Oxera

Agenda

Advancing economics in business

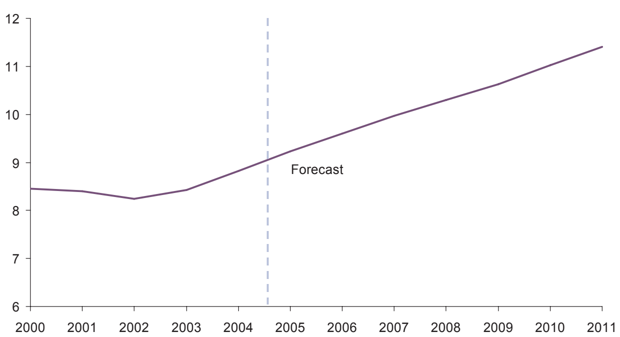
Pricing signals at airports: implications for airlines and the environment

As the demand for flights continues to grow, there is increasing concern about congestion at airports and the noise and emissions produced by aircraft. Airport charges can play a key role in ensuring that existing infrastructure is used efficiently, and in encouraging airlines to use quieter and less-polluting planes

Air traffic has been growing in recent years following significant liberalisation of aviation in both the EU and several Asian markets. This growth is expected to continue, allowing more people to travel long distances more frequently (see Figure 1 for EU flight number forecasts). However, such substantial growth raises concerns about congestion and the environmental impact of aircraft emissions and noise.

Perhaps the most immediate response to both problems would be to start building new infrastructure to ease congestion, and to place direct limits on the noise levels that an individual aircraft can produce if it is to be permitted to land at a particular airport. However, the airport charging structure can also make a significant contribution to ensuring that existing infrastructure is used as efficiently as possible—thus avoiding costly and often unpopular airport expansion—and to encouraging airlines to use aircraft that produce the least emissions and noise pollution for nearby residents.

Figure 1 Number of flights in EU airspace (m)



Source: Eurocontrol (2005), 'Medium-term Forecast: Flight Movements, 2005–2011', volume 1, section 1.3. Eurocontrol is the group of European air traffic control companies.

This article examines the potential roles for charges, looking at them in the particular context of a fixed-revenue allowance for the airport—that is, where the structure of charges provides incentives to airlines, but the charges are not being altered to increase the total revenue earned by the airport. Such fixed-revenue structures are common to many airports around the world, particularly the congested ones, because either they have their charges regulated, or they are publicly owned and operated as not-for-profit entities.

Basic structure

To a large extent, airport charges are levied in a similar way in many jurisdictions around the world. These broadly follow on from the charging principles of the International Civil Aviation Organization (ICAO).[1] The most important statements of principles contained within this document include the following:

> Landing charges should be based on the weight formula, using the maximum permissible take-off weight as indicated in the certificate of airworthiness ... allowance should be made for the use of a fixed charge per aircraft or a combination of a fixed charge with a weight-related element, in certain circumstances, such as at congested airports and during peak periods.
>
> … Noise-related charges should be levied only at airports experiencing noise problems and should be designed to recover no more than the costs applied to their alleviation or prevention ... any noise related charge should be associated with the landing fee, possibly by means of surcharges or rebates ... noise related charges should be non-discriminatory between users and not be established at such levels as to be prohibitively high for the operation of certain aircraft.

In light of these comments from ICAO, many airports around the world use a system comprising the following key elements:

– *a landing charge*—levied for the use of runway capacity and expressed as a fee per tonne of maximum take-off weight;
– *a charge per departing passenger*—levied for the use of terminal capacity and often differentiated between domestic and international passengers;
– *a fee for parking aircraft*—levied after the expiry of a free period which is sufficient to turn the planes around under normal circumstances.

However, while the approach is relatively simple, it does not necessarily reflect the underlying economics of airports, since it does not ration demand efficiently; nor does it necessarily reflect the marginal impact on the costs of an airport.

