PEAK-LOAD PRICING AND AIRLINE REACTIONS AT EUROPEAN AIRPORTS

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ABSTRACT

Conventional wisdom in the economics of pricing holds that peak-load pricing can enhance welfare in cases where demand peaks are clearly identifiable and highly predictable. However, this pricing tool has not found acceptance among airlines in the past. In the very few cases in which peak-load pricing has been introduced, regulators have faced strong opposition from airlines. Recent research has focused on whether airlines could pass the additional costs associated with peak-load pricing on to passengers. Expanding on this work, this paper assesses how peak-load pricing would impact airline costs and forecasts how airlines would react to the implementation of a peak-load pricing regime. We use a simultaneous autoregressive model to predict airline pricing reactions. Our findings indicate that for certain routes, airlines would subsidize revenue decreases in off-peak times with price increases during peak times. This finding corroborates the perception held by airlines that a peak-load pricing regime would encourage new competitors to enter the market at off-peak times.

Keywords: Price differentiation, peak-load pricing, special interest groups, pricing behaviour, airline reactions

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1. INTRODUCTION

Although the global financial crisis has had a negative impact on the aviation sector, one can assume that a return to stability will lead the long-run growth trends in air transport to continue. According to ICAO forecasts (2007) the air transport passenger market is expected to increase at the rate of 4.6 per cent annually (in terms of passenger-kilometres). The problems associated with managing this growth are even more acute if one considers air freight, which is expected to expand at 6.6 per cent annually. In the absence of sufficient capacity expansion, this demand growth may be counterproductive for air transport. First, passengers will likely deal with considerable delays. Second, environmental costs are expected to rise. Third, air carriers will bear additional costs resulting from delays. At present, several European Airports already face severe capacity problems. A forecast of demand growth to the year 2025 without additional capacity growth predicts excess demand of around 3.7 million flights (see EUROCONTROL, 2004, pp. 2-11). In concrete terms, this means that in year 2025, more than 60 European airports are expected to face severe capacity problems in their peak hours and at least 20 airports will have to cope with capacity problems not only during a few peak hours, but around 10 hours per day. In Germany, for instance, this would translate in a situation in which all six major airports (including Berlin-Brandenburg International Airport, which is currently under construction) face excess demand during peak times (see Röhl, 2007, p. 8). In light of these expected supply bottlenecks, it is highly necessary to introduce capacity management systems that will mitigate the negative impacts of excess demand.

Alongside administrative measures to handle increasing capacity, airport expansion programmes represent one possible solution. Yet expanding an airport is no easy task. In every single case in Germany in which plans have been made to expand airport capacity, significant legal and bureaucratic challenges have arisen. In addition, the ability of environmental organizations to intervene in the legal process with various objections renders timely airport expansion projects a near impossibility. The construction of the new Munich airport, for instance, took a total of 29 years: although construction itself was completed in 6 years, 23 years were needed to work through the 5,724 separate legal challenges (see Röhl, 2007). It is clearly recognizable, therefore, that in the short and medium term, capacity expansions will not be capable of bringing the scarcity problem under control.

From an economic perspective, pricing measures are another means of handling excess demand. Efficient airport pricing is a well analysed topic in the literature. Wolf (2003, pp.

121-131), for instance, states that marginal-cost pricing (first-best solution) leads to the well-known problem of deficit. To cope with this issue, he analyses several price differentiation schemes, concluding that Ramsey pricing schemes are the appropriate second-best solution for achieving full-cost recovery and the minimization of welfare losses. In addition, he mentions that in the short run, peak-load pricing could be a valuable instrument for coping with capacity problems. In this way, economization measures to ration demand in the short to medium term could represent a viable coping strategy. Given certain assumptions concerning demand and technology, airports could price at marginal costs during off-peak times and at marginal plus capacity costs during peak times.[1] This pricing structure assumes that peaks are clearly recognizable. Therefore, peak-load pricing is of no use if an airport is highly congested with continued excess demand during the whole day. In addition, peak-load pricing can also function as a signal for capacity expansion. This is the case when in spite of peak-load pricing, excess demand at certain times exists, thus indicating that airport capacity is insufficient.

