Privatization, restructuring and its effect on performance: a comparison between the German and British airport sector

Gajo Ovasapian, Coskun Sagol, Tolga Ülkü and Jelena Zivanovic, GAP Team Berlin and HUB

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Abstract:

This paper encompasses a comparative analysis of the economic and technical performance of nine airports from 1998 to 2004. Methods data envelopment analysis (DEA), partial factor productivity (PFP), financial ratio analysis (FRA) and Stochastic Frontier Analysis (SFA) are applied to identify the characteristics of British and German airports and compare two different ownership structures: the privatized and public privatized. The analysis aims at identifying to which degree privatization contributes to or enhances the performance of the airports. Our results give support to the fact that the English (fully privatized) airports outperform the German ones. Due to higher charges the German airports generate higher revenues in comparison to the British airports.

Prof. Dr. Hans-Martin Niemeier
Hochschule Bremen
Werderstr. 73
28199 Bremen

Prof. Dr. Jürgen Müller
FHW Berlin
Badensche Str. 50-51
10825 Berlin

Prof. Dr. Hansjochen Ehmer
Internationale Fachhochschule Bad Honnef
Mühlheimer Str. 38
53604 Bad Honnef

I) Introduction

. With the liberalization of air transportation, airports have found themselves operating in an increasingly competitive environment, which is now also leading to significant organizational changes. Some of the publicly owned airports of the past have over the last two decades been partially or fully privatized and they have to act now much more as profit oriented businesses, reflecting the request for higher returns to shareholders (Vogel, 2006). Whether this new organizational structure is giving a comparative advantage to the privatized airports in the fast-paced world of the airline industry is one of the central issues discussed in the literature. The financial performance of the privatized airports in comparison to the government owned ones, both in Great Britain and Germany, will be addressed in this paper.

With the rise in air travel and the need to add capacity to existing airports, the importance of financing further infrastructure network has come to the fore. But the need for significant investments in infrastructure was faced by the difficulty in the availability of state resources for such projects and therefore led to considering privatizations of airports, also in Germany. Hereby the sale of state-owned airports implies not only the flows of money to the public sector, but also that the management and operations are taken over by the private sector, which means that profit maximization becomes the core motive of the business[1].

Our focus in this paper is to analyze and compare the German and English airports and to assess their performance in relation to their ownership structure. The UK airline industry has gone through a drastic change over the last two decades by changing from public ownership to the private sector. Following the Airport Act 1986, the BAA group went public in 1987 and the rising value of its share prices has become with time a symbol for the successful privatization and a role model for other European airports. Even though the European governments have procrastinated with the privatization of their airports, the first trends towards privatizations are to be seen in Austria, the Netherlands, Italy, Greece and Germany throughout 1990s. Nevertheless, the privatizations in Continental Europe have not been as rapid as in the UK for few airports have been placed fully into the private hands.

In our analysis we differentiate therefore among fully privatized airports, partially private and public airports. We have examined a sample of three English and six German airports that

[1] examples are Duesseldorf , Hamburg, Fraport

have been exposed to similar market conditions and economic development patterns. The partially privatized and public German airports are to be compared with privatized British airports. Different econometric methods (DEA, SFA, PFP and financial ratios) will be applied to identify the characteristics of British and German airports and assess the effect of different ownership structures: the privatized airports, which are predominant in the UK, and publicly owned ones, being situated in Germany.

The aim of the analysis is to find to which degree privatization enhances the performance of the airports. The paper follows in the tradition of an earlier paper "Privatization, Corporatization, Ownership Forms and their Effects on the Performance of the World's Major Airports" by Oum, Adler, and Yu (2006) which investigates the effects of ownership forms and management structure on the performance of a large sample of international airports, based on a dataset from 2001-2003. The specific focus of that study too was on the productive efficiency and profitability among airports, differentiating between airports that were

- owned and operated by government departments,
- 100% government-owned corporations,
- mixed enterprises with government majority ownership,
- mixed enterprises with private majority ownership and
- independent airport authorities,

Their analysis sheds light on the following issues

1) airports with government majority ownership and those owned by multi-level of government are significantly less efficient than airports with a private majority ownership.

2) it shows no statistical significance to suggest that airports owned and operated by governments, independent airport authorities, or airports operated by 100% government corporations have lower operating efficiency than airports with a private majority ownership.

3) it reflected significantly higher operating profit margins for airports with a private majority ownership and the lowest operating profit margin for airports with government majority ownership or multi-level government ownership.

4) made it obvious that airports with a private majority ownership derive a much higher proportion (56%) of their total revenue from non-aviation services than other types of airports while offering significantly lower aeronautical charges (excluding U.S. airports).

II) Traditional regulation, the increasing need for capacity and financial resources in an age of increasing commercialization

Traditionally, airports represented natural monopolies, usually exposed to ex-ante regulations[2] High opportunity costs and cumbersome political and administrative authorization procedures for the expansion of terminals or the building of a new airport have prevented or slowed down the market penetration of potential competitors (Ehmer, Müller-Rostin, Müller and Niemeier, 2007) and thereby opened ground for strategic management behaviour (Brunekreeft/ Neuscheler 2003). The other typical characteristic of airports is the presence of monopolistic bottlenecks. They provide the access to the crucial infrastructure and are in the position to raise airport charges to a monopoly level. Thus, the market power of airports worldwide is subject to regulation to ensure that they do not misuse their privileged position. [3]

In the literature two kinds of regulation concepts are being emphasized:

- price cap regulation used by the British airports (Heathrow, Gatwick and Stansted) and applied by some partly privatized European airports and

- cost based regulation applied predominantly in the remaining airport industry.

[2] for exeptions see Australia

[3] exceptions are found in Australia with light handed regulation

After price cap regulation had been applied to British airports first, after their privatization following the UK Airport Act of 1986, other European regulators followed: Hamburg airport became subject to the price cap first in 2000, followed by Malta airport in 2001 and Budapest airport in 2006[4].

Price-Cap regulation sets incentives for cost reduction and revenue generation whereas cost based rate of return regulation ensures no monopoly profits, but also an incentives for the financing of infrastructure. Price-Cap regulation on the other hand provides incentives for long run underinvestment.

The charges set under the cost based regulation should create just enough revenues to cover total costs including the depreciation of capital and a normal rate of return on capital for the airports. However, the incentives towards gold plating are present, while the risk of regulatory taking is minimal.

Nevertheless, cost plus regulation has been less attractive to the privatized airports, because it often involves inefficient price structures and provides no or limited incentive for opening up new airports. On the other hand, price cap regulation should offer a relatively higher profitability, set up incentives to open up new airports and lead to higher rates of entry (Niemeier 2002).

Regulation of airport charges in Germany and the UK

In Germany cost based regulation has been prevalent, as the regional regulators for the 18 German commercial airports have found this type of regulation adequate. On the other hand, since 1986 the UK Secretary for State for Transport has assigned price cap regulation to four airports: Heathrow, London, Gatwick and Manchester (Graham 2006). The exception from aforementioned cost regulation in Germany is the Hamburg airport and Frankfurt airport, which introduced a form of price cap regulation.

The United Kingdom has been the earliest user of price cap regulation for a whole range of regulated industries, like electricity, telecommunication, rail transport, gas and water. In the UK, both BAA plc London and Manchester airports have been subjects to single till price cap regulation since 1987-88. The other smaller regional airports do not have direct

[4] see Ehmer et al, (2006)

price control, as they are not considered to have sufficient market power to warrant this. Currently there is some consideration of extending regulation to some of the smaller airports.[5]

Price cap regulation in the UK

The UK regulatory regime for airports is characterized by the following:[6]

• a regulatory determination is made about the underlying capital structure and the expected evolution of costs once every five years, at the beginning of the five year regulatory period. Once the determination is made, airports have complete pricing freedom with regard to pricing structure and pricing levels, provided their price level stays within the cap.

• The price cap is set at the Retail Price Index less an adjustment for productivity. In recent years, the productivity adjustment (the X in RPI-X) has been quite large and exceeds the inflation rate. This results in a requirement for the airports to lower not only nominal, but also real prices.

• At the five year review the airports may be allowed special price increases to deal with a) new capital and b) other extraordinary items. Thus when a new terminal or runway is planned, the CAA allows the airport to increase its prices above RPI-X to reflect the increased cost of the new facilities.

Germany regulation

Pursuant to § 43 of the Air Transport Licensing Regulation (Luftverkehrszulassungs-ordnung; LuftVZO), German airport fees for take-off and landing, terminal use and the parking of aircraft require the permission of one of the respective 16 state authorities. They have to ensure that the fees are in line with

[5] Betancor and Rendeiro (2006)

[6] Ibid

-the principles of full cost recovery and

-in line with the national public transport policy etc.

Regulation is thus based on the cost-plus principle. This raises the problem that incentives for cost cutting are limited, so that from the policy point of view the current regulation needs to be revised. [7]

Dynamic implication given the need for an increase in capacity

One of the reasons why the airport industry has been showing a trend towards privatization is due to the higher growth rate of air traffic and the associated capacity needs. Studies have shown that some airports like Düsseldorf and Frankfurt have reached their capacity limits or they will reach it in the near future. But the required investments for necessary capacity expansions of the airports were not forthcoming; due to insufficient public resources (Sterzenbach/Conrady 2003) The Figure 1 below gives an indication of some of the capacity enhancing project being planned.

The increasing numbers of passengers and changing market conditions have led to stricter efficiency standards for the airports, also as a result of their competition with other airports (Stucke 2000) Here, privatization should strengthen this trend, as it helps to find the needed resources by using the funds from the private sector, allows for revenue enhancing improvements to take place and achieves a better performance through the management orientation towards higher productivity and cost efficiency. Graham (2006) argues that the costs fell considerably for Heathrow, Gatwick and Manchester since 1990 and Gatwick since 1995.[8]

Privatisation

The greater technical and allocative efficiency of public utilities has been the core argument by many proponents of privatization since the lack of incentive and sanction

[7] Heymann, (2006)
[8] however, costs have risen slightly in the recent years due to additional security measures.

