



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Airport privatisation: A successful journey?

Prof Anne Graham*

University of Westminster, 35 Marylebone Road, London NW1 5LS, UK

ARTICLE INFO

Keywords:
Efficiency
Impacts
Privatisation
Regulation
Success
Airport

ABSTRACT

It is now over 30 years since the first airport privatisation occurred with BAA in the UK in 1987. Therefore, the aim of this paper is to assess the impacts of this development and evaluate its effectiveness, using examples from all over the world. It begins by considering some key issues such as the extent of government involvement; the selection of operator/investor; the choice of network/group versus individual operations; and the relevance of economic regulation. This then leads on to an investigation of measures of success, particularly in relation to efficiency and service quality. Reflecting on the privatisation journey, the paper defines key changes that have occurred concerning how privatisation is considered now compared to its early days in terms of motivation, geographical reach and type of model, investor and sale. It also highlights the importance of the regulatory and competitive environment and briefly considers the impact of the coronavirus pandemic in 2020.

1. Introduction

An increasingly important theme in airport government policy, yet nearly always controversial, is private sector involvement or privatisation. It is now over 30 years since the first airport privatisation occurred with BAA in the UK in 1987. Since then a significant number of other countries have adopted such policies, albeit that the scope and extent of private participation has varied considerably (Enrico et al., 2012; Gillen, 2011; Airports Council International (ACI, 2017a; Deloitte, 2018). The first notable wave of such changes occurred between 1996 and 2001 at a number of European airports (e.g. Dusseldorf, Naples, Rome, Birmingham and Bristol), in Australia and New Zealand, Malaysia and South Africa, and in some South and Central American countries (e.g. Argentina, Bolivia and Mexico). This was temporarily hindered by 9/11 and some other less favourable political and economic developments (e.g. SARS, the Iraq War) in the early 2000s, but by 2004, with an improved overall outlook, privatisation came back onto the agenda of an increasing number of airports or countries (such as Brussels, Budapest, Paris, Cyprus, India and Thailand). However, this second wave was subsequently slowed down by the onset of the global financial crisis and economic recession in 2008, although conversely in a few countries (such as Portugal, Spain and Greece), airport privatisation was seen as a way to raise funds to offset the large sovereign debts that had accumulated and restore some health to public sector finances. The post-recession years then saw a return to greater private participation in countries as varied as France, Japan and Brazil, but the dramatic and

rapid spread of the Coronavirus pandemic in 2020 has brought with it a huge uncertainty regarding future airport prospects.

The most recent global data for 2017 (ACI, 2018) shows that of the top 100 busiest airports for passenger traffic, 51% have some type of private sector participation. This drops to 39% for the top 500 busiest airports as it tends to be the larger airports that have experienced such changes. This also means that only around 14% of scheduled commercial airports of all size have some private participation - 614 of around 4300 airports in the world - but this represents 41% of all passengers. Substantial differences exist for world regions. Leading the way is Europe with 43% airports having some private sector involvement (representing 75% of the passenger volume) followed by Asia-Pacific (26% airports; 45% passengers) and Latin America-Caribbean (25% airports; 60% passengers). The share of airports in Africa is only 3% (11% passengers) and is similarly very low in North America (2% airports; 1% passengers) and the Middle East (1% airports; 13% passengers) (ACI, 2017).

While it is widely acknowledged that greater public sector involvement in airports is an important industry trend, it is not always clear what is meant by terms such as 'privatisation' and 'private sector participation'. There are also what is known as Private-Public Partnerships (PPPs or 3Ps) and sometimes these are considered separately from privatisation, but often the terminology is used interchangeably. For this paper PPPs are included under the privatisation definition, which should be interpreted in the broadest sense as any transfer of economic activity from the public to the private sector.

* Corresponding author.

E-mail address: grahama@westminster.ac.uk.

The motivations for airport privatisation, as with other industry sectors, are varied and complex and depend on the economic, political and air transport environment of individual countries. However, a study of a large number of privatisations discussed in the rich collection of academic literature up until 2010 identified the following six most significant objectives for airport privatisation, in order of importance (Graham, 2011): (1) improving efficiency and performance; (2) providing new investment funds, (3) improving the quality of management and encouraging diversification; (4) improving service quality; (5) producing financial gains for the public sector; and (6) lessening the public sector influence. These are clearly reflected in the stated rationale for UK airport privatisation way back in the 1980s:

'The [UK] Government is committed to converting as many as possible of Britain's airports into private sector companies as part of its policy of reducing the role of the State. The Government is confident that the privatisation of airports will bring substantial benefits. Besides reducing the size of the public sector, privatisation will assist the Government's objective of creating wider share ownership. It will also increase employee participation as, in line with previous privatisations, employees will be encouraged to buy shares at the time of sale. Privatisation will also provide for greater freedom for management. For example, airports will have access to private capital. It will also encourage more innovative management, and lead to efficiency gains and greater responsiveness to customers. These benefits will have profound consequences for the future operation of airports in Britain.' (Department of Transport, 1985).

Such factors have continued to be significant drivers. As already identified after the global recession of 2008 for some struggling governments in Europe, 'producing financial gains for the public sector' became the overriding objective in order to lessen public debts – a prime example being Portugal (Cruz and Sarmiento, 2017). As the privatisation trend has continued, more generally there appears to have been a movement away from key political and ideological arguments, such as looking to the private sector as a means of addressing public sector inefficiencies and raising quality levels, with a shift towards more pragmatic considerations, such as a need for new capital for investment or additional government income by selling off airports or granting airport concessions.

The aim of the paper is to assess the 'successfulness' of this 30+ year airport privatisation journey by synthesising previous research of many different countries and regions. The definition of successfulness has been kept intentionally vague so that a number of different aspects of airport performance can be considered. The paper is based on the Martin Kuntz Memorial Lecture given by the author at the European Aviation Conference in Athens in 2018. It begins by considering some key issues such as the extent of government involvement; the selection of operator/investor; the choice of network/group versus individual operations and the relevance of economic regulation – arguably with the level of controversy associated with each of these rising in turn. This then leads on to an investigation of measures of success, particularly in relation to efficiency, service quality and commercial revenues, before the paper concludes.

2. Key issues related to airport privatisation

2.1. The extent of government involvement

One of the noticeable developments through the years has been the emergence of a whole range of different types of privatisation which have been applied depending on the government's objectives, and the specific circumstances and requirements of the airport. A popular model in the early stages of privatisation was a share flotations/initial public offering (IPO) or equity market issue. 'Listed' airports appeared in Europe - BAA (1987), Vienna (1992), Copenhagen (1994), Zurich (2000), Fraport (2001) and Paris (2005) - but also elsewhere such as in Auckland (1998), Malaysia (1999) and Thailand (2004). However, in the last ten years or so, with the exception of the IPO of Aeropuertos

Espanoles y Navegacion Aerea (AENA) in Spain in 2015 and a couple of smaller airport operators, such models have largely been abandoned in favour of other approaches. A model that has maintained a more consistent popularity over the years is the trade or freehold sale (or very long lease) to a single or more commonly a consortium of investors. This has been used extensively for UK regional airports, other European airports (e.g. Dusseldorf – 1998, Turin – 2000, Rome – 2000, Malta – 2002, Milan – 2011, Toulouse – 2015, Lyon – 2016) and elsewhere (e.g. South Africa – 1998, Wellington – 1998, Sydney - 2002).