In addition, slot allocation mechanisms, such as auctions or slot trading, are also widely discussed in the economic literature on scarcity at airports. The current administrative system in Europe for allocating slots based on grandfather rights is problematic from an economic perspective, since it does not ensure that slots are allocated to those who value them most (Menaz & Matthews, 2008). Furthermore, administrative rationing has been criticised by anti-trust authorities (see Starkie, 1998, p. 113). The auctioning or trading of slots can, however, generate an efficient (1st Best) outcome as shown, for instance, in Brueckner (2009), Verheof (2010) and Basso & Zhang (2009). Despite their theoretical efficiency these mechanisms have been barely applied at all in practice. This might be due to practical barriers such as the complementary nature of slots or market power concerns (see Menaz & Matthews, 2008). Furthermore, Forsyth and Niemeier (2008) point out that the structure of the airport charges is of similar importance as efficient slot allocation processes. In particular they show that a combination of a slot allocation process and peak-load pricing can lead to more efficient airport utilisation. In this paper we do not cover the slot allocation process itself but focus on peak-load pricing instead.

However, pricing measures such as peak-load pricing are extremely difficult to implement. This is mainly due to lack of acceptance by existing users. Schank (2005, pp. 417-425) demonstrates that peak-load pricing in Boston and London failed because of lack of

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[1] For an in-depth treatment of peak-load pricing, see e.g. Crew et al., 1995.

acceptance by user groups, who managed to form effective opposition to the pricing scheme. In New York, peak-load pricing at La Guardia airport resulted in the relocation of almost all commuter flights to Teterboro, a regional airport located in New Jersey. These empirical findings are not only confirmed in individual cases. In general, peak-load pricing is officially opposed by the IATA (2000, p. 1; Forsyth & Niemeier, 2003, p. 16) based on the argument of cross-subsidization.

Starkie (2005, p. 6-7) gives the following reasons for the failure to implement efficient pricing structures:

- First, governmental ownership induces a situation in which a majority of airports do not seek profit maximization (see also Forsyth & Niemeier, 2003, pp. 14-15);
- Second, it is very difficult for airport managers to reject the traditional charging scheme, which is based on the partly erroneous assumption that aircraft weight correlates with runway damage;
- Third, airlines oppose such pricing instruments, although they use similar pricing schemes themselves (yield management);
- Fourth, airport managers are unwilling to adopt such pricing schemes as they are thought to undermine capacity expansion efforts, in turn preventing higher passenger volumes over the long run.

One institutional argument in particular should be pointed out. The nature of the regulatory regime in place can play an important role for efficient pricing (see Laffont & Tirole, 2000, pp. 66-67). In this regard, Starkie (2005) highlights the possible inefficiencies of price-cap regulation. According to empirical observations, price-cap regulated airports tend to engage in capacity expansion programmes rather than implement peak-load pricing. The regulatory environment may weaken incentives for the adoption of efficient pricing structures. First, in several cases, airport price-cap regulations have been accompanied by the introduction of sliding scales. Second, the majority of price-cap regulated airports are subjected to single-till regulation. Regardless of the specific regulatory conditions, the role of special interest groups is essential. In other words, carriers (especially legacy carriers) attach high importance to the prevention of peak-load pricing and to the preservation of the existing pricing scheme.[2] Looking for reasons as to why carriers oppose peak-load pricing, researchers have focused lately on the impact that peak-load pricing has on airline profits. In

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[2] For an overview of positive economic theory in transport infrastructure pricing, see e.g. Knockaert et al., 2009.

this respect, it is crucial to identify whether airlines can shift additional cost burdens to passengers or not. Forsyth (2008) notes in this connection that additional costs during peak times cannot be fully passed on to passengers, at least not in all cases. By contrast, savings from lower charges at off-peak times can be fully passed through to passengers (due to competitive pressures), thus resulting in lower air fares. It is therefore essential to study the impact of peak-load pricing on airlines' costs as well as to analyze which business strategies can help airlines to cope with peak-load pricing. This paper is organized as follows: Section 2 identifies the effects of peak-load pricing on airline costs; section 3 addresses possible user reactions (including pricing reactions) to peak-load pricing; and section 4 concludes.

2. THE EFFECTS OF PEAK-LOAD PRICING ON AIRLINE COSTS

In order to study the effects of peak-load pricing to airline costs, we must first classify airline costs. Traditionally, the ICAO takes into account only operating costs and leaves out extraordinary costs. Operating costs can be useful in benchmarking airline cost efficiency, and, at the same time, reveal differences between airlines. Table 1 shows the main elements of airline operating costs for international scheduled operations, for US and European airlines.