Airport/Terminal	Planned investment	Opening date/Major projects
Amsterdam-Schiphol	US$ 18.7 billion US$ 1.16 billion	Terminal expansion, 5th runway; new offshore airport after 2025 (project currently on hold); Current terminal & runway projects until 2006
London-Heathrow	US$ 9.2 billion (incl. $5.8 million for T5)	Terminal 5 - first stage not expected to open before 2008; improvements at the other four terminals
Frankfurt	US$ 5.0 billion	CargoCity South expansion, third terminal & fourth runway
Paris (third airport)	US$ 4.0 billion	New airport after 2015 (assuming go ahead)
Paris (CDG + Orly)	US$ 3.0 billion	Terminal & runway work until 2006
Berlin-Schönefeld	US$ 3.2 billion	First-phase expansion into BBI until 2009
Rome-Fiumicino	US$ 2.9 billion	Staged terminal expansion until 2005
Barcelona	US$ 2.7 billion	Third runway, new pax & cargo terminals
Lisbon	US$ 2.4 billion	Completely new airport at Ota not before 2010
Lublin/Poland	US$ 2.3 billion	Completely new airport planned in eastern Poland
Zürich	US$ 1.6 billion	'Project 2000' Fifth Expansion Phase, to open 2003/4
Madrid-Barajas	US$ 1.6 billion	New pax + cargo terminals, new runway
London-Gatwick	US$ 1.4 billion	New midfield terminal and refurbishment of facilities
Copenhagen	US$ 1.2 billion	New pax & cargo terminals, road & rail access
Munich	US$ 1.1 billion	Second terminal until summer 2003
Düsseldorf	US$ 1.1 billion	New terminals, rail station, runway extension
Leipzig/Halle	US$ 1.0 billion	New terminal with rail station, new runway
Vienna	US$ 910 million	New terminal, apron, tower, office park
London-Stansted	US$ 840 million	Improving ground access; third satellite terminal
Manchester	US$ 780 million	2nd runway ($275m) completed, terminal expansion
Stockholm-Arlanda	US$ 720 million	Third runway, capacity increase
Lyon	US$ 700 million	Doubling of capacity
Cologne/Bonn	US$ 610 million	New terminal with rail link & station
Zagreb	US$ 600 million	Master Plan projects
Prague	US$ 585 million	Major terminal expansion, new runway
Funchal/Madeira	US$ 550 million	Runway, apron extension & terminal upgrade
Stuttgart	US$ 550 million	Third terminal; new cargo complex (completed)
Hamburg	US$ 500 million	New terminal & satellites, new apron
Dublin	US$ 500 million	Terminal modernisation (new Pier C, Terminal D)

Figure 1 Capacity enhancing airport projects in Europe and associated financial costs,
Source: Quelle: DG Tren (2003), Section 4 - S. 143.

mechanism leads to the inefficiencies of public organizations. Transaction costs theory stressed the importance of the costs related to running a business. Coase (1937) argues that the firm will emerge as a consequence of this, and therefore it would be able to reduce the costs of organizing transactions under alternative institutional arrangements. Here we can infer that the airports will be changing their institutional form once the alternative allows for transaction cost saving.

On the other hand, Property Rights Theory illuminates the missing incentives for efficiency present in the public utilities exist as a result of given property and ownership rights. The more extensively the property rights are connected with the ownership rights by means of production, the higher the motivation is present in rendering good performance. Principal-agent theory treats the efficient delegation and cooperation in the world of asymmetric information and moral hazard through a contract between the principal and the agent. In order to realize the profit maximization, principal (shareholder) assigns the tasks to the agent (managers) to take over the management of the business and

employ necessary resources to carry over the tasks. Since both principal and agent want to maximize their utility and thereby each of them pursues its own interests, the divergence in goals may emerge as a result of this. However, the divergence in goals between the shareholders and management results in principal-agent problems and agency costs have to be incurred in order to overcome this. The smaller divergence in goals implies that the income of the agent is more profit-based and therefore the incentives for better performance are higher.

In state-owned organizations evaluation and control mechanism for performance is hard to be implemented because instead of shareholders the government is acting as a principal. Unlike the agent in the private sector, the agent in public institutions does not take a stake in profits nor is obliged to receive sanctions such as lay-offs or salary reductions. Instead, he may pursue a good image policy not encapsulated within profit motivation. In such a case, perhaps externality of increased quality (i.e. better service, more luxurious terminal and link to political economy play a role (i.e. avoid bad press). Furthermore, higher costs may be covered or are diversified through tax collection). Then there could be the risk aversion of public owned infrastructure.

Therefore, the agent is less orientated towards the company's efficiency than one in the private sector. Moreover, the fear from possible takeover or bankruptcy is missing in the state-owned enterprises. Due to the lack of market competition, or market exit and management incentives to retain the profits, no incentive for cost reductions is in existence. As a result of this process many public enterprises are running losses. On the other hand, private companies aim at profit maximization in which both agent and principal get awarded in case of high efficiency and better performance and have incentives to work towards the higher profits and reduce costs. Clearly, the efficiency of the privatized company is influenced by both the competition in the market and ownership structure.

From an investor's point of view, the airports depict an attractive investment object because of high growth rate in the air transport, strategic perspectives and the potential of high revenues and value appreciation (Sterzenbach/Conrady 2003). Maurer (2003) points out that through existing revenue and economization potentials high rate of return with comparably small risk are promised to the investors. Investors do expect not only the efficiency improvements as a result of privatization, but also new revenue-generating

activities to be developed, better capacity utilization as well as the expansion of the non-aviation sector (Hirschausen et al 2004a).[9].

III) A look at the empirical evidence

In our analysis we have examined a small sample of British and German airports: Heathrow (LHT), Gatwick (LGW), Stansted (STN), Düsseldorf (DUS), Frankfurt (FRA), Hamburg (HAM), Hanover (HAJ), München (MUC) and Stuttgart (STR) in a period from 1998 to 2004. The economic and technical performance of the airports is measured by means of DEA, SFA, PFP and financial ratios. Before proceeding with the analyses, we will give a short overview on he development of airport privatization in these two countries.

Privatization in Germany

Privatization processes have taken place in Germany for different reasons; however, currently no German airport is fully privatized. Several partially privatized airports can however be found: Düsseldorf, Hamburg, Hanover, and Frankfurt am Main (Fraport)[10]. Düsseldorf went first public by accident. A fire destroyed parts of the airport in 1996 and no public funds for a huge investment in the reconstruction works were available. As a consequence, the sate of Nordrhein-Westphalia took the initiative in selling off 50% of the airport. Hochtief Airport GmbH and Aer Rianta International bought this stake for 180 million Euros in 1997. After the purchase the airport partners invested 389 million Euros in the reconstruction of the terminal B. The investors' intention was to enable the airport to be able to use its full capacity that in the shortest time possible and to follow a growth-oriented strategy. The traditional cost-based regulation continues to be used by the state regulator. (Becker et al. 2003)

In October 2000 the Hamburg airport went partly into the private hands. Hochtief Airport GmbH and Aer Rianta International bought 36% for approximately 270 million Euros, and later increased their stake to 40%. The original owner, the City of Hamburg, still

[9] Recent experiences of airport privatization or takeovers associated with and very high multiples (Budapest, BAA;) and the emergence of specialized investment banks like Maquire etc make privatization politically easier to sell.

[10] Recently , a small number of regional airports have also become privatized

controls 60% of the shares, but may reduce its stake further. In 2000 the traditional cost-based regulation was replaced by a (dual-till) price-cap regulation (Becker et al. 2003)

The partial privatization of Frankfurt airport occurred in 2001. After the placement of 25% of shares in the stock market, diverse holders, including a 10% share held by Lufthansa, now hold them. The airport followed the Hamburg model and agreed with the regulator and the airport user council to introduce a price-cap regulation in 2002. Hannover is a further example of partially privatized airport. 70% is owned by the state of Lower Saxony and the city Hannover, whereas 30% is in the ownership of Fraport AG.

The remaining German airports continue to be owned by local or state government. The representative bigger airports are München airport and Stuttgart airport. The following Table 2 gives an overview of different airports, their ownership pattern, and number of passengers as well as the time of privatization.

Flughafen	Eigentümer	Anteil (%)	PAX 2005 (Mio.)	Zeit der Privatisierung
Primärflughäfen	Flughäfen mit Drehkreuzfunktion			
Frankfurt (Fraport)	Land Hessen Gemeinden Bund Streubesitz	32,1 20,5 18,4 29,0	72,2	2001
München	Freistaat Bayern Bund Stadt München	51,0 26,0 23,0	30,7	
Sekundärflughäfen	Flughäfen, die ein attraktives Einzugsgebiet aufweisen und daher von mehreren Netzwerkfluggesellschaften an ihr Drehkreuz angebunden sind.			
Düsseldorf	Stadt Düsseldorf Hochtief Airport GmbH Aer Rianta International	50,0 30,0 20,0	16	1997
Hamburg	Stadt Hamburg Hochtief Airport GmbH/ Aer Rianta International	60,0 40,0	11	2000
Stuttgart	Land Baden-Württemberg Stadt Stuttgart	50,0 50,0	9,5	
Tertiärflughäfen	Tertiärflughäfen: Alle weiteren internationalen Verkehrsflughäfen			
Hannover	Land Niedersachen Stadt Hannover Fraport AG	35,0 35,0 30,0	5,7	1998

Table 2 Ownership structures of major German airports (2003)

Source: Beckers et al (2003, p11) and Niemeier (2003b), S. 3.

Privatization in the United Kingdom

In contrast to Germany, airports in the United Kingdom are not owned and managed by a government entity. Indeed, the UK government policy actively promotes and encourages private ownership of airports, and the majority of British airports are either partially or fully privatized (Ehmer, Müller-Rostin, Müller and Niemeier, 2007). Three types of airport ownership predominate in the United Kingdom:

1) Fully privatized airports (a private company manages and owns the airport; examples include Liverpool and the BAA airports)
2) Partially privatized airports (these airports are under joint local government and private ownership; examples include Birmingham and Newcastle)
3) Public airports (these airports are owned and often managed by local governments, e.g. Manchester)

The fundamental change in the airport industry occurred after the 1986 Airports Act, which provided for the privatization and commercialization in the sector and aimed at reducing the financial burden on the public sector by encouraging efficiency in the operations and access to private capital (Graham 2006). British Airports Authority (BAA) was converted into private ownership after the Act. When the airports were still owned by the public sector, it was difficult to borrow and mainly for this reason the government decided to privatize their operations. BAA, Peel Airport, Macquarie Airport and the public owned Manchester airport today own most of these regional airports. In 2006 Airport Development and Investment Limited (AID), the investment arm of the Spanish construction firm Ferrovial, have taken over the BAA GROUP at a considerable premium.