Whilst these two divestiture models have had a major impact in changing the nature of the international airport industry, an equally important development has been the use of a concession or PPP type approach (Cruz and Marques, 2011) which transfers management to the private sector for typically a 20–30 year period, but importantly the government retains ownership. This has often been used in developing or emerging economies such as Lima (2000), Montego Bay (2003), Delhi/Mumbai (2006) and Brasilia/Sao Paulo (2012) although not exclusively as other examples include London Luton (1998), Zagreb (2012), ANA in Portugal (2013) and Kansai (2015). A special type of concession agreement has been used, known by the generic term Build Operate Transfer (BOT), when substantial new investment is needed, for example a greenfield airport or new terminal. Again, this approach has tended to be favoured in emerging economies (but not always) where higher growth is predicted, necessitating expanded infrastructure. Examples include Ankara (2003), Hyderabad/Bengaluru (2004), Larnaca/Paphos (2005), Varna/Burgas (2006), Madinah (2012) and the new Istanbul airport which opened in 2018. Due to the growth in popularity of the PPP model according to ACI, 2017 in 2016, it accounted for around 41% of all airport privatisations with trade sales and share flotations representing a further 23–24% each.

However, in reality this paints rather too simplistic a picture of how the airport industry has evolved, as through time variations within each model have emerged and been moulded to suit specific needs. Arguably it is now more appropriate to consider a continuous spectrum of airport ownership and operating models, with government owned at one end, privately-owned or operated at the other end, and government-owned with private sector participation in the middle (Deloitte, 2018). Chaouk et al. (2019) argue that cultural dimensions, human resources strategies and administrative governance issues in addition to the very specific nature of the social-political environment are all factors that need to be considered in privatisation transactions. The extent of government control and whether ownership is handed over fully or partially to the private sector naturally tends to be a very controversial decision and reflects the broader national and political systems that are in place (Brutsch, 2013). An important consideration is that airports can be viewed as strategic and vital national/regional assets, that have both economic benefits and environmental costs to the communities they serve. Inevitably the private and public sectors will have different motivations in managing airports. Thus, privatisation decisions involve the government weighing up their influence over strategic planning decisions against the obligations and risks of ownership, and the benefits to be gained by totally devolving operational and financial responsibilities to the private sector.

The PPP approach with the government maintaining ownership has become a popular means by which to spread the risks between the private operator and government, but the concessions contracts are complex, and experience over the years has shown that achieving favourable outcomes for governments, the operator and users is an extremely challenging task (Deloitte, 2018). Decisions also have to be made in relation to whether the operator of the airport (with a PPP or any other type of privatisation) is fully or just partially privately owned (either majority or minority) when not all control is relinquished to private operators (Albate et al., 2014). In many of the minority private cases the private sector will primarily just act as a provider of a source of capital. Interestingly within Europe there is a stark contrast where in the UK there are many fully privately-owned airport operators (Ison et al.,

2011; Graham, 2008) whereas in continental Europe, partial private ownership is more the norm (ACI Europe, 2016). Overall, in Europe 25 per cent of airports are owned by mixed public–private shareholders compared with just 16 per cent that are fully privatised, with the rest being under public control (ACI Europe, 2016). A similar situation exists globally in relation to the top 20 airport operators with private participation in the world, where only eight are fully private companies (Table 1).

2.2. The selection of the operator/investor

One of the most significant outcomes of privatisation has been a shift from a national to global airport industry with international investors and expertise (Forsyth et al., 2011). In the early stages of privatisation investors were typically established airport operators (keen to expand their scope of operations beyond traditional national boundaries, make gains from horizontal integration and share their expertise at less developed airports) or international infrastructure companies, whereas airport privatisations are now dominated by international funds from financial institutions such as infrastructure funds, pension funds, insurance funds and sovereign wealth funds (Condie, 2015; Rikhy et al., 2014). Most of these funds are interested not just in airports but in most types of infrastructure assets, and so tend not to have the same degree of allegiance to the airport business as with some of the earlier investors. In essence, this demonstrates a movement away from airports being considered specialist assets to more mainstream infrastructure investments. This is also reflected in a growth of secondary sales and transactions that have been experienced in Europe and elsewhere. The

Table 1
Top 20 airport operators with private participation in 2018.

World ranking by revenue (2018)	Airport operator	Country	2018 Revenues (\$US mn)	Private share
1	Aéroports de Paris (ADP)	France	5270	Partial
2	AENA	Spain	5088	Partial
3	Fraport	Germany	4093	Partial
4	Heathrow Airport Holdings	UK	3945	Full
8	Japan Airport Terminal	Japan	2464	Full
11	New Kansai International Airports Company	Japan	2249	Full
12	Airports of Thailand	Thailand	1924	Partial
16	Beijing Capital International Airport Group	China	1698	Partial
19	TAV Airports	Turkey	1430	Full
20	Shanghai Airport Authority	China	1403	Partial
23	Aéroporti di Roma	Italy	1208	Full ^a
24	Malaysia Airports Holdings Berhad	Malaysia	1202	Partial
25	Flughafen Zürich AG	Switzerland	1180	Partial
26	Sydney Airport	Australia	1178	Full
27	Guangzhou Baiyun International Airport	China	1167	Partial
28	Manchester Airports Group	UK	1163	Partial
31	Gatwick Airport	UK	1060	Full
33	ANA – Aeropostos de Portugal	Portugal	995	Full
34	Flughafen Wien AG	Austria	941	Partial
37	SEA Group	Italy	839	Partial

^a < 1% public.

Source: Compiled by author from Airline Business (2019) and Graham (2018).

appeal of airport assets is linked to them generally being long life assets with relatively low demand risk and high growth potential, stable and predictable cash flows, and with a diverse range of revenues from both aeronautical and non-aeronautical sources.

