**G**erman **A**irport **P**erformance

Changes in the Structure of German Airport Charges

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**Abstract**

This paper discovers new developments in the structure of German airport charges, which provide with key indications when analyzing risk sharing, welfare effects, and allocative efficiency in the aviation industry. To do that, an innovative approach is adopted here by looking at the structure of charges from a point of view of fixed vs. variable charges. In line with the theoretical observations, the paper also attempts to empirically illustrate that in German international airports this ratio has significantly changed in the last decade. At first, the share of passenger related charges has reached record high levels in 2007. And secondly, this share has continuously increased since 1998. Meanwhile the paper demonstrates the causes of airports being increasingly exposed directly to passenger traffic fluctuations. Subsequently, after several simplifying assumptions, it can be observed, that variable charges can be translated into a heavier market risk, resulting a higher involvement of near-monopolist airports into real market conditions. The paper concludes by focusing on strategic implementations of such developments, in terms of a new transformed risk environment and on behalf of airports, airlines and regulators.

***Keywords***: German airport charges, pricing, variability, risk-sharing, airline-airport relationship

**Introduction**

The demand for air traffic services provided by civil aviation industry has considerably increased over the general view and, despite the temporary world economic crisis, the trend is expected to continue well into the future. In Germany, the figures of the *Arbeitsgemeinschaft Deutscher Flughäfen* (ADV) show a 47% increase of passenger air traffic from 129.5 Million in the year 1998 to 190.5 Million in the year 2007.

The growing size of the aviation industry increases concerns over airport pricing. While airlines and airports represent two major and clearly distinct sectors, their interaction is determined by a specific characteristic of mutual dependence, which consequently contributes to create a particular pattern of market risk distribution. This pattern, dynamic rather than static, can be observed through several dimensions. One of these dimensions, analyzed in this paper, is the airports’ pricing of its aeronautical services: airport charges[[2]](#footnote-2).

While traditionally these charges have been weight-based, nowadays an increasing trend towards passenger-based charges is observed. The distribution between fixed (weight) and variable (passenger) charges can be a very important indicator of airline – airport relationship. This recent developments are created by, and in their turn create new set of incentives and constraints in the aviation industry.

Therefore, the aim of this paper is three folded: 1) to provide empirical evidence that the share of variable (or passenger) related charges, for a sample of representative German international airports, has significantly increased relative to fixed (or weight) charges; 2) to examine the possible causes and renovated airport–airline risk-sharing relations of such a change in the structure of charges; 3) and to illustrate the probable risks and risk-motivated strategic changes of the firms operating under above- stated developments.

Extensive body of literature exists on the subject of airport pricing. However, most of the studies concentrate on a welfare maximising perspective. The present paper contributes to the previous literature by exploring the structure of airport charges, from a risk sharing perspective. In this setting, the papers aims to discuss factors influencing airport charges such as, liberalization and deregulation process in the aviation industry, negotiating power between airlines and airports, technological advancements in aircraft manufacturing, airport congestion, structure of airport’s ownership, price regulation and airports’ specific competitive environment.

The paper is organized along the following thematic lines: section one gives a general overview on the topic of airport pricing. The methodology and the results of empirical calculations are presented in the next section. The third section focuses on the causes of determining the change in the structure of charges are explored. Section four analyzes some of the possible causes of such a structural change. And the last fifth section concludes by outlining the main results/outcomes (particularly concerning risk sharing implementation) of our research project on Changes of Airport Charges.

**2. Background on Airport Pricing**

In Europe the recently released European Directive on Airport Charges has brought renewed emphasis on the topic of airport pricing. However, this event may well be considered just a peak of a period when the academia, the industry and the public authorities have shown continuously increasing concern with the issue. The background on which this happened is generically described as the liberalization and deregulation process in the aviation industry.

In the past, both the airlines and the airports were seen mostly as means of public transport, serving rather social purposes and having large access to public funds to cover potential losses. By contrast the airlines, at least a decade ago, and airports, nowadays, started to behave more and more like commercially oriented enterprises (Graham, 2003); a transformation process that affected also the airport charges.

Foremost, the competition between airlines induced a race to the bottom to cut costs. Among others, this was also transformed into a pressure to minimize those costs that are to a limited extent under the control of the airlines, such as airport charges (Barrett, 2000). Shortly, the airports, from mere infrastructure providers, started to increasingly perceive themselves as profit oriented entities, competing for airlines and passengers (Malina, 2006). The gradual withdrawal of public funding made them try to diversify sources of income. Hence, the share of revenues from non-aviation activities expanded (Hamon, 2003). However, for the moment, airport charges remain the most important source of revenue for many airports around the world. Exhibit 1 shows that in Germany the situation is no different.

