

Does privatization spur regulation? Evidence from the regulatory reform of European airports

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Abstract: This paper conducts an empirical analysis of the relationship between privatization and regulation drawing on data from a wide sample of European airports. We provide first econometric evidence that privatization promotes regulatory reform, either detailed regulation or de-regulation. Additionally, airports with a high proportion of national passengers and those where slots are fully coordinated are more likely to keep subject to basic regulation. Once the regulatory reform is chosen, the potential market power of the airport may determine the choice of the regulatory setting. Large airports are more usually subject to detailed regulation, while airports with nearby competing airports are more usually de-regulated.

Keywords: Privatization; regulation; air transportation; airports

JEL codes: L33, L43, L93

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1. Introduction

Privatization and liberalization have reduced the presence of public firms in strategic markets. However, such policy reforms do not mean that governments no longer intervene in the decisions of the new private firms, especially when these firms have substantial market power. Indeed, ownership and regulation may constitute alternative forms of government intervention. The idea that governments choose between regulation and public ownership when intervening in public services with monopoly characteristics is clear in the contractual approach to government intervention promoted by Gómez-Ibáñez (2003).

Our main hypothesis is that the shift from public to private ownership leads to significant changes in regulation. Our primary contribution relies on providing an empirical test of the dynamic link between privatization and regulatory reform. Here we focus the attention on airports that –unlike network infrastructures- are subject to mixed degrees of competition and monopoly characteristics. Hence, national authorities can hold different views on just how strong this monopoly is and just how reliable competition in the sector is. Thus, the dynamic relationship between privatization and regulation can give rise to different responses.

The structure of this paper is as follows. Next, we provide background on airport regulation related to our main hypothesis. After this, we explain the main trends affecting the privatization and regulation of airports in Europe. In the following section, we formulate and estimate an empirical equation that provides a formal test of the link between privatization and regulatory reform. The last section contains our concluding remarks.

2. Background on airport regulation

We examine the link between privatization and regulatory reform in airports. Note that monopoly conditions are not as robust in airports as they are in network utilities. Some airports can enjoy market power whereas some other may be subject to stronger competitive pressures from other airports or countervailing power from airports' main costumers, the airlines.

Privatization likely gives price regulation a more prominent role because some private airports may have sufficient market power to charge high prices. In those cases where

regulation is needed, it is generally claimed that optimal regulation of airports should meet the following criteria (Oum et al., 2004, 2008, Gillen & Niemeier, 2008):

- i) Independent agencies of the political entities should be responsible for regulation.
- ii) Before prices are finally agreed to, a formal consultation process between airports and airlines is required.
- iii) Price regulation should establish the correct incentives for cost reduction and investment in additional capacity.
- iv) Price regulation should be established on an individual basis because the market power of each airport depends on characteristics such as the volume and type of traffic or the potential competition from other airports (Starkie, 2002; Gillen, 2008, Bel & Fageda, 2010).

Considering these criteria, the following methods of airport regulation can be distinguished:

1) Basic regulation. Under this scheme, prices are set and adjusted according to costs. However, the eventual prices depend on regulations or administrative rules that fail to make explicit the determinants of either costs or prices. Note that generally airports and airlines do not enter into a formal consultation process. Furthermore, regulation is never the responsibility of an independent agency.

2) Detailed regulation. Under this scheme, a formal mechanism establishes the assets that are to be regulated. In addition, prices are set and adjusted each year according to a mathematical formula, which considers performance indicators that might include costs, revenues, evolution in traffic volume and depreciation rates. In some instances, a formal consultation process accompanies regulation between airports and airlines. However, regulation is not usually the responsibility of an independent agency. Among the mechanisms applied in detailed regulation, we should distinguish between price-cap and rate-of-return regulation.

