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The Symbolic Use of Price Differentiation - The Case of Hamburg Airport -

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0. Introduction

Hamburg airport is a prime example among all other German airports. As a secondary airport was the first one, which introduced price cap regulation, the second airport privatised, and one of the first which restructured its charging system. This paper will assess the effects of the airport's new tariff structure. It will be shown in particular that the price differentiation in Hamburg airport didn't have any economical effect. The reasons may be found within the positive theory of regulation. It seems that price differentiation in Hamburg airport has more a character of symbolism than an economical background. Therefore, subsection 1 gives a historical review on the introduction of price cap regulation, subsection 2 deals with the current tariff structure and subsection 3 analyses the impact of the differentiation principles. Finally subsection 5 concludes.

1. Historical background

Privatisation of Hamburg airport has already been a major issue since the beginning of the 80's. The public sector saw in privatisation the possibility to decrease budgetary deficits and additionally to enhance economical efficiency. Opponents of privatisation argued that Hamburg airport is an important regional factor, which enables high business activity and guarantees enhanced economical welfare. Therefore, Hamburg airport should stay under the responsibility of the public sector. However, due to this controversial discussion the privatisation plans could only be implemented in 1995[2]. Initially a consortium consisting of Hochtief AG and Aer Rianta International purchased 36 percent of the shares of Hamburg airport. This part was successively raised up to 49 percent (Dummann, 2005, p.13). Therefore, private participation is still a minority in Hamburg.

With the privatisation arose also the question of regulation. The main reason for regulation is the existence of natural monopoly. This question is however not yet definitely answered. Doganis (Doganis, 1992, p. 48) for instance calculated for Great Britain decreasing average costs to the output level of 1.5 M passengers. ICAO (ICAO 2000 p. 3) found out similar results. Pels et. al. (Pels, Nijkamp, Rietveld, 2003, pp.341-361) separated airport movements

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[2] The situation was much more complex, since the ownership of Hamburg airport was shared between the federal government and the Free and Hanseatic city of Hamburg.

from passenger handling and found out that average European airports operate under constant returns to scale in the case of transport movements and under increasing returns to scale in the case of passenger handling. Similar results are also registered from the US American airport sector (see Gillen, Lall, 2001, pp. 283-306). Concluding to the question whether Hamburg airport is a natural monopoly or not, Niemeier (see Niemeier, 2002, p.39) states that all evidences indicate that German secondary Airports operate under constant returns to scale for air transport movements up to the level of 150,000 movements and weak increasing returns to scale in the case of passenger handling up to the level of 12.5 million passengers. These conditions still hold for Hamburg airport (although, Hamburg airport is about to exceed these figures). Besides, an additional reason for regulating Hamburg airport (see Niemeier, 2002, p 39) is the absence of solid intermodal competition, especially within the wider area of Hamburg, a fact which makes regulation highly important.

In contrast to the airport regulatory system in Germany[3] participating actors in Hamburg proposed the introduction of price cap regulation. This proposal comprised following points:

- Disaggregation of the regulated services. Only those services should be regulated, which cannot be duplicated within a reasonable time (essential facilities).
- Introduction of the dual-till principle, in order to avoid charges, which convey the incorrect signal to the users[4]. In addition, single-till has the disadvantage to lower incentives to develop the non aviation sector.
- The level of the X Factor was proposed to be 2[5].
- Introduction of a consultation and quality control system.

After several consultation rounds with the airlines this proposal was adopted with a major amendment: For each percent of additional passenger growth lying over 4 percent, the X factor rises with 0.5 percent. (see Article 2, öffentlich-rechtlicher Vertrag über die Festsetzung und Anpassung regulierter Flughafenentgelte).
To that end the Free and Hanseatic City of Hamburg closed a contract with the Hamburg airport. The contract had a duration of five years and was extended for five more years in 2004.

Regarding the effects of price cap regulation it has to be noted, that they will not be addressed within this analysis. However, it is crucial to mention that the introduction of price cap regulation is one of the most important points in the airport's history. Besides, in order to have reliable results, it is necessary to make a long term observation of the achievements of price cap regulation in Hamburg. This will show whether its introduction was justified and whether there are better regulatory instruments existing. Starkie for instance (Starkie, 2005, p.5) observed that, price cap regulated airports (especially airports with capacity problems) in the UK and Ireland tend towards excessive capacity investment by implementing airport expansions rather than adopting efficient price rules. This can also be partly observed at Hamburg airport, which is about to undertake the so-called Hamburg 21 expansion program (see www.ham.airport.de).

[3] Airport regulation in Germany occurs mainly at cost basis (single till). Airport charges must be approved by the respective federal state authority. Costs as well as "reasonability" and accordance with the general transport policy are the examined criteria for the charging level. The regulatory regime is therefore closer to a rate of return regulation than to a cost plus regulation. In addition, Airlines play an active role in this process by participating in closed hearings (the general public is not allowed to be present). With respect to the disadvantages of this regulatory system see Niemeier, 2002, pp. 40-41.
[4] This is the case in times of congestion. (Starkie, 2001, p. 128) states that in times of congestion the use of single-till leads to an increase of retail revenues and at the same time to a decrease of airport charges.
[5] The level of the X Factor was calculated as an equal share (airlines and airports) of the expected productivity growth (4 percent) (see Greinus, 2004, p.67).