Table 1: Operating Airline Cost Shares for International Scheduled Operations

Direct operating costs	US [%]	EU [%]
Flight operations	41.7	40.5
• flight crew		8.0
• fuel and oil		22.7
• airport and en-route charges		9.8
Maintenance	10.0	10.5
Capital costs & insurance	6.1	5.5
Rentals	7.9	4.9
Sum	65.7	61.4
Indirect operating costs		
Station and ground	17.0	11.5
Passenger-services	5.6	12.3
• cabin staff		7.1
• other passenger services		5.2
Sales, ticketing and promotions	5.4	11.1
General and administration	6.3	4.7
Sum	34.3	39.6
Total	100.0	100.0

Source: AEA (2007), ATA (2007)

Direct operating costs are mainly related to aircraft type and represent almost two third of all operating costs. Within this cost category, flight operations represent the highest cost element and vary in accordance with distance travelled (mainly due to increasing fuel consumption). Direct operating costs also vary significantly according to the type of routes flown and business model of the carrier. For instance, long-haul operations tend to have a higher operating cost share than short-haul operations. In addition, this cost share rises to up to 80 per cent for charter and low-cost carriers (mainly due to indirect operating cost savings).

An alternate, highly instructive approach for classifying costs employs the standard notion of fixed and variable costs and is grounded in the concept of escapability. According to this concept, costs are classified into three major categories:

- The first category is costs related to flight hours (flying costs, representing around 30 to 45 per cent of total costs). These include expenditures for fuel, flight personnel, direct maintenance, passenger services and finally airport and ATM charges. Such expenditures are mainly related to aircraft use, which means that they are escapable if a flight does not take place.
- The second category is fleet-related standing costs (representing around 25 to 30 per cent of total costs). These costs are only escapable in the medium term, which is typically one year. This cost category includes aircraft capital expenditures, wages, as well as overhead costs for maintenance. These costs correlate positively with the activity level of the carrier, which means carriers can save on these expenses only by reducing their activity level.
- The third cost category is fixed indirect costs (representing around 25 to 35 per cent of total costs). These costs are only escapable in the long run, and include expenses for administration, sales, marketing as well as ground station activities.

This cost classification scheme seems to be more useful for assessing the impact of peak-load pricing on airline costs. For ultimately, carriers pay close attention to the revenues generated by each single flight when scheduling their networks. In order to keep a certain city pair on a flight schedule, it is essential that the flight cover at least flying costs.[3] For this reason, carriers aim to achieve high load factors. The introduction of peak-load pricing would therefore cause a shift in the break-even point towards higher load factors in the peak period

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[3] Due to the fixed nature of schedules, short run marginal costs are very low. Therefore, every additionally ticket sold makes an additional contribution to cost recovery. Peak-load pricing is, however, a pricing scheme which cannot be implemented in the short run, but rather in the medium run. We therefore regard flying costs to be the relevant factor for airlines in decisions concerning when to schedule flights under a peak-load pricing scheme.

and vice versa in the off-peak period, since peak-load pricing raises costs for the airline in the peak period and reduces them in the off-peak period.

However, the additional cost burdens of peak-load pricing will impact carriers in different ways. To evaluate these impacts, we must therefore begin by differentiating air carriers according to the following criteria:

1. the degree of slot scarcity faced by the carrier at the airport in question;
2. the significance of airport charges for the carrier;
3. the level of charges at the airport.

The degree of slot scarcity is the first criterion that can have a decisive impact on the level of peak-load pricing.[4] As excess demand at peak times varies at different airports, the amount of the charge during the peak period will vary respectively.[5] We therefore conclude that carriers using an airport as their home base that is slot congested at certain times of day will bear greater financial burdens than other carriers. In addition, when comparing two airports that both have excess demand in the peak period, we conclude that the carrier at the airport with higher peak demand will have to pay more for airport charges if peak-load pricing is implemented. Finally, due to the cost relatedness of the pricing scheme, airport cost efficiency can result in cost differences for carriers even if airports have similar slot scarcity.

The second criterion is the share of airport charges as a percentage of airline operating costs. As shown in table 1, airport charges (including ATM charges) represent 9.8 per cent of total operating costs. This figure is an average value and reflects predominantly the cost situation of an international carrier. Depending on geographical factors and the carrier's business model, this cost share can increase up to 20 per cent. First, airport-charges cost share increases for short-haul flight operations and decreases for long-haul operations.[6] Therefore, if a carrier offers predominantly short-haul flights, it is expected that the airport-charges cost share will rise for operating decisions and vice versa. Second, airport charges are the dominating factor when low-cost carriers decide whether a destination will be served or not.