Table 2 shows that some of the existing investors can be traced back to the first surge of airport privatisation in the late 1990s. At the same time, others – particularly the traditional airport operators - have now ceased or scaled down their international involvement. For example, this has been the case with Heathrow Airport Holdings (formerly BAA) which pulled out of all its international activities by 2008 to focus on its UK airports, especially Heathrow. UK transport operators such as Stagecoach and National Express also sold their interests in UK airports around the turn of the century to concentrate on other activities, suggesting that perhaps the synergies from airport operations which these transport operators had hoped for were not as significant as was first thought. Moreover, a few investors have been partially or fully acquired by others. For example, Hochtief AirPort, a subsidiary of the international construction service provider Hochtief, was sold off to AviAlliance in 2013 (a subsidiary of the Public Sector Pension Investment Board) to reduce Hochtief’s debts and to focus on the core activities of construction, services and maintenance. Similarly, Abertis, the world’s largest toll road operator, discontinued its Airports Division in 2013 to focus on its core business.

At the same time there has been the development of specialised airport management companies in their own right, such as TAV and Corporación América Airports. Excluded from the table are the many pure financial investors who typically do not contribute to the day-to-day management of the airports, but view airports as attractive investments. Airlines, who might have a motive for being involved to influence operational or investment decision, have been markedly absent in such investment with a few exceptions, most notably Lufthansa with Fraport (8.4% share) and Munich (joint ownership/operations of T2).

Over the years the nature of the airport investor has changed and certainly will continue to do so in the future. The number of significant

Table 2
Major international airport operators/investors in 1998, 2008 and 2018.

1998	2008	2018
AENA	AENA	AENA
Aeroporti di Roma	Aéroports de Paris	Aéroports de Paris
Aéroports de Paris	Aer Rianta/DAA	Aéroports de Paris
Aer Rianta/DAA	TBI (acquired 1999)	
AGI	Amsterdam/Schiphol	Amsterdam/Schiphol
Amsterdam/Schiphol	BAA	
BAA	Copenhagen Airports	Copenhagen Airports
Copenhagen Airports	Frankfurt/Fraport	Frankfurt/Fraport
Frankfurt/Fraport	Manchester Airport/MAG	Manchester Airport/MAG
Manchester Airport/MAG	National Express	
National Express	SEA Aeroporti de Milano	SEA Aeroporti de Milano
SEA Aeroporti de Milano	Abertis (acquired 2005 ^b)	
TBI	Vancouver Int’l Airport Authority/Vantage	Vancouver Int’l Airport Authority/Vantage
Vancouver Int’l Airport Authority/Vantage	Flughafen Wien	Flughafen Wien
	Ferrovial	Ferrovial
	Houston Airport System/Airports Worldwide	Vinci (acquired 2018)
	Hochtief AirPort	AviAlliance (acquired 2013)
	Infratil	
	MAp	
	Malaysia Airports	Malaysia Airports
	TAV Airports	TAV Airports
	Zurich	Zurich

Note: Other key operators/investors in 2018 include Changi, GMR Airports, Corporación América Airports; grey boxes indicate where organisations are no longer active in international airport operations.

^a 10% AENA.

Source: Compiled by author from Airline Business and various other sources

players has increased dramatically - CAPA Centre for Aviation has identified over 50 'Major Global Investors (MGIs)' who have an interest in at least five airports, of which at least one is foreign. Given the wide range of investors involved, the relative successfulness of the different types of operators/investor is extremely difficult to gauge and is very much dependent on airport specific circumstances and external factors. Many decisions will be highly political, such as choosing local partners and international airport expertise that may be more acceptable than selecting foreign financial owners. The different stages of an airport's lifecycle will also influence the type of investor. Various sorts of airport investments are better suited to certain types of operators/investments. For example, in [Condrie's \(2015\)](#) view, different investors focus on airport assets in the following ways: Sovereign wealth funds - highest quality airports taking minority stakes; pension funds and insurance companies - larger airports with low traffic risk and well-defined markets, infrastructure funds - possibility of more niche markets because of the shorter time horizons; airport companies - airports outside Europe where risks are too high for financial investors; construction companies - involvement only in PPP consortia (to help manage the construction risk).

2.3. The choice of group versus individual operations

Another key issue when there is more than one airport to be privatised is whether the airports should be sold individually/independently or as one entity. This may be particularly relevant if there is some type of airport network arrangement - [ACI, 2017](#) estimates that globally this is the situation in 69% of countries. Often within an airport group there will be one or a few large international airports that are profitable, and clusters of small regional or local airports that are not. As a consequence, the profits from the large airports may cross-subsidise the loss-making airports and so the smaller airports on their own may appear very unattractive for privatisation. Arguably, other potential benefits of group operations also exist, such as the ability to share resources and expertise, reduce costs due to scale effects, and adopt a strategic and co-ordinated approach to airport development. Selling airports as a group may enhance the financial benefits for the government.

On the other hand, group operations may seriously inhibit competition, giving the airports lower incentives to compete among themselves, as users may have little choice but to use one of the group airports. It may reduce service quality levels, discourage investment at certain airports (particularly if there is spare capacity elsewhere) and lessen the ability of management to innovate and react to the needs of individual airport users, as operators instead try to co-ordinate the activities of the different airports to maximise profits. Thus, if airport groups are privatised without being restructured or split up, some of the potential benefits of privatisation for the users may, arguably, not be achieved. Such airport groups do not necessarily have to be large in number, as similar arguments can apply to just a pair of airports serving major urban centres, especially if they share the same catchment areas and abuse of market power is potentially an issue.

In practice, governments have adopted different approaches as can be seen from [Table 3](#). For example, in Portugal ([Marques, 2011](#)) and Argentina ([Lipovich, 2008](#)), as well as Spain, the group operation was maintained whereas in Australia the main airports were privatised individually with limits on multiple investments. The group structure in the cities of Paris, Rome and Milan has been maintained. In Brazil ([Neto et al., 2016](#)) and India, the largest airports within the respective airport system were originally privatised individually as concessions/BOTs with cross-ownership restrictions. However, in the 2017 round of issuing concessions in Brazil, the rule was relaxed and Fraport took control of two of the four airports. Subsequently 12 Brazilian regional airports were sold in three separate lots in 2019. Mexico adopted a half way approach, dividing the airports into five different smaller groups with a mixture of small and large airports in each group, three of which were privatised with cross-ownership restrictions between the groups

Table 3
Examples of airport group privatisations.