**Exhibit 1: Share of Aeronautical Revenues in Total Revenues, 1998-2004**



Source: Airports financial reports, GAP Database; Own calculations

**2.1 Airport Pricing Under Regulation.** During the 1970s and 1980s a renewed interest in the regulation of natural monopolies can be observed. In the airports industry discontent was expressed with the possible risk of market abuse and extraction of monopolistic rents. Hence it was called for an economic regulation; to facilitate prevalence of market failures that take place in an incomplete competition where the required conditions of efficiency are not fulfilled or in the absence of a competitive environment at all (Marques, 2008, p.164). In other words, the regulation tries to imitate the disciplines of a competitive market (Starkie, 2005). Therefore, a number of intensive schemes were proposed and implemented, deregulation was encouraged to free up competition and market entry, in some countries changes in airport ownership occurred. Meanwhile the academic debate attempted to shed light on some shortcoming of the generally accepted theory of regulation. Exogenous constraints and the limited access to information of the regulators were the main sources of inefficient regulatory outcomes (Laffont, 1998). Thus, economic price regulation is at most a second-best solution. Furthermore, the regulatory approach did not meet the standards of principal-agent theory, whose aim is to highlight the information limitations that impair agency relationships.

**2.2 The Problem of Efficient Pricing.** A short exposure on the current importance of airport charges shows that the focus has been mainly on levels. Making some relaxing assumptions on complex reality leads us to the following simpler description of market interplay: the airlines want lower charges, the airports higher ones and the public authorities want them to be at a fair level, transparent and non-discriminatory. Yet, aside from the levels, the structure of charges can have significant effects on the productive and allocative efficiency of airports, as well. Recent publications point out that the airports’ pricing structure may be at least as important as the levels. For instance, Starkie argues that to avoid excessive investment, regulation should emphasize not only the level of average prices, but give adequate regard to pricing structures that should reflect peak-demand (Starkie, 2005).[[3]](#footnote-3)

Regarding airport pricing, in general, and the structure of airport prices, in particular, a large amount useful references exists from a welfare prospective, such as Morrison (1983, 1987), Oum and Thretheway (1988), Hogan and Starkie (2004), Starkie (2005), Klenk (2004) and Niemeier (2002, 2004). In sum, theory advises that the most referred recommendation out of possible economic principles of pricing is based on marginal cost-pricing. So, only users who value the airport service as much as its cost of provision are ready to pay (Boiteux, 1964). However, in the case of airports, this first-best pricing would produce dead-weight losses. Airports require large infrastructure investments and sunk costs are acknowledged to be high. Economies of scale are debated only in the sense that it is not clear at what scale they stop to exist (Niemeier, 2002). Additionally, airports are multi-product firms. Therefore, like in other network industries, marginal social cost pricing will result inevitably in accounting deficits (Oum and Thretheway, 1988, p.). What is to be done, then?

* For airports with free capacities, the marginal costs are very low, much below average costs (Forsyth, 2006). In this case, a second-best alternative such as a Ramsey Pricing scheme can be advantageous. This means to set prices according to the inverse elasticity of demand, and the basic principle refers to the willingness to pay off the users.[[4]](#footnote-4) (Morrison, 1982; Martin-Cejas, 1997)
* For airports facing capacity constraints, peak pricing or even congestion pricing find more theoretical support. These refer to charging differently between peak and off-peak periods, and let the highly demanded slot be acquired by those who can afford paying the higher prices of congestion. The others have always the option to switch towards a less congested slot. This is simply a way of rationing demand by price mechanism. (Forsyth and Niemeier, 2003)
* For airports facing more severe congestion problems, as solution would be the establishment of a fixed charge per landing, besides the traditional weight and passenger related charges, which would discourage the landings of small aircrafts, like in a two-part tariff.

Aside from these theoretical considerations, in practice, the basic principles of airport pricing have been set out in the Article 15 of the Chicago Convention (1944). Further elaborations of those principles have been made by ICAO (1997, 2001). By and large, they all support the view that airport charges should be fairly-determined, non-discriminatory and should lead to cost recovery. On these grounds, marginal cost pricing has been rejected as not being consistent with the equity principles of Article 15. The other discriminatory schemes are treated likewise. In fact, the implementation of ICAO recommendations has led a pricing strategy based on cost-recovery combined with an ability to pay derived from the weight of the aircraft (Abeyratne, 2001). Essentially, costs were linked to damage, and damage was considered to be provoked by the aircraft weight. However, this opinion has recently been challenged. Starkie attributes the perpetuation of the traditional pricing scheme more to an inertia mechanism, based partly on the mistaken assumption that aircraft weight and runway damage are highly correlated (Starkie, 2005). He, together with Hogan, has shown that runway damage reflects a range of factors, of which weight (MTOW) is only one (Hogan and Starkie, 2004). On top of these, as pointed out in the beginning of the section, the industry incentives and the organizational structure of airports have changed. The basic principles of airport pricing should account for this, and change too.