2. The current charging system at Hamburg airport[6]

One year after the introduction of price cap regulation Hamburg airport also restructured its charging system. The main element of the new charging system was the introduction of differentiated noise charges according to measured noise emissions.

Starting from the old pricing system, this was a two-part tariff, including a fixed and a variable component. The fixed component was based on the maximum take off weight (MTOW) and was differentiated according to the ICAO Annex 16, chapters 2 and 3. Two-part tariffs are the most common charging system in German airports and in general in European airports, since it is (falsely) believed that runway damage correlates with aircraft weight.

Hamburg is a city with rich history in protest against flight noise. Since the beginning of the 70's several protest groups were formed against flight noise. These groups opposed all air transport related activities and gained power successively. The policy in Hamburg recognized their voting potential and in order to appease them appointed in 1971 the commission against flight noise.

This commission brought out originally a plan regarding a price differentiation scheme in order to alleviate the problem of flight noise. However, this proposal was perceived to be improper by the airport administration, because it was too stringent, and as a consequence this could have resulted to an exit of users from Hamburg. The commission however was convinced that landing fees should reflect the noise level and came up with a second plan, which included the following points (Köhler, 2007):

- Introduction of two types of price differentiation
    - Surcharges for night flight activities
    - Separation of the noise charges from the rest of airport charges. Noise charges should differ according to the measured noise emissions.
- Implementation of the new system without additional costs for airlines. The noise charge should encourage airlines to use less noisy aircrafts, but it should not increase their total costs[7].
- Technical improvements such as the construction of a noise protection hall.

The airport administration as well as the carriers accepted after discussions this suggestion and as a result the airport continued on the one hand with the implementation of the new charging system, which was introduced at the end of 2001, and on the other hand with the technical improvements.

To that end Hamburg airport established its own noise measuring system and introduced seven noise classes. In addition, to the sum of the fixed charge and the noise charge a surcharge of 100 percent for take offs and landings between 10:00 p.m. and 10:59 p.m. and a surcharge of 200 percent for take offs and landings between 11:00 p.m. and 5:59 a.m. was levied. These surcharges seem at first glance high enough in order to encourage users to start or land at other times.

[6] One would expect that the introduction of price cap regulation would lead to the adoption of more efficient pricing rules such as Ramsey-pricing or peak-load-pricing (see Wolf 2003, pp.121-131), which is not the case. However, this is a more general observation. It seems that the major reason for that is the opposition by the airlines. For a more extended analysis on this topic see Starkie, 2005 (pp. 6-7), as well as Forsythe & Niemeier 2003 (pp 14-15) and Schank 2005 (pp. 417-425).

[7] It is clear that this charging proposal has nothing in common with internalisation of noise (external) costs. According to the author's knowledge, the City of Hamburg did not assign any corresponding study dealing with the costs of flight noise.

Start and landing fee for Turbojets (Payable per t MTOW)	Before 2002		After 2002
	Daytime	22:00-07:00	
without ICAO accreditation	73.63 €	82.83 €	3.00 €
ICAO Annex 16 Chapter 2	46.02 €	55.22 €	3.00 €
ICAO Annex 16 Chapter 3	15.65 €	15.65 €	3.00 €
ICAO Annex 16 Chapter 3 (bonus list)	9.2 €	9.2 €	3.00 €

Table 1: Fixed user charge at Hamburg airport before and after 2002. Source: published Hamburg Airport Charges.

The changes in the variable part of the tariff (payable per passenger) can be seen in table Table 2:

Passengers	Before 2002	After 2002
Domestic flights	3.09 €	6.50 €
Flights from/ to Europe	3.83 €	7.35 €
International Flights	3.83 €	7.65 €

Table 2: Passenger charges at Hamburg airport. Source: published Hamburg airport charges.

Table 2 shows clearly that the variable component of the charge has almost doubled. This is the first indicator for a charge variabilisation. However, this topic will be addressed within the next subsection.

The differentiated noise charge is depicted in Table 3. In Table 3 it is clearly observable, that most of the aircraft models landing at Hamburg (Short or medium haul) belong whether to class 3 or 4. That is 27.00 € or 55.00 €. In addition aircraft types of the 7th class belong to the older aircraft generation, and therefore it is expected to be replaced in the near future.

Concluding on the charging policy at Hamburg airport, it can be stated that a certain degree of differentiation has been introduced. On the other hand the charging scheme became apparently more variable.

Noise Classes						
1	2	3	4	5	6	7
up to 71,9 dB(A)	72,0 to 74,9 dB(A)	75,0 to 77,9 dB(A)	78,0 to 80,9 dB(A)	81,0 to 83,9 dB(A)	84,0 to 86,9 dB(A)	up 87,0 dB(A)
5.50 €	**13.00 €**	**27.00 €**	**55.00 €**	**160.00 €**	**421.00 €**	**1350.00 €**
AC69	AT722	A3181	A300F	A3006	A3004	AN12
AC6T	AT725	A3191	A3202	A3102	A3302	B7073
AC70	BA31	AJ25	A3211	A3103	A3303	B7272
AT42	BA461	AJ25	A3212	A3201	AN26	B727F
AT422	BE55	AN2	B7373	A3402	B7271	B7472
AT423	BE58	B7376	B7375	A3403	B747S	B7473
AT424	BE60	BA462	B7377	B7374	DC93	BA115
AT425	BN2	BA463	B7378	B7474	DC94	C141
ATP	C406	BBJ	B7572	B7573	FK28	DC103
BA41	C525	BJ40	B757F	B7673	LR24	DC86
BE02	CJ1	C337	BE40	B7772	MD81	IL62
BE10	CJ2	C340	BH06	C130	MD82	IL76
BE20	CRJ7	C551	DA20	DC101	MD83	IL86
BE30	D328J	C560	DA21	DC3	MD88	TU34
BE3B	E121	C650	DA50	DC92	TU54	YK42
BE90	E145	CV44	FK10	DC95	YK40	
BE99	F2TH	CV58	FK27	G2	B7372	

