GAP

GERMAN AIRPORT PERFORMANCE

Hochschule für Wirtschaft und Recht Berlin
Berlin School of Economics and Law

TEAM "BENCHMARKING & PARTIAL PRODUCTIVITY"

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Methodology:

The fundamental methodologies of benchmarking contain partial and total productivity indicators (PFP and TFP) and econometric methods such as Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). PFP shows a simple ratio between different inputs and outputs, such as capital, labor and financial productivity, to give a basic idea about productivities in different areas of airport operations. TFP aggregates all the factors of production in a combined index, where the weights of the factors relate to the factor prices.
The main differences between DEA and SFA are explained as follows: "…non-statistical approaches such as DEA have the disadvantage of assuming no statistical noise, but have the advantage of being non-parametric and requiring few assumptions about the underlying technology. SFA models on the other hand have the attraction of allowing for statistical noise, but have the disadvantage of requiring strong assumptions as to the form of the frontier" (Jacobs, 2000 p. 3).
DEA and SFA analyses allow to identify best practice, so that in a second stage regressions one can identify the reasons behind different level of observed efficiencies.
One of the main problems in a benchmarking analysis is how to measure and account for the capacity utilization of an airport, given that much of the investment is of a lump sum type, i.e. a large increases in either runway or terminal capacity. Links to optimal investment cycles are obvious.
In addition to that, in some points one faces comparability problems between the airports, especially between those in different countries. Differences in accounting practices, regulatory regimes, governing structures and different degrees of vertical integration are the most problematic issues of a benchmarking.
Given these comparability problems, we have also tried to build some other methodologies for a better benchmarking, such as comparing runway and terminal utilization.

Data:

The technical and traffic data (from yearly reports and other public sources and direct contacts with airports) come mainly from German, British, Irish, Italian and French Airports and cover the period 1998 to 2006. Data collection continues to up to 2007 and for additional airports. The main variables in the database are the following;

Terminal side							
Total number of gates	Terminal capacity per hour	Terminal size (in sqm)	Total number of check-in-counter	Total number of baggage claim units	Total number of parking spots	Departure lounge in sqm	Pax screnning units

Airside							
Total number of RWY	Total length of RWY (in m)	RWY capacity per hour	Total number of loading bridges	Total number of remote stands	Apron area (in sqm)	Airport area (in sqm)	Runway area

Other			
Operating Hours	Distance to city centre /in km)	Ownership	Employees

Traffic			
Aircraft Movement	Passengers	Cargo(in tonnes)	WLU

Finance					
Total Revenues	Aeronautical Revenues	Non-aeronautical Revenues	Total Operating Costs	Staff Costs	EBIT etc.

Results from Different Research Papers:

Kamp, Vanessa; Niemeier, Hans-Martin :
„Benchmarking of German Airports - Some First Results And An Agenda For Further Research"

According to a Malmquist-DEA by using 17 German international airports with data from 1998-2002, the performance at nearly every airport decreased from 2001, mainly due to the aftermaths of September 11th in 2001. This was especially the case for the terminal side because the capacity expansions in the form of new or additional terminal buildings increased excess supply whereas the passenger volume was decreasing.

Abdesaken, Gerry; Cullmann, Astrid (2007) :
"The Relative Efficiency of German Airports: An Application of Partial Factor Methodology and Data Envelopment Analysis"

An analysis which uses time series cross-sectional data from 1998 to 2004 with international German airports was meant to be the initial phase in partial factor calculation and comparison in the context of the German airport industry. Initial results verified with frontier comparisons have shown that FRA, MUC, STR, and TXL are the most technically efficient German airports. In terms of financial health, most of the airports in the sample performed poorly, many of which just barely managed to cover operating costs. However, it is important to remember that partial factor methodology and DEA are only relative measures, and do not provide conclusions based on absolute efficiency.
Since the larger German airports included in benchmarking studies of ATRS and TRL received unfavorable efficiency scores, and these same airports operated more efficiently in