Nevertheless, there are some significant developments in the structure of airport charges, not necessarily in accordance with the theoretical recommendations laid above. There seems to be a tendency around the globe, that airport charges are becoming more passenger related. Concerning the issue of passenger charges, there even existed claims from the airlines, through IATA, that these should be levied by the airports directly from the passengers on departure, and not through the airlines (Doganis, 1992, p.). Yet, the common practice is that airports include passenger fees straight into the charges manuals and airlines seem to be a supporter of such fees. Passenger related variable charges diminish, to some extent, the risk of an airline to land with lower seat loading factors. At the same time, a more weight-based oriented scheme is preventing an airport from being directly exposed to market fluctuations. Such a scheme acts, for the airport, as a shock absorber. In the short-term, it lets the airline bear most of the costs if a passenger demand downturn occurs. Hence, the structure of charges can offer clues on how the market risk is shared between airlines and airports.

**2.3. Airport-Airline Vertical Integration.** Before discussing a risk-sharing perspective, it is fundamental to understand the kind of relationship between airlines and airports. This is one of particular specificity. Although commercial in its nature, vertical integration differs from a usual supplier-customer relation, as one cannot exist without the other and each depends on the other for the provision of its services to the final demand, passengers and freight (Klenk, 2004, p.126). Moreover, increasingly in the last period, they both derive their revenue from the same primary source. This high mutual dependence is often recognized by various stakeholders, like International Air Transport Association – (IATA) or Airports Council International (ACI). Under these conditions, and especially due to industry liberalization and deregulation, in Germany, the setting of airport charges is increasingly perceived as being subject of a negotiation process between airlines and airports. But, the outcome of a negotiation, as often the case, can rather reflect information and power asymmetries between the parties involved. The binding relationship contributes to strengthen the effects of asymmetries.

The so-called tax-box effect is often a preferred indicator to use in negotiations. The tax-box effect is defined as the share of airport aeronautical charges which an airline can directly pass through to the passenger in the ticket prices. Practically, these are all the per passenger charges, in the pricing scheme of an airport. But, airlines often argue that they are not able to pass through the whole tax-box, due to binding impact of competition and price elasticity.[[5]](#footnote-5) For them, a fair analysis would have to take into consideration these two aspects as well. However, from the point of view of an airport, it doesn’t matter how much airlines can pass through, as their revenue just becomes dependent on passenger numbers. In this case, considering the full share of passenger related charges makes more sense. Due to complexity reasons, here we shall confine with the latter view.

**2.4 Risk Sharing.** According to our knowledge the literature has shown little concern for the risk-sharing reflected by price structures. With a few exceptions, this issue has been touched only marginally. Nevertheless, where it was mentioned, there seems to be a wave of sympathy towards a development where airport charges become variable. For instance, although admitting that a higher share of passenger dependent charges increases the over-all financial risk on airport’s side, Graham sees such a situation as desirable. This is because airport charges will become more connected to the revenue streams of the airlines (Graham, 2003). In the same tone, Michael Klenk argues that airports should bring a greater participation to the market risk, by incorporating more of the real market conditions within their pricing schemes (Klenk, 2004). Nevertheless, risk-sharing issue will be discusses repeatedly throughout the paper.

1. **The structure of airport charges, in Germany, 1998-2007**
	1. **3.1. Methodology**

A sample of representative German international airports is selected. Due to data availability regional airports are eliminated, nevertheless the sample remains representative, jointly covering about 90% of the passenger market. According to their scale they can be classified as small, medium and large size airports (see table 1).

**Table 1: Sample of airports**

|  |  |  |
| --- | --- | --- |
| **Small** | **Medium** | **Large** |
|  **Airport** | **IATA Code** |  Airport | **IATA Code** |  Airport | **IATA Code** |
|  Bremen | BRE |  Köln | CGN |  Frankfurt | FRA |
|  Dresden | DRS |  Hamburg | HAM |  München | MUC |
|  Münster-Osnabrück | FMO |  Stuttgart | STR |  Düsseldorf | DUS |
|  Leipzig | LEJ |  Tegel | TXL |  |  |

Source: Own calculations

Subsequently, a common and relevant fleet mix for all airports in the sample is chosen (common, to make figures comparable between airports and relevant to cover a significant share of airports’ aviation revenues). This was done using statistical data regarding the type of aircrafts landing at German airports. Data was provided by ADV.