Original government owned airport group	Privatisation date	Privatisation approach
UK - British Airports Authority (BAA): 3 London and 4 Scottish airports	1987	Group privatisation by share flotation but the group was required to be split up in 2009.
Australia - Federal Airports Corporation (FAA): 22 main airports	1997-1998 and 2002 (Sydney)	Individual privatisation with long-term leases with multiple ownership restrictions.
Rome - Aeroporti di Roma: Ciampino and Ciampino airports	1997	Group privatisation with a partial share flotation.
Argentina: 33 main airports	1998	Group privatisation with a concession.
Mexico: 58 main airports	1998	Five smaller groups (one large/few smaller ones each). Three privatised through a concession approach with subsequent flotation.
India - Airport Authority of India (AAI): 92 main airports	1999 (Cochin), 2004 (Bengaluru and Hyderabad), 2006 (Delhi and Mumbai).	Individual concession/BOT privatisations, AAI operates remaining airports.
Paris - ADP: 3 Paris airports and others	2006	Group privatisation with a partial share flotation.
Italy - SEA Milan: Malpensa and Linate airports	2011	Group privatisation with a partial trade sale.
Brazil - Infraero: 67 main airports	2012 (São Paulo-Guarulhos, São Paulo - Viracopos, Brasília), 2013 (Rio - Galeão, Belo Horizonte - Confins), 2017 (4 main airports), 2019 (12 regional airports).	Individual concession/BOT privatisations, Infraero operates remaining airports.
Portugal - ANA Aeroportos de Portugal: 9 main airports	2013	Group privatisation with a concession.
Spain - Aeropuertos Espanoles y Navegacion Aerea (AENA): 46 airports	2015	Group privatisation with a partial share flotation.

Source: Compiled by author from [Graham \(2018\)](#).

([Galeana, 2008](#)).

Whilst unique and complex local factors influence each decision identified in [Table 3](#), the case of the UK BAA airports does throw some light on this issue. BAA (operator of London Heathrow, Gatwick and Stansted, and four Scottish airports) was privatised in 1987 as a single entity - a decision that was fiercely opposed by some:

Group privatisation would 'merely replace a public sector organization by a private sector one' ... 'Competitive privatization of airports would result in an increase in competition, more consumer choice, more competition in the provision of services ..., increased managerial efficiency and better investment decisions'

([Barett, 1984](#)).

'...privatising the BAA in its present form has few advantages and would fail to deal adequately with the real problems. Increasing competition is the most effective way of improving performance'

([Starkie and Thompson, 1984](#)).

The UK government, however, was not convinced with these arguments. This remained a controversial issue until eventually the UK competition authority (the Competition Commission) concluded that common ownership of the airports in South-East England and Lowland

Scotland gave rise to adverse effects on competition (Competition Commission, 2009) and BAA was then required to divest some of its airports; completing its sale of Gatwick in 2009, Edinburgh in 2012 and Stansted in 2013. In 2016, the successor to the Competition Commission, the Competition and Markets Authority (CMA), undertook a detailed assessment of the effects of such divestment (CMA, 2016). It identified a number of factors that indicated increased competition at the three airports since divestment, such as greater passenger growth, more competitive airport charging, and increases in capital investment, operational efficiency and service quality levels. Similar evidence was found specifically for the Scottish market (Pagliari and Graham, 2019). This suggests that group operations may inhibit the benefits of privatisation and that having the right industry structure and competition is essential.

2.4. The relevance of economic regulation

Arguably the most controversial issue related to privatisation is economic regulation. Previously when most airlines and airports were under public ownership and strict government control, formal economic regulation was generally considered unnecessary because any issues related to market failure could be dealt with directly by governments in their role as suppliers within the industry. Airport charges were often simply set on a cost-plus basis. However, since privatisation has become a popular trend in both the airport and airline industry, this traditional supplier-consumer relationship has been fundamentally transformed. As a result, governments have felt the need to intervene to correct market failure by using economic regulation, especially at many of the larger privatised airports.

The types of regulation, regulatory till (i.e. single versus dual till) and detailed mechanisms vary considerably. The UK paved the way by adopting an incentive-based price cap for BAA and a number of other countries such as France, Hungary, Spain, Portugal, India and South Africa adopted fairly similar price cap or revenue cap mechanisms for their privatised airports. By contrast the privatised Brussels airport follows a cost based (rate of return) system (Kupfer et al., 2013), which also now appears to be the case at Hamburg airport (and at the partially privatised Frankfurt airport) (Steer Davies Gleave, 2017) after a shift from a price cap (with traffic sharing mechanism) that was used in earlier years after privatisation in 2000 (Niemeier, 2002). In a few cases a more light handed approach has been adopted, for example at Copenhagen airport when it was first privatised in 1994, or has subsequently been introduced after a period of heavy handed price cap regulation in Australia in the early 2000s (Forsyth, 2008) and most recently at Gatwick airport in 2014 (Littlechild, 2018).

There has been considerable research concerning the merits and drawbacks of different regulatory approaches and it is not the intention to revisit any of this. The key issue here when considering the successfulness of privatisation, is that it is very difficult to isolate this development without taking into account the regulatory context. Varying regulatory approaches have different impacts on efficiency levels. Moreover, some privatised airports (e.g. Heathrow, Paris, AENA, ANA and India) under incentive regulation are subject to service quality targets to ensure that airports are not incentivised to cut costs by reducing the quality of service. Likewise, the regulatory system can have an impact on optimal investment (cost based potentially leading to over investment, incentive based potentially leading to under investment) and certain airports (e.g. Heathrow) have specific requirements within their regulatory framework to ensure that the investment is as planned. Ideally governments should investigate the existence of significant market power at each airport and gain a full understanding of the extent of airport competition before deciding which airports needs regulation at the privatisation stage but this has rarely happened.

Thus, the simple point being made here is that with any assessment of the impact of privatisation on airports, the effects of regulation and competition must be considered at the same time. It may well be that the

regulatory system might inhibit some of the benefits that privatisation could bring or have a much greater impact on performance than privatisation itself. Likewise, the level of competition that exists is important, as it may be a much more powerful influence. This also links back to the discussion about group versus individual operations. Privatisation of airports through restructuring or dismantling airport groups may bring possibilities to encourage competition, where maintaining the group structure could merely transfer a public monopoly to a private monopoly, thus reducing any incentives to become more efficient, and increasing incentives under private operation to exploit market power (Frontier Economics, 2020).

3. Measures of success

Having identified some key issues related to airport privatisation, its successfulness will now be assessed. At a basic level, there is ample proof to show that BOT privatisations and other models have enabled substantial new investments to be made which otherwise may not have occurred when there was public sector control. However, there is also strong evidence to demonstrate that the actual privatisation process has not always been successful. This has arisen for a number of different reasons, such as conflicts that have occurred between governments and the new private operator and the enforcement of the terms of privatisation agreements; problems related to the selection of the most suitable investor; or inappropriate/unrealistic estimations of passenger airline demand and the financial situation. For example, there was the unilateral cancellation of the agreements by the government at Budapest and Male airports. At Manila airport in the Philippines, Fraport was involved with a privatisation project which led to a complex and extended dispute with the Philippine government, whereas in Berlin, there were several separate attempts to use private investors to develop a new airport to serve the city until this approach was abandoned following a number of legal challenges. Elsewhere in Toronto, Stewart and Costa Rica the airport (or privatised facilities) have been sold back to the airport operator or there has had to be a renegotiation of existing agreements, as at Quito airport and in Argentina. In the US, there were two attempts to privatise Chicago Midway airport – one failing because of an inability to secure the required financing and the other because one of the two final bidders dropped out. In Spain, originally there were plans to privatise Madrid and Barcelona airports as concessions, but this faced fierce opposition and so instead the group AENA was partially privatised. There are also a few cases of airports actually being renationalised – the UK being a prime example where both Cardiff and Prestwick airports are now back in state ownership.