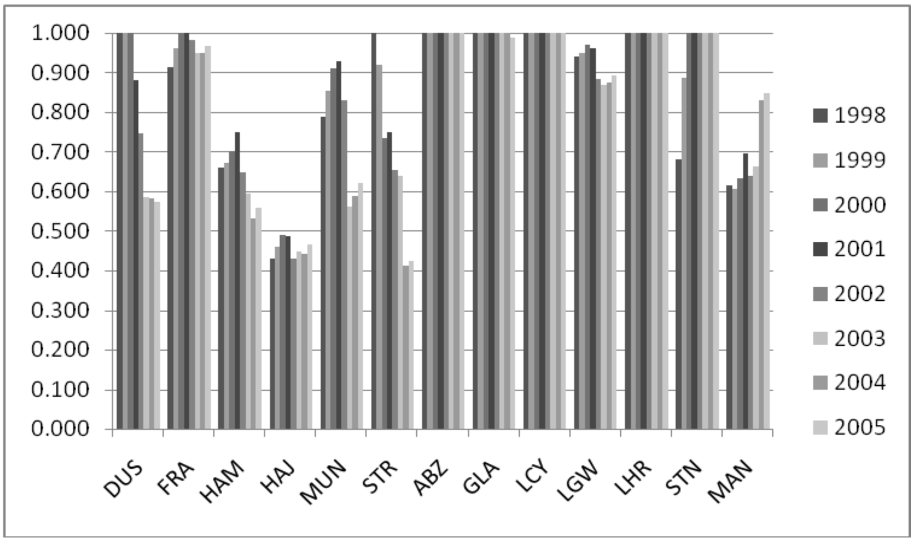
the German context, then by the transitive property are German international airports indeed inefficient when compared to other airport industries.

Müller, Jürgen; Ülkü, Tolga; Živanović, Jelena (2007) :

"Privatization, restructuring and its effects on performance: A comparison between German and British airports"

This study which compares 7 British and 6 German airports with data between 1998 and 2005 draws the following conclusions:

- Strong evidence that the British airports were more efficient in terms of costs and labour productivity.
- The picture of the overall performance of privatized airports in the sample is less conclusive.
- Mixed results on German airports:
  - Partially privatized German airports tend to achieve lower labor and capital productivity (e.g. Frankfurt, Hanover) while Stuttgart has the best labor productivity.
- Higher traffic volume and better capacity utilization are characteristics of British airports, whereas more overcapacities are encountered at the German airports.
  - Some ratios in the PFP analysis supported the hypothesis for higher efficiency of privatized airports, but sometimes this trend is subtle.
- Partial indicators are dramatically affected by the changes in capacity.

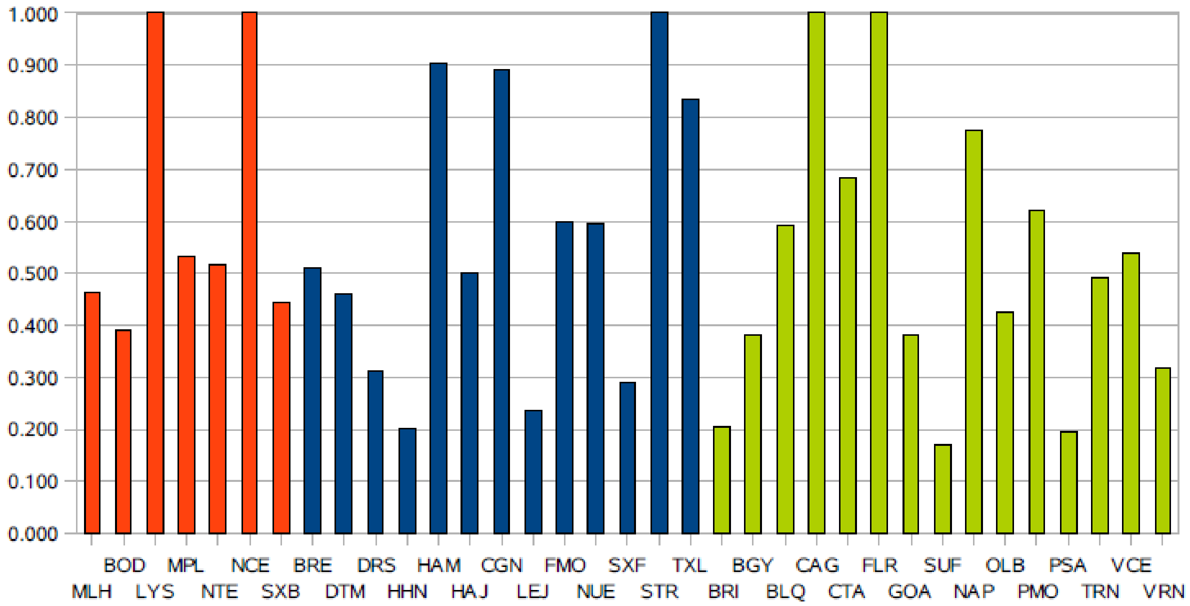


DEA Scores between 1998-2005

Živanović, Jelena (2008) :

"Measuring the efficiency of German airports in the European context"

This analysis with 35 Airports from Germany, France and Italy show how the DEA analysis is sensitive to the input-output specification and the impact on conclusions about efficiency. However, the French airports outperform the German and Italian counterparts, whereas the average efficiency of German airports is somewhat higher than the one of Italian airports. The factors, ownership structure, airport size, average aircraft size, capacity characteristics and location, were examined in Tobit regression. The airports processing more WLUs achieve higher technical efficiency. The efficiency is reduced by expansions of airport area and increasing number of runways.