**Table 2: Share of the fleet mix in the total number of flights**

|  |  |  |  |
| --- | --- | --- | --- |
| **Airport** | **Fleet mix****(by aircraft family)** | **Average 1998-2007** | **2007** |
| BRE | **B737****A320****CRJ****BAE146** | 37.66% | **51.72%** |
| DRS | 49.91% | **58.04%** |
| FMO | 40.06% | **52.10%** |
| LEJ | 46.91% | **50.97%** |
| CGN | 51.22% | **67.52%** |
| HAM | 50.01% | **59.40%** |
| STR | 58.96% | **60.12%** |
| TXL | 73.89% | **81.52%** |
| FRAU | 58.31% | **61.92%** |
| MUC | 64.74% | **67.51%** |
| DUS | 68.57% | **73.07%** |

**Source:** Own calculations using *ADV* data

Some methodological facts and assumptions:

* For each airport, the aggregated levels of charges were weighted with the share of each aircraft’s movements in the total number of movements.
* Due to an increasingly deregulated market, at German airports there are now highly individual charges structures, which differ extensively, especially among international airports. Hence, a comparative analysis of aeronautical charges proves to be a challenging task. This is the main rationale why ground-handling and fuel charges, for instance, were not considered. Details regarding these are usually not reported in a consistent manner, by the airports, and are even rarely published.
* Government taxes, such as DFS, BMI, were included in the calculations.
* The data used is based merely on published charges manuals, and it does not take into account any available rebates, discounts or other charges publications such as incentive schemes.
* The currency used is Euro. Before 1999, prices in Deutsch Marks were converted to Euro, at 1/1 parity.
* Seat Loading Factor of 70%[[6]](#footnote-6) is assumed.
* Unless night flights restrictions, 70% during day-time and 30% night-time flights are assumed.
* Despite the fact that some airports may derive considerable revenues from cargo, a simplifying assumption allows to consider only passenger traffic.
* Charges were weighted with the share of different type of passengers (Domestic/EU/Non-EU/Transfer passengers), based on statistical data from DeStatis.
* In terms of charges structure a distinction between variable and fixed charges is made. Authors call fixed components of airside charges those that are aircraft related and variable those that are passenger related (see table 3).

**Table 3: Definitions**

|  |  |
| --- | --- |
| **Term** |  **Definition** |
| **Variable charges**  |  Passenger related charges |
| **Fixed charges** |  Weight and other aircraft related charges |
| **Variability** |  Share of passenger related charges in total charges |
| **Variabilization** |  The process by which the share of passenger related charges is increasing |

* 1. **Results**

A change in the airside charges structure for all the airports analyzed is found. First, in terms of levels, the share of variable charges has reached record high levels in 2007, especially for medium and big airports (exhibit 2). Second, in terms of trends, with a few exceptions (see chapter 3.2.2 for further discussion), the share of variable charges has continuously increased over the period, reflecting a clear tendency that charges become more passenger related (exhibit 3).

**Exhibit 2: Level of Variability at German Airports, 2007**

**Exhibit 2: Levels of Variability at German Airports, 2007**

 Source: Own calculations

**Exhibit 3: Trends of Variability at German Airports, 1998-2007**

Source: own calculations

While the structure has considerably changed, it seems that expensiveness (measured by airlines’ total turn-around costs per flight) has suffered minor modifications; it stagnated, or even slightly decreased in some cases (exhibit 4). This steadiness proves that the results of variabilization are consistent; i.e. identified rend of variabilization is not a result of an increase in costs.

**Exhibit 4: Weighted average costs per turn-around flight, 1998-2007**

Source: own calculations

**3.2.2. Statistical proof**

Exhibit 3 shows an overall increase of charges’ variability for all observed airports, however significantly large deviations can be detect during the process. Therefore, in the following section a formal statistical proof is constructed to demonstrate the increasing trend of variabilization.

The same methodology is applied as in chapter 3.1, in addition of constructing a panel dataset of 120 observations on behalf of the same 12 airports, for the period 1998 – 2007.

In the following generalized least squares model trend is employed to explain variability as dependent variable.

|  |
| --- |
| **Table 4:**Method: Generalized Least Squares |
| Sample(adjusted): 120 |
| Included observations: 120 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| TREND |  0.018477 |  0.003742 |  4.938293 |  0.0000 |
| C |  0.303631 |  0.023216 |  13.07835 |  0.0000 |
| R-squared |  0.184208 |  Mean dependent var |  0.405257 |
| Adjusted R-squared |  0.176655 |  S.D. dependent var |  0.124221 |
| S.E. of regression |  0.112716 |  Akaike info criterion | -1.509870 |
| Sum squared resid |  1.372137 |  Schwarz criterion | -1.460771 |
| Log likelihood |  85.04287 |  F-statistic |  24.38674 |
| Durbin-Watson stat |  0.221413 |  Prob(F-statistic) |  0.000003 |

Although only 18% of variance of variabilization can be explained by trend, the key contribution of the model is that time trend is significant with 1% significance level. In order to improve the model, total charges are added as an independent variable, to exclude the artificial effect of the correlation between total charges and variability.

|  |
| --- |
| **Table 5:**Dependent Variable: VARIABLE/TOTAL |
| Method:Generalized Least Squares |
| Sample(adjusted): 1 120 |
| Included observations: 120 after adjusting endpoints |
| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
| TOTAL | -0.000166 |  3.34E-05 | -4.964013 |  0.0000 |
| TREND |  0.022127 |  0.003468 |  6.380522 |  0.0000 |
| C |  0.638823 |  0.070723 |  9.032753 |  0.0000 |
| R-squared |  0.336913 |  Mean dependent var |  0.405257 |
| Adjusted R-squared |  0.324519 |  S.D. dependent var |  0.124221 |
| S.E. of regression |  0.102095 |  Akaike info criterion | -1.698941 |
| Sum squared resid |  1.115292 |  Schwarz criterion | -1.625292 |
| Log likelihood |  96.44178 |  F-statistic |  27.18324 |
| Durbin-Watson stat |  0.268675 |  Prob(F-statistic) |  0.000000 |

After adding total charges to the model, trend still remains significant. Trend, here, can be interpreted as its influence on variabilization, with relatively stable total costs.