Delving more deeply, one of the most frequently studied success measures relates to whether privatisation improves operating performance, particularly efficiency. Some of the key results from previous research are summarised in Table 4. The studies here range from considering individual airports, separate countries or the global situation and so a very diverse set of cases is being assessed.

As regards efficiency levels, generally the results are inconclusive with some studies finding no statistical link between privatisation and efficiency whereas others have observed a positive relationship (or even negative one). However, there are three key factors to note. First a number of different methodologies and datasets have been used and so there is no consistency. Second when looking at longitudinal studies, the extent of any efficiency gains will depend very much on the situation beforehand when the airports were state owned. Third, when looking at cross-sectional public vs private airport studies, in many cases it is likely that the best performing airports will have been picked for privatisation as these will be attractive to investors. Hence an identification of the 'more efficient' private airports may merely reflect that these airports are inherently more efficient.

In relation to the discussion above regarding the extent of government involvement, some of the results related to mixed ownership, or partial versus total privatisation, are worthy of a mention. While the

Table 4
The impacts of privatisation on economic performance as identified in selected research literature.

Parker (1999), Oum et al. (2003), Holvad and Graham (2004), Vasigh and Gorjidoz (2006), Lin and Hong (2006), Barros (2009), Barros and Weber (2009), Ahn and Min (2014), Tsui et al. (2014), Vasign et al. (2014)	No impact on efficiency
Vogel (2006), Barros and Dieke (2007), Assaf (2010), Botasso and Conti (2012), Perelman and Serebrisky (2012), See and Li (2015), Marques et al. (2015), Chen et al. (2017), Olariaga and Moreno (2019)	Positive impact on efficiency
Curi et al. (2010), Gutiérrez and Lozano (2016)	Negative impact on efficiency
Oum et al. (2006), Oum et al. (2008), Curi et al. (2010), Adler and Liebert (2014)	Public majority ownership is less efficient than private majority ownership.
Assaf and Gillen (2012)	Private involvement has positive impact on efficiency, but regulation rather than ownership is the key performance driver.
Adler and Liebert (2014)	Public airports operate less efficiently than fully private airports in relatively non-competitive conditions, but there no impact in a competitive setting.
Bel and Fageda (2010)	Non-regulated private airports charge higher prices than public or regulated airports.
Rolim et al. (2016), Aguirre et al. (2019)	Privatisation has caused traffic growth

literature has tended to not pay enough attention to this model (Albalade et al., 2014) the limited evidence (Oum et al., 2006, 2008; and Adler and Liebert, 2014) indicates that the incentives for efficiency are weaker under partial privatisation with a minority private share. This may reflect the role of the private sector in being merely a source of capital and with the government maintaining strong control of the airport management and operations, but it may also be as a result of the conflicting objectives that may occur with such public-private partnerships.

Also, as argued above, it is important to consider economic regulation and competition when assessing whether privatisation promotes airport efficiency. In earlier research the effects tended to be examined independently but more recently these have been investigated together. Indeed Assaf and Gillen (2012) found that it was regulation rather than ownership that is the key driver of performance, Adler and Liebert (2014) observed that private versus public performance varied according to the level of competition, and Bel and Fageda (2010) found that privatised airports had higher aeronautical fees than public ones, but only when not regulated. Finally, in connection to traffic and competition, it is interesting that both Rolim et al. (2016) and Aguirre et al. (2019) all observed higher traffic volumes after privatisation which Rolim et al. argued could be as the result of privatised airports being more effective in producing routes developments strategies, such as route support and risk sharing with existing and new airlines.

Another success factor frequently discussed is whether privatised airports enhance service quality levels. This is a different issue to explore, especially because of the highly subjective nature of service quality and lack of detailed publicly available datasets on comparative service quality. As a result, very little research concerning this issue could be reviewed but instead a basic snapshot of the situation, similar to that undertaken by Poole (2019), has been provided by making a comparison with Skytrax quality rankings, which are the most widely used rankings in the public domain. Table 5 shows that only nine out of top 20 Skytrax airports in 2018 had some private involvement in 2018, although Table 6 indicates that 13 out of the top 20 airport operators with private involvement featured in the top 100 Skytrax rankings. This does not present a convincing picture as to whether private airports

Table 5
Skytrax top 20 rankings 2018.

1. Singapore	11. Tokyo Narita
2. Incheon	12. Amsterdam
3. Tokyo Haneda	13. Kansai
4. Hong Kong	14. Vancouver
5. Doha	15. Taiwan Taoyuan
6. Munich	16. Helsinki
7. Central Japan	17. Vienna
8. Heathrow	18. Shanghai Hongqiao
9. Zurich	19. Copenhagen
10. Frankfurt	20. Sydney

Note: Airports with private involvement are shown in italics.
Source: Skytrax (2019)

perform better or worse.

Finally, it is often argued that airport privatisation may lead to a growth in non-aeronautical or commercial revenues, with private operators more able to foster this type of business. There is some anecdotal evidence to support this view, even suggesting that some privatised airports have become no more than ‘shopping malls with runways’. However, robust empirical research is harder to come by. It is also difficult to disentangle this from general trends that saw a growth of non-aeronautical revenues, especially in the 1990s as commercial space expanded and non-aeronautical services were developed and diversified, but have latterly presented a more challenging picture as airports face greater competition from on-line services, heightened security controls and more mature, demanding passengers. The regulatory framework, particularly in terms of whether there is a single or dual till, will also have an impact. A rare commercial revenues study by Fuerst and Gross (2018) of 75 airports in 30 countries does find that state run and partially privatised airports appear to generate a significantly smaller share of commercial sales than fully privatised airports, although the authors do note that the sample size used to explore this specific relationship was comparatively small.

4. Discussion and conclusions

Table 7 summaries the main changes that have occurred from the start of the unique privatisation journey to the current situation by considering motivation, geographical reach and type of model, investor and sale. Such developments have transformed the structure of the global airport industry and have led to the emergence of multi-airport

Table 6
Position of top 20 airport operators with private involvement within Skytrax top 100 rankings 2018.