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[4] We regard in this case only airports at which peak-load pricing can bring desirable results. This does not include airports without any capacity problems, or airports with permanent excess demand.

[5] We note in this case that the form of regulation in place can be a serious barrier to the implementation of peak-load pricing. There are also many cases in which peak-load pricing could lead to huge profits. Regulatory regimes aiming at cost recovery would prevent the implementation of peak-load pricing.

[6] For the short-haul operations of British Midland and KLM UK, the airport-charge cost shares in 1999 were 15 and 23.4 per cent, respectively (see Doganis, 2002, p. 146).

Third, despite the internationally similar tariff structure (two-part tariff), the charge level varies immensely from airport to airport. Table 2 shows these differences for a standard aircraft type.

As depicted in table 2, the implementation of peak-load pricing at a high cost airport like Paris CDG or Vienna would burden carriers operating from these airports more than others. In addition to table 2, US carriers have lower airport-charge cost shares (currently 2.2 percent of total operating costs, see ATA, 2010). The reason for this is twofold: First, carriers in the US often operate their own terminals. Second, parts of airport charges are paid directly by passengers. In this way, US carriers currently have a cost advantage compared to European carriers.

Table 2: Representative Airport Charges for a B747-400 with 395t MTOW, 335 passengers and 3h parking time for winter 2010/11, in USD

Airport	Charge in US $		Total Charge	Ratio of the Components
	Weight based	Passenger based		
Tokyo NRT	8,649	7,537	16,186	53 : 47
London LHR	2,742	12,363	15,105	18 : 82
Paris CDG	3,755	10,359	14,114	27 : 73
Buenos Aires EZE	3,153	10,218	13,371	24 : 76
Vienna	4,387	8,454	12,841	34 : 66
Amsterdam	4,763	7,058	11,821	40 : 60
Frankfurt	1,359	10,379	11,738	12 : 88
Atlanta	1,363	10,050	11,413	12 : 88
Chicago	3,111	7,705	10,816	29 : 71
London LGW	4,410	6,033	10,443	42 : 58
Madrid	5,119	5,026	10,145	50 : 50
Bangkok	1,892	7,739	9,631	20 : 80
Singapore	3,600	5,981	9,581	38 : 62
Manchester	4,261	4,354	8,615	49 : 51
Nairobi	1,880	6,700	8,580	22 : 78
Rome FCO	1,461	6,422	7,883	19 : 81
Hong Kong	3,560	0,990	4,550	78 : 22

Source: Own calculations

The third criterion is the extent to which the peak-load pricing scheme is applied. As table 2 shows, the degree of variability – that is, the ratio between the fixed (aircraft-related) and variable (passenger-related) components of the charge – fluctuates significantly between airports. Although lately a shift towards greater variability has occurred, European airports still charge a certain fixed amount based on aircraft MTOW. Applying peak-load pricing only to the fixed cost component would severely discourage full-service carriers (FSCs) from expanding flight frequency (see Brueckner, 2010; Givoni & Rietveld, 2009), as FSCs typically operate large networks and also commit themselves to offering frequent flights in order to minimize the passengers' schedule delay.

3. AIRLINE REACTIONS TO PEAK-LOAD CHARGES

In spite of the fixed nature of airport charges over the short run, airlines have certain opportunities for countering their impact on cost structures. Over the medium-term carriers can implement various strategies to steer direct and indirect operating costs, thus allowing the impact of additional peak-load expenses to be mitigated. In this regard, we draw a distinction between operational measures (such as the choice of aircraft size and location effects) and pricing measures. In particular, we discuss how airlines can evaluate the best strategies to implement.

3.1 INCREASE IN AIRCRAFT SIZE/REDUCTION OF FLIGHT FREQUENCY

From the regulator's point of view, one of the desirable airline reactions would be the use of larger aircraft[7] combined with a reduction in flight frequency during peak periods. Aircraft size is an important determinant of unit costs per passenger, because it has a direct influence on operational costs and hourly productivity. Cost advantages are achieved with larger aircraft due to several factors; aerodynamic benefits and larger, more efficient engines, for example, reduce fuel consumption per weight unit. Furthermore, a larger aircraft also leads to higher labour productivity. Thus, costs per seat-kilometre decrease with increasing aircraft size. Figure 1 illustrates this interrelation.

