German Airport Noise Surcharges – Method of Calculation and Effects

Kristin Huebner[1], Kai Johannsen[2]

[1] *TU Berlin/ DLR e.v., 10623 Berlin, Germany, Email: kristin.huebner@dlr.de*

[2] *Flughafen Berlin Brandenburg GmbH, 12521 Berlin, Germany, Email: kai.johannsen@berlin-airport.de*

Abstract

Over the last decade, nearly all major German airports have switched to noise surcharges based on measured sound levels at take-off and landing of aircrafts even though the impact of noise surcharges on airline fleet decisions is not yet proven.

Noise surcharges represent about 1% of a network airline's operating costs, which reduces the probability of a steering effect of noise surcharges to a minimum. Thus an analysis of the level and structure of airport charges identifies a monetary incentive to operate noise-reduced aircrafts.

An empirical study at five German international airports over a 10-year period analyzing the development of the fleet mix at the airports shows the fraction of movements of quiet aircrafts did increase. However, the study could not prove this development was caused by noise charges rather than a general fleet modernization process. In fact, there are many other factors, e.g. fuel consumption or range, on the decision of which aircraft type is operated at certain airports.

Nevertheless, the study does indicate some marginal impact of noise charges. Recommendations for an optimization of noise charges could be drawn and are presented.

Introduction and Objectives

As a result of growing air traffic during the past decades, the reduction of aircraft noise has become a major objective of the aviation industry. One approach is to achieve a monetary incentive for airlines by the application of an economic instrument, in particular noise surcharges. Noise surcharges are part of the airport charges which an airport raises to finance its infrastructure. Airport charges in general have to follow different regulations. Noise surcharges in general are widely used across European and German airports. They occur for every start and/ or every landing of an aircraft.

There are basically two methods applied to calculate noise charges for different aircraft types. One approach is based on ICAO noise chapters (1 to 4). Under standardized conditions and operational processes, aircraft types are assigned to noise chapters during the aircraft's certification process. The noise surcharges are thus calculated on the basis of the ICAO chapters. Nowadays, aircrafts operating in Europe are either chapter 3 or even chapter 4. In Germany, in addition to ICAO chapters, a so called 'Bonusliste' [1] is applied which privileges quiet chapter 3 aircrafts in the level of noise charge to pay.

Another approach to calculate noise surcharges is based on locally measured noise emissions. Related to the noise emissions, noise classes are defined individually by airports. Each operating aircraft type is assigned to a noise class according to its mean noise level over a given period. The noise surcharge is calculated by the noise class of an aircraft.

In comparison, the advantage of the classification into ICAO chapters is the international standardization. A significant differentiation between modern aircrafts is not given any more since most aircrafts already comply with chapter 4 limitations. Also the local noise emissions are not considered. Moreover, most current aircrafts are listed on the 'Bonusliste'. Therefore a trend towards individually determined noise classes can be identified. 8 out of 22 German international airports already apply noise classes (compare with Airport Charges Manuals 2010). It enables airports to calculate noise surcharges in relation to the mean emitted noise and at the same time to consider the local circumstances. However, a harmonized approach does not exist. Each airport calculates noise surcharges on individual noise classes and surcharge levels.

Noise surcharges are an incentive for airlines to adjust their fleet decisions with respect to purchasing politics and rotation scheduling towards the operation of noise-reduced aircrafts given that noise surcharges directly influence their operating costs. Eventually costs significantly determine an airline's purchase and operation planning process.

Previous research was not able to prove an effect of noise surcharges on airline fleet decisions. Only little research studied the impact of noise surcharges in particular. Evangolinos [3] found empirically that noise surcharges have no impact on the choice probability of a specific aircraft type. A more qualitative study of the German 'Ökoinstitut' [4] was not able to identify an effect of noise surcharges on fleet decisions by studying the cost and aircraft mix at three German airports for a three year period. However, guidelines to improve the noise surcharges system were developed.

Method

According to the 'Ökoinstitut' study, the aim of the presented study was to show if noise surcharges have a steering effect on fleet decisions and therefore the aircraft mix of airlines, and respectively the aircraft mix at an airport. An empirical approach was amended by a qualitative investigation.

At first the plausibility of the impact of noise charges on airline decisions from an airline view was analyzed qualitatively. A literature review and a direct inquiry at two European network airlines helped to examine the cost structure and the different planning processes of an airline and finally to assess the possible effect of noise charges.