Top 20 airport operators	Skytrax 100 rankings
1. AENA	42 (Barcelona); 43 (Madrid)
2. Aéroports de Paris	37
3. Heathrow Airport Holdings	8
4. Fraport	10
5. Japan Airport Terminal	3 (Haneda)
6. New Kansai International Airports	13
7. Airports of Thailand	36 (Bangkok)
8. Beijing Capital International Airport	33
9. TAV Airports	Not in ranking
10. Shanghai Airport Authority	18 (Hongqiao)
11. Sydney Airport Group	20
12. Aéroporti di Roma	85
13. Manchester Airports Group	Not in ranking
14. Malaysia Airports Holdings Berhad	44 (Kuala Lumpur)
15. Flughafen Zürich AG	9
16. Gatwick Airport	54
17. Guangzhou Baiyun International	Not in ranking
18. ANA – Aeroportos de Portugal	57 (Lisbon)
19. Flughafen Wien AG	17
20. GMR Airports	66 (Delhi)

Source: Skytrax (2019)

Table 7
Summary of key changes during the airport privatisation journey.

	Beginning of journey	Current situation
Nature of airport industry	National	Global
Main motivations for privatisation	Efficiency, investment	Investment, government income
Main privatisation model	IPOs, trade sales	PPPs
Main investors	Airport operators	Financial investment funds
Main type of sale	Primary	Primary and secondary
Main areas for primary sales	Developed economies	Emerging economies

international companies. The focus has been on the key economic and financial impacts of privatisation without considering in any detail the user, societal or environmental impacts which could be topics of future research.

If successfulness is measured in simple operating efficiency terms, the paper has not provided conclusive evidence for the superiority of private management over public management. However, arguably it is now the need for investment capital or additional government income that are more important drivers of privatisation than efficiency. It is certainly very evident that BOT privatisations and other models have enabled substantial new investments to be made which otherwise may not have been made when there was public sector control. However, the extent to which privatised airports are more capital efficient in terms of providing optimal investment is an issue which has rarely been assessed. Firm conclusions regarding the impact on service quality can also not be drawn.

This paper has suggested that there are some key factors that are inhibiting the achievement of some privatisation outcomes that might be expected. The first factor relates to the extent of government control. The available research evidence (albeit quite limited) suggests that a mixed model, with minority private ownership, which is the common situation in continental Europe, is the least successful situation. The second factor relates to airport groups. If these are privatised as a single entity with no restructuring as has happened with a number of cases, any possible benefits of privatisation could well be significantly weakened by the lack of competitive forces. The evidence in the UK, where the restructuring and introduction of competition came about a long time after the original privatisation, appears to confirm this. This also relates to the last factors, namely regulation and/or competition in general, which, according to some evidence, matters much more than privatisation when considering efficiency. So, more focus on governance and institutional structures in addition to privatisation could potentially yield more insight.

Of course, relevant stakeholders (governments, airports, airlines, employees, shareholders, residents etc) will give different priorities to alternative measures of success relative to their own roles and perspectives. Arguably, the most publicly aired divergent views are associated with the opinions of the airports versus the airlines. Whilst officially both the International Air Transport Association (IATA) and ACI have stated that they have a neutral view on privatisation, agreeing that there is a no-one-size-fits-all solution for all the ownership models that exist, there is considerable divergence concerning the benefits that privatisation has brought and whether it presents opportunities or threats in the future. Such conflicting views have been around since the start of the airport privatisation journey. Indeed, a few years after the first key wave of privatisation was experienced in the late 1990s, their opposing views were clearly expressed:

‘There are skeptics who say that privatisation is driven by the needs of short-term financial results in a business that must plan for the long-term. But in practice, this would lead to underinvestment, and the evidence is, on the contrary, that privatised airports indeed do invest heavily in infrastructure to meet future demand and ensure customer service levels’

(ACI, 2008)

‘Success must be measured not just by the maximisation of revenues from an airport sale, but by whether privatisation has delivered a cost-effective service of an appropriate quality for the travelling public. The record with airport privatisations as with other infrastructure industries is often disappointing.’

(IATA, 2005)

Moreover, in the last few years the debate has become more heated and intense, with both the airlines and airports going to some length to make their divergent views heard (e.g. see ACI, 2017/2018a; IATA, 2019 and Deloitte, 2018/2018b):

‘Private investment in airports ... has proven to help deliver strong traffic growth, significant increase in capital expenditure, and improvement in service quality in airports around the world’

(ACI, 2018)

‘There is a global need to finance new airport infrastructure to meet future demand and if government spending cannot be relied upon as it has been in the past then there is ample evidence of the value created by private investment in airports around the world’

(ACI, 2018)

‘But it is wrong to assume that the private sector has all the answers. Airlines have not yet experienced an airport privatization that has fully lived up to its promised benefits over the long term ... IATA research shows that private sector airports are more expensive. But we could not see any gains in efficiency or levels of investment. This runs counter to the experience of airline privatization where enhanced competition resulted in lower pricing to consumers’

(IATA, 2018).

Nevertheless, despite the lack of consensus between these two stakeholders and others, the privatisation journey is by no means over. Up until the end of 2019, the outlook for airport privatisation deals and further secondary transactions was looking positive with relatively strong traffic growth being forecast, a growing need for capital investment in the industry and increased pressures on government finances. In Europe, for example, airport transaction multiples had risen to average 22x in 2016–2018 compared with 15x in 2013–2015 (PWC, 2019). The appetite for airport privatisation was clearly still present, even though the list of potential investors was somewhat different from that in earlier years, with some operators having abandoned their involvement (often due to the need to focus on core activities - either within or outside the airport industry - or to generate funds to reduce debt), and with some investment funds having shifted their preference to other infrastructure projects.

However, all this dramatically changed with the coronavirus pandemic in 2020, that has had a severe unprecedented impact on the entire international air transport industry, causing airport revenues from both aeronautical and non-aeronautical to fall sharply or disappear altogether. As a result, currently airport investment no longer looks low risk, capable of producing steady returns with proven longevity, and this casts considerable doubts as to whether the private sector will be confident or willing to further invest in the industry. In the early months of 2020, share prices of many listed airports fell up to 50% to reach an all-time low around mid-March (CAPA, 2020). They have recovered somewhat but have not reached their pre-coronavirus levels, although to a certain extent this has just mirrored what has happened generally on the stock exchange. The credit rating of certain airports has also been downgraded.

At the time of writing in Summer (2020), airports and governments quite clearly have different priorities, and a number of privatisation

deals or secondary transactions have been delayed or suspended. This is affecting airports of all sizes. For example, at one extreme the controversial sale of the remaining government 50.8% share of the large Paris airport company ADP was suspended indefinitely, whereas the sale of 25% of London's smallest airport in Southend by Stobart to AviAlliance was also stopped. There is huge uncertainty over airport sales that were planned in countries such as Brazil, India, the Philippines, Rwanda, Uzbekistan, Kazakhstan and Ukraine (CAPA, 2020). However, a few planned privatisations, such as in Japan and Kazakhstan seem set to go ahead. Moreover, the sale of 49% of GMR Airports, a subsidiary of the large Indian company GMR, with interests in Delhi and Hyderabad airports as well as a number of international ones, was completed in July 2020 to ADP, primarily to reduce debt in the parent company.