Table 3: Noise classes and charges at Hamburg airport. Source: published Hamburg airport charges.[8]

3. The effects of the charging scheme at Hamburg airport

Talking about the effects of the charging scheme at Hamburg airport, it is important to be noted, that carriers seem to be gratified with the regulatory and charging policy followed by Hamburg airport. The main reason for this seems to be the introduction of price cap regulation, an instrument which gives airlines planning reliability. Another possible reason could be the change of proportions between the fixed and the variable component of the charge. In addition, the noise charge seems to be less relevant to the users, since carriers, driven from the need to decrease energy costs, are using more and more modern aircraft models, which are at the same time less noisy. All these issues will be addressed within this subsection.

3.1 General effects: Charging level

In general Hamburg airport has profited since the introduction of price cap regulation and the restructuring of its charges. Table 4 shows that the number of passengers at Hamburg airport has steadily increased up to the level of almost 12 million passengers in the year 2006[9]. The average growth rate was almost 4.9 percent. This lies above the 2002 Boeing forecast for Europe (3.4 percent). At the same time aircraft movements grew under proportionally compared to the passengers. This figure lies around 0.3 percent. Therefore, it is obvious that carriers transported more passengers and/or freight per flight in the observed period (see Table 4).

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[8] In the list of the noise classes belong more aircrafts, which however, are not considered as relevant for the analysis.

[9] The 2002 decline fits within the general development of traffic demand all over the world and is strongly connected with the impact of 9/11.

Year	Aircraft movements	Number of Passengers (In million)	Average passengers per Flight
2001	158,569	9.5	60
2002	150,217	8.9	59
2003	149,365	9.5	64
2004	151,349	9.9	65
2005	156,128	10.7	69
2006	168,389	11.9	71

Table 4: Aircraft movements, number of passengers and average passengers per flight. Source: Author's own calculations, based on data from the federal statistics agency.

It is apparent that carriers utilised better the existing fleet. In addition, regarding the aircraft size it would be very helpful to separate between short and long haul. Givoni and Rietveld for instance (Givoni, Rietveld, 2006, p.10) analysed inefficiencies resulting out of the trend to use smaller aircrafts in the short haul. Airlines favour a higher frequency of service. This is mainly connected with the forming of hubs and spokes. Such a trend could not be noticed at first for Hamburg. At this point a better look to the distribution of the movements by weight can help to derive some useful findings.
In Figure 1 there are several interesting findings related to this issue. First, movements of small aircrafts have decreased over time. Second, the class of 25 to 75 t increased[10]. This is hardly surprising because from Hamburg (as a secondary airport) mainly continental destinations can be reached. Third, movements of large aircrafts stayed almost constant. Combined with the fact that within the same period of time there was no serious change in the number of the destinations, which can be reached from Hamburg[11], it can be suggested that air carriers increased the frequency of service within the existing network instead of using larger aircrafts. From this point of view the empirical Givoni/ Rietveld findings can be confirmed.

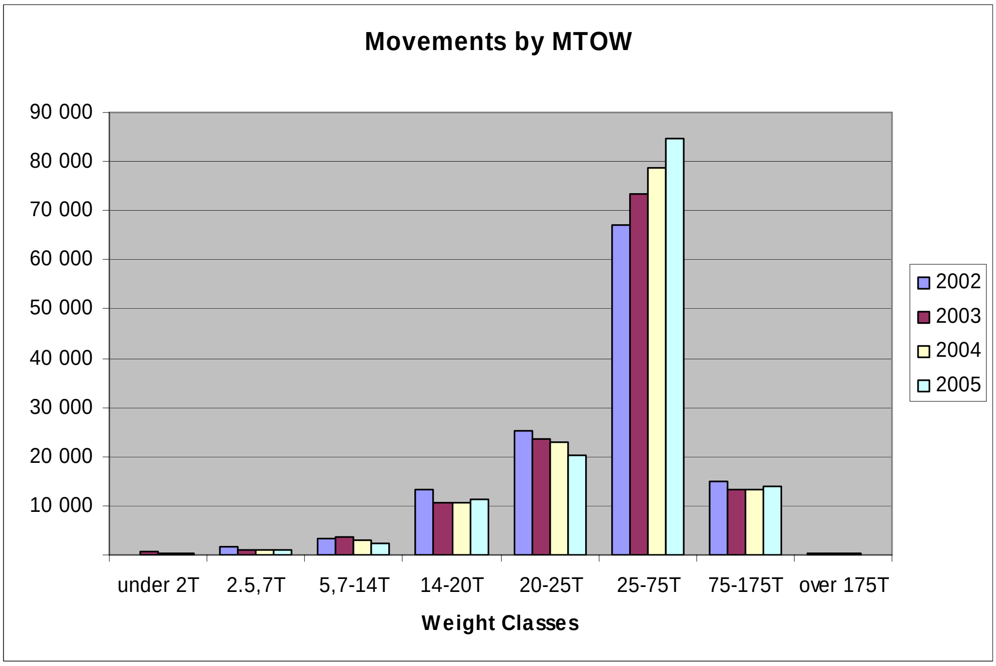

Figure 1: Distribution of aircraft movements. Source: Authors own calculations based on data from the Federal Statistics Agency.