Note that several authors have claimed that price regulation may not be necessary if it is clear that the airport operator's ability to set high charges is only modest. First, the airlines also wield market power that can counter that of the airport manager (Brueckner, 2002). Second, the threat of re-regulation can in itself constitute an element of dissuasion, as illustrated by the case of Australia (Forsyth, 2008). Finally, the airport operators can receive incentives to charge lower prices to attract more traffic, since the more passengers they attract, the higher the volume of revenue generated by the commercial activities offered in the airport terminal (Starkie, 2001).

However, it should be stressed that deregulation does not mean that governments fully relinquish the monitoring of airport activities. Airports remain subject to the threat of re-regulation and the ex-post control exerted by the competition policy authorities.

3. Privatization and regulation of airports in Europe

In this section, we examine major trends in the ownership and regulation of airports in Europe. In particular, we apply our analysis to those European airports that generate a high volume of traffic. Our sample comprises the hundred airports in the European Union, Switzerland and Norway with most passenger traffic in 2007. Table A1 in the appendix lists the airports used in this empirical analysis. Among the hundred airports included in our sample, 17 are located in the United Kingdom, 16 in Spain, 14 in Italy, 11 in Germany, eight in France, and four each in Norway and Greece. The remaining countries account for three or fewer airports in our sample.

Table 1 shows the airport operators in the sample that have been either fully or partially privatized. The privatization of the British Airport Authority (BAA) in 1987 was the first such experience in Europe. At the time of its privatization, the firm was managing three airports in the London area (Heathrow, Gatwick and Stansted), three airports in Scotland (Aberdeen, Edinburgh, Glasgow) and Southampton. Since the early nineties, many other airport operators have been privatized in the UK. In fact, Manchester airport is currently the only large British airport to be fully controlled by a public firm. Note that airport privatization in the United Kingdom has generally been more prevalent than in the rest of Europe, and it has been of a different nature. Private investors in the UK have taken on the management of British airports, and at the same time they have purchased the airport infrastructure and land (with few exceptions, prominent among which is Luton Airport). Thus, airport privatization in the UK typically involves the transfer of assets to private investors. By contrast, in continental Europe, airport privatization typically means that private investors gain control of the firm managing the airport through a long-term concession or a management contract, but the government retains ownership of the infrastructure and land. Hence, in continental Europe privatization is usually implemented through the contracting out of airport management.

It is clear, therefore, that the airport privatization program has been particularly ambitious in the UK, involving full privatization in most cases. However, several large airports have also been privatized in Italy and Germany. The privatization of Venice airport

took place at the same time as that of the BAA. In the middle of the nineties, the operators at Fiumicino and Ciampino in Rome and at the airport in Naples were sold to private investors. More recently, the airports of Pisa, Torino and Bologna have been fully or partially privatized. In Germany, private investors are shareholders of three of the country's largest airports - Frankfurt, Dusseldorf and Hamburg - and a number of others including Hanover. Finally, several airports in Europe's capital cities have been fully or partially privatized since the mid-nineties. These include Charles de Gaulle and Orly in Paris, Athens, Budapest, Brussels, Copenhagen and Vienna.

When private investors are not key shareholders in the firm managing the airport, regional or local governments are typically in charge of individual airports. However, there are a number of exceptions to this pattern - for example, the central government manages the airports of Amsterdam, Dublin and Prague. In each case, though, there were plans to privatize, but they have yet to be implemented. In addition, a number of central governments manage airports as a single national system. This is the case of Spain, Portugal, Finland, Norway and Romania (and to a lesser extent, Sweden as well). All these countries, with the exception of Spain, are characterized by the heavy concentration of air traffic in the capital city.

Insert Table 1 about here

Table 2 shows the main characteristics of the regulation process of airports in Europe. As mentioned above, it is generally believed that regulation should be implemented by an independent agency; however, in practice, regulation has been introduced by a central government agency in most European countries. The main exception is Germany where regional governments are responsible for regulation. Independent regulation has only been adopted in the United Kingdom, the Netherlands, Ireland and Austria.