The average cost curve for smaller aircraft (AC_1) reaches its minimum at the point of maximum seat load capacity. Assuming a utilization factor beyond X, the use of the larger aircraft would decrease average costs. In addition, the extent to which it is possible to compensate for increased airport charges depends not only on the cost advantages attained but also on prevailing passenger preferences and demand characteristics. If the increase in charges is very large compared to total costs, then these charges can only be offset through

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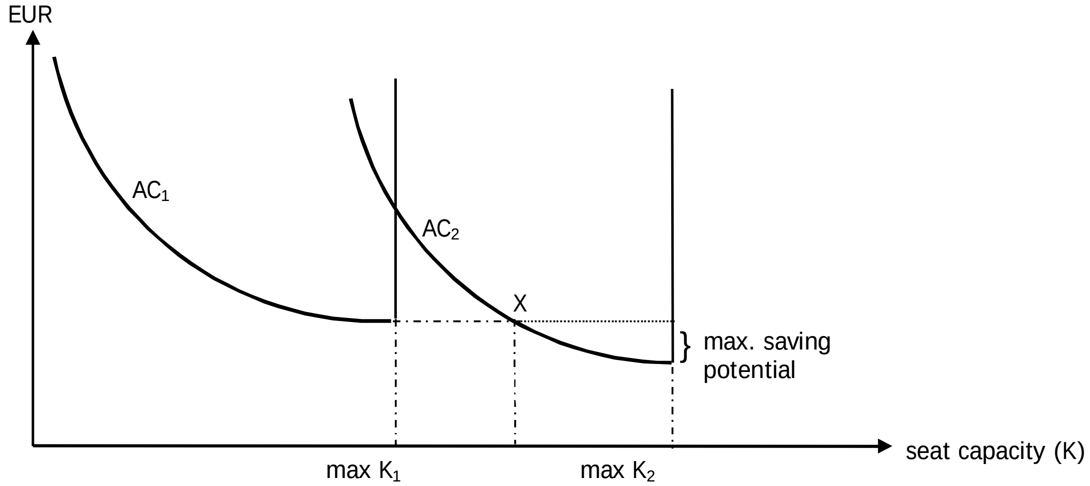
[7] A better usage of airport capacity would be achieved not only by a cutback in frequency, but also by the fact that larger aircraft have lower wake-vortex separation requirements and lower runway occupancy times. Consequently, larger aircraft typically occupy runways for a shorter time than lighter ones (see Wolf, 2003, p. 65 ff.; Doganis, 1992, p. 83).

sufficient passenger load and adequate marginal return per seat.[8] Hence, a half-empty aircraft would be less cost efficient than two smaller, highly utilized aircrafts.

Figure 1: Economies of Size & Fill in Relation to Increased Aircraft Size



Source: Own illustration, based on Button (1982), p. 79.

If an airline pools two flights together during the peak period (assuming identical demand for each flight), it can be expected that some time-sensitive passengers will be lost. To pre-empt this disadvantage it is necessary to choose an aircraft according to the future demand situation. Based on current average load factors of 70–80 per cent (see AEA, 2008, p. 8), this would mean additional cost benefits (see Wei, 2006). However, if an airline loses many time-sensitive passengers, financial penalties are likely. In this regard, so-called high-yield traffic is the most likely customer segment to be lost, as these customers are more sensitive to flight frequencies (see Hanlon, 1996, p. 167; NERA, 2004, p. 83 ff.). Yet a cutback in frequencies seems to be a reasonable option for certain sub-segments. On routes dominated by business travellers or hub flights with quick transfer guarantees, frequency reductions would lead to lower revenues. In such markets, airlines will be unwilling to change frequencies. The implementation of such strategies is more probable in the case of point-to-point short-haul flights due to the larger impact of increased charges.

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[8] The most cost-effective combination in general is maximum range with a full payload. Hence, a suitable traffic density is necessary to tap the full cost advantages from maximum load (see Doganis, 2002, p. 122).

High frequencies imply both greater flexibility and more flight hours. The higher the aircraft utilization, the lower the average costs. Consequently, lower frequencies are more costly and a cutback in frequency can have negative effects on productivity, especially on short- and medium-haul flights (see Doganis, 2002, p. 133 ff.). Ultimately, therefore, the airline reaction will be determined by the interplay of these various factors. However, there are two additional factors that hinder a possible implementation of lower frequencies:

1. Airport schedules: Existing schedules mean frequency changes can only be implemented in the medium to long run.
2. Large aircraft availability: Not all carriers can switch to larger aircraft. Because of their homogenous fleet structures, low-cost carriers in particular have a limited ability to introduce larger aircraft compared to FSCs.