[10] To this class belong all typical (single-aisle) aircrafts, used for the short and medium haul, such as the whole B737 series.
[11] 2002 were served 176 destinations. This figure increased marginally at 178 destinations in 2005.

Air transport demand is expected to grow significantly in the near future. According to demand forecasts, the average yearly growth will be around 3.4 percent (Boeing, 2002, p. 37) for Europe. Therefore, demand growth at just one airport should be analysed in context of general demand growth. In the case of Hamburg airport it is important to test: first, whether there are some other conterminal airports which perform better in terms of airport activity within this period and second how do other similar German airports perform. In order to deal with these issues the airports of Hannover and Bremen have been selected due to the fact that that they share parts of their catchment areas with Hamburg. As an airport with a similar size, the airport of Stuttgart has been chosen.

Year	Hamburg	Bremen	Hannover	Stuttgart
2001	158,569	43,941	89,908	n.a.
2002	150,217	34,151	85,641	144,200
2003	149,365	32,143	86,449	144,900
2004	151,349	33,813	85,459	156,900
2005	156,128	33,663	88,935	160,400
2006	168,389	31,836	n.a.	164,700

Table 5: Comparison in movements between the airports of Hannover, Hamburg Stuttgart and Bremen. Source: Author's own calculations based on data from the Federal Statistics Agency.

Table 5 shows that airports Hannover and Bremen performed almost at the same (or even declining) level. Hamburg airport could keep its high level within the years 2001-2005 and even to create additional performance in 2006. Therefore, it seems here that there are no major shifts towards regional competitors of Hamburg airport. Concerning the comparison of airports Hamburg and Stuttgart it is obvious that Stuttgart achieved a better performance starting with a lower level. However, Stuttgart[12] could not exceed the amazing performance of Hamburg in 2006.

A better view on this issue can be obtained when considering the development of market shares of Hamburg airport with respect to the German airport market.

Market Shares in percentage				
	Passengers		Freight	
Year	domestic	international	domestic	international
2001	9.7	5.4	9.1	0.6
2002	9.6	5.2	9.7	0.5
2003	10.2	5.0	10.9	0.4
2004	10.1	4.7	12.2	0.4
2005	10.4	4.9	12.1	0.3

Table 6: Market shares of Hamburg airport with respect to the German airport market. Source: Federal Statistics Agency

Table 6 depicts two major findings:

- First, market shares for international services have declined over time.
- Second, market shares for domestic services increased considerably.

A main reason for this phenomenon is the strengthening of the hub and spoke system with airport Munich ascending to the second major hub airport in Germany. Furthermore, with

[12] The Stuttgart airport is a just formally privatised airport and, is regulated with the old cost based regime and uses a "typical" two-part tariff

respect to domestic freight, Hamburg seems to take advantage of its location (the major German port).

Concluding to the general impact of the price level it can be stated that Hamburg grew above average within the environment of a growing market. The due to the price cap regulation declining real price level has a certain share in this growth. The tariff structure (two-part tariff) combined with the variabilisation of the charges, enabled users to increase service frequency and at the same time kept their start and landing costs under control. This however, was possible because slots in Hamburg airport are still available. However all evidences show, that this situation is expected to change in the near future and Hamburg airport will have to face capacity problems. Airport administration copes with this problem by implementing capacity increase programs (Hamburg 21).

3.2 The effects of the tariff structure

Continuing to the analysis above, it is useful to have a closer look at the degree of variability of airport charges in Germany. The degree of variability of a two-parThe degree of tariff gives the variable part of the total charge in percentage. Öko-Institut (Öko-Institut., 2003, p. 53) calculated total airport charges (inclusive noise charges) for all major German airports. All aircrafts calculations gave almost the same result. The degree of variability of Hamburg airport charges was around 50 percent in 2001 (see Figure 2).