Price-caps are applied in several airports in the UK (Heathrow, Gatwick, and Stansted) and in other large airports including Dublin, Stockholm-Arlanda, Vienna, Budapest, Frankfurt, Dusseldorf, Hamburg and Copenhagen. Rate-of-return regulation is applied in Amsterdam, Brussels, and in those German airports where price-caps have not been introduced.

Note that airports in the UK and Ireland are not subject to regulation, with the exception of those mentioned above. Airports in Switzerland, Poland, and the airports of Gothenburg, Prague, Bucharest and Riga are not subject to price regulation either. Among

these non-regulated airports, private firms control only a number of UK airports and Zurich fully or partially.

Basic regulation is applied at all other airports, which includes all the airports in Spain, Italy, Norway, Greece, Portugal, France (except Paris), and the airports of Helsinki and Sofia. Recall that there do not seem to be any major differences between non-regulated public airports and those subject to basic regulation. Prices are set directly by the firm that manages the airport in the case of non-regulation, a situation that only differs from that of a basic regulation scenario when the firm is controlled fully or partially by private investors.

Insert Table 2 about here

At this juncture, it should be pointed out that Directive 2009/12/EC of the European Parliament and the Council of 11 March 2009 on airport charges may lead to major changes in the regulation procedures of European countries. This directive has to be incorporated within corresponding national legislations before 15 March 2011 and is applicable to all airports in the European Union handling more than five million passengers each year, as well as to each country's main airport should it handle fewer than five million passengers. The directive establishes that the entity managing the airport should be independent and that a formal consultation process should be initiated between airlines and airports before charges are finally approved. However, each country is to maintain considerable powers of discretion as regards the specific mechanism regulating the behavior of the airport operator.¹

4. An empirical analysis of the relationship between the privatization and regulation of airports

It is our claim that privatization spurs regulatory reform. Indeed, airport privatization may lead to more detailed regulation methods, such as price-caps, or even de-regulation when it is clear that the corresponding airport wields no market power.

Table 3 classifies the various airports in our sample regarding the degree of involvement of private investors in their management. Among the 100 airports in the sample, 26 are fully controlled by private firms, 11 are partially controlled by private firms and the rest are government controlled at different territorial levels. Table 3 highlights the existence of substantial differences between public and private airports.

¹ Furthermore those countries whose airports are managed in an integrated way - as a centralized single system-, can opt out from the obligation of establishing airport prices based on the costs of each individual airport (art. 4).

Insert Table 3 about here

The average volume of traffic handled by fully private airports is higher than that at public airports, while the prices charged by the former are markedly higher.² In the case of partially privatized airports, the mean volume of traffic is notably higher than in the other sub-groups of the sample, while prices are similar to those charged by fully privatized airports. Bel and Fageda (2010) show by multivariate econometric analysis that the prices set by private, non-regulated airports are higher than those set by public airports or regulated private airports. Note that this does not necessarily mean that private airports are more inefficient than the other airports in the sense that they fail to provide the correct incentives for cost reduction and investment. It may well be the case that private non-regulated airports enjoy a certain degree of market power; but it might also be the case that prices at public airports (especially when subject to basic regulation) are artificially low.

Table 3 also illustrates the relationship between the form of ownership and the regulation mechanism. Basic regulation becomes less common as the weight of private ownership in the firm managing the airport increases. Price-cap regulation (or rate-of-return regulation) is not common in public airports, while a significant proportion of (fully or partially) private airports are subject to some form of detailed regulation. In the case of public airports, basic regulation is clearly the dominant form.

Note that the proportion of non-regulated airports is also significant in the case of those that have been fully privatized. In our sample, all the airports that are fully controlled by private firms and which are not subject to regulation are located in the UK. As we shall see below and in detail, airports in the UK are only regulated when it is clear that they might enjoy a degree of market power. In continental Europe, only Zurich airport is not subject to regulation, and it this is partially controlled by private firms. Public firms manage all the remaining non-regulated airports in continental Europe.