Three refinements, or additions, to this basic method of charging are considered below, each attempting to solve a specific problem (see Table 1). Different solutions will be more or less appropriate for different airports, given their specific circumstances. However, as highlighted in the table, changing existing structures is likely to have an adverse effect on particular groups of airlines, and may therefore give rise to resistance to change.

Demand-related charging

The first incentive that can be provided via the structure of charges at airports is to manage the demand from various airlines. There are a few airports for which demand exceeds capacity at the current pricing level and structure at almost all times of day—with some of the most congested being those surrounding London. However, there are many more airports globally that experience some degree of congestion or capacity shortage at peak times of day and year. Demand-related charging attempts to alleviate some of these capacity constraints.

To analyse demand-related charging, it is important to understand the nature of airport capacity. An airport will not have a single level of capacity—rather, there are three related elements:

– *runway capacity*—limits the number of aircraft that can land or take off at a given airport;
– *terminal capacity*—limits the number of passengers who can use the airport in a given period of time;
– *stand capacity*—limits the number of aircraft that can simultaneously be waiting to disembark or board passengers.

The aim of demand-related charging structures is to align prices more closely with where demand constraints are binding, and thereby incentivise airlines to adjust their traffic in order to make best use of capacity. Airlines can adjust their operations in a number of areas. For example, aircraft size can be varied: a larger plane will use more terminal capacity, but the same stand and runway capacity.[2] Therefore, the relative levels of landing and passenger charges can be used to incentivise best use of the available capacity at an airport.

Peak charging is an example of this, whereby higher fees are levied by time of day, day of the week, or during different times of the year when capacity constraints bind. New York's main airports levy an additional $100 per take-off during peak hours (between 3pm and 10pm), when large numbers of transatlantic flights depart. London's Luton Airport levies higher per-passenger fees during the summer months than in winter, as a large proportion of the airport's traffic comprises summer holiday flights.

A further problem faced by some airports with limited runway capacity is that of airlines booking slots and then failing to use them. This results in inefficient use of runway capacity: were the slots returned soon enough, they could be reallocated to another airline.

Table 1 Solutions to problems offered by various charging mechanisms

Problems faced by the airport	Possible solution	Examples	Airlines adversely affected?
Congestion on runways and in terminals	Demand-related charging	Düsseldorf International Airport's slot-reservation fee Peak and off-peak landing charges at Luton Airport	Some intercontinental operators, since they have more limited choice about when to land
Airlines not bearing the costs they cause the airport, leading to inefficiency	Cost-reflective charging	Dublin Airport's runway damage charge	Operators of particular types of aircraft with undercarriages which cause more damage to runways
Noise and emissions from planes	Environmental charging	Zurich Airport's charges for noisier aircraft	Operators of older aircraft fleets, since these tend to be noisier and more polluting

Source: Oxera.

This was a particular problem at Düsseldorf International Airport, since it is limited to only 38 aircraft movements per hour due to noise and other externalities, a level that is significantly below the technical capacity of the airport's runway. In 2003, the airport allocated almost 100% of its available runway capacity; however, 20% of slots were unused because airlines not using their allotted slots failed to return them for reallocation to other airlines.[3] To combat this problem the airport introduced a slot-reservation charge, which is subtracted from other airport charges if the slot is used, but is levied if it is not. This relatively small fee reduced 'no shows' by almost half in 2004, which would seem to suggest that fees of this type could have significant potential to optimise use of scarce capacity at other congested airports.

The final element of available capacity—stands—is potentially the most flexible. This is because most airports have 'apron space' where passengers can disembark away from the terminal on 'remote' stands, and travel by bus to the terminal. However, if stand space is problematic, decreasing the available period of free parking may encourage more rapid turnaround of aircraft; if delayed departures of aircraft are problematic, penalty fees for departing after the scheduled time may be effective.