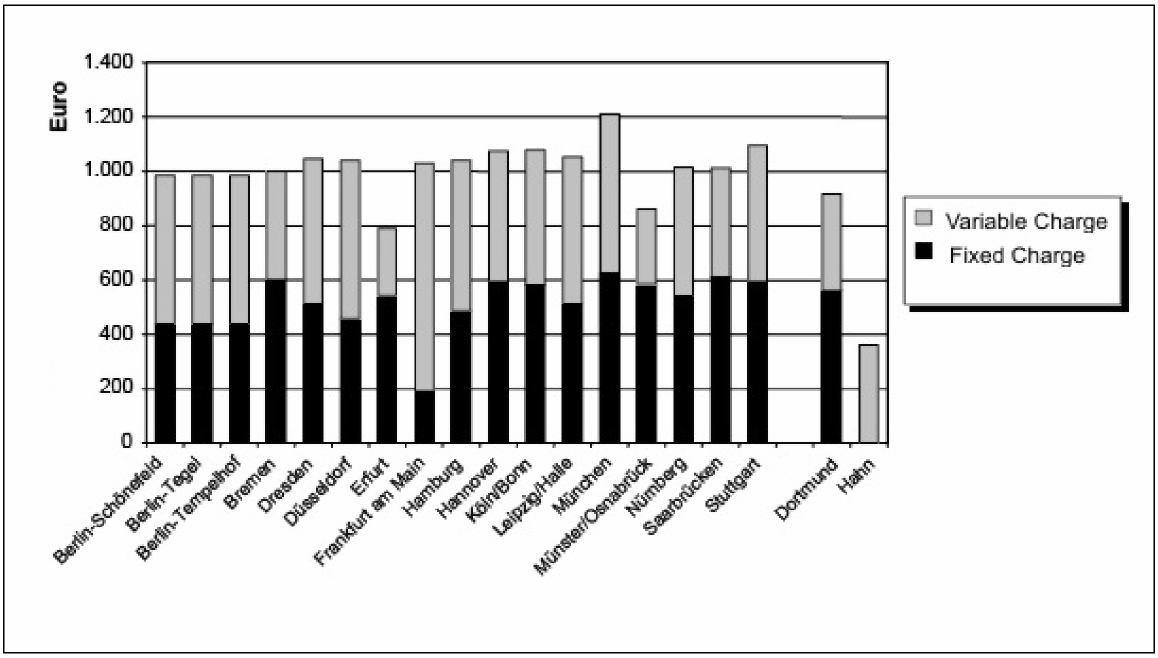

Figure 2: Comparison of total airport charges for the major German Airports. Reference case: Boeing-373 300 with 83 passengers on board and a weight of 63 t. Source: Öko-Institut (2003) p. 53.

In order to depict the situation at Hamburg airport after 2002 more clearly a sample of 4,275 take offs and landings at Hamburg since 1998 has been collected and according to the effective charging system the factual degree of variability has been calculated. Table 7 confirms the assumed results. The degree of variability has almost doubled.

Period	Average Degree of Variability (in Percentage)
Before 2002	37,64
After 2002	73,96

Table 7: Maximum degree of Variability at Hamburg airport. Source: Authors own calculations

Turning to the differentiation elements of the tariff, Hamburg airport performs its own noise measurements. The noise level (see Figure 3) at Hamburg airport declined since the introduction of the new charging system (2002) only insignificantly.

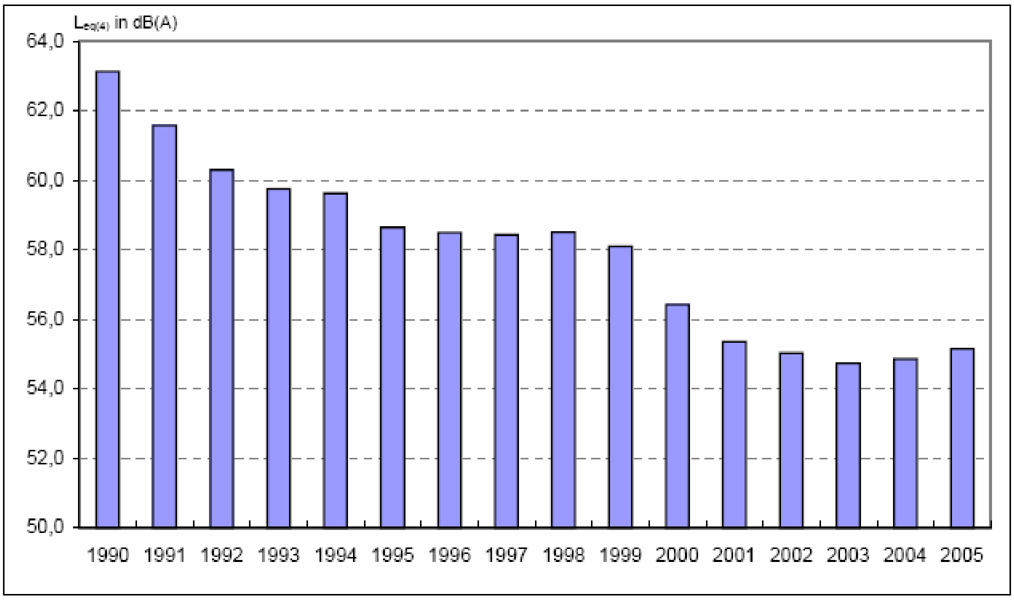

Figure 3: Noise level at Hamburg airport. Source: Wylensek, 2006, p. 23.

However, a more careful observation shows that the noise level has already declined significantly since the beginning of the 90’s. This development suggests that noise reduction is mainly connected to technical aircraft developments. ICAO regulation was one main reason for developing new less noisy aircrafts. However, the main point for aircraft manufacturers was the interest of the carriers to save energy costs (up to the current situation less energy consumption correlates strongly with less noise). However, less noisy aircrafts can only be constructed by increasing fuel consumption in the future (Köhler, 2007).