In the long-run, the air transport industry has always been fairly resilient in bouncing back after a crisis, although the scale of COVID-19 problem is something never previously experienced. In spite of the huge uncertainty over future traffic levels, the need for airport investment – a key motivation for airport privatisation – will remain, and governments will certainly be in a much worse situation to provide financial and funding support themselves. Thus, we may very well return to an environment again where airports are recognised as relatively safe long-term investment assets, but it may well take a few years to revert back to this situation.

Author statement

This paper is entirely the work of the single author Prof Anne Graham.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jairtraman.2020.101930>.

References

- ACI, 2008. A Global Industry. ACI, Montreal.
- ACI, 2017a. Airport Ownership, Economic Regulation and Financial Performance. ACI, Montreal.
- ACI, 2017b. Airport Networks and the Sustainability of Small Airports. ACI, Montreal.
- ACI, 2018a. Creating Fertile Grounds for Private Investment in Airports. ACI, Montreal.
- ACI, 2018b. Privatization Has Proven Successful in Developing Airport Infrastructure to Cope with Traffic Growth press release 18 September. Available at: <https://aci.aero/news/2018/09/18/privatization-has-proven-successful-in-developing-airport-infr-astructure-to-cope-with-traffic-growth/>. (Accessed 1 October 2018).
- ACI, 2018c. Privatization Can Provide a Viable Solution to Global Airport Infrastructure Gap, press release 19 June. Available at: <https://aci.aero/news/2018/06/19/privatization-can-provide-a-viable-solution-to-global-airport-infr-astructure-gap/>. (Accessed 1 October 2018).
- ACI Europe, 2016. The Ownership of Europe's Airports 2016. ACI Europe, Brussels.
- Adler, N., Liebert, V., 2014. Joint impact of competition, ownership form and economic regulation on airport performance and pricing. *Transport. Res. Pol. Pract.* 64, 92–109.
- Aguirre, J., Mateu, P., Pantoja, C., 2019. Granting airport concessions for regional development: evidence from Peru. *Transport Pol.* 74, 138–152.
- Ahn, Y.H., Min, H., 2014. Evaluating the multi-period operating efficiency of international airports using data envelopment analysis and the Malmquist productivity index. *J. Air Transport. Manag.* 39, 12–22.
- Albalade, D., Bel, G., Fageda, X., 2014. Beyond pure public and pure private management models: partial privatization in the European airport industry. *Int. Publ. Manag. J.* 17 (3), 308–327.
- Assaf, A.G., Gillen, D., 2012. Measuring the joint impact of governance form and economic regulation on airport efficiency. *Eur. J. Oper. Res.* 220 (1), 187–198.
- Barrett, S., 1984. Airports for Sale. The Case for Competition. Adam Smith Institute, London.
- Barros, C., 2009. The measurement of efficiency of UK airports, using a stochastic latent class frontier model. *Transport Rev.* 29 (4), 479–498.
- Barros, C., Dieke, P., 2007. Performance evaluation of Italian airports: a data envelopment analysis. *J. Air Transport. Manag.* 13 (4), 184–491.
- Barros, C.P., Weber, W.L., 2009. Productivity growth and biased technological change in UK airports. *Transport. Res. E Logist. Transport. Rev.* 45 (4), 642–653.
- Bel, G., Fageda, X., 2010. Privatization, regulation and airport pricing: an empirical analysis for Europe. *J. Regul. Econ.* 37 (2), 142–161.
- Bottasso, A., Conti, M., 2012. The cost structure of the UK airport industry. *J. Transport Econ. Pol.* 46 (3), 313–332.
- Brutsch, U., 2013. International airport management: the government perspective. *J. Airt. Manag.* 8 (2), 100–104.
- Business, Airline, 2019. Airport group financials. *Airl. Bus.* 36–37, November.
- CAPA, 2020a. COVID-19 Airport Investments No Longer So Risk Free. Available at: <https://centreforaviation.com/analysis/reports/covid-19-airport-investments-no-longer-so-risk-free-519163>. (Accessed 15 June 2020).
- CAPA, 2020b. COVID-19 Bailouts for Airport Investors, Only China Plans Expansion. Available at: <https://centreforaviation.com/analysis/reports/covid-19-bailouts-for-airport-investors-only-china-plans-expansion-518551>. (Accessed 15 June 2020).
- Chaouk, M., Pagliari, R., Miyoshi, C., 2019. A critical review of airport privatisation in the Kingdom of Saudi Arabia: case study of Medina Airport. *Case Studies on Transport Policy* 7 (2), 433–442.
- Chen, Y.H., Lai, P.L., Piboonrungraj, P., 2017. The relationship between airport performance and privatisation policy: a nonparametric metafrontier approach. *J. Transport Geogr.* 62, 229–235.
- CMA, 2016. BAA Airports: Evaluation of the Competition Commission's 2009 Market Investigation Remedies. CMA, London.
- Competition Commission, 2009. *BAA Airports Market Investigation*, Final Report. Competition Commission, London.
- Condie, S., 2015. Airport ownership trends in Europe. *J. Airt. Manag.* 10 (1), 14–23.
- Cruz, C.O., Marques, R.C., 2011. Contribution to the study of PPP arrangements in airport development, management and operation. *Transport Pol.* 18 (2), 392–400.
- Cruz, C.O., Sarmiento, J.M., 2017. Airport privatization with public finances under stress: an analysis of government and investor's motivations. *J. Air Transport. Manag.* 62, 197–203.
- Curi, C., Gitto, S., Mancuso, P., 2010. The Italian airport industry in transition: a performance analysis. *J. Air Transport. Manag.* 16 (4), 218–221.
- Davies Gleave, Steer, 2017. Support Study to the Ex-Post Evaluation of Directive 2009/12/EC on Airport Charges. European Commission, Brussels.
- Deloitte, 2018a. Airport Ownership and Regulation. IATA, Geneva.
- Deloitte, 2018b. Balanced Concessions for the Airport Industry. IATA, Geneva.
- Department of Transport, 1985. Airports Policy White Paper. Department of Transport, London.
- Enrico, S., Boudreau, B., Reimer, D., Van Beek, S., 2012. ARCP Report 66: Considering and Evaluating Airport Privatisation. Transportation Research Board, Washington, DC.
- Forsyth, P., 2008. Airport policy in Australia and New Zealand: privatization, light-handed regulation, and performance. In: Winston, C., de Rus, G. (Eds.), *Aviation Infrastructure Performance A Study in Comparative Political Economy*. Brookings Institution Press, Washington.
- Forsyth, P., Niemeier, H.-M., Wolf, H., 2011. Airport alliances and mergers – structural change in the airport industry? *J. Air Transport. Manag.* 17 (1), 49–58.
- Frontier Economics, 2020. Coming Down to Earth. Available at: <https://www.frontier-economics.com/uk/en/news-and-articles/articles/article-i6391-coming-down-to-earth/>. (Accessed 15 June 2020).
- Fuerst, F., Gross, S., 2018. The commercial performance of global airports. *Transport Pol.* 61, 123–131.
- Galeana, O.A.R., 2008. The privatisation of Mexican airports. *J. Air Transport. Manag.* 14 (6), 320–323.
- Gillen, D., 2011. The evolution of airport ownership and governance. *J. Air Transport. Manag.* 17 (1), 3–13.
- Graham, A., 2008. Airport planning and regulation in the United Kingdom. In: Winston, C., de Rus, G. (Eds.), *Aviation Infrastructure Performance A Study in Comparative Political Economy*. Brookings Institution Press, Washington.
- Graham, A., 2011. The objectives and outcomes of airport privatisation. *Research in Transportation Business and Management* 1 (1), 3–14.
- Graham, A., 2018. *Managing Airports: an International Perspective*, fifth ed. Routledge, Abingdon.
- Gutiérrez, E., Lozano, S., 2016. Efficiency assessment and output maximization possibilities of European small and medium sized airports. *Res. Transport. Econ.* 56, 3–14.
- Holvad, T., Graham, A., 2004. Efficiency measurement for UK Airports: an application of data envelopment analysis. *Empirical Economics Letters* 3 (1), 31–39.
- IATA, 2005. Airport Privatisation Economics Briefing. IATA, Geneva.
- IATA, 2018. Airlines Urge Caution on Airport Privatisation press release 5 June. Available at: <https://www.iata.org/en/pressroom/pr/2018-06-05-04/>. (Accessed 1 October 2018).
- IATA, 2019. Airport Privatization Fact Sheet. IATA, Geneva.
- Ison, S., Francis, G., Humphreys, I., Page, R., 2011. UK regional airport commercialisation and privatisation: 25 years on. *J. Transport Geogr.* 19 (6), 1341–1349.
- Kupfer, F., Meersman, H., Pauwels, T., Van de Voorde, E., Struyf, E., Vanelslander, T., 2013. Economic regulation of airports: the case of Brussels airport company. *Case Studies on Transport Policy* 1 (1–2), 27–34.
- Lin, L., Hong, C., 2006. Operational performance evaluation of international major airports: an application of data envelopment analysis. *J. Air Transport. Manag.* 12 (6), 342–351.
- Lipovich, G.A., 2008. The privatization of Argentine airports. *J. Air Transport. Manag.* 14 (1), 8–15.
- Littlechild, S., 2018. Economic regulation of privatised airports: some lessons from UK experience. *Transport. Res. Pol. Pract.* 114, 100–114.
- Marques, R., 2011. Together or separately? The efficiency and market structure of Portuguese airports. *J. Air Transport. Manag.* 50 (2), 136–139.
- Marques, R., Simões, P., Carvalho, P., 2015. The influence of the operational environment on efficiency of international airports. *J. Adv. Transport.* 49 (4), 511–522.