DEA Efficiency Scores

Ülkü, Tolga (2008) :
"Capacity Measurements in Airport Sector: Drawbacks of Conventional Methods and Benchmarking Airports Using Declared Capacity"

This paper supports and gives strong evidences on the following hypotheses:

- Runway and terminal operations of an airport are two separate activities, which in an ideal case should be investigated separately.
- Using declared runway capacity gives better results on a capacity (efficiency) benchmarking than using partial productivity indicators such as aircraft movements / number of runways.
- Larger airports can operate their runway systems more efficiently than smaller ones.
- Declared maximum runway capacity understates the actual capacity which can be used.
- Slot coordinated airports operate their runway systems more efficiently.

TABLE 2: Runway utilization given by yearly actual capacity / available capacity, 2002

Rank	Airport	IATA Code	Result	Rank	Airport	IATA Code	Result
1	Düsseldorf	DUS	99.49%	33	Oslo	OSL	45.09%
2	Zurich	ZRH	91.69%	34	Moscow Domodedevo	DME	44.47%
3	Paris CDG	CDG	91.60%	35	London City	LCY	42.67%
4	Frankfurt/Main	FRA	89.07%	36	Valencia	VLC	41.01%
5	Madrid	MAD	87.94%	37	Toulouse	TLS	40.22%
6	London Heathrow	LHR	84.67%	38	Rhodes	RHO	40.08%
7	Nice	NCE	82.12%	39	Mahon	MAH	39.92%
8	Istanbul	IST	79.00%	40	Budapest	BUD	39.71%
9	Brussels	BRU	78.92%	41	Malaga	AGP	39.44%
10	Munich	MUC	74.55%	42	Gothenburg	GOT	38.78%
11	Stuttgart	STR	74.49%	43	Jersey	JER	38.74%
12	Amsterdam	AMS	72.05%	44	Larnaca	LCA	38.57%
13	London Gatwick	LGW	69.17%	45	Venice	VCE	37.16%
14	Lisbon	LIS	67.04%	46	Chania	CHQ	37.12%
15	Hamburg	HAM	66.84%	47	Heraklion	HER	34.95%
16	Marseille	MRS	63.44%	48	Faro	FAO	34.06%
17	Warsaw	WAW	62.22%	49	Clermont Ferrand	CFE	31.78%
18	Geneva	GVA	61.62%	50	Bremen	BRE	31.58%
19	Copenhagen	CPH	61.50%	51	Almeria	LEI	29.56%
20	Manchester	MAN	59.31%	52	Tenerife	TFS	29.17%
21	Vienna/Schwechat	VIE	56.62%	53	Sevilla	SVQ	28.38%
22	Nuremberg	NUE	56.00%	54	St.Petersburg	LED	27.62%
23	Moscow Vnukovo	VKO	55.97%	55	Ljubljana	LJU	25.76%
24	Rome Fiumicino	FCO	55.73%	56	Strasbourg	SXB	24.52%
25	Athens	ATH	54.21%	57	Kerkyra (Corfu)	CFU	24.30%
26	Paris ORY	ORY	53.34%	58	Genoa	GOA	23.65%
27	Lyon	LYS	53.08%	59	Sofia	SOF	22.18%
28	Arrecife (Lanzarote)	ACE	51.77%	60	Dresden	DRS	20.43%
29	Stockholm	ARN	51.55%	61	Santiage del Monte	OVD	18.30%
30	Cologne/Bonn	CGN	51.05%	62	Billund	BLL	18.24%
31	Gran Canaria	LPA	48.50%	63	Riga	RIX	16.71%
32	Bologna	BLQ	45.51%	64	Vilnius	VNO	4.66%