The conclusion is that there exists strong empirical evidence supporting the hypothesis of variabilization. The evidence clearly shows that charges are becoming more and more passenger related; therefore, the task of the following chapter is to theoretically and intuitively explain the factors driving such developments in the structure of airport charges.

1. **Why have charges become more variable?**

In this section various theoretical hypothesize are obtained to explain the strong variability trend, which was intensively being proved up to this point. Some of these reasons are backed up by data analysis, others remain hypothesis because of low data availability, rest of them contain too many complexities and will be left as potential research opportunities. To keeps things organized, the proposed hypothesis will be divided into three groups according to their origin: airlines, airports and technological or market driven.

**4.1. The Airline Side**

**4.1.1. Increase in demand and airline efficiency.** As mentioned in the beginning of this paper, the air traffic demand has been increasing at relatively high pace during the last years. In the same time, this increase in demand has been accompanied by an increase in efficiency of the airlines revealed by higher Seat Load Factor per flight (see Appendix 1). One can argue that airports, in order to grasp the most out of the situation, have switched towards more passenger related charges. This is because the income generated by weight-based fees is dependent much more on the number of aircraft movements, which increased on a slower pace compared to passenger numbers. Thus, relatively, airports would have lost money if they would have stick with the traditional scheme (Exhibit 5).

**Exhibit 5: Simulation, ratio fixed/variable charges, different SLF**



Source: Michael Klenk, 2004, p.130

**4.1.2. Impact of LCC.** As it can be observed from Exhibit 3, the pace of charges variabilization was higher starting 2003-2004. The moment coincides with Low-Cost Carriers (LCC) boom in the European market, and accordingly in Germany. Low-cost airlines are known to be tough negotiators on airport charges. Usually, these cover a higher proportion of an LCC cost structure, compared to legacy carriers. Thus, one would expect that an airport with a larger presence of LCC flights to have a higher share of variable charges. Yet, Exhibit 6 contains too much variation, so the hypothesis can not be confirmed (e.g. at Cologne airport although close to 70% of the flights are low-cost it has one of the lowest levels of variability). However, it is worth to note that variability and LCC approach and at last coincide at both extremes. To see this, have a look at what is nowadays called true LCC airports (non LCC airports respectively). For instance in Hahn, a uniform LCC airport excluding cargo, charges have already reached 100% variability, while Dresden airport’s variability equals LCC share (around 30%).

**Exhibit 6: Correlation between variability and share of LCC, 2008**

*Source:* ADV, Low Cost Monitor 1/2008

As already mentioned, the aimed hypothesis was not proved. Hence it is reasonable to study the time variant correlation of variability and share of LCC. The panel data is for 2005–2008, while ADV reports its “Low Cost Monitor” since 2005. This few reports from ADV make sense, while LCCs started to affect the markets since 2004, as mentioned above. However a further statistical analysis aiming to find a correlation between LCC share and variability failed to prove the hypothesis. Therefore this hypothesis will be let for future researchers to prove. It is still worth closely examining exhibit 7, which partially contributes to the hypothesis.

**Exhibit 7: Correlation between variability and share of LCC, 2005-2008**

*Source:* Own calculations based on ADV, Low Cost Monitor 1/2006 – 1-2009

**4.2. The Airport Side**

**4.2.1. Non-aviation importance and the derived demand.** One should not take as granted that the airports were just the naive victims of a ruthless airline behavior. First, as Charlton (2008) emphasizes, the airport industry has matured to a remarkable extent. It has acquired the power to defend its interests, and one example is the European Directive on Airport Charges, where unlike the initial proposal of including airports above 1 million passengers, the “compromise” level was raised to 5 million. Second, many German airports developed a robust non-aviation business. In general, this business is dependent on passengers. Without passengers there is almost no non-aviation side. But, passengers depend on airlines to be brought in (Graham, 2008). In these circumstances the whole relation between airlines and airports has become more complicated. The attention of the airport has shifted, a few centimeters. There is a reorientation towards passengers as its main customer (Francis, 2003, p.267). To get to the point, in recognition of the expansion of commercial business and the increasing importance of passengers as clients, airports may have accepted benevolently a switch towards more variable charges, encouraging airlines to open new routes and bring more passengers. If this hypothesis receives public validation, then it brings us nothing else but to acknowledge more than ever before that airports face a “derived” demand. Basso and Zhang (2007) showed that the models on airport pricing can be grouped in two categories: those where the demand for airport services depends on airport charges and congestion costs, and those where the demand for airport service is a derived demand – where the equilibrium in the downstream, airline market determines the demand for airports. In this context, the variabilizations of airport charges seem to promote the second category. The assumption, here, would be that the downstream market is influenced by the incentives given to airlines, through their cost structure.

