	Visual, body searching, X-ray inspection, location.
Passenger flow control	Flow holding, camera surveillance, pre-departure screening.
Baggage and cargo screening	X-ray inspection, carry-on luggage screening, luggage surveillance from drop off to loading, personnel screening.
Intelligence and communications	Telephone and radio communications, emergency power, bomb threat contingency plans, evacuation plans.

Source: Fleming and Ghobrial (1993)

5.- PERFORMANCE INDICATORS IN THE AIRPORT INDUSTRY

5.1.- Introduction

The privatization of a firm leads to an increase in productive efficiency, since in the absence of regulation, the firm pursues profit maximization. However, if the firm exerts monopoly power, it is possible that allocative efficiency is reduced. In such a case, regulation could be a means for limiting market power, although regulation might affect the economic efficiency as well. The impact would depend upon the regulatory system implemented. In the airport industry, the most common form of regulation is price intervention. If charges are established independent of profits, productive efficiency would be feasible, although usually prices are fixed in such a way that firm profits would be under control. Price controls permit an improvement in allocative efficiency by reducing monopoly power. However, it could also reduce productive efficiency (Forsyth, 1997). Hence, regulation may affect the economic efficiency of the airport industry. It is therefore necessary to develop performance indicators that permit control of airport activities liable to be affected by regulation.

The evaluation of airport efficiency is not a trouble-free task. The geographic, economic, political and social features of the airport region complicate any industry efficiency assessment. Doganis (1992) points out that evaluations tend to be based on profit margin analysis. Obviously, this criterion is inadequate since it does not incorporate any information concerning the resources that go into obtaining such a margin. Therefore, it is essential to establish indicators aimed at assessing the effectiveness of resource utilization, which at the same time, may serve as control tools for airport managers seeking to identify those areas with problems requiring prompt corrective measures. Indicators would also be of great help for governments concerned with regulation. For example, indicators could be used to ensure that national resources are being used in the most efficient way and that airports are not exerting their monopoly power and are providing the services required by users at a reasonable price.

Given the trend toward airport privatization, government responsibility should be directed toward the establishment of a regulatory policy that would channel private sector performance so that it matches public interests. In this sense, the use of indicators may contribute to the evaluation of such an accomplishment. In the British case (BAA), privatization brought clear management efficiency improvements, mainly at airports in London. Nevertheless, the Monopolies and Merger Commission may carry out controls at these airports with the aim of determining if their monopoly power is being exerted against public interests. The main criticisms relate to the following three areas: (i) service quality, (ii) fares structure and levels, and (iii) investment levels and quality. Other elements not subject to regulation, such as rents, licenses and commercial concessions are controlled by a commission as well. This was of great importance due to the tough regulation applied on BAA airports, which resulted in aeronautical charges that were below associated costs, and a need to cross subsidize these services with revenues arising from commercial activities. As a consequence, in order to complement the aeronautical-side deficit, users had to pay monopoly prices in commercial areas, and thus subsidize air transport carriers.

According to the literature on airport industry management, financial and economic indicators are usually the most utilized (see Ashford and Moore, 1992, and Doganis, 1992). Given that one of the main objectives of a private firm is costs minimization, a useful measure of efficiency must cover financial aspects. Economic objectives such as inputs productivity are also of importance for any industry. Therefore, a menu of economic indicators is also necessary. Nevertheless, as we have indicated above, these indicators should be complemented by other measures that would allow for an evaluation of the airport services and activities that may lead to troubles for users. Elements such as quality of service and negative airport externalities should be considered as well. For instance, waiting times or congestion at the terminal building are of primary importance in users perception of service quality.

5.2.- Elements that determine indicators design

Before we propose a set of indicators, some aspects that directly affect their utilization have to be pointed out. First, airports develop similar activities for different objectives. In addition, these objectives may conflict with one another. For example, an increase in airport runway capacity through the establishment of additional approaching routes, would also raise the level of noise. Furthermore, each airport has a different social, economic and political environment. For this reason, to propose a set of indicators without taking into account the special features of airports is a risky task. Indicators ought to be adequate to the social, economic and political characteristics of each airport. The disparities between airports needs to be considered in order to fix reference standards.

Second, information needed for the calculation of indicators must comply with certain requirements, such as easy access, clarity and accuracy, in a way that could be comprehended by non-specialists. This should cover most aspects of airports (ICAO, 1991). It is very important that this evaluation and control process be carried out as an integral part of the airport planning program, and not merely as a means for assessing private manager responsibilities. Of course, there is a conflict due to information asymmetry, with the private operator having an incentive to hide relevant information from the regulator. This situation might be softened by periodical controls allowing for continuous supervision with reference to reasonable services standards.