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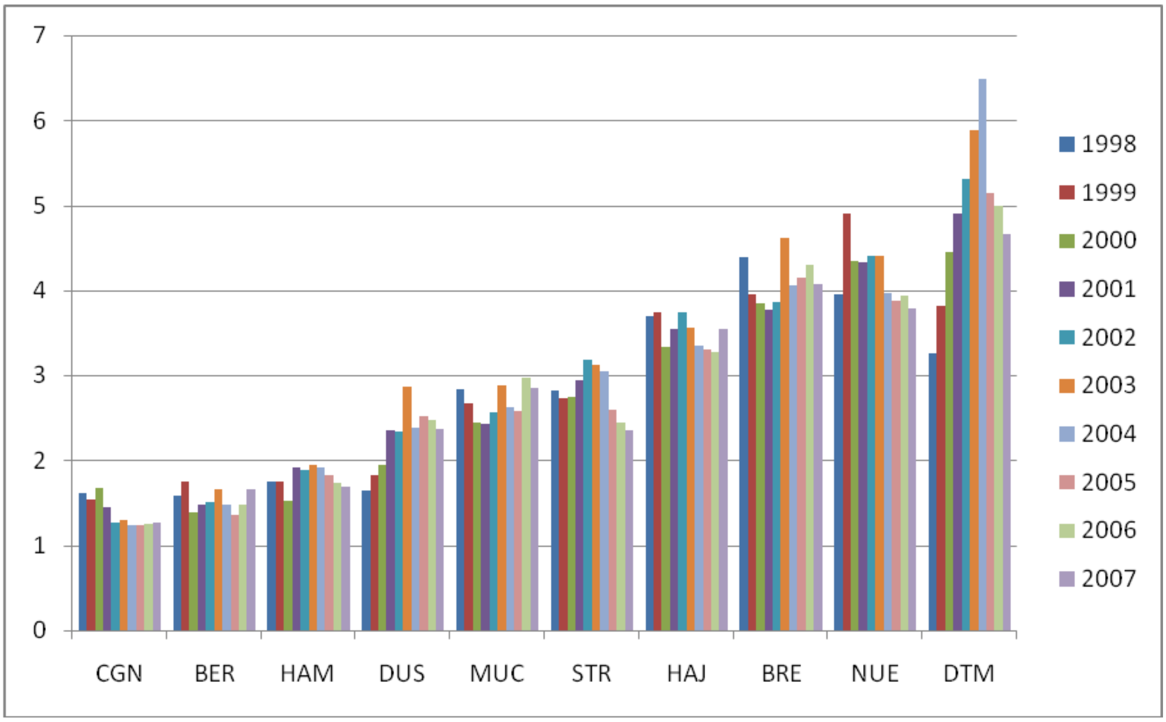
Ülkü, Tolga (2009) :

“Efficiency of German Airports and Influencing Factors”

Research on 10 German Airports benchmarks them, shows their ranking (see the chart below) and shows the importance of LCC traffic, capacity expansions, privatization, regulation and the staff costs on the efficiency of airports.



*The higher the score is, the less efficient the airport is.

Bubalo, Branko (2009) :

"Benchmarking Airport Productivity and the Role of Capacity Utilization – A Study of Selected European Airports"

This paper aims at investigating the runway capacity utilization, idle slots and idle runway capacity of 33 European airports, which represent about 75% of the overall European air traffic in terms of handled aircraft operations. By looking at capacity and demand at each airport, it should be possible to get an overview about the current minimum amount of available idle capacity. The airport sample, which has been chosen from a previous unpublished study of 60 European airports, includes airports with signs of congestion, which means that capacity is over 75% utilized and further growth of demand will result in increasing delays. The relationship between demand and capacity will be shown on an annual, daily and hourly basis.

Zolotko, Mikhail (2009) :

"Re-estimating Financial Performance of European Airports"

We focus our attention on the issues of privatization of the European airports and its impact on their financial performance. We use a dataset that is more extensive in terms of number of airports and time span, and contains a somewhat different set of variables.

In this research financial ratio analysis is used. Specifically, static comparative analysis that discovers the differences between the performances of the airports that never changed their ownership structure is supplemented with dynamic analysis that reviews the change in performance after the change in ownership.

Table 2. Results of mean tests.

Ratio	Private	Partially privatised	Public
EBITDA/Equity	0.162	**0.221**	0.174
EBITDA/Assets	0.092	**0.153**	0.093
EBITDA/Fixed assets (H)	**0.088**	**0.110**	0.060
EBITDA Margin	**0.327**	0.286	**0.323**
EBIT/Equity	**0.120**	**0.155**	0.090
EBIT/Assets	<u>0.066</u>	**0.082**	0.039
EBIT/Fixed assets (H)	**0.057**	**0.068**	0.023
EBIT Margin	**0.223**	0.141	0.114
Capex/Depreciation	**2.416**	1.158	1.079
Non-aviation revenue share	**0.437**	0.247	<u>0.400</u>
Debt/Assets	0.396	**0.629**	**0.621**
Fixed Assets Turnover*	0.216	0.241	**0.275**

The given values are average ratios for the corresponding ownership groups. Mean ratios that were found to differ insignificantly from each are shown in the same font.

Further Research and Targets:

1- Trying to improve the sample
2- Trying to improve new methodologies, e.g.”Runway Utilization”, “Terminal Utilization”, Delay Statistics
   Paper outline “Airside Efficiency of Selected European Airports”