**4.2.2. Ownership.** Presently, ownership at German Airports show complicated structures (see Appendix 2). In the last decade, here, several airports have been partially privatised. However most of them remain under total public control and, usually, local and regional governments are involved. This situation illustrates the importance of airports to the local communities. The view of airport serving social purposes is still strong. A market oriented attitude, in which the airport takes more risk that could lead to higher rewards, is often rejected in favour of job creation and support for the local economy. In general, publicly owned airports may set various objectives, but efficiency and profitability may not be the dominant ones. A correlation between the ownership structure and the share of passenger related charges at German Airports reveals the fact that all the partially privatised airports are in the high variability club (Exhibit 8). Possibly, this is because private ownership is more open to adopt market oriented principles, and less risk-averse. This structure perfectly goes along with public airports pricing logic, which is to guarantee more stable revenues to public airports. Another opportunity here is to relate charges structure of a given airport before and after the change in the ownership, however due to data availability constraints; this remains an open research question.

 **Exhibit 8: Variability in 2007 according to ownership structure**



Source: Data on ownership structure from ADV, 2007

**4.2.3. Congestion.** In this section the issue of congestion and its effects on airports’ decision between fixed and variable charges is explored. The assumption or hypothesis, here, is that airports may have an incentive to switch towards more passenger related charges in order to maximize revenues, in case of limited runway capacity. A graph aiming to show the correlation between average capacity utilization and variability levels for 2007 does not present consistent results (Exhibit 9). The apparent correlation between the two variables is contradicted by the fact that only four or five German airports face congestion problems. The others do not (except of some peak hours, but to a much lower extent). Thus, most probably the management of the airports with free capacities do not have any incentive to take into consideration capacity utilization levels when they decide their pricing structure. Anyhow, what about those 4 or 5 airports (FRA, MUC, DUS, STR, TXL) that indeed face capacity constraints? Here, as the correlation still exists, at least the conditions are in place to support the argument that congestion plays a role in their decisions. Unfortunately, it’s hard to be quantified how big this role is. Nevertheless, without uncertainty, its importance will increase in the future.

 **Exhibit 9: Correlation between capacity utilization and variability, 2008**

 Source: Own calculations using

data from German Airport

Coordinator (FHKD), 2007

* 1. **Market Driven Factors and technological changes**

**4.3.1. Does the decrease of aircraft weight per seat matter?**

Some authors look at the weights of aircraft; however, it is the balance between the seats number and the weight of the aircraft that should be considered. So a natural hypothesis is: due to continuous technological advancements which decrease the aircrafts’ weight per seat indicator, airports move gradually towards more per passenger fees. The motivation behind this is to compensate for a relative loss, due to less revenue generated by a high share of weight-based fees. Historically, it is confirmed that the average number of seats per aircraft has increased; the only counter-trend was provoked by LCCs, but not with a decisive impact (Humphreys and Francis, 2002, p.5). As it can be depicted from Exhibit 10, if we consider the maximum possible capacities of the aircrafts from each family (in assumed fleet mix), there is evidence that aircraft with more seats typically have less weight per seat.

**Exhibit 10: aircraft weight per seat, by aircraft family**

**B737**

**A320**

**CRJ**

**BAE146**

Source: own calculations

**4.3.2. Airlines push airports to shift the risk.** The process of setting charges started to look in Germany more like being market-driven, based on negotiations between airlines and airports. The outcome of a negotiation, however, can be a reflection of the balance of power between the parties involved. On the topic of the negotiating power between airlines and airports, conflicting views exist. The common view is to consider airports in a better bargaining position, due to its natural monopoly characteristic. Quite often it is argued that by simply comparing their balance sheets, we see how airlines are struggling to survive, many of them being on the verge of bankruptcy, while the airports are as profitable as gold mines. Yet, this traditional view has been challenged lately. There are opinions that airports do not have monopoly power, or at least not anymore, and they do have to face competition between each other; so airlines do have choices. In UK, for instance, the fact that the airports have been unable to charge up to the price-cap, gives credit to such idea (Charlton, 2008, p.3). Airport competition is nothing but a delicate and debated topic; debated, more in a sense that some say the competition is higher some say is lower. One of the condition for the airports to compete on price is that this to be relevant enough for the airlines. On this issue, a great misconception has gathered around the idea that airport charges are just a tiny part of an airline’s costs. Based on this idea, some authors have even argued against the competitive privatisation of British airports in mid 1980s (Barrett, 2000). Yet, as facts developed, those airports are now in a situation with significant competition potential. The figure put forward by ACI and ICAO, is that airport charges represent just 4% of an airlines total turn-around costs (Hamon, ACI Europe, 2003). But, this figure can be misleading, as it represents just a world average that should not be generalised. For instance, the percentage is expected to be higher for low-cost airlines, around 8-10%.[[7]](#footnote-7) Moreover, the share of airport charges in airline’s costs depends also on the route characteristics. Just as an example, this percentage can go up to 20% for some of the Lufthansa flights (Klenk, 2004). The ADV put forward a general estimation of about 9-10% for the German market (ADV, 2009). But, although still low, these percentages can be decisive to bring an airline on positive or negative in its financial report.