Recapitulating all these points it can be concluded that the introduction of modern aircraft technology and the replacement of the older aircraft generations as well as the technical measures are more related to the development of the noise level in Hamburg than the introduction of the price differentiation according to the noise classes. Besides, additional demand was served with smaller aircrafts, and although (see Figure 4) the relation between noise and weight is not exactly linear it can still be argued that heavier aircrafts are also noisier (at least single-aisle aircrafts are normally less noisy than twin-aisle aircrafts of the same generation).

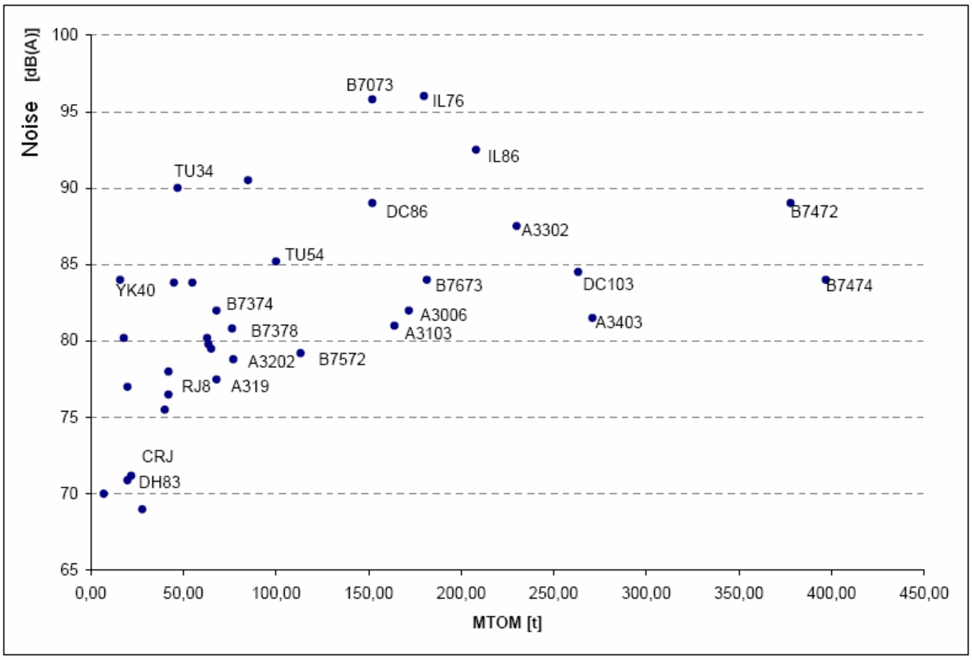

Figure 4: Relation between noise and weight. Source: Wylensek, (2006) p. Anlage 25.

However, there is a potential noise reducing impact of the differentiation scheme. This could be the case if a carrier within its own aircraft fleet has different types of aircrafts disposable to choose from. In Hamburg for instance, the DHL replaced after the introduction of the noise charge an old B 727 landing every Monday afternoon with a newer B 757. Nevertheless, demand in the end market rather than the noise charge plays an important key role here. In Hamburg there are still very noisy aircrafts landing despite the 1350 € noise charge (Köhler, 2007).

The second element of differentiation is the surcharges for night flights. The degree of differentiation (100 respective 200 percent) appears to be high enough to encourage users to take off or land at other times. However, as Figure 5 shows, after a generally declining period, in the year 2006 night movements increased with a rate of almost 17 percent. This could have had three major reasons:

- First, scarcity of slots because Hamburg almost reaches its capacity limits. In this case users can only have the still available (night) slots.
- Second, landing time is a factor depending on starting time at origin. Therefore, landing times for scheduled services are bound to starting times at origin and users are forced to accept them.
- Third, as in Figure 5 clearly depicted night flights depend on the demand of the end market. If the demand exists and the user can earn money by using his aircraft at this time, then there is no doubt that he will offer flight services whilst taking surcharges into account.