IV) Methodology:

1) Financial ratio analysis (FRA):

The analysis of financial statements is designed to reveal relationship (i.e. ratio) between items on the financial statements and trends of individual items over time. By knowing these relationship and trends, investors and shareholders are in a better position to exercise sound judgement regarding the current and future performance of a company.[11] Financial

[11] Mowen and Hansen,(2006) p. 654-673.

ratios are the tools of financial analysis. They are the result of analytical techniques and may isolate areas requiring further investigation. In order to take full advantage of these calculations they have to be assessed and interpreted with due consideration of the background information on the company, the state of the airport industry sector on a global scale and general economic conditions and trade cycles as the most important parameter of traffic development.

It is useful to classify ratios into five fundamental categories according to the needs of different users:[12] Liquidity ratios, which measure the firm's ability to meet its short-term immediate obligations. Debt management (financial leverage ratios), which measures the extent to which the firm has been financed by debt. Profitability ratios, which measure management's effectiveness as shown by the returns generated on sales and investment.

2) Partial factor productivity (PFP)

PFP is a very simple tool, i.e. the ratio between one input and one output. Since variation in other inputs on or other output often takes place at the same time, a partial measure (like movements per Pax) can be misleading. Nevertheless it is often used as a simple benchmarking tool to compare performance over time, when some of the other inputs will move proportionally or we are only dealing with one central input and one output.

3) DEA:

Data Envelopment Analysis (DEA) examines the efficiency of similar production units using so-called dominance comparisons of the units' inputs and outputs. Each production unit is compared to other production units in the whole sample in order to determine whether there exist other production units (or combination of production units) using the same or less of the inputs to produce the same or more of the outputs. If this is the case, the production unit is termed inefficient. Otherwise, the production unit is efficient. In this way the efficiency concept is a relative one as it is only concerned with efficiency in relation to the sample and not some absolute efficiency standard (Graham 2000).

4) Stochastic Frontier Analysis (SFA):

[12] Ibid.

V Empirical analysis

1. Financial ratio analysis (FRA):

a) Liquidity

The primary emphasis of the liquidity ratios is on the company's ability to pay off short-term obligations using assets that are most readily converted into cash and the speed at which cash moves through the firm. Assets that may be converted into cash in a short period of time are referred as liquid assets; they are listed in financial statements as current assets. Current assets are used to satisfy short-term obligation, or current liabilities. On common liquidity ration is the current ratio.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

The current ratio is the ratio of current assets to current liabilities, indicates a company's ability to satisfy its current liabilities with its current assets.

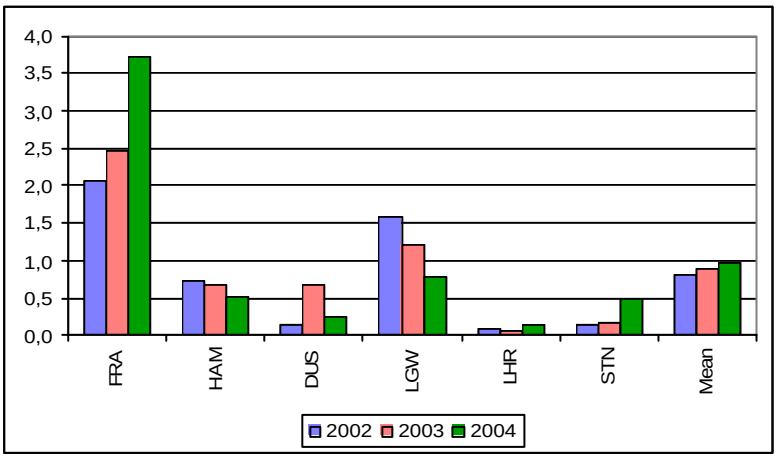


Table 3 Ratio of current assets to current liabilities in the sample

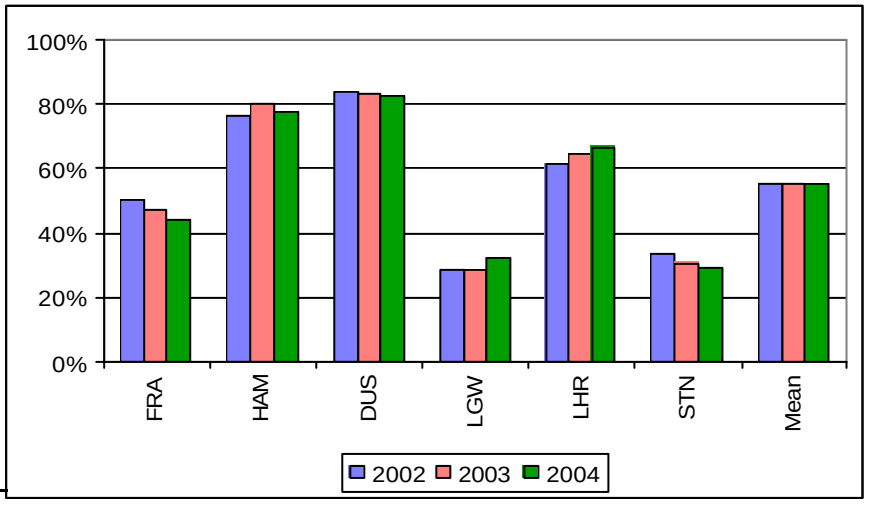
The average current ratio was 0.98, respectively in 2004, up from 0.79 in 2002. The liquidity of UK airports was lower than that of German airports. Fraport had the highest current ratio at 3.7, exceeding all others. Heathrow had the lowest current ratio at 0.13 in 2004, respectively due to its very low current assets and high current liabilities. Stansted had the second lowest current ratios at 0.7. It is important to note that the UK airports started to increase their current assets after 2003. They started to form higher cash reserves for fast tactical financing measure (Siemens Financial Services, 2006). There was a big increase for Fraport after 2003, because Fraport paid back its short term debts.[13]

b) Dept management

Financial leverage ratios are used to assess how much financial risk the company has taken on. Firms with low leverage ratios have less risk of loss when the economy is in a downturn, but they also have lower expected returns when the economy booms. Conversely firms with high leverage ratios run the risk of large losses but also have a chance of gaining high profits. The prospects of high returns are desirable, but investors are averse to risk.

Debt ratio: Debt ratio measures the percentage of total funds provided by creditors. Debt includes short –term liabilities, long-term liabilities and all bonds. Investors and creditors are the two major sources of capital. As the percentage of assets financed by creditors increase, the riskiness of the company increases. The debt ratio is calculated as follows:

$$\text{Debt ratio} = \frac{\text{Total debt}}{\text{Total assets}}$$



[13] Fraport Annual Report 2004.

Table 4 Percentage of total funds provided by creditors

The average debt ratio was 55.4%, respectively in 2004, down from 55.8% in 2002. Stansted had the lowest ratio at 29.1% in 2004, that is, only 29% of its assets were financed by debt. Fraport had the second lowest debt ratio at 44.4% in 2004. Dusseldorf had the highest debt ratio among the group at 82.2% in 2004. Most of the financial funds were spent to complete the new terminal in front of Pier C (6.2 million Euro), the baggage transportation system (2.5 million Euro), and modification of the SkyTrain with Station C (a total amount of 8.2 million Euro) due to the 'airport 2000 plus'- the greatest investment programme in the entire history of the airport. One of the most important financial goals the group of companies set itself for 2004 was to reduce its bank debts considerably in order to strengthen the equity capital quota.[14]

c) PROFITABILITY

Operating profit margin: Profitability is the net result of a large number of policies and decisions. The ratios examined thus far reveal some interesting things about the way the firm is operating, but the profitability ratios give final answers about how effectively the firm is being managed. The profitability ratios measure the ability of the firm to earn an adequate return on sales, total assets and invested capital.

The average operating margin for the selected UK and German airports was 24.3%, respectively in 2005, down from 26.3%; respectively in 2002. UK airports achieved higher operating margins than German airports. Heathrow had the highest operating margin at 39.1%, respectively in 2005. Fraport had the lowest operating margin at 14.6%; respectively in 2005. The operating margin for Dusseldorf decreased from 31.4% in 2002 to 21.1% in 2005. Because the cost of materials increased by 43% since 2002.

[14] Dusseldorf International Airport Annual Report 2003-2004.

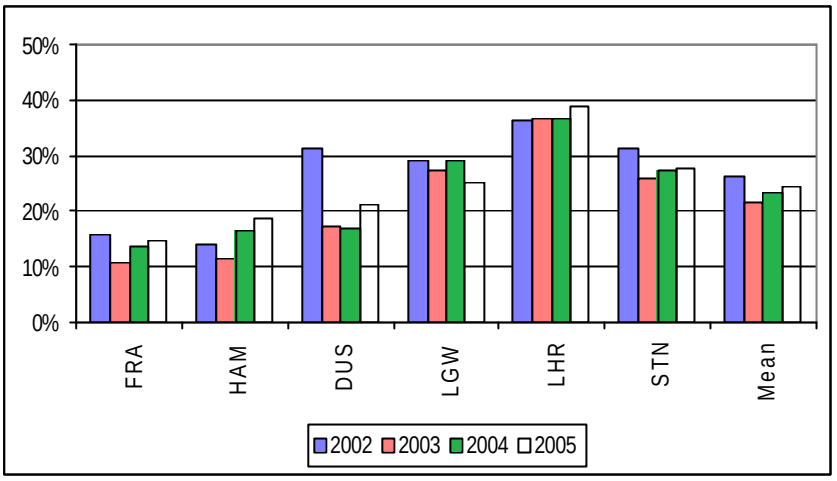


Table 5 Operating profit margins

This increase was mainly caused by the higher cost of maintenance and conversion services provided by outside companies and services provided by Flughafen Düsseldorf Cargo GmbH.[15] The other operating expenses also increased because of the provisions in an amount of €38 million during 2003.[16]

2 Partial productivity analysis

a. <u>Regarding Financial Comparison:</u>

We have looked at a number of financial indicators and recorded our impressions below, but further analysis is necessary: Table 6 below shows that British airports are more cost efficient than the German ones, but this is probably related to them much lower degree of vertical integration and the greater degree of outsourcing.[17]

Generally speaking the British airports have much lower aeronautical-revenues per WLU in comparison to the German airports. On the other hand, non-aeronautical revenues play a bigger role for British Airports and are often the core business of these airports, since they outsource ground-handling activities and take in concession fees. Non-Aeronautical Revenues are less important as a source of revenue for the German airports. But overall, the German airports seem to have higher revenues per WLU.