In short, public ownership seems to be associated most frequently with basic regulation, whereas several private airports are subject to detailed regulation. In addition, some public airports are not subject to regulation in continental Europe while some private airports (which may not enjoy any market power) are not subject to regulation in the UK.

We can provide a more formal test of the relationship between privatization and regulation at Europe's airports by estimating the following equations for airport a :

² Our price data include the following charges: landing fees, rights to approach and park aircraft, charges for using the terminal, noise and safety surcharges (where applicable). Information is provided by *airportcharges.com* for 2008. The prices used refer to an A-320 aircraft with an occupancy factor of 70% (105 passengers).

$$\begin{aligned}
Regulatory\ reform_a = & \alpha + \beta_1 Private_a + \beta_2 Total_Traffic_a + \beta_3 \%National_Traffic_a + \beta_4 Slots \\
& + \beta_5 Number_Nearby_airports + \varepsilon
\end{aligned} \tag{1}$$

$$\begin{aligned}
Type_Regulation_a = & \alpha + \beta_1 Private_a + \beta_2 Total_Traffic_a + \beta_3 \%National_Traffic_a + \beta_4 Slots \\
& + \beta_5 Number_Nearby_airports + \varepsilon
\end{aligned} \tag{2}$$

In equation (1) the dependent variable, *Regulatory reform*, is a discrete variable that takes the value zero in the case of airports subject to basic regulation, and it takes the value one in the case of airports where some regulatory reform has been implemented. The regulatory reform may imply detailed regulation or de-regulation. In equation (2), we focus the attention on airports where some regulatory reform has been implemented. In this equation the dependent variable, *Type_Regulation*, is a discrete variable that takes the value zero in the case of non-regulated airports, and it takes the value one in the case of airports subject to detailed regulation.

Recall that our sample of routes is based on the 100 largest airports in the European Union (EU-27), Norway and Switzerland. As we outlined above, by basic regulation we refer to a scheme in which prices are fixed by law or administrative regulations that do not make explicit the determinants of either costs or prices. Furthermore, by detailed regulation we refer to a scheme in which a formal mechanism establishes the assets that are regulated, and in which prices are set and adjusted each year according to a mathematical formula that considers such aspects as costs, revenues, evolution in traffic volume and depreciation rates. Recall also that prices are set directly by the firm (public or private) that manages the airport in case of non-regulation.

The explanatory variables included in equation (1) are the following:

1) The percentage of private property owned by the management company, *Private*. This variable allows us to test the relationship between privatization and regulation. We expect a positive sign of the coefficient associated to this variable in equation (1). Indeed, the greater the weight of private investors in the firm managing the airport, the higher is the probability that some reform has been implemented in the regulation of such airport. Less clear is the expected sign of the coefficient associated to the variable of private ownership in equation (2). Once the regulatory reform has been implemented, the choice between detailed regulation or de-regulation may well depend on other aspects not necessarily related with ownership, like the potential market power of the airport.

2) The airport's total volume of traffic, $Total_Traffic$. Price regulation at airports with a higher volume of traffic is generally more complex. Note also that large airports may enjoy substantial market power. Hence, the probability that the airport is subject to detailed regulation should be higher when the amount of traffic that handles is higher. This means that we expect a positive sign of the coefficient associated to the variable of traffic both in equations (1) and (2).

3) Domestic traffic as a percentage of the airport's total traffic, $\%National_Traffic$. Airport policies may be designed to favor national passengers, so airport charges may be conditioned by non-explicit and detailed criteria when the proportion of domestic traffic is high. Hence, as the weight of domestic traffic at the airport increases, the probability of the airport being subject to basic regulation is expected to rise. Thus, we expect a negative sign of the coefficient associated to this variable in equations (1). Less clear is the result expected in equation (2).

4) Dummy variable for coordinated airports in the allocation of slots, D^{slots} . It takes the value one for coordinated airports and the value zero for non-coordinated airports and schedule-supervised airports. Excess of demand should be higher for coordinated airports where excess of demand requires the application of standard procedures for slot allocation ('grandfather rights', 'use-it or lose-it', criteria for new slots and new entrants, etc). Airport operators in non-coordinated airports have more flexibility in the allocation of slots to airlines.