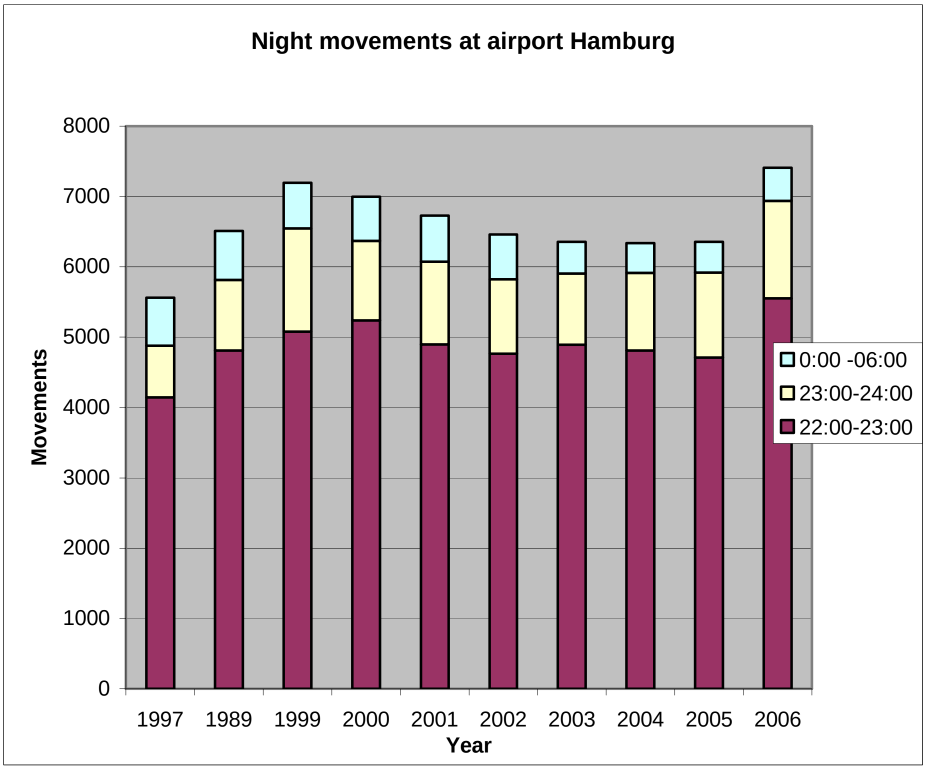

Figure 5: Night movements at Hamburg airport. Source: www.fluglaerm-hh.de.

In order to recognise the possible effects of the noise charge at Hamburg a multinomial logit model is used. To that end a sample of 2,680 take offs and landings was collected. To this sample belong 40 major aircraft types landing at Hamburg.

Furthermore it is assumed that passenger demand is given and that airlines are perfectly informed about demand. The knowledge about passenger (freight) demand as well as further flight related factors (e.g. distance) lead carriers to choose a certain aircraft size, which in this case is very well approximated with the take off weight. Increasing take off weight suggests increasing utility since carriers transport more passengers and/ or freight and therefore can earn more money.

In addition, all the heuristic findings of this analysis have been incorporated in the model. That is at first the effect of price cap regulation. This effect is captured by a simple index. Every year real charges decrease by two percent. The fist year is denoted with the value of one and all subsequent years are adjusted accordingly. The higher the value of the price cap index the lower the utility of the airline.

Furthermore, the degree of maximum variability of charge for each individual aircraft type has been calculated and incorporated in the model. Large aircrafts have a higher degree of variability. After the restructuring of the take off and landing fees this is also observable for smaller aircrafts. Increasing charge variability increases also expected utility, because airlines can catch the passenger’s value of time better by offering more frequent flights.

Next, the differentiated noise charge as well as the surcharge for night flights was taken into account. Higher noise charges cause higher costs and therefore utility decreases.

Finally, a variable indicating the life cycle of the aircraft has been introduced[13]. The reason for this is that older aircrafts will naturally be replaced after 30-35 years. Therefore, it is expected that within the observed period of time several aircraft models (e.g. B 727 200, Yak40, etc.) will be replaced because of their age. As a result the deterministic part of the equation to be estimated has the following form:

$$\text{aircraft choice} = asc_i + a_i TOW + b_i PC + c_i Noise + d_i\ var + e_i life + f_i night$$

With:	asc_i:	constant term related to the aircraft model
	TOW:	Take Off Weight
	PC:	Effect of the Price Cap Regulation
	Noise:	Differentiated Noise Charge
	Var:	Degree of Variability
	Life:	Life Cycle of the aircraft
	Night:	Surcharges for Night Flights
	a_i, b_i, c_i, d_i, e_i, f_i:	Model parameters

Certainly, there are several additional factors affecting utility. In particular, the price of an aircraft affects capital costs, and therefore is a decisive parameter for the choice of aircraft A or B. Furthermore, maintenance related costs as well as fuel costs are crucial for carriers. Lastly, the possibility to choose another aircraft within the existing fleet of an airline is from the author's point of view an effect which is highly desirable for this analysis. However all the mentioned factors are airline related and therefore, the collecting of the corresponding data turned out to be impossible. As a consequence the results presented in this analysis have only preliminary character.

Table 8 shows the major aircraft types in the sample:

Choice Code	Aircraft type	Movements	In percent
3	A 300 - 600	96	2.25
6	A 319	217	5.08
8	A 320 - 200	192	4.49
9	A 321 - 100	171	4.00
10	RJ 85	249	5.83
11	RJ 100	117	2.74
14	B 737 - 300	726	16.99
15	B 737 - 400	147	3.44
16	B 737 - 500	311	7.28
17	B 737 - 700	110	2.57
18	B 737 - 800	282	6.60
20	B 757 - 200	107	2.50
22	Canadair	560	13.10
23	Fokker 70	116	2.71
35	E 145	137	3.21
Number of observations			2,680

Table 8: Major aircraft types in the sample. Source: Author's own calculations

In Table 9 the estimation (performed with Biogeme) results are listed:

[13] The lack of the corresponding data led to the choice of a life cycle variable connected with the maximum operating time of all aircraft models. However, the "real" life cycle of the aircraft concerned would be a better indicator.