In a second step, an empirical study of the aircraft mix at five comparable German international airports for a ten year period from 2000 to 2010 was undertaken. The chosen airports were Hamburg (HAM), Stuttgart (STR), Berlin Schoenefeld (SXF) and Berlin (TXL) which do have similar movements and apply noise classes based on local measurements. Furthermore Dusseldorf (DUS), which still applied ICAO chapters until 2010, was selected as a reference to compare developments. The airport charges at these airports were examined over the period to determine whether the level and structure of noise charges can be expected to have a steering effect and if the operation of less noisy aircraft generates less specific costs per seat. The actual impact of noise charges was then analyzed through the aircraft movement data of chosen airports by examining the development of each airport's aircraft mix over the ten year period in two-year-intervals. First, the development of the aircraft mix was analyzed on basis of noise classes to show whether there was a movement reduction of noisy aircrafts. Second, the development was analyzed on the basis of seat capacity categories where existing aircrafts have been assigned to operate. The seat capacity categories were further divided into noise related classes to show whether noisy aircrafts were replaced by less noisy aircrafts of the same seat capacity. The empirical approach aimed at identifying evidence of a reduction in the movement of noisy aircrafts that incur higher charges after the implementation of noise classes.

The empirical study was limited on the analysis of only commercial flights of aircrafts with an MTOW higher than 14 tons. Any prohibitions or restrictions of night flights were ignored as well as changes of the airport charges systems within the ten year period. Due to the missing data for the reference airport before 2004 a comparison of the aircraft mixes could only be undertaken from 2004 to 2010. Other noise abatement measures such as the noise-reduced modification of aircrafts or rescheduling and relocation of noisy aircrafts to other airports could not be considered.

Results

It could be shown that fleet planning processes of airlines are very complex and that a multitude of factors such as fuel consumption, range, seat capacity etc. influence fleet decisions strongly. Since a fleet decision is based on cost effectiveness and profitability, the major cost factors are considered. Airport charges display about 7% of an airline's operating costs, noise charges only 1% [2]. Compared to the ratio of fuel costs, noise charges are no object of the fleet planning and scheduling process which goes along with the following statement of a main European network airline [6]: 'Still today, noise charges do not directly affect our decisions. Political reasons or the public opinion rather push noise reduction.' Therefore, according to the airlines' cost structure and planning processes, a steering effect of noise charges is very unlikely and cannot be expected with network carriers.

But then the cost analysis of airport charges showed that at all studied airports the operation of noisy aircrafts results in higher specific costs per seat no matter what method of calculation of noise surcharges was applied (compare Figure 1). Regarding interconvertible aircrafts a cost advantage per seat will be achieved by operating noise-reduced aircrafts.

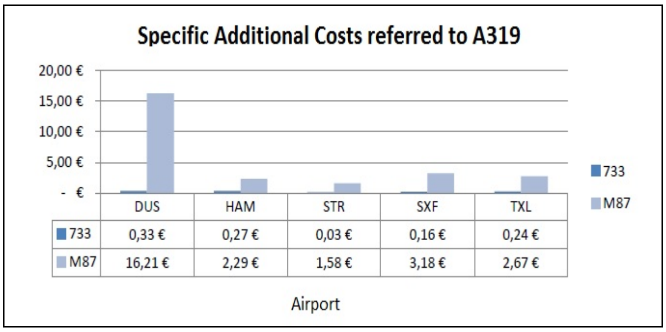
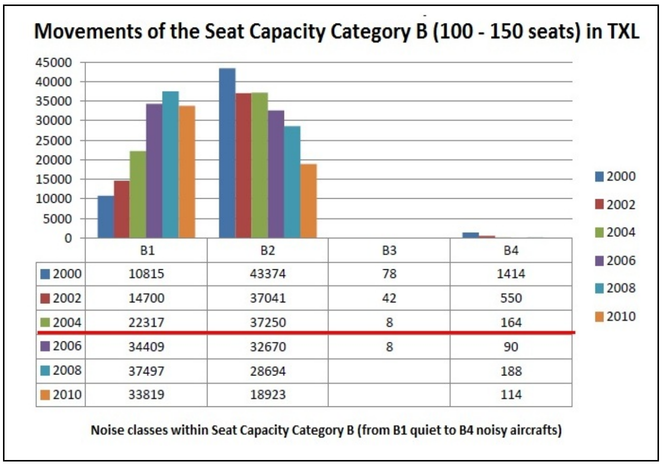


Figure 1: Specific Additional Costs per Seat per Turnaround referred to an A319 in Euros from 6am to 22pm in 2010 (compare with Airport Charges Manuals of the studied airports)

At the reference airport DUS with ICAO chapters, the incentive appeared between aircrafts of the 'Bonusliste' (e.g. 733) and aircrafts which do not assign for the 'Bonusliste' (e.g. M87). The biggest incentive at the other airports appeared only for aircrafts which are not assigned to the main noise classes. All in all, the airports demonstrate a tendency towards higher incentives at night time. Eventually according to the cost analysis an impact of noise charges on fleet decisions can be expected, especially at night. The effect will be higher for aircrafts that emit much noise and therefore are charged higher. However the cost incentive level varies at the studied airports due to the different calculation of noise charges and the resulting cost savings by operating a noise reduced aircraft. The incentive level basically results from the structure and design of the airport charges.