Given that basic regulation also implies an administrative rather than solely economic approach to airport regulation, we can expect a positive relationship between the likelihood of using basic regulation and administrative rules for coordinating airports. Indeed, coordinated airports clearly use administrative rules in allocating slots to airlines. Note also that non-coordinated airports must be uncongested airports, so detailed regulation may not be so necessary at these airports. Thus, we expect a negative sign of the coefficient associated to this variable both in equations (1) and (2).

5) The number of airports that lie fewer than 100 km from airport a , and which are managed by different operators, $Number_nearby_airports_a$. We only consider airports with passenger traffic greater than 150,000 individuals. This traffic threshold is the same as that used by Eurostat for differentiating between main and small commercial airports. Note that the higher the number of nearby airports with commercial traffic, the lower will be the airport's market power due to possible competition of those airports. We claim that

regulation is less needed when the airport does not have a substantial market power. Then, the coefficient associated with this variable of competition is expected to present a positive sign in equation (1) because potential competition may promote a regulatory reform, and a negative sign in equation (2) because de-regulation is a feasible policy choice in a scenario of potential competition.

Table 4 shows the correlation matrix of the variables used in the empirical analysis. It seems that correlation between variables is not particularly high. The highest correlation is found between the variables of traffic and slot coordination. In an alternative specification that excludes the variable of slot coordination as explanatory variable, we find that results for the rest of variables are not altered.

Table 5 shows the results of the estimation of equation (1) and table 6 shows the results of the estimation of equation (2). Given the discrete nature of the dependent variables, the estimation is made using the logit technique.

It is likely that our empirical setting does not satisfy the assumption of independence of irrelevant alternatives (IIA). Indeed, we argue that regulators first make a basic choice between basic regulation and regulatory reforms and then, in a second step and given that reforms are chosen, they decide whether to introduce either detailed regulation or no regulation at all. In this situation, a nested model structure may be applied to overcome the IIA assumption. The nested logit relaxes this assumption by clustering related alternatives into nests. In our context, we have two nests and three policy alternatives. One nest is to maintain basic regulation and the other nest is to apply a regulatory reform (either detailed regulation or non regulation). The choice between basic regulation and regulatory reform that is considered in equation (1) is estimated by using a nested logit framework, while the choice between detailed regulation and de-regulation once reform has been decided (equation (2)) is estimated by using a traditional logit model.³

Given the low number of observations available, we are not able to include dummy variables for each country. In equation (1), the nested logit estimation does not converge to any result if we include all country specific effects but we show results of an additional specification of equation (1) that include dummy variables for the countries with the fifth largest air transport markets: United Kingdom, Spain, Germany, France and Italy. Here the

³ Note that all our explanatory variables are airport-specific variables because they do not vary within each airport. Hence, we are not able to estimate both equations (1) and (2) within the nested logit framework.

reference case would be a group of countries that have each of them few airports in our sample. The inclusion of the country dummies reduces the explanatory power of the model but the estimated coefficients for individual variables does not change the implications of results for the variables of ownership, total traffic and degree of competition. The number of observations in equation (2) is even lower and, given the degrees of freedom, including country dummies distorts all the analysis.

Insert Table 4 about here

Insert Table 5 about here

The results from the estimation confirm our main predictions. Most significantly, regulatory reform is more likely when private firms manage airports. Indeed, the variable of private ownership takes a positive value in equation (1) where the dependent variable is a discrete variable that takes the value one in case of regulatory reform. The variable of private ownership is also positive and statistically significant in equation (2) so that no regulation may be preferred to detailed regulation once the reform has been decided. The latter result may be consequence of the high proportion of observations from UK where most private airports, except the largest ones (Heathrow, Gatwick and Stansted) are not subject to regulation. Market power of non-regulated airports in UK should not be high.