Cost-reflective charging

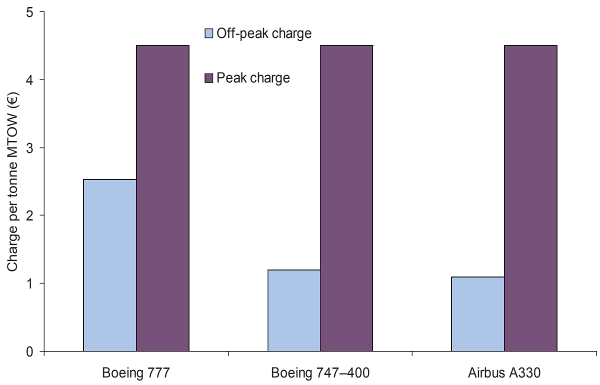
Another approach to incentive-based charging is to consider making charges as cost-reflective as possible. The advantage of this is that airlines have to bear the costs associated with their actions, and are therefore incentivised to minimise these costs. Airports following the ICAO guidelines tend to adopt an average accounting cost approach to setting charges, which can result in relatively high terminal charges and low runway charges, since terminals are generally substantially more expensive to construct than runways.[4]

Alternatives to this approach include short-run marginal cost pricing (SRMC) and long-run marginal cost pricing (LRMC). LRMC attempts to present airlines with the long-run costs associated with meeting their demand for use of airport capacity. It is generally calculated by estimating demand growth in the future, and what this implies in terms of building new terminals, runways, and other aeronautical facilities, then smoothing this cost across all users. The intention is to indicate to airlines the longer-run costs they are imposing, by requiring the airport operator to invest in new capacity, rather than simply paying for the upkeep of existing capacity.

In contrast, SRMC pricing highlights the costs imposed on the airport in the short run, such as additional wear and tear on a runway. It excludes the capacity-enhancement elements that are included in the LRMC value, until the point at which the capacity enhancement has to be built. Since capital investment at airports tends to be lumpy (eg, an additional runway is a very large and expensive addition to an airport), adopting SRMC pricing can lead to 'spikes' in prices at the point at which new capacity is required. Therefore, the SRMC approach is usually adopted only for specific elements of an airport's charges. However, prices close to SRMC may be observed at some smaller airports which have low levels of congestion at any time of day; in such cases, the capital costs may already have been fully depreciated or, indeed, written off. Such airports can therefore sustainably operate only by covering variable costs.

An example of a more congested airport which has adopted some elements of an SRMC charging structure is Dublin Airport. This airport has implemented an SRMC-based runway charge, based on estimates of the damage caused to its runway infrastructure by different plane types.[5] This approach to charging can lead to some marked differences in runway charges for certain aircraft types. For example, a Boeing 777 is currently charged around €755 to land at Dublin during off-peak periods, while a Boeing 747 is charged €475 (despite weighing around one-third more) because of its lower tyre pressure, and hence reduced runway damage.[6] At most other airports, the 747 would pay substantially more than the 777 since charges are usually weight-based. During peak periods, when the airport's runway is more congested, all planes are charged the same fee per tonne. As Figure 2 shows, these fees are usually more than double the equivalent off-peak fee. The peak-charging approach can be interpreted as an attempt to mimic LRMC pricing at congested periods. When the runway is congested, airlines are charged a fee which more closely represents the long-run costs of supplying additional runway capacity, rather than simply maintaining the existing runway.

Figure 2 Landing charges at Dublin Airport



Note: MTOW, maximum take-off weight.
Source: Oxera calculations using airport charge information from Dublin Airport Authority, available from www.dub.aero; airport charges valid from January 2005.

Environmental objectives

A key objective of many governments is to reduce noise and atmospheric pollution caused by aircraft when landing and taking off. Most airports following the simple average accounting cost approaches do not create incentives to reduce these environmental effects.

An example of government-led policy change is provided by the UK government's introduction of a new Civil Aviation Bill into Parliament in June 2005, which increases the powers of airport operators to levy charges relating to aircraft noise, vibrations, and atmospheric emissions. The aim of this is to make it easier for airports to encourage airlines to use quieter and less-polluting aircraft, as well as allowing them to impose financial penalties if aircraft stray from designated flight paths, causing additional noise pollution.

At present only limited use is made of charges designed to encourage quieter aircraft. One example is Zurich Airport, which levies additional charges for the noisiest classes of aircraft.