The analysis of the development of movements showed a reduction of movements of loud noise classes (old generation aircrafts such as 733-5) and at the same time increased movements of low noise class aircrafts (current modern aircrafts, e.g. 736-9). This development represents a change of aircraft generations that was executed in the past decade and at the same time is overlapped by a general growth of air movements. The interaction of different effects does not allow a conclusion concerning the impact of noise surcharges. Only a general modernization process can be presumed since the reference airport DUS showed a quite similar development when applying TXL noise class assignments for DUS. Furthermore, all airports showed a movement concentration of basically only two major noise class aircrafts which eventually has to result in a redesign and reassignment of aircrafts to noise classes to achieve a further cost differentiation between currently operated aircrafts.

The analysis of the development of movements within one seat capacity category showed reduced movements of noisy aircrafts and increased movements of quiet aircrafts of the same seat capacity category (compare Figure 2).



	B1	B2	B3	B4
2000	10815	43374	78	1414
2002	14700	37041	42	550
2004	22317	37250	8	164
2006	34409	32670	8	90
2008	37497	28694		188
2010	33819	18923		114

Figure 2: Absolute Movements of Aircrafts of the Seat Capacity Category B in TXL (red line represents the implementation of noise classes in TXL in 2005)

The normed noise class B1 contains new generation aircrafts such as the 318 and 319 or 736 and 737 whereas aircrafts like the 733 and 735 are assigned to B2. B4, for example, contains the noisy M87. A replacement of noisy aircrafts by modern noise-reduced aircrafts can be assumed but due to the lack of rotation plans not be proven. This development, which is again similar in DUS, represents a recent general modernization tendency. When having a closer look at the haul-off of specific aircraft types at the different airports one interesting effect could be observed: The haul-off of certain aircrafts was undertaken at a different pace and extent at the studied airports. For instance, one airline operated the M87 for a longer period in STR than in HAM. Though various factors might have caused this decision, this aspect can be seen as a hint for a marginal effect of noise surcharges on airline decisions and fleet mix. Noise surcharges might be able to accelerate the haul-off of an aircraft type at an airport.

Though there exists a cost advantage in terms of less specific costs per seat for modern noise-reduced aircrafts, the fraction of noise surcharges of the operational costs is too low, the process too complex, and the possible short time reactions too few to let noise surcharges be a significant decision factor for an airline’s fleet decision process. Also the empirical study was not able to prove any impact of noise surcharges or even a steering effect. Solely, some hints for a marginal influence on the pace and extent of a haul-off could be identified. The reduced operation of noisy aircrafts and the local replacement of noisy aircrafts by modern quiet aircrafts only represents the general modernization process undertaken during the past decade and complies with the actual market share of aircraft types [5].

Conclusion and Recommendations

Though a steering effect of noise surcharges could not be proven even if a cost incentive to operate noise reduced aircrafts exists, these results correspond with existing research and present an orientation concerning a possible steering effect. Weaknesses of the existing charging systems were identified and recommendations for a stronger impact of noise surcharges given. One major weak point appears within the ICAO classification/‘Bonusliste’ as well as within the noise class system: Both approaches lack a significant cost differentiation between currently operated and newly introduced aircrafts. Applying either method, most aircrafts are assigned to only two classes/chapters. Therefore an advanced fragmentation of noise classes or ICAO chapters and an increased range of charges should be undertaken to create incentives for the future. For the present, the calculation method of noise classes should be preferred over ICAO chapters since local noise conditions are considered, a more detailed price differentiation is possible and the system can be monitored regularly. Thus, consistently with existing literature further harmonization of the calculation methods and the application of noise charges should be pursued. A uniform frame for airlines to react to would be provided. In terms of the internalization of external costs and a source-based cost allocation noise charges should be increased and adjusted to local circumstances. Further, the method of accounting could be adapted such as an incident-based or airline-based accounting method. So that the ratio of noise charges of the operating costs of airlines also increases. Airports should make sure that their charging system does not privilege noisy and light aircrafts compared to quiet but heavier aircrafts. Fixed and variable charges need to be adjusted. Besides, the charging system should be monitored continuously. Generally, a revision of the existing charging systems in Germany is necessary but it should be balanced on whether the airline industry will wait for the introduction of a new aircraft generation. Moreover, the international regulations for airport charges do not currently allow for great advances. Future research should study whether there are further opportunities to increase the impact of noise charges and try to display the complexity of airline decision processes. It can be questioned how far other methods of calculation can be applied in practice and whether they comply with existing recommended practices and guidelines.

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