We also find that large traffic volumes appear significantly associated with more detailed regulation. The variable of total traffic takes a positive value both in equation (1) and equation (2). Recall that airport management is more complex in larger airports and the potential market power of these airports is also higher. As expected, our results also provide evidence that basic regulation is more used in slot coordinated airports since the dummy variable for coordinated slots takes a negative sign in equation (1). In a similar vein, basic regulation is also more used in those airports with a high proportion of national traffic because this variable takes a negative sign in equation (1) as well.

Finally, the variable of number of nearby airports with different manager, which approaches the potential degree of competition, takes a positive sign in equation (1) and a negative sign in equation (2). Thus, potential competition seems to promote regulatory reforms, and once the reform is chosen de-regulation arises as a feasible policy alternative if the airports does not have substantial market power.

5. Concluding remarks

Our analysis contributes to the literature by undertaking an empirical study of the dynamic link between privatization and regulatory reform. To the best of our knowledge, this is the first study providing econometric evidence for the use of privatization and regulation as potential substitutes for government intervention.

Privatization may spur regulatory reform especially in case of large airports and airports subject to some degree of competition. By contrast, airports with a high proportion of national passengers and those where slots are fully coordinated seem to be less affected by regulatory reforms. Once the regulatory reform has been chosen, the crucial aspect in the choice of regulation is the potential market power of the airport. Large airports, with substantial market power, tend to be subject to detailed regulation and airports that have nearby competing airports tend to be deregulated.

We believe that the nature of privatization in the UK likely explains the positive relationship between privatization and de-regulation. Privatization in the UK usually involves the full transfer of asset ownership (along with airport management services). Greater reliance on competition by the British authorities might explain why most private airports are not subject to regulation (as is also the case in Australia), whereas only the three largest airports – Heathrow, Gatwick and Stansted - are subject to (more detailed) regulation. Unlike the situation in the UK, privatization in continental Europe usually involves the contracting out of airport management through the partial or full privatization of the airport operator, whereas the respective government retains asset ownership. Because of their nature, concessions are subject to more detailed regulation than public management. Thus, the relationship between privatization and detailed regulation could be take place if we were focusing the attention just in Continental Europe.

Privatization grants greater importance to regulation to the extent that private managers might have greater incentives than public managers to set high prices. Our analysis suggests that this is particularly true under certain circumstances, which include the airports' potential to generate traffic, and the use of concession contracts to privatize airport operators. Instead, full privatization –involving transfer of asset ownership- might result in non-regulation for those airports where market power does not seem a potential problem.

Unlike other transportation infrastructures, such as motorways or railways, airports present mixed degrees of competition and monopoly characteristics. Thus, different

responses might exist to the dynamic relationship between privatization and regulation. In addition to this, national policies might have different perspectives on how reliable competition is in the sector. The effects of these different national points of view and traditions of government intervention can greatly influence the dynamic relationship between privatization and regulation. Further research should be undertaken to shed more light on this issue.

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TABLES

Table 1. Privatization of main airports in Europe

Airport	% Private ownership	Year (s) of first sale to private investors
London-Heathrow (LHR)	100	1987
London-Gatwick (LGW)	100	1987
London-Stansted (STN)	100	1987
Edinburgh (EDI)	100	1987
Glasgow (GLA)	100	1987
Aberdeen (ABZ)	100	1987
Venice (VCE)	71	1987
Liverpool (LPL)	76	1990
Glasgow-Prestwick (PIK)	100	1992
Vienna (VIE)	60	1992-1995-2001
Copenhagen (CPH)	60.8	1994-1996-2000
Belfast (BFS)	100	1994
London city (LCY)	100	1995
Birmingham (BHX)	51	1997
Bristol (BRS)	100	1997
Naples (NAP)	70	1997
Hahn (HHN)	65	1997
Rome-Fiumicino (FCO)	95.75	1997-2001
Rome-Ciampino (CIA)	95.75	1997-2001
London-Luton (LTN)	100	1998
Dusseldorf (DUS)	50	1998
Hannover (HAJ)	30	1998
Zurich (ZRH)	42	2000
Hamburg (HAM)	49	2000
Torino (TRN)	44.29	2000
Frankfurt (FRA)	29	2001
Athens (ATH)	45	2001
Newcastle (NCL)	49	2001
Malta (MLA)	80	2002-2005
Brussels (BRU)	62.1	2005
Budapest (BUD)	75	2005
Larnaca (LCA)	100	2005
Pisa (PSA)	78	2005
Paris-Charles de Gaulle (CDG)	32.5	2006
Paris-Orly (ORY)	32.5	2006
Bolonia (BLQ)	13.90	2007
Leeds (LBA)	100	2007