A troublesome element in the evaluation of airport performance and productivity is defining the output utilized. An airport output is not homogenous. It can be defined in terms of number of planes, passengers and cargo volumes. However, each of these output measures is only related to a part of the infrastructure. Runways are related to the number of landed aircraft, while terminal building size depends upon the amount of passengers and cargo processed. Therefore, none of these measures taken in isolation comprehensively explain airport costs and revenues.

Doganis (1992) argues that the choice of output must be in accordance with its economic importance in terms of revenues and costs generation. In this sense, for most airports around the world, the greatest proportion occurs in activities developed in the

terminal building, such as passengers and cargo handling. Therefore, an output measure that combines both variables would cover the largest proportion of airport revenues and costs. Passengers and cargo volumes are an indirect measure of the total number of processed aircraft. Actually, the variable "work-load units" (WLU) is frequently used as an adequate measure of airport output. A work-load unit corresponds either to a passenger (80 Kg. average weight plus 20 Kg. of luggage) or to 100 Kg. of cargo. However, it is important to note that a passenger or a 100 Kg. unit of cargo do not require the same use of physical and financial resources, and do not generate the same revenues either. On the other hand, some indicators demand a given output measure. For example, when assessing revenues arising at commercial activities, the use of traffic units in the denominator does not make sense.

Output measures are relatively easy to obtain, consequently there should not be any problems in obtaining the necessary data required by indicators. In turn, input measures give rise to more serious problems. The most important inputs at airports are labor and capital. Regarding the former, the easiest measure is provided by the number of workers. However, this is not homogenous, as it includes both part- and full-time personnel, in addition to qualified workers such as technicians and managers, and unskilled personnel. Therefore, given that different types of workers carry out different tasks at airports, it would be necessary to develop a more comprehensive and accurate measure for determining the labor input. A solution may be found in considering the financial value of the input (see Doganis, 1992). Nevertheless, such a measure also presents considerable problems since it reflects not only the quantity of the input applied, but also the relative wage differentials among airports. This further complicates the use of indicators that serve as standard references. Consequently, the utilization of the number of workers as a measure of the labor input is advisable. The number of workers, however, would need to be properly classified in order to evaluate a particular area. For example, if aeronautical revenues per unit of labor input is to be calculated, it is convenient to incorporate in the denominator only those workers directly involved in the activities.

Regarding the capital factor, the situation is even more complicated. This is essentially due to the diverse nature of capital inputs. For instance, the difference arising between small capital resources with a short economic life and large long term investments such as runways and buildings, makes posterior input allocation very difficult to measure. ICAO recommends the utilization of assets value in order to measure capital. However, the existence of diverse accounting methods means care will have to be taken. For example, if capital goods investments are financed by government funds, it is very likely that depreciation would not be entered into the accounts. This procedure is common at those airports traditionally operated as public firms. Determining asset value at such airports is misleading due to a lack of regular accounting practices. Nevertheless, although it is difficult to trust financial measurements of capital, there is no alternative. As a consequence, if the evaluation of inputs is to become more reliable, the whole industry will need to adopt a common accounting system.

5.3.- Performance indicators of airport infrastructures

The performance indicators presented in this work are commonly used in the airport industry. However, in some cases it might be necessary to make a selection or an *ad hoc* design according to the special airport features and services to be assessed. Although the proposed list is not exhaustive, it intends to cover those aspects or areas that might be problematic for regulators or managers. There are particular areas where the infringement of public interests is more likely. For example, at airports subject to price regulation, there are problems regarding incentives for investing in new capacity and with the quality of service. This is the result of strong operator tendencies toward reducing costs at the expense of service quality. Therefore, it is important to have a set of financial and economic indicators available that would help in analyzing airport performance. These could include costs coverage, profitability, asset investments and the use of available resources.

In Table 5.1, a set of financial indicators is presented. Two groups are distinguished. The first are the *strategic* indicators that are needed to evaluate policies with medium and long term effects, such as return on capital investments. Secondly, *other financial indicators,* where measures such as cash-flow provide an accurate evaluation of the day to day financial situation of the airport.

Table 5.1. Financial performance indicators

Type	Examples
Strategic indicators	•Return on capital investment •Payback period •Current assets/Liabilities •Self financing ratio •Debtors and creditors ratio
Other financial indicators	•Cash flows •Revenue flows •Expenditure flows •Actual and budgeted revenues and expenditures •Outstanding debtors and location of debt •Outstanding creditors and location of credit

Source: Lemaitre (1997)

Efficiency economic indicators are shown at Table 5.2. These are classified into six distinct categories: overall costs performance, labor productivity, productivity of capital employed, revenue-generating performance, performance of commercial activities and overall profitability. In order to asses the economic efficiency of an airport through time, or to check whether regulated standards are being met, specific indicators are required. For example, we might need to explore labor and capital productivity if we wish to establish that resources are being used in the most efficient way. Alternatively, to determine the

performance of commercial areas, it is necessary to have specific revenue indicators (Doganis, 1992).