Parameter	Value	Std error	t-test
asc1	-4.28	2.14	-7.35
asc10	-1.28	0.39	-3.30
asc11	-1.06	0.50	-8.00
asc12	-3.33	0.72	-16.99
asc13	-5.38	3.68	-5.38
asc14	+5.47	1.13	+8.06
asc15	-1.12	0.51	-8.16
asc16	-0.94	0.38	-2.49
asc17	-3.32	0.46	-7.14
asc18	+0.00	-	-
asc19	-3.33	0.64	-19.16
asc2	-3.33	0.64	-19,16
asc20	-1.77	0.66	-9.94
asc21	-4.68	2.61	-6.60
asc22	+1.76	1.17	+5.53
asc23	-3.63	0.48	-7.57
asc24	-1.45	0.58	-9.30
asc25	-3.33	0.67	-18.46
asc26	-5.38	3.68	-5.38
asc27	-3.33	0.71	-17.37
asc28	-2.20	0.79	-2.76
asc29	-3.33	0.67	-18.37
asc3	-3.50	0.47	-7.38
asc30	-2.16	0.78	-2.77
asc31	-2.67	0.99	-2.71
asc32	-2.89	1.09	-9.76
asc33	-1.67	0.81	-9.78
asc34	-2.24	0.81	-1.76
asc35	-1.98	0.41	-4.79
asc36	-3.33	0.66	-18.48
asc37	-5.38	3.68	-5.38
asc38	-1.17	0.51	-8.40
asc39	-3.99	1.86	-7.91
asc4	-2.89	1.09	-9.76
asc40	-4.69	2.62	-6.60
asc5	-2.98	1.14	-9.65
asc6	-1.08	0.38	-2.81
asc7	-3.59	1,53	-8.67
asc8	+0.40	1.26	+1.08
asc9	-2.78	0.44	-6.29
Beta (TOW)	+0.24	0.44	+2.00
Beta (PC)	+00001	+5.91	+0.00001
Beta (Noise)	-0.0005	+1.93	-0.0003
Beta (Var)	+0.00008	+3.47	+0.00002
Beta (Life)	+0.00006	+3.98	+0.00001
Beta (Night)	-0.0005	+5.64	-0.0003
Log-likelihood			-7,1618.69
Observations			2,680

Table 9: Estimation results.

Almost all parameter estimates related to the aircraft model (asc_i) are statistically significant[14]. The weight related parameter (Beta (TOW)), is statistically significant as well. In contrast, all other parameter estimates are equal to zero.
This is with respect to the noise charges and the surcharge for night flights hardly surprising, since in the analysis made above this was already assumed.
However, surprising are the results of the life cycle parameter. Apparently this is connected with the way that the index was constructed. Due to the lack of the respective data the year

[14] A 320 – 200 and A 321 – 200 are the only exceptions.

of the first delivery of the aircraft model concerned was used in order to calculate the life cycle index. However, the factual age of the aircraft concerned is relevant and not its maximum age. New data collection at this point is necessary.
Next, price cap regulation has no effect on aircraft use. This is conceivable since price cap regulation associates with the price level. Therefore, price cap regulation could have an impact on airport activity in general but not on aircraft choice.
Finally, the degree of variability has likewise no effect on aircraft choice. This is quite surprising, because variable charges favour smaller aircrafts, and have indirectly an impact on aircraft choice.
Concluding to the empirical findings, it can be noted that the model presented above needs to be developed. However, it gives a first impression regarding the effect of noise charges in Hamburg. Additionally, taking all heuristic findings into account, one can argue, that *the introduction of noise charges at Hamburg airport did not induce carriers to use less noisy aircrafts*.

A very important aspect for the introduction of the differentiated noise charges was that no major interest group objected it. The policy was in favour of it; the users could live with it because at the same time they could achieve the introduction of their favoured price level and price structure; the airport could improve its environmental image and finally the environmental organisations were not really content with it, but they found the principles of the new charging scheme better than the old ones (Köhler, 2007).

As in this case recognisable, price differentiation in Hamburg has been introduced because the main special interest groups favoured it, regardless of its necessity. All evidences show for Hamburg that the differentiated noise charge has no effect. This paradox can only be explained within the framework of the positive theory of regulation. Using game theoretical instruments Grossmann/ Helpmann (see Grossmann/ Helpmann, 2001 pp. 270-275) for instance showed that there are policy fields in which regulation is designed to have no effect at all[15]. This is the case when interest groups interfere within the political process. This theoretical framework seems to fit exactly within the case of Hamburg airport. Therefore, price differentiation has more a symbolic use than any intended economical effect.
In addition, the lack of a central regulatory authority in Germany enables users to intervene successfully in the regulatory process and therefore also in the charging scheme. The degree of variability is crucial for the users, especially legacy carriers, since legacy carriers have to cope with the “problem” of severe competition from Low Cost Carriers. A more variable tariff can on the one hand disperse risks connected with demand fluctuations and on the other hand could help legacy carriers to expand their service frequency and therefore to advance the value of their own network.

4. Conclusions

Hamburg airport passed through a reorganisation process within the last years. This process resulted to privatisation, price cap regulation and differentiation of its charges according to measured noise emissions. With respect to the differentiation principles there are no significant effects recognisable. In addition, the tariff became more variable after the restructuring process. This gives users the opportunity to extend service frequency. The performance of Hamburg airport shows that the reorganisation of the charging structure was only the first step, and needs to be further developed. Efficient noise charges should reflect the costs of noise. Uyeno, Hamilton & Biggs (Uyeno, Hamilton & Biggs, 1993, pp. 3-18) showed that such an estimation possible is.
The regulatory framework enables airlines to intervene in the regulatory process. Consequently, the political economy of regulation is the more adequate theoretical instrument for this analysis. The analysis provides first evidences for confirming the symbolic

[15] In this case social welfare decreases.

use of price differentiation. Price differentiation will occur, if the most important interest groups favour it. In addition, concerning the variability of the tariff structure, it seems that the intervention of interest groups can even lead to a more variable charge.

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