[15] Dusseldorf International Airport (DUS), Annual Report 2004, DUS.
[16] Dusseldorf Ibid
[17] Most of the UK airports are not engaged in ground handling and also outsource most of their non-aviation activities

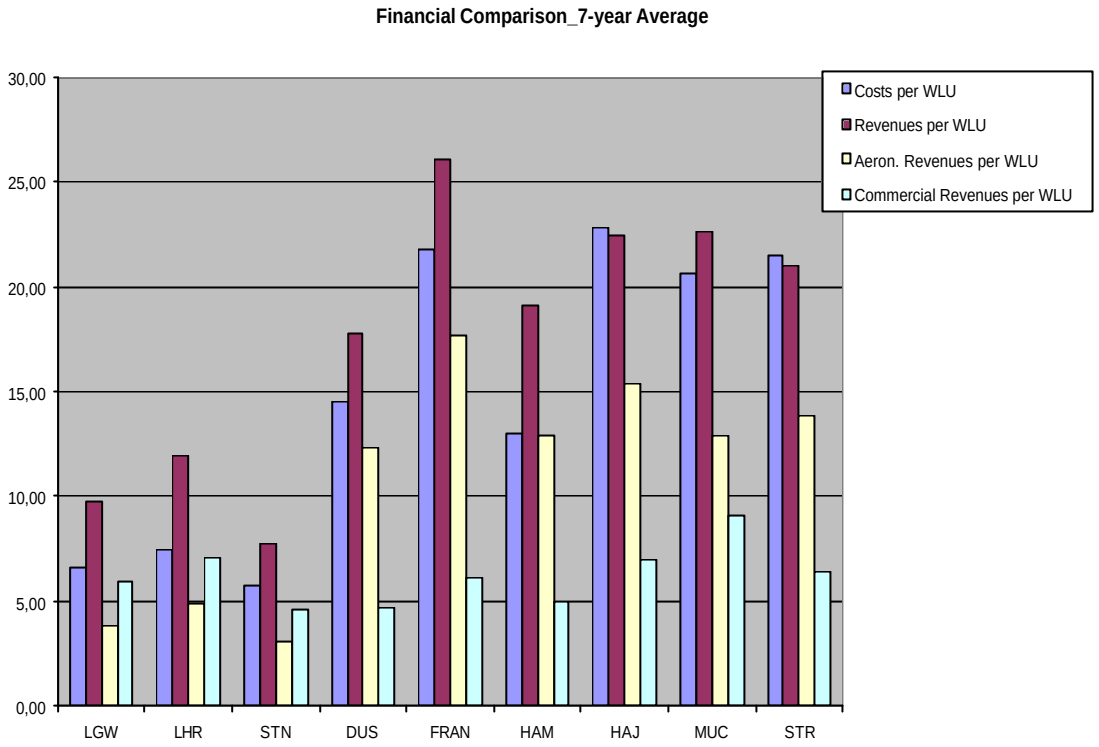


Table 6: Financial comparison based on the seven-year-average

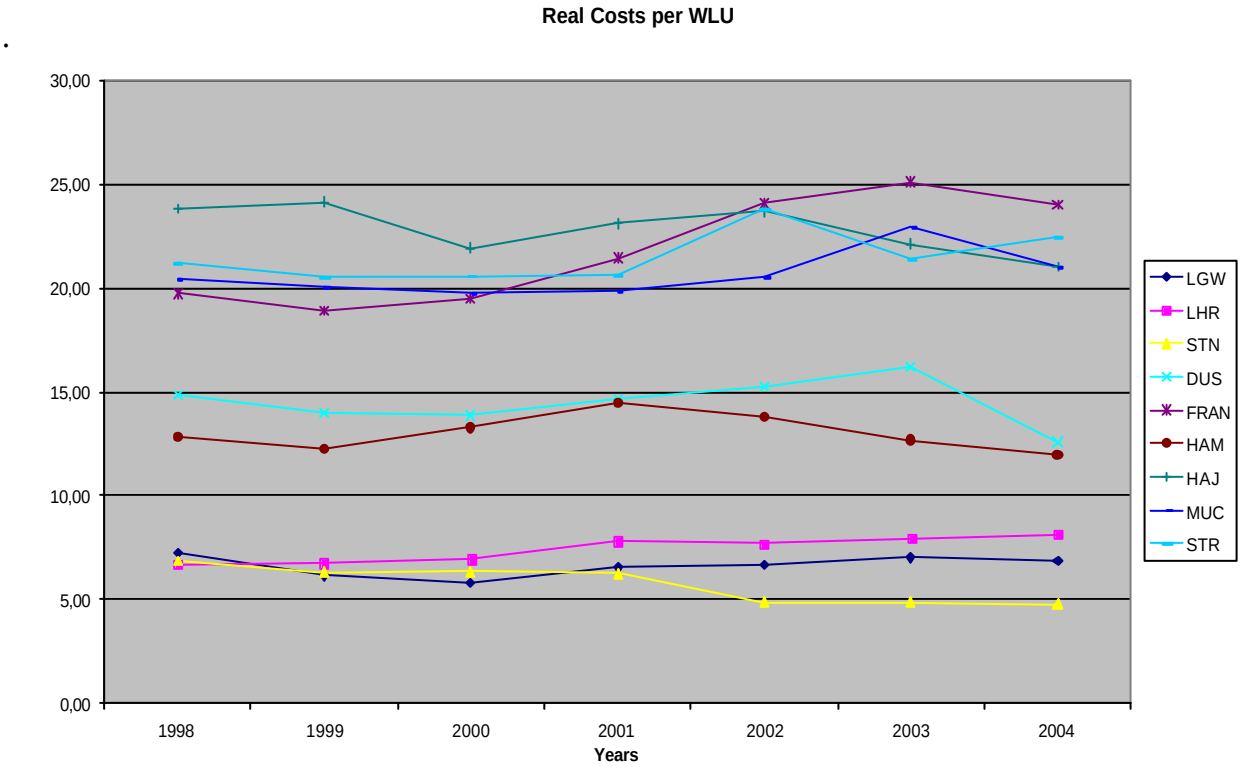


Table 7: Real Costs per WLU

Non-Aeronautical Revenues play a big role in British Airports, since they outsource ground-handling activities and take concession fees in Non-Aeronautical Revenues .As a consequence; German airports seem to have higher revenues per WLU (or per PAX)
These indicators do not tend to change in time too much, they are stable.

When we analyze Table 7: Real Costs per WLU, Hannover has the highest real cost per WLU and the expenses exceed revenues. Real costs per unit at the other airports, such as Heathrow, Frankfurt, Gatwick and Düsseldorf, slowly increased after 2000, most probably due to higher security measures. Graham (2006) has found similar results.

Nevertheless, the British airports incur significantly lower costs than the German airports. HAM and DUS, two partially privatized airports, tend to run lower costs than other public airports in Germany. From 2003 to 2004 a sharp drop in costs among some airports, such as DUS is to be observed, which we still need to investigate.

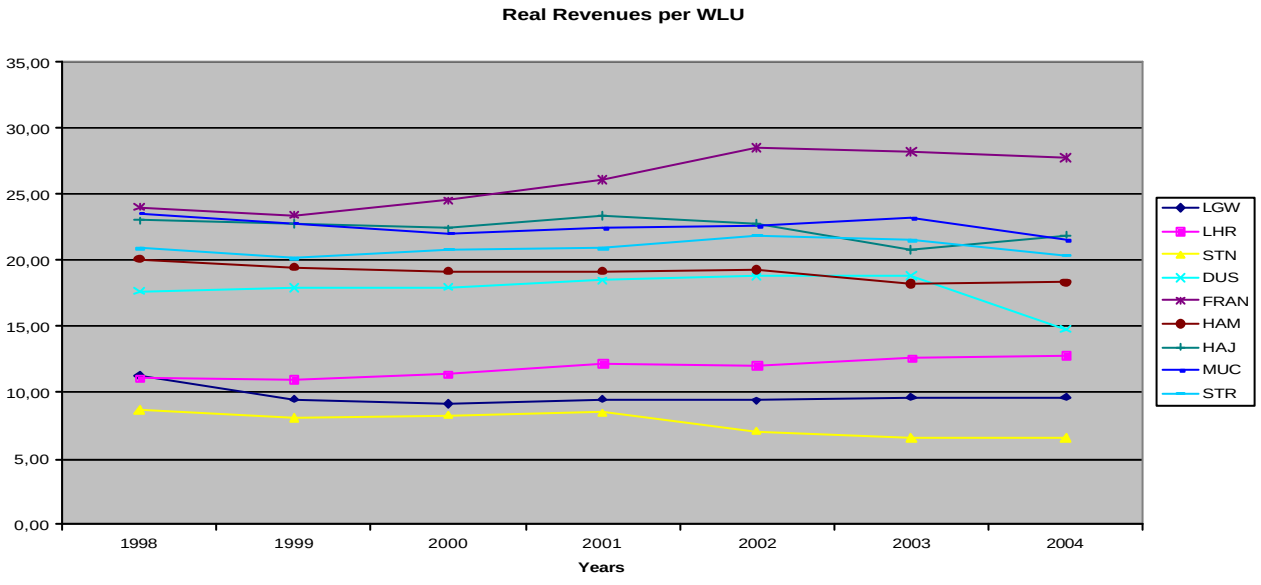


Table 8: Real revenues per WLU

German Airports have much higher Aeronautical Revenues per WLU, ranging between 15 and 28€. Maybe it stems from high level of charges?