Note: We do not account for further changes in the identity of private investors after the first sale.
Source: Gillen and Niemeier (2008), Graham (2008) and web sites of the corresponding airports.

Table 2. Method of regulation in European airports

Country	Airports	Regulation-method
United Kingdom	Heathrow, Gatwick, Stansted, Manchester	Price-caps
	Rest of airports	No regulation
Spain	All airports	Basic Regulation
Italy	All airports	Basic Regulation
Germany	Dusseldorf, Frankfurt, Hamburg, Hannover	Price-caps
	Rest of airports	Rate of return
France	Charles de Gaulle, Orly	Price-caps
	Rest of airports	Basic Regulation
Norway	All airports	Basic Regulation
Greece	All airports	Basic Regulation
Ireland	Dublin	Price-caps
	Shannon, Cork	No regulation
Switzerland	All airports	No regulation
Portugal	All airports	Basic Regulation
Poland	All airports	No regulation
Sweden	Stockholm-Arlanda	Price-caps
	Goteborg	No regulation
Belgium	All airports	Rate of return
The Netherlands	Amsterdam	Rate of return
Other countries	Copenhagen, Malta	Price-caps
Other countries	Vienna, Budapest	Price-caps
Other countries	Helsinki, Sofia	Basic Regulation
Other countries	Prague, Bucharest, Riga, Larnaca	No regulation

Source: Oum et al (2004), Gillen & Niemeier (2008), IATA (2007), Cunha & Brochado (2008), and the corresponding civil aviation authorities.

Table 3. Data about airports according to the type of ownership of the managing firm

Managing firm	Total number airports	Mean traffic (10 ³ passengers)	Mean prices	% Airports with no regulation	% Airports with basic regulation	% Airports with detailed regulation
Mostly private	26	12821	2455	50%	15%	35%
Partially private	11	19598	2380	18%	36%	46%
Public	63	9776	1866	17%	67%	16%

Source: Eurostat, Airportcharges.com, Oum et al (2004), Gillen & Niemeier (2008), Graham (2008), IATA (2007), Cunha y Brochado (2008) and the corresponding civil aviation authorities.

Table 4. Matrix of correlation of the variables used in the empirical analysis

	Private	Total_Traffic	%National_Traffic	D ^{slots}	Number of nearby_airports
Private	1				
Total_Traffic	0.12	1			
%National_Traffic	-0.15	-0.21	1		
D ^{slots}	0.31	0.39	0.11	1	
Number of nearby_airports	0.36	0.03	-0.17	-0.29	1

Table 5. Estimates of the equation for regulatory reform (nested logit)

Explanatory variable: Regulatory form (1: Regulatory reform, 0: Basic regulation)		
Private	0.03 (0.008)***	0.04 (0.027)*
Total_Traffic	0.00008 (0.00003)***	0.00019 (0.0001)*
%National_Traffic	-3.06 (1.35)**	-3.17 (4.00)
Dslots	-1.39 (0.66)**	-0.54 (1.42)
Number of nearby_airports	0.64 (0.32)**	1.65 (0.92)*
DUK	-	17.75 (4,684.40)
DSpain	-	-18.45 (694.06)
DGermany	-	20.61 (4,444.44)
DFrance	-	-2.35 (2.58)
DIItaly	-	-19.79 (1,107.62)
Number of observations	300	300
Number of cases	100	100
Log likelihood	-72.45	-44.21
χ^2 (Joint. Significance)	26.89***	10.27
LR test for IIA	3.84**	10.22***