In general, research tried to show that airports enjoy economies of scale - which corroborated with sunk costs character of airports make the case for a natural monopoly - up to a certain traffic level, beyond which they experience diseconomies of scale. In Germany, Niemeier believes that many airports are still in the economies of scale range, and those which are not, like FRA or MUC, enjoy protection from legal barriers to entry (Niemeier, 2002, p.23). However there is one issue that can considerably diminish the market power of an airport. According to Starkie (2008) the degree of market power is very much determined by the availability of proximate airports or other transport substitutes. In our case, Germany has a very dense network of airports, with an average distance of 77km. Moreover it has a very well developed rail and road infrastructure (Petzold, 2003). This issue goes hand in hand with the opinion that airports have to face the countervailing power of the airlines, which now are large and sophisticated companies (Starkie, 2001). According to The Australian Productivity Commission (2001) an airline has countervailing power if it is able to threaten convincingly with a withdrawal from the airport because this withdrawal has more negative effects on financial results for the airport than for the airline, and can force the airport to set more competitive prices (Malina, 2006, pp.21-22) The relative proximity between German airports gives green light for such threats to become possible. To add up, airlines enjoy a very important advantage in comparison to airports, derived from the very nature of their business, which is flexibility. If no other choice, they can take their fleet and move it to another airport. According to this second view expressed here, one could argue that airlines, being in a stronger bargaining position, just pushed the airports to make charges more passenger related, and to shift more of the market risk, to the airports. As exaggerated as it may be this statement serves the only purpose of strengthening the idea that airlines have become more capable of putting pressure on an airport. They undoubtedly had an important role in the process of variabilization. And it is not farsighted to argue that from their point of view a complete variability would be desirable.

1. **Implications of Variabilization**

The objective here is not to formulate a positive statement on the impact of variabilization. But, rather to suspect that this process produces a change in the risk configuration of the German aviation industry. Some risk may have shifted from the airlines to the airports, which are now more sensible to market fluctuations than in the past.

**5.1. Quantifying Risk.** The question about risk refers especially to the negative consequences for an airport that can be triggered by an exogenous demand shock. A special event, such as the 9/11 or a global financial crisis can create a sudden decrease in the demand for air traffic services. This translates in lower revenues for the airports, which are now more dependent on the number of passengers. It is true that the risk may appear only in the short-term, reflected by a decrease in the Seat-Load-Factor per flight. Over longer intervals it is expected that airlines, quite flexible and sophisticated companies, restore levels of efficiency, and implicitly seat loading factors, and bring the airports on the same cost/revenue basis. Of course, the recovery period can be longer, and it depends very much on the gravity and the characteristics of the demand shock.

The discussion about risk raises the question if it can be quantified. This is not an easy task. However a simple way to do it is to examine changes in the revenues and balance sheet ratio’s induced by a possible exogenous demand shock. To do this scenario technique is applied, assuming a decrease in the passenger demand between 5% and 25% (with a step of 5%). This model also assumes, that only the aeronautical revenues are affected and the impacts on different segments of demand (LCC, charter, business etc.) would be uniformly distributed.

 **Table 6: Impact of a demand shock on the revenue/costs ratio**



Total Revenues

Total Costs

Source: Own calculations based on financial reports data from 2004 (or 2005)

Intuitively, the expected results were to show a clear positive correlation between variabilization and the impact of demand shock: the more variability in a given airport, the more impact of shocks on the decline of revenue/cost ratio. However, Table 5 fails to demonstrate a clear correlation caused by deviation of several airports.

Therefore, another model is built to show the marginal change of cash flow of a given airport amid five different levels of reaction, when a negative 20% demand shock is observed with a 1% increase in variabilization (exhibit 11). The model, as expected, shows a decreasing airline-airport cash flow, with decreasing airport reaction. The only, but interesting deviation (with positive effect) is Dusseldorf airport, which is the only airport in the sample with negative profits.