- Neto, C.M.D.S.P., Casagrande, P.L., Lancieri, F.M., Moraes, J.N.P., 2016. Pro-competition rules in airport privatization: international experience and the Brazilian case. *J. Air Transport. Manag.* 54, 9–16.
- Niemeier, H.-M., 2002. Regulation of airports: the case of Hamburg Airport – a view from the perspective of regional policy. *J. Air Transport. Manag.* 8 (1), 37–48.
- Olariaga, O.D., Moreno, L.P., 2019. Measurement of airport efficiency. The case of Colombia. *Transport and Telecommunication Journal* 20 (1), 40–51.
- Oum, T., Yu, C., Fu, X., 2003. A comparative analysis of productivity performance of the world's major airports: summary report of the ATRS global airport benchmarking research report – 2002. *J. Air Transport. Manag.* 9 (5), 285–297.
- Oum, T., Adler, N., Yu, C., 2006. Privatisation, corporatisation, ownership forms and their effects on the performance of the world's airports. *J. Air Transport. Manag.* 12 (2), 109–121.
- Oum, T., Yan, J., Yu, C., 2008. Ownership forms matter for airport efficiency: a stochastic frontier investigation of worldwide airports. *J. Urban Econ.* 64 (2), 422–435.
- Pagliari, R., Graham, A., 2019. An exploratory analysis of the effects of ownership change on airport competition. *Transport Pol.* 78, 76–85.
- Parker, D., 1999. The performance of BAA before and after privatisation: a DEA study. *J. Transport Econ. Pol.* 33 (2), 133–146.
- Perelman, S., Serebrisky, T., 2012. Measuring the technical efficiency of airports in Latin America. *Util. Pol.* 22, 1–7.
- Poole, R., 2019. Annual Privatization Report: Aviation. Reason Foundation, Los Angeles.
- PWC, 2019. Airport valuations have taken off – the question is where will they land? Available at: <https://www.pwc.co.uk/transport-logistics/assets/airport-valuation-s-february-2019.pdf>. (Accessed 15 June 2020).
- Rikhy, H., Roberts, J., Cheung, S., 2014. Global airport privatisation: trends, recent developments and challenges ahead. *J. Airpt. Manag.* 8 (4), 300–304.
- Rolim, P.S., Bettini, H.F., Oliveira, A.V., 2016. Estimating the impact of airport privatization on airline demand: a regression-based event study. *J. Air Transport. Manag.* 54, 31–41.
- See, K.F., Li, F., 2015. Total factor productivity analysis of the UK airport industry: a Hicks-Moorsteen index method. *J. Air Transport. Manag.* 43, 1–10.
- Skytrax, 2019. World's Top 100 Airports 2018. Available at: <https://www.worldairportswards.com/worlds-top-100-airports-2018/>. (Accessed 7 December 2019).
- Starkie, D., Thompson, D., 1984. Privatising London Airports. Institute for Fiscal Studies, London.
- Tsui, W.H.K., Balli, H.O., Gilbey, A., Gow, H., 2014. Operational efficiency of asia-pacific airports. *J. Air Transport. Manag.* 40, 16–24.
- Vasigh, B., Gorjidoz, J., 2006. Productivity analysis of public and private airports: a causal investigation'. *J. Air Transport.* 11 (3), 144–163.
- Vasigh, B., Erfani, G., Sherman, B.W., 2014. Airport performance and ownership structure: evidence from the United Kingdom, United States, and Latin America. *Journal of Aviation Technology and Engineering* 4 (1), 40–49.
- Vogel, H., 2006. Airport privatisation: ownership structure and financial performance of European commercial airports. *Compet. Regul. Netw. Ind.* 1 (2), 139–162.