Among the German airports, the Hamburg and Düsseldorf generate the lowest revenues whereas the Fraport occupies the leading position. Stansted has the lower ratio of all airports. Maybe because of pressure from low cost carriers?

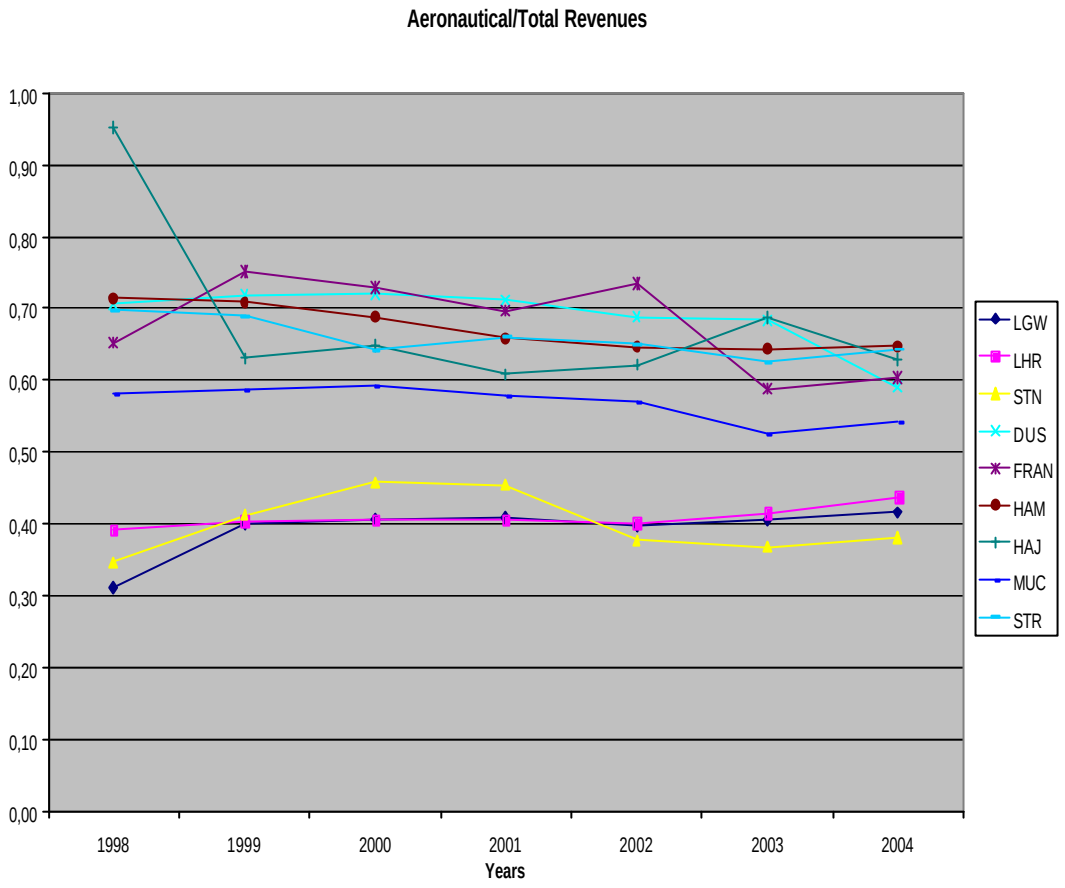


Table 9: Aeronautical Revenues / Total Revenues

The aeronautical to total revenues ratio reveals that the German airports have a fairly high proportion of their revenues stemming from the aeronautical activities (approximately 60%-70%) and therefore they have a higher ratio than the British airports. On contrary, the share of non-aeronautical revenues plays quite a significant role at the British airports, which generate approximately 60% of total revenues from non-aeronautical activities. The British airports clearly focus more on their commercial activities. Since the crisis in air transport following 9.11.2001, the increased focus towards commercialization can be observed for the British airports. .

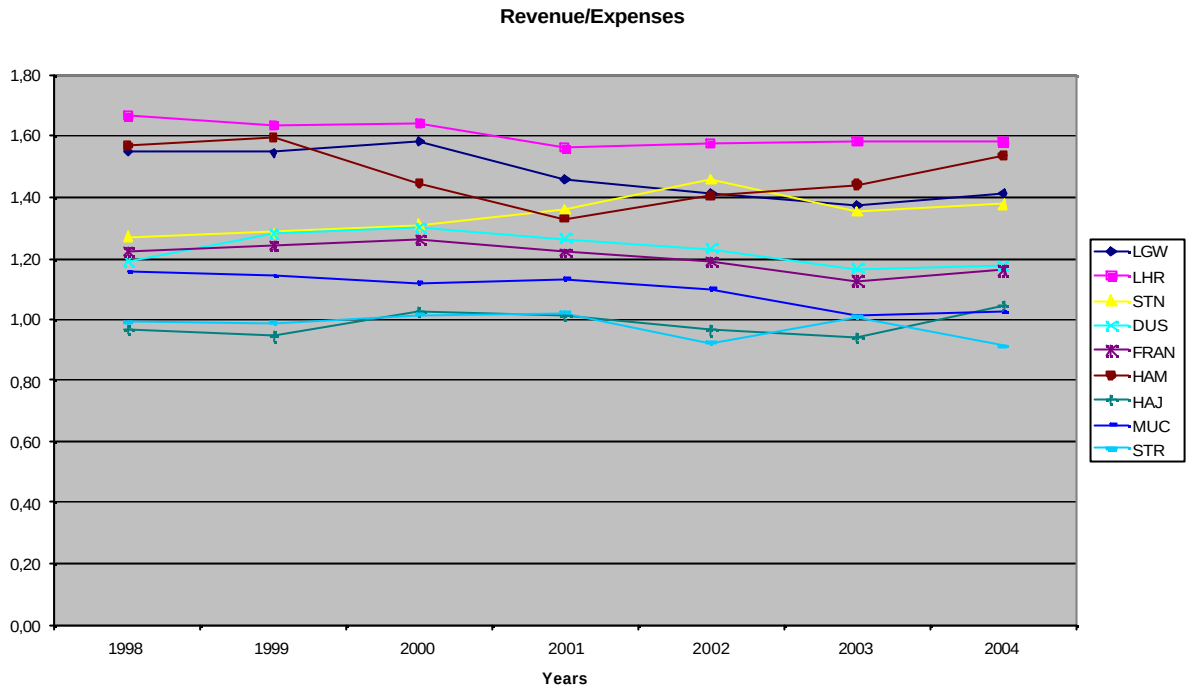


Table 10: Revenues / Expenses

From Table 10 we observe that LHR leads the chart, i.e. earned the most revenues relative to expenses. Other privatized airports, such as Gatwick, Stanstead and the partially privatized German airports HAM, DUS and FRAN, follow London Heathrow.

b. <u>Regarding Labor and Capital Productivity:</u>

In Table 11, all three British Airports are much more efficient than German airports with respect to labor productivity measured in movements and WLU[18] per employee, because of the different degree of vertical integration we have already mentioned. Also labor market characteristics may play a role (fewer and less powerful labor unions as well as less rigid the labor market as opposed to the German labor markets).

With respect to capital productivity (or capacity utilization), which is her measured in movements per runway and pax/gate, the picture is not so clear. However, in average British still have higher productivity ratios.

[18] The work load unit (WLU), an output index that combines passengers and freight, is a popular productivity measure used for benchmarking

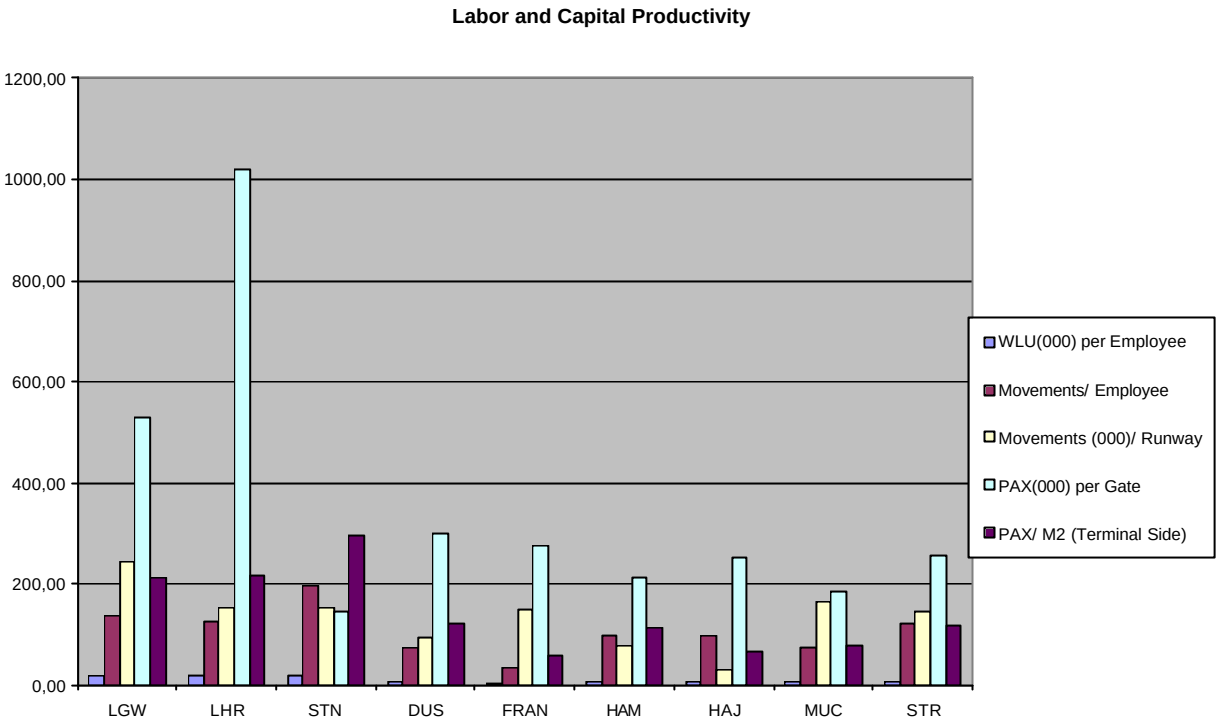


Table 11: Labor and Capital Productivity, 7year average

When looking at productivity developments of labor over the period at the individual airports in Table 12, British airports show a leading position when using WLU/employee.