**5.2. Infrastructure development.** Congestion problems that German airports face – already existing or expected in the future – trigger discussions about airport capacity expansion. Regarding this topic, one can easily get the feeling that in Germany this is much more a matter of political approval, environmental constraints or public agreement. What is less obvious is that it’s also a matter of financing. Regarding airport infrastructure financing, ACI acknowledges that the level and structure of airport charges should be connected to the economic costs of investment plans (ACI 2005, p.4). Moreover, ICAO and EC encourage pre-financing by the use of airport charges which, they say, should reflect the long-term costs of specific investment. In this way it can reduce the reliance of airport operators on external sources of funding (ICAO, 2000; EC, 2001). But, as Niemeier states, although they have the needed degree of freedom, German airports failed to install a workable price mechanism to further such objective (Niemeier, 2002, p.14).

Moreover, if the assumption that airports bear now more market risk holds, then this may increase the over-all cost of raising capital from private units. Consequently, it affects negatively the expansion plans of airports and puts supplementary pressure on what was an already sinuous problem.

**5.3. Demand volatility.** Michael Klenk sees the variabilization of airport charges as desirable. But, he agrees that this would be indeed fairer for both sides if a true market mechanism would be in place. The mechanism would look to reward airlines, by lowering charges if they would beat an agreed traffic target, and give compensations to airports, by increasing charges, in case of an economic downturn with low traffic developments (Klenk, 2004). Basically, the objective is to soften the effects of a possibly volatile demand. Nevertheless, the kind of market mechanism suggested here, which should complement a potential variabilization of airport charges, has been short-live in Germany. Attempts to implement it, with one exception, seem to have failed. Four of the partially privatized German airports – FRA, HAJ, DUS and HAM – engaged in what are called Private Framework Agreements; which are basically contracts with the airlines that have public character. This is considered to be a form of price-cap regulation. The formula, unlike the typical price-cap, contained also an adjustment factor, based on the evolution of passenger traffic (Müller and König, 2008). Yet, by 2009, in three of these cases, the contracts were not extended for a new term. Only for HAM this form of price-cap was kept in place.

**5.4. The role of the regulator.** It is worth making it clear, that this paper does not argue against the variabilization of airport charges and the authors do not see it as a negative development. However, it’s reasonable to at least point out the possible negative consequences. If an airport is in difficulties, most probably the regulator will step in. The regulator is not unreasonable or irrational. If there is a severe downturn which means that the regulated part of the airport becomes loss making we would expect the airport to ask the regulator for a re-opener to look at the numbers again. This would result in a higher level of fixed charges and a lower level of variable charges. Yet, when conditions are bond the results may be suboptimal and the authority’s reaction may be exaggerated, especially to the disadvantage of the airlines. So, both sides, the airlines and the airports, should be interested to weigh the consequence early, before the conditions become bond.

**5.6. Let’s don’t forget the “invisible hand”.** Aside from the concerns put forward so far, regarding the change in the structure of airport charges, there are reasons of hope. All clues lead us to the conclusion that the variabilization process is an outcome of a market mechanism. And despite the nowadays heavily criticism on its virtues, sometimes, the market knows the best. After all, the negotiated discounts between airports and airlines have been more successful to drive prices down than any of the regulatory frameworks (Barrett, 2000).

1. **Conclusions**

This paper started by assessing how the deregulation process affected the traditional patterns of the airport-airline relationship. The argument is that this is the background where the changes in the structure of airport charges should be discussed. For nearly all of the analyzed German airports, this structure has changed last decade; in a sense that the share of variable charges has increased. As possible reasons for such a development the paper identifies not a single, but rather a constellation of factors. Those factors that could be proven empirically are presented in the paper: correlation between increase in passenger demand and increase in airline efficiency, a relative decrease of aircrafts weight compared to number of passengers they carry, a possible disequilibrium in the balance of power between airports and airlines, the ownership structure of airports and congestion problems.

Subsequently, the argument becomes that this development is most likely changing the risk sharing configuration in the aviation industry, making the airports more exposed to market uncertainties than in the past. If this is true than it can increase the cost of raising capital and make infrastructure investments needed for airport expansion more burdensome. However, this development need not be interpreted as necessarily bad, just that stakeholders should be aware of the possible negative consequences. The level of risk to which airports are exposed, if any, still has to be better quantified before it can be credibly used in a decision-making process. The proxy used here represents just a rough approximation.

All in all, the development of charges structure can give us important clues about the risk sharing and welfare effects in the aviation industry. This study provides a first empirical basis upon which further research on the topic of risk and risk allocation can be conducted.

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**Appendix 1:** Evolution of Seat Loading Factor, AEA, 1991-2008



**Source:** Own Calculations using data from AEA Official Website

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2. Throughout this paper, unless otherwise specified, by „airport charges“, we mean only the aeronautical airport charges, excluding the charges from commercial (non-aviation) activities. [↑](#footnote-ref-2)
3. Search for another example, possibly Niemeier [↑](#footnote-ref-3)
4. [↑](#footnote-ref-4)
5. Search the Ernst&Young study [↑](#footnote-ref-5)
6. See Appendix 1: Evolution of SLF 1991-2008 [↑](#footnote-ref-6)
7. See Ryanair financial reports [↑](#footnote-ref-7)