Table 5.2. Economic and productivity indicators

Type	Examples
Overall cost performance indicators	•Total cost per WLU (after depreciation and interest) •Operating costs per WLU (excluding depreciation and interest) •Capital cost per WLU •Labor cost per WLU •Labor costs as percentage of total costs •Capital costs as percentage of total costs •Aeronautical costs per WLU •Capital costs to value added ratio •Labor costs per employee
Labor productivity indicators	•WLU per employee •Total revenue per employee •Value added per employee •Value added per unit of staff plus capital costs •Value added per unit of staff costs
Productivity of capital employed	•Value added per unit of capital costs •WLU per £1,000 net asset value •Total revenue per £1,000 net asset value
Revenue generation performance	•Total revenue per WLU •Adjusted revenue per WLU •Aeronautical (or non-aeronautical) revenue as a percentage of total revenue •Aeronautical revenue per WLU •Non-aeronautical revenue per WLU
Performance of commercial activities	•Concession plus rental income per passenger •Concession revenue per passenger •Rent or lease income per passenger •Concession revenue per m^2 •Rent or lease income per m^2 •Airport concession revenue as percentage of concessionaires' turnover
Profitability measures	•Surplus or deficit per WLU •Revenue to expenditure ratio

Source: Doganis (1992)

Revenues from leasing, licenses and concessions derive from activities that are not subject to regulation. However, these activities must also be evaluated since they might generate issues that are against the public interest. For example, if rents paid by commercial area tenants are excessive in comparison to other rents in the leases market, it might be necessary to impose controls. Aeronautical charges are determined according to the single till approach. Under such an approach, airport costs and revenues are foreseen to take into account all services. Aeronautical charges are fixed in such a way as to permit a given profitability level that, in turn, depends upon previous costs and revenues estimations. Once the regulatory pricing formula is in place, the private operator might increase rents above those charged in commercial areas, and hence, act against public interests.

As we have already mentioned, if airports are subject to price regulation they may also be tempted to reduce service quality, and consequently their costs. Therefore, it is crucial to investigate the perception users have about the services provided at airports. Before carrying out any quality assessment, it is necessary to define a standard level of service that would be feasible and reasonable. Such standards would permit the airport regulator, under a penalty threat, to demand the attainment of a certain level of service.

In the British case, air carriers have argued that it is necessary to reach agreement regarding the standard level of services, as well as for provisions that would entitle them to compensation in case of non-fulfillment. They maintain that any deviation from standards would affect their service quality and that without compensation such a mechanism would not be effective. BAA, however, argues that airport services are provided jointly by airport operators and airlines and, therefore, the level of services do not depend entirely upon its performance, but also upon air carriers and handling staff. Carriers, in turn, argue that penalties must be applicable only to BAA, given that airlines operate in a competitive environment and have strong incentives to maintain and improve their quality. Nevertheless, in spite of this dispute, it is not quite clear whether the airport operator should be solely responsible for the attainment of standard levels of quality. In any case, a key aspect of this compensatory mechanism is identifying who is responsible for non-achievement of standards. Leaving aside these difficulties, in order to guarantee a certain level of service within the context of regulation, it is essential that an agreement regarding quality standards be reached.

The procedures for evaluating the factors determining the level of service in the terminal building are complex, leading to the use of such variables as "time of service" and "level of congestion" as proxies for the quality of services provided. Nevertheless, Table 5.3. shows a set of quality indicators that comprise an important part of most of the conflictive aspects of airport activities.

In a study carried out at Birmingham airport (see Mumayiz and Ashford, 1986), it was established that users perception of time of service depended upon the type of market. For European scheduled flights, a check-in waiting time of 7.5 minutes or less was considered satisfactory, while a time equal or greater than 14 minutes was perceived as intolerable. For charter flights, these limits would be respectively between 11 and 21 minutes. According to the same study, a general waiting time of not more than 12 minutes would indicate a satisfactory level of service.

However, there is a trade-off between the level of service offered and its costs. The higher the level of service, the higher the amount of resources required. If we could identify all or some costs associated with the time wasted by passengers at queues, and the economic resources wasted as a consequence of this waiting period, it would be possible to assess the losses arising from the level of services provided. In summary, the establishment of an inadequate level of service could negatively influence users and even airport interests. An illustrative example is provided by the check-in service. The more time spent by passengers in front of check-in counters, the less time available for shopping in the airport commercial area.