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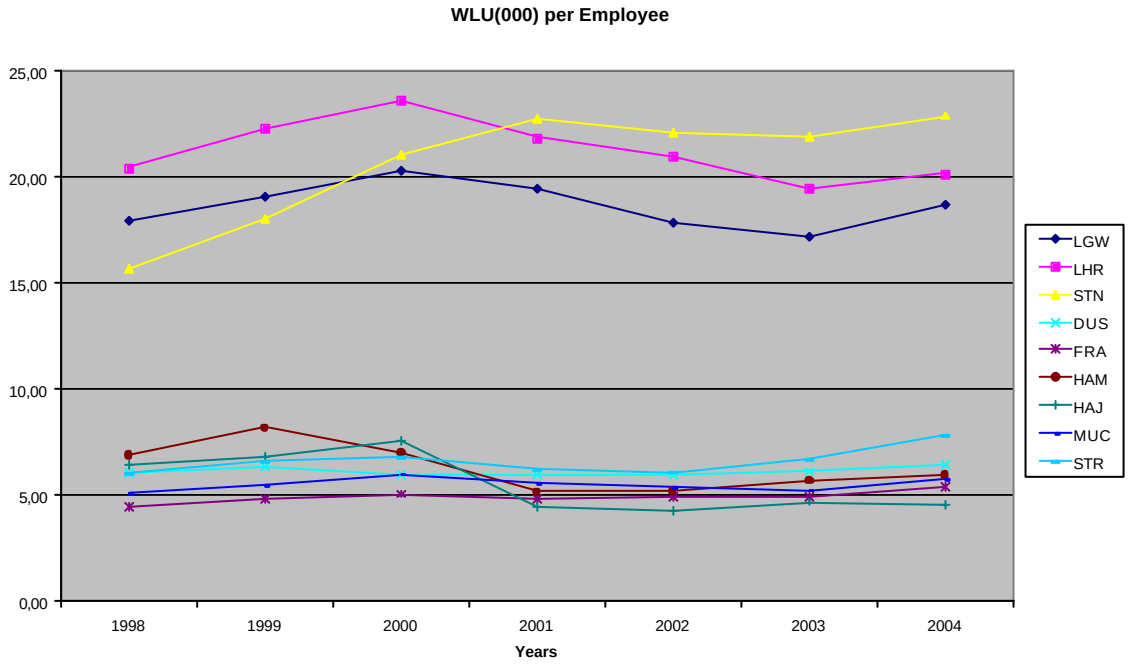

Table 12: WLU (000) per Employee

load units. Heathrow is more productive than Gatwick, but Stanstead has steadily improved.

With some 2000 WLU per employee, the British airports are more productive than the German airports. On average they handled something more than 5,000 WLU per employee. This of course reflects the high degree of outsourcing at British airports[19].

Among the German airports, Stuttgart seems to have become the most labor efficient airport in Germany, replacing Hamburg, Frankfurt performs the worst. We see the same picture, when looking at pax/employee, as the 2 indicators do not differ much.

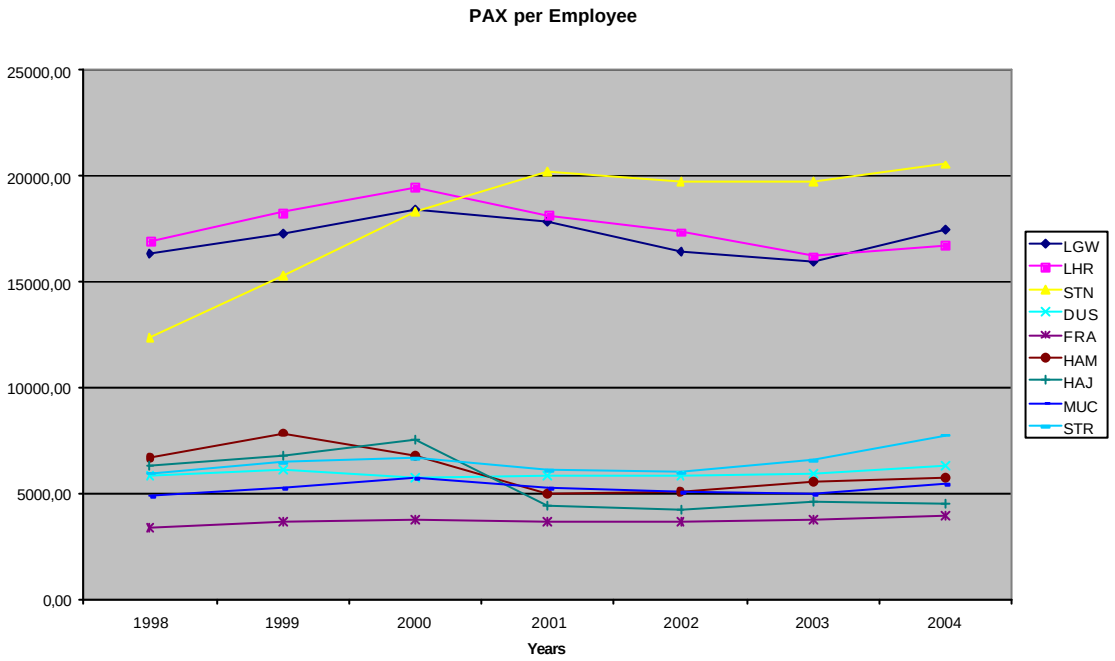

Table 13: PAX per Employee

Over the period of six years the British airports consistently outperform the German ones in the numbers of passengers per employee. Higher traffic volumes contribute to boosting the ratio for London airports.

The number of passengers at the Munich airport conspicuously increased from 2003 to 2004 due to the opening of the Terminal 2 in 2003. Frankfurt had the smallest ratio and is the worst performer over the period of analysis.

[19] For a better comparison one should exclude outsourced activities but this is quite difficult since most of the airports annual reports are not transparent enough

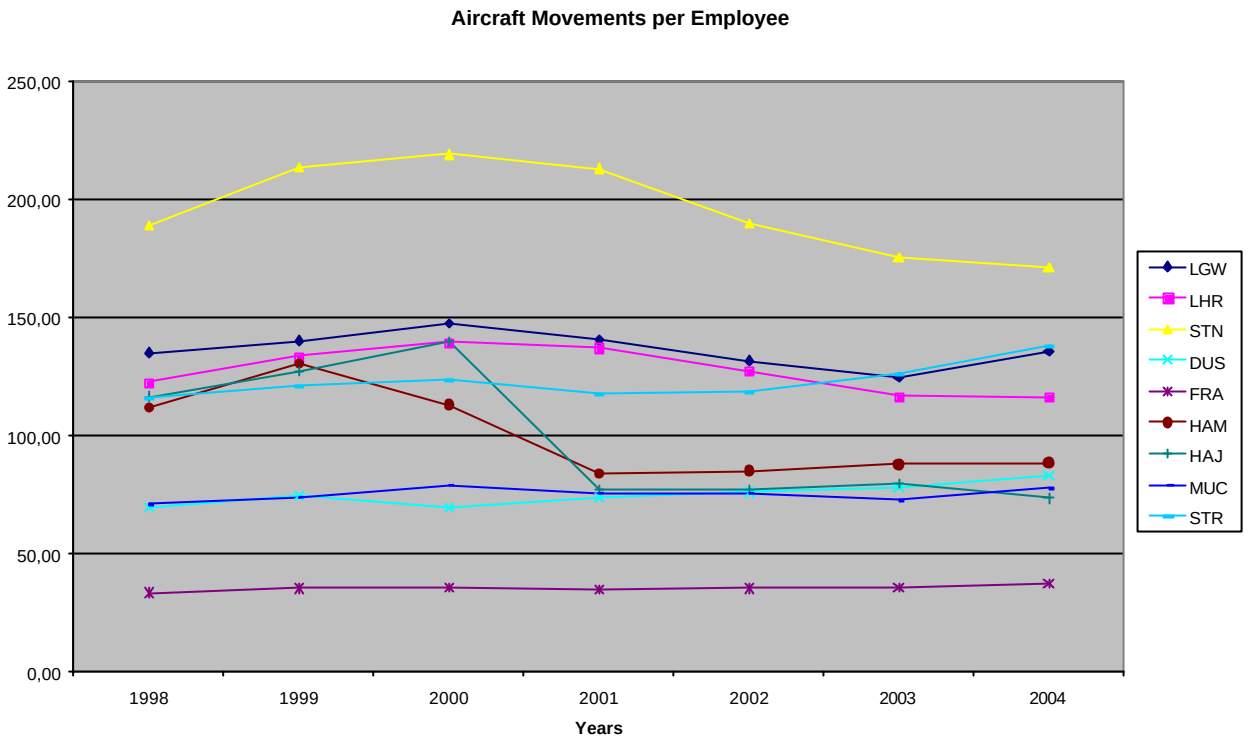

Table 14: Aircraft movement per Employee

The highest aircraft movement per employee characterizes STN, even though the ratio decreases over time. In comparison to better performers, British airports, German airports realized fewer aircraft movements per employee and their labor productivity is much smaller. (The exception is STR)