Note 1: Standard errors in parenthesis

Note 2: Statistical significance at 1% (***), 5% (**), 10% (*)

Table 6. Estimates of the equation for type of regulatory reform (logit)

Explanatory variable: Type of regulatory form (1: Detailed regulation, 0: No regulation)	
Private	-0.022 (0.011)**
Total_Traffic	0.0002 (0.0001)**
%National_Traffic	-1.27 (2.07)
Dslots	-0.59 (1.43)
Number of nearby_airports	-1.30 (0.47)***
Intercept	0.17 (0.99)
Number of observations	45
Log likelihood	-16.80
Pseudo -R ²	0.46
χ^2 (Joint. Significance)	12.74***

Note 1: Standard errors in parenthesis (robust to heterocedasticity)

Note 2: Statistical significance at 1% (***), 5% (**), 10% (*)

Annex

Table A1. Sample of airports used in the empirical analysis

Airport	Airport	Airport
Aberdeen (ABZ)	Helsinki (HEL)	Stuttgart (STR)
Alicante (ALC)	Heraklion (HER)	Tegel (TXL)
Arlanda (ARN)	Ibiza (IBZ)	Tenerife North (TFN)
Amsterdam (AMS)	Lanzarote (ACE)	Tenerife South (TFS)
Athens (ATH)	Larnaca (LCA)	Thessalonica (SKG)
Basel (BSL)	Leeds (LBA)	Toulouse (TLS)
Barcelona (BCN)	Linate (LIN)	Trondheim (TRD)
Belfast (BFS)	Lisboa (LIS)	Turin (TRN)
Bergamo (BGY)	London-Heathrow (LHR)	Valencia (VLQ)
Bergen (BGO)	London City (LCY)	Warsaw (WAW)
Bilbao (BIO)	Liverpool (LPL)	Venice (VCE)
Birmingham (BHX)	Luton (LTN)	Verona (VRN)
Bologna (BLQ)	Lyon (LYS)	Vienna (VIE)
Budapest (BUD)	Madrid (MAD)	Zurich (ZRH)
Bucharest (OTP)	Málaga (AGP)	
Bordeaux (BOD)	Malta (MLA)	
Bristol (BRS)	Milan-Malpensa (MXP)	
Brussels (BRU)	Manchester (MAN)	
Cagliari (CAG)	Marsella (MRS)	
Catania (CTA)	Menorca (MAH)	
Krakow (KRK)	Munich (MUC)	
Copenhague (CPH)	Nantes (NTE)	
Köln-Bonn (CGN)	Naples (NAP)	
Cork (ORK)	Newcastle (NCL)	
Charleroi (CRL)	Nice (NCE)	
Ciampino (CIA)	Nuremberg (NUE)	
Dublin (DUB)	Oslo (OSL)	
Dusseldorf (DUS)	Palma de Mallorca (PMI)	
East Midlands (EMA)	Palermo (PMO)	
Edinburgh (EDI)	Paris-Charles de Gaulle (CDG)	
Faro (FAO)	Paris-Orly (ORY)	
Fiumicino (FCO)	Porto (OPO)	
Fuerteventura (FUE)	Praga (PRG)	
Frankfurt (FRA)	Pisa (PSA)	
Gatwick (LGW)	Prestwick (PIK)	
Gran Canaria (LPA)	Rhodes (RHO)	
Glasgow (GLA)	Riga (RIX)	
Girona (GRO)	Schonefeld (SFX)	
Ginebra (GVA)	Seville (SVQ)	
Göteborg (GOT)	Shannon (SNN)	
Hahn (HNN)	Sofia (SOF)	
Hamburg (HAM)	Stansted (STN)	
Hannover (HAJ)	Stavanger (SVG)	