Table 5.3. Quality of service indicators

Type	Examples
Delays	•Time of service: check-in time, luggage delivery time, etc. •Waiting time •Waiting time variability
Service reliability	•Baggage service reliability •Number of luggage incidents •Number of passenger delayed at departures •Required time before departure •Connecting time
Costs	•Costs for passengers of food and drink •Departure fee •Connecting fee •Other services fees
Comfort and entertainment	•Crowding at the terminal: number of square meters per occupant •Clarity and level of noise •Temperature and humidity levels •Choice of leisure activities •Sociability •Cleanliness •Air pollution

Source: Lemaitre (1997) adapted.

The use of indicators as tools for assessing a given activity is ineffective if there are no reference standards delineating acceptable performance margins. However, once the particular features of each airport are taken into consideration, these "desirable" or "best practice" reference standards should be considered as provisional guides only. There is not a unique optimum level for a given indicator. The appropriate and optimal reference level depends upon the circumstances of each airport. Furthermore, there may be conflicts between the different objectives pursued. For example, an improvement in the level of

quality may require a substantial increase in costs, which would eventually be translated into higher fares. After considered these arguments, it remains important to reconcile the establishment and implementation of indicator reference standards. Table 5.4. gives some examples of indicators and their associated standards.

Table 5.4. Examples of reference standard levels

Type	Indicator (example)	Best practice
Financial	Return on capital investment	>1.0
Labor productivity	Passengers per employee	2000 to 5000
Service quality	Number of square meters per occupant at peak hours	25-35 (international) 16-20 (national)

Source: Adapted form various studies.

Doganis and Graham (1995) have carried out evaluations of the economic and commercial aspects of 25 European airports through the application of a set of performance indicators.[31] The authors emphasize the existence of comparability problems due to differences in the activities developed at airports in the study. They try to lessen the problem through corrections aimed at allowing for a consideration of the whole group as operators of the same activities.[32] The sample includes private airports such as Glasgow, partially privatized ones such as Copenhagen, publicly owned but commercially oriented airports such as Geneva, and airports like Stockholm, which is part of the Swedish Civil Aviation Authority. The main objective of this study was to analyze the trends and development of industry performance, and identify the relationship between profitability and type of airport. Airports with different ownership structures and varying sizes were incorporated into the study. Table 5.5 provides a summary of the results of this study.

Finally, it should be pointed out that differences in the type of services developed in airports, such as in the degree of public intervention, accounting systems, financial sources, subsidies and standards, complicates the use of indicators for assessing airport performance. In addition, there are two important features that affect airport operations and are present in the evaluation of the resources applied. The first concerns the impossibility of storing airport output, which inevitably leads to a lessening in capacity The second feature has to do with airport externalities. For instance, the level of noise might induce a ban on night activities, which would lead to under-capacity use and an increase in average costs. All these elements, combined with the geographic, economic, social and political characteristics of the airport region, hinders airport performance assessment.

[31] Airports included in the study were: Amsterdam, Stockholm, Barcelona, Birmingham, Bilbao, Basel Mulhouse, Copenhagen, Cardiff, Dublin, Düsseldorf, East Midlands, Oslo, Frankfurt, Glasgow, Geneva, Gatwick, Heathrow, Lisbon, Madrid, Manchester, Milan, Nice, Newcastle, Vigo and Vienna.

[32] Adjustments carried out in the study indicate that results must be carefully analyzed. Comparability problems are still present, and consequently each airport should be considered according to its context.

Table 5.5. European airports best and worst practice values

Indicators	Worst practice	Value*	Best practice	Value*
Cost indicators:				
•Total cost per WLU	Basel-Mulhouse	14.3	Oslo	2.94
•Operating cost per WLU	Vienna	10.58	Oslo	1.94
•Capital cost per WLU	Basel-Mulhouse	6.51	Oslo	0.99
•Labor cost per WLU	Vigo	7.07	Oslo	0.73
Productivity indicators:				
•WLU per employee	Vigo	4,367	Oslo	48,808
•Total revenue per employee	Vigo	17,930	Oslo	389,053
•Value added per employee	Vigo	9,280	Oslo	329,997
•Value added per unit of staff costs	Vigo	0.30	Oslo	9.23
Revenues indicators:				
•Total revenues per WLU	Vigo	4.11	Vienna	19
•Aeronautical revenues per WLU	Vigo	2.38	Vienna	9.9
•Non-aeronautical revenues per WLU	Lisbon	1.67	Vienna	9.1
•Rent and lease income per passenger	Vigo	1.55	Gatwick	8.8
•Concession revenue per passenger	Vigo	1.12	Gatwick	7.65
Financial indicators:				
•Revenue to expenditure ratio	Vigo	31	Oslo	272

Source: Prepared with data from Doganis and Graham (1995)
*Note: Monetary values are expressed in US dollars.

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