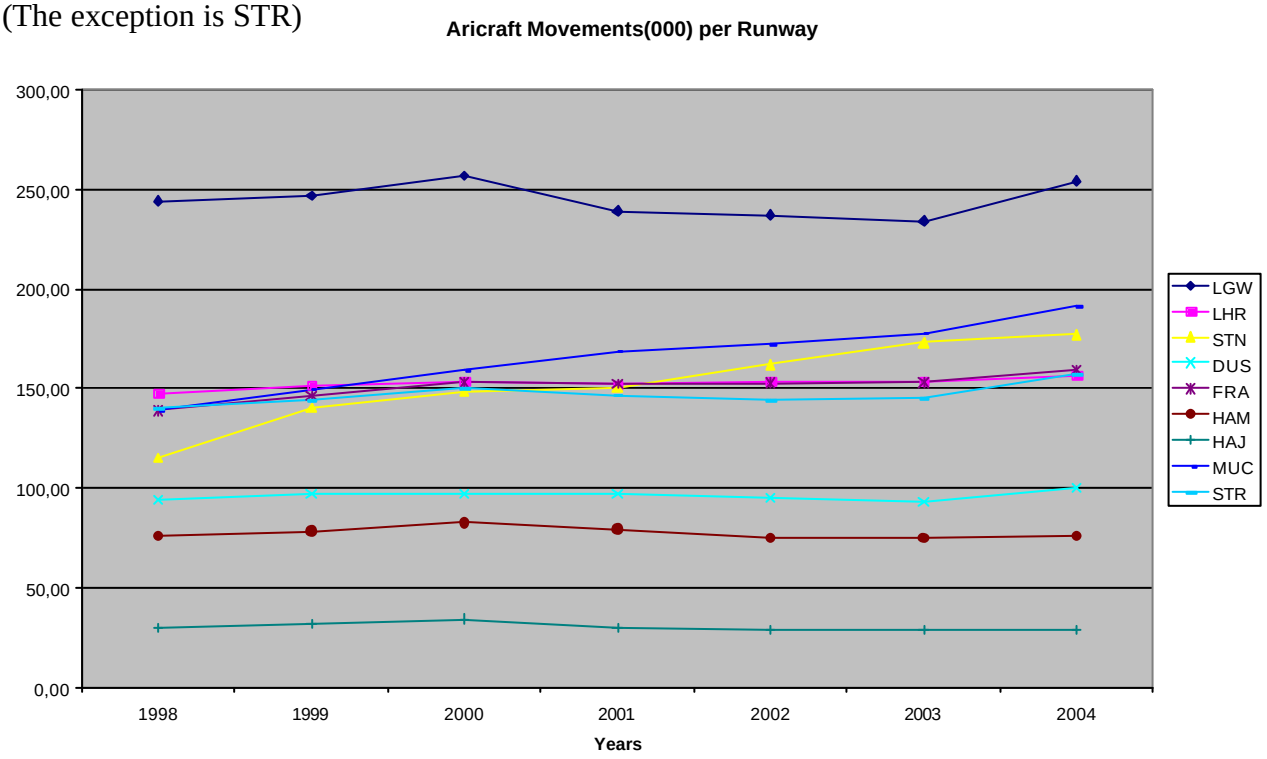

Table 15: Aircraft Movements (000) per Runway

With almost 250,000 of aircraft movements per runaway Gatwick stands out among the airports, as it has only one runway, whereas the Hanover, characterized by less than 50,000 movements per runaway, used 3 runways. Gatwick is one of the airports with the most traffic volume in the world; however, it has only one runway at its disposal and must operate under capacity bottlenecks.[20]. Remaining two London airports, Frankfurt and Munich airports achieve also high level of aircraft movements. The Munich airport achieved the best capacity utilization consistently after 2000 among the German airports; however, most other German airports are operating with overcapacity and could therefore be regarded as relatively unproductive. Obviously, much of this is not to be influenced in the short term, and not at all by different governance structures

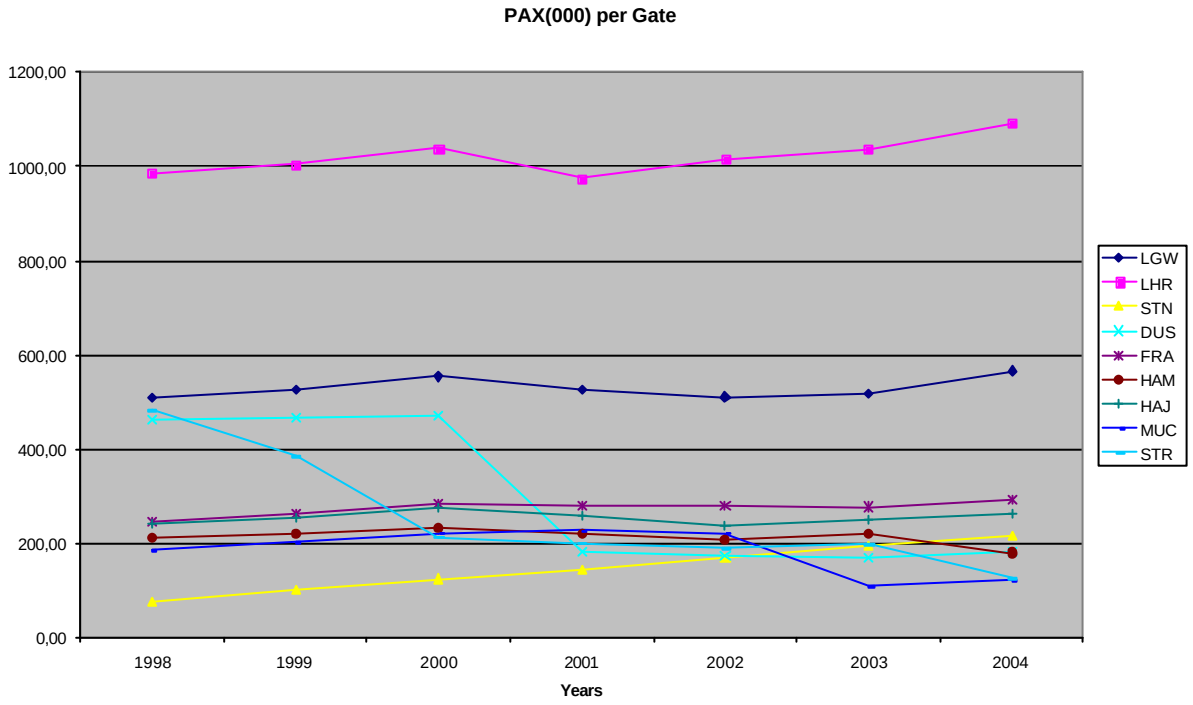

Table 16: PAX (000) per Gate

A different picture emerges when looking at pax/gate. With more then 1000 thousand passengers per gate Heathrow has outperformed both British and German airports. The airport in Frankfurt served approximately 300,000 passengers per gate between 1998 and 2004 and thereby the airport reached its capacity limit.[21] More interestingly, DUS is initially

[20] Even though the construction of a new runway has been expected in the near future, due to the protests of residents about noise and gases the decision has been postponed till 2019

[21] In order to be able to serve additional 25-30 million passengers per year, the authorities decided to build the Terminal 3

characterized by very large number of passengers, which dropped sharply in 2001. Before 2001 two terminals were not used due to the fire accident and capacity utilization in the remaining terminals strongly improved, but dropped when the number of gates increased from 34 to 84.

A similar story is behind the remarkable drop over the period of analysis in Stuttgart and Munich. Both opened new terminals and more or less doubled the number of gates.

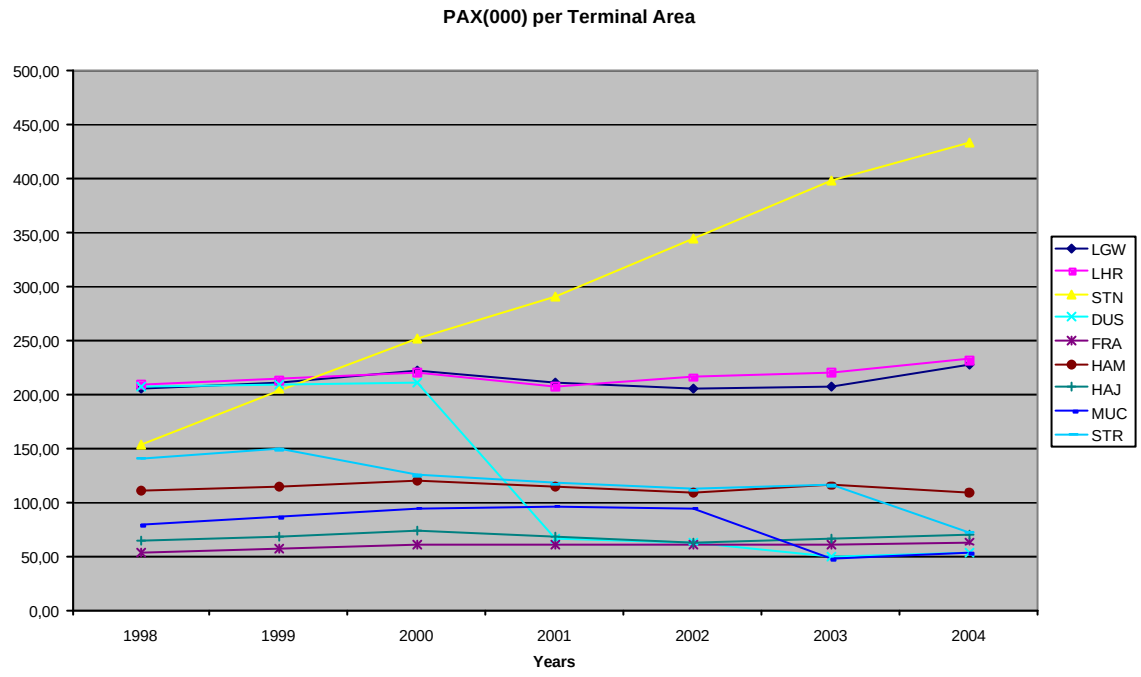

Table 17: PAX (000) per Terminal Area

This productivity development after large capacity increases can also be observed when looking at pax/terminal . Stansted really stands out, it has the most passengers per terminal area, amounting to 434,000 PAX/ m^2 (terminal area). Heathrow and Gatwick follow it. German airports report about 100,000 or fewer passengers per terminal area and are in this sense comparably less productive than their British counterparts. Stuttgart drops again, as the new terminal comes in to operation.

3. Data envelope analysis (DEA)

Following Pels, Nijkamp and Rietveld (2001) and Kamp (2004), the most appropriate input-output combination for the DEA seemed to be the following:

Output: Number of Passengers

Inputs: Terminal Area, Number of Check-in Counters, Number of Gates

Since the DEA deals with the technical capacity comparison, these three capacity measures are the most important ones passengers. However, in our partial analysis above, we have also seen how problematic these input variables are.