Externality-based charges may become more important in the future, particularly at airports that wish to expand, and that are required to comply with various environmental regulations. London Heathrow, for which the UK government has suggested it supports the construction of a third runway, may be a candidate for this. This is because, in order for the runway to be built, the airport and surrounding areas must comply with EU legislation on the concentration of NOx.

Resistance to change?

Many airports adopt relatively simple average-accounting cost-based charging structures at present. The discussion in this article has shown that there is considerable scope for gains by using more appropriate charging structures to incentivise:

- optimal use of scarce capacity;
- more cost-reflective charges, potentially reducing airport operating costs;
- improved environmental outcomes.

However, a key challenge to capturing these gains will be overcoming resistance from incumbent airlines, many of which may suffer financially from these new charging structures. In particular, the use of demand-management techniques is likely to be resisted. More efficient use of runway capacity will often require some airlines to reduce their operations to allow other airlines to make better use of the capacity with larger planes; alternatively, the incumbents may have to incorporate larger planes into their fleets.

Such a situation might occur at London's Heathrow Airport, which, as the world's third-busiest airport (by passenger numbers), is also one of the most congested, since it has only two main runways. In comparison, Atlanta Hartsfield, the world's busiest airport, has four runways; Chicago O'Hare, the second busiest, has six, and Tokyo Haneda, the fourth busiest, has three.[7] The airport operator might therefore be tempted to introduce fixed per-lane landing fees rather than weight-based charges, to encourage more efficient use of its runway. Were this to happen, airlines that operate relatively small planes might be forced to adjust their fleet mix—for example, bmi operates a fleet of relatively small planes at Heathrow, currently carrying around 90 passengers per flight, while the average at Heathrow is in excess of 150 per flight.[8]

Airports will continue to face a number of challenges in the coming years, and the discussion here suggests that airport charges have an important role to play in providing solutions. Similar solutions may also be relevant more broadly across other infrastructure sectors (eg, toll roads), particularly those solutions that focus on tackling congestion.

---

[1] ICAO (2001), 'ICAO's Policies on Charges for Airports and Air Navigation Systems'. ICAO is a United Nations agency which aims to standardise systems in the global aviation industry.
[2] This will not be the case for Airbus A380, which will require special 'airbridges'. Stand capacity for these aircraft will therefore be separate from that for other aircraft.
[3] Schwarz, R. (2005), 'Düsseldorf International: Development Paths for Slot-restricted Airports', presentation at the Institute of Economic Affairs Airports 2005 conference, May 5th, London. Rainer Schwarz is Managing Director of Düsseldorf International Airport.
[4] For example, the construction of Manchester Airport's second runway, completed in early 2001, cost £172m; the likely cost for T5 at Heathrow is well in excess of £3 billion.
[5] Hogan, O. and Starkie, D. (2004), 'Calculating the Short-run Marginal Infrastructure Costs of Runway Use: An Application to Dublin Airport', Chapter 5 in D. Gillen, P. Forsyth, A. Knorr, O.G. Mayer and H-M. Niemeir (eds) (2004), *The Economic Regulation of Airport*s, Ashgate.
[6] Oxera calculations using airport charge information from Dublin Airport Authority, available from www.dub.aero; airport charges valid from January 2005.
[7] *Airline Business* (2005), 'Airports: Top 100 Ranking', June, p. 60.
[8] CAA, UK Airline Statistics, 2005; www.caa.co.uk.

If you have any questions regarding the issues raised in this article, please contact the editor, Derek Holt: tel +44 (0) 1865 253 000 or email d_holt@oxera.co.uk

Other articles in the July issue of *Agenda* include:

- **financing the water industry: lessons from PR 04**
  Keith Palmer and Hannah Nixon, Cambridge Economic Policy Associates
- **over-indebtedness: what's new?**
- **supermarket price wars: is government intervention needed?**

For details of how to subscribe to *Agenda*, please email agenda@oxera.co.uk, or visit our website

www.oxera.com