Since the sample does not include airports with huge differences in capacities, Constant Returns to Scale were assumed to hold, when applying the DEA. Output oriented DEA was implemented in the analysis. It means, DEA focuses on maximizing the output, holding the inputs constant.

The DEA results with a sample of 9 airports led to the following results:
Hannover was clearly operating below capacity; it could have served more than two times passengers as it actually did. The poor performance of Hannover airport does not stem from an expansion of capacity, but from the ongoing overcapacity when it is compared to the other airports in the sample.

The dramatic decrease of productivity in Stuttgart seems to be the result of expansions of gates (1998:15, 2004:70), terminal size (1998:51,154m2, 2004:120,894m2) and check-in counters (1998:57, 2004:116). However, while more than doubling the physical capacity of the airport, the number of passengers only increased from 7,237,239 in 1998 to 8,821,533 in 2004, still leaving it with significant excess capacity.

The same explanation applies to Düsseldorf, in which after the recovery from a fire, the two input measures used more than doubled from 1998 to 2004. But, the number of passengers stayed stable, even slightly decreased, also as a result of noise related capacity restrictions

Lastly, the measured efficiency in Munich airport halved in 2003 due to the opening of a new terminal, with increasing numbers of gates and check-in counters. Number of passengers again increases too slightly, but have increased steadily also beyond 2004. Clearly, such lumpy capacity increases play an important role as far as the long-term strategy of the airport is concerned, since capacity in the airports is subject to indivisibilities. Such capacity investments require some time until the expected results are achieved.

Considering the British airports, one can see that Heathrow did perfectly in all the years with a corresponding efficiency score of 1.000. In addition to that, Gatwick and Stansted reached almost the most efficient score.

Hence, conclusion of the DEA analysis is that, the German airports lie far behind the optimal output level, which would pertain if the inputs were used efficiently. While the mean efficiency score for British airports is 0.965 for the period, it is 0.687 for German airports.

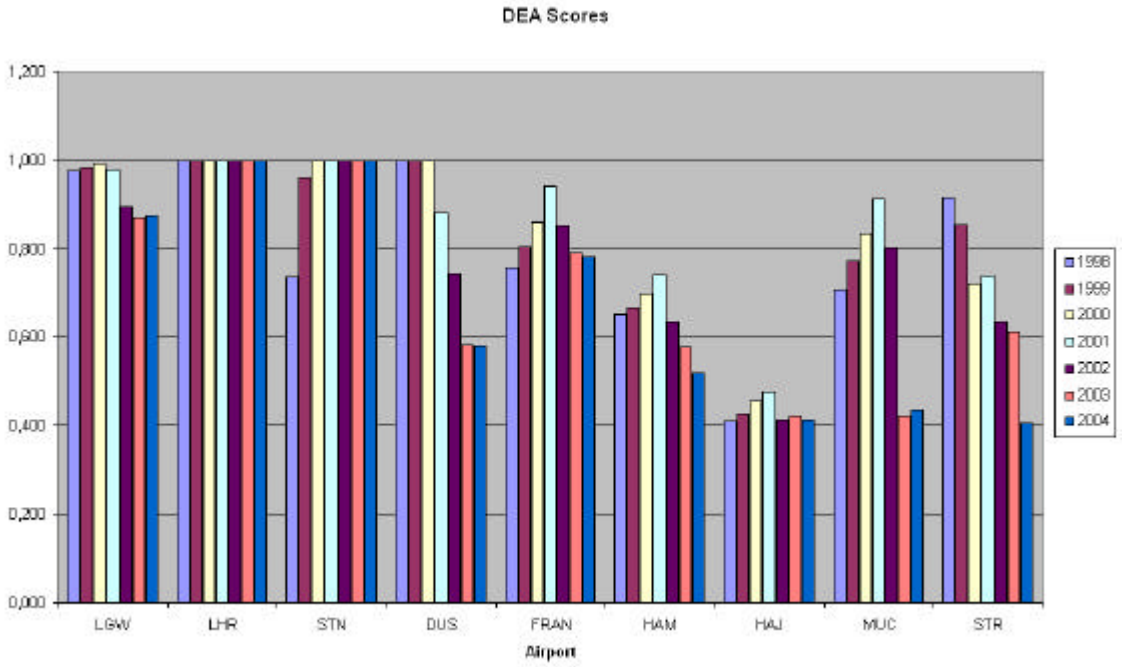

Table 18 DEA Scores

4 Stochastic Frontier analysis (SFA)

Due to the fact that only traffic and technical data are used in this study, estimating a Cobb-Douglas production function for the airports make sense. When the Cobb-Douglas Production function is estimated, two variables used, check-in counters and gates, are significant, whereas terminal area is not. In addition, the number of gates has a negative coefficient. The “gamma” indicates, that 96% of the residual variation

is due to the inefficiency effect, which indicates that the inefficiency results from mismanagement rather than random noise (i.e. measurement error, bad weather)[22]

	coefficient	*standard-error*	*t-ratio*
ßo	13.6973	0.6384	21.4560
Terminal			
Area	0.0223	0.1144	0.1952
Check-in			
Counters	0.8136	0.2015	4.0375
Gates	-0.2201	0.1084	-2.0304
sigma-squared	0.4773	0.2564	1.8614
gamma	0.9616	0.0230	41.8972

Table 19 Results of the SFA analysis

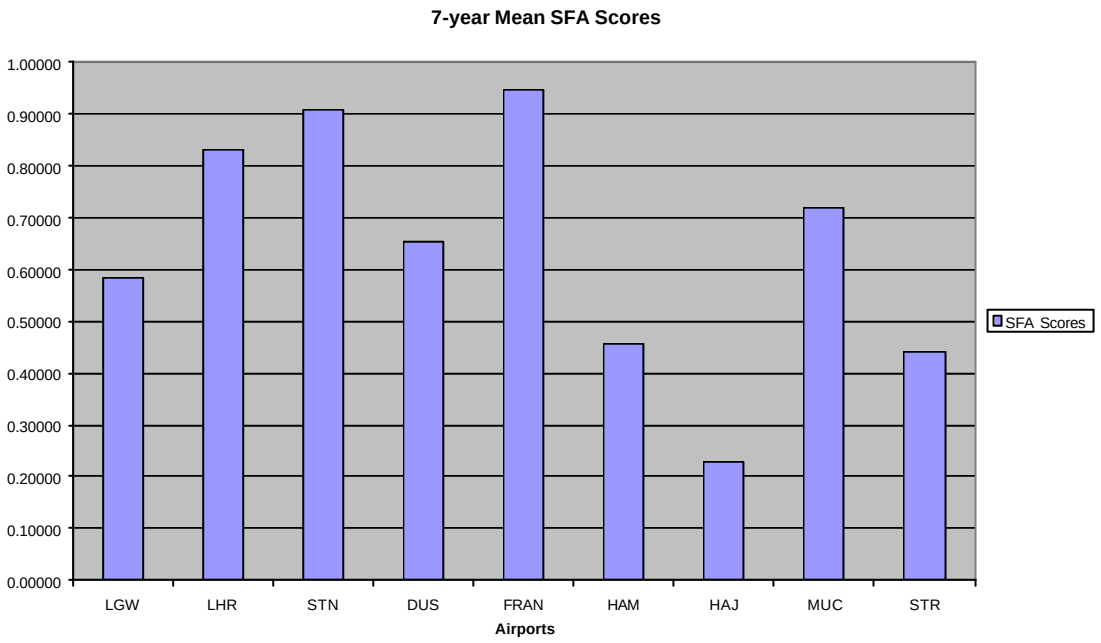

Table 20 Mean SFA Scores

According to the Stochastic Frontier Analysis in Table 20, Frankfurt airport is the most efficient one. One reason for this might be the fact that, the estimated Cobb-Douglas production function applies to Frankfurt the most. Hannover again performs very poorly as in the DEA.

[22] see also Kamp, 2004

In average, the SFA score for British airports is 0.7739, whereas it is 0.5742 for the German airports. Its average score is slightly higher that 0.200, stating that these airports actually can serve 5 times more passengers.

In contrast to the DEA, the SFA does not conclude that British airports work in almost full efficiency. Gatwick, for example, has only an efficiency score of almost 0.600. However, together with the DEA, the SFA confirms that the British airports are more efficient in terms of technical capacity as far as the passengers are concerned. But the question, whether it stems from the success of better management as a result of privatization, still need to be investigated further and with better data.

VI Conclusion

The impact of ownership structure on the performance and efficiency of the airports has been discussed extensively in the literature. We conducted the analysis on the case of the German and British airports in an attempt to better illuminate the effects of structural changes, as airport privatization started to take also effect in the Continental Europe. Partial privatizations allowed new investors to finance infrastructure expansion and provide for changes in management. In this process of changing the ownership, regulation of airport charge also changed. Some airports were switched from cost based regulation to price cap regulation. As a result, we would expect that these airports aimed at enhancing their operating efficiency and financial performance.

In our comparison of nine airports, we found strong evidence that the British airport more efficient in terms of costs and labour productivity. Some of the trends at the British airports are also present at the Hamburg and Düsseldorf airport (e.g. low costs, higher revenue/expense ratio). However, the airports in London earn significantly smaller revenues, especially those related to aeronautical activities. More traffic volume and better capacity utilization are characteristics of British airports whereas often overcapacities are encountered at the German airports. We obtained mixed results about German airports. Some ratios give support to the hypothesis of higher efficiency of partially privatized airports, but sometimes the trends seem to be subtle. For example, when as a result of

better access to funding, a new terminal is added, the performance drops significantly. Our PFP analysis points out that on average Stuttgart publicly owned airport represents the most efficient airport in terms of labour productivity, whereas SFA favours Frankfurt airport as the most efficient. DEA results reveal that British airports are better performers and that the efficiency of German airports decreased over last two years of analysis.

The need for further research and a broad comparison on European level is needed. Unavailability of data, unconsolidated data sources and other constraints most often limit such benchmarking analysis. Therefore, researchers face a key challenge in their attempts to compare the effects and fruits of privatization in order to provide many with a better picture of the airport sector.

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