In summary, the feasibility of introducing lower frequencies and larger aircraft depends strongly on specific market and demand characteristics. For example, Givoni & Rietveld (2009) have shown that service frequencies are not only significant in terms of the time and price elasticity of passengers.[9] They are also an important instrument in competition, and can strongly influence a carrier’s choice of aircraft.

3.2 TEMPORAL AND SPATIAL RELOCATION EFFECTS

A further possible reaction of carriers is the reassignment of flights to off-peak times. While such a reassignment is a primary goal of peak-load charges, it can only be achieved if monetary incentives are strong enough to motivate a rescheduling of arrival and departure times. The primary aims in flight scheduling are to achieve high aircraft utilization; the optimal timing of flights to cater to passenger time preferences; and high market shares. These considerations as well as several operational and external conditions (e.g. night-flight restrictions, maintenance requirements and the availability of slots) can considerably impede flexible flight planning (see Lüking, 1993, p. 249, 253 ff.).

In general, peak flights are strongly favoured by passengers. Therefore, the loss in revenue connected with rescheduling to off-peak times should not be underestimated. Alongside this expected commercial disadvantage, aircraft size is also of importance. On routes with high demand, rescheduling to lower demand periods can require flights to be combined or the operation of smaller aircraft in order to reach an adequate load factor. Hence, extensive

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[9] For a theoretical discussion, see Fischer, 1997, pp. 101-114.

rescheduling towards off-peak periods would be connected with demand losses and cost disadvantages due to a decrease in the usage of aircraft and flight crews. Because of the required adjustment in fleet structure, rescheduling seems to be a less attractive solution as a response to peak charges. Savings in the off-peak period have to be substantial to compensate for the operational and commercial disadvantages.

Similarly, in the case of frequency reductions, the ability of rescheduling to be implemented is limited by existing slot allocation procedures in Europe. Currently allocation of slots at Community airports primarily takes place according to Council Regulation (EEC) No 95/93. At airports with serious capacity shortages (declared as coordinated airports) air carriers need permissions to use the facilities for take-off and landing at a particular time, which are allocated bi-annually by an independent coordinator for the entire respective flight plan (summer or winter season).[10] Therefore, at slot coordinated airports, the rescheduling of flights can only be implemented in the next period while taking into account the associated condition of slot pairing. Furthermore, rescheduling to off-peak at the airport of origin can potentially lead to increased activity during peak times at the destination airport. Hence, it might become very difficult to find slots at the destination airport.

According to the current allocation principles air carriers can claim slots in the next scheduling period if they are utilized for at least 80% otherwise the slots will be returned to the slot pool for reallocation to competitors (so-called grandfather right and use-it-or-lose-it rule). From this it follows that, because of competition issues, there are serious doubts that airlines will be willing to give up their valuable peak-time slots. There is evidence that established carriers use slots as a barrier to entry in order to increase demand for their own services (see Starkie, 1998, p. 113). This argument is even stronger if one takes into account that during peak periods, carriers realize scarcity rents (see for instance Menaz and Matthews, 2008).

Another alternative mainly applicable to low-cost carriers is the relocation of operations to less congested secondary airports with available capacity and no peak charges. In contrast to the relocation of flights to off-peak periods, this approach enables more attractive flight times. However, due to expected demand losses (especially in transfer traffic), airlines have

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[10] The mentioned regulation act should ensure, that the allocation happens in a neutral, transparent and non-discriminatory way. For further details see Council Regulation (EEC) No 95/93 of January 1993 on common rules for the allocation of slots at Community airports and amending acts, basically Regulation (EC) No 793/2004.

only shown minor interest in pursuing such a strategy to date. The use of peripheral airports is a reasonable alternative only for charter airlines or some low-cost airlines, as their supply of short- and medium-haul point-to-point flights is mainly directed at the price-sensitive segment of leisure travellers. We would not expect FSCs that use the airport as base station to implement such a strategy.

3.3 PRICING STRATEGIES

Compared to other operational conditions, pricing strategies can be changed relatively fast. The question as to whether carriers can shift additional cost burdens to passengers without significantly eroding demand hinges on several factors. The demand characteristics and preferences of customers are of high relevance in this regard, yet also important are route lengths, the commercial and operational significance of a route in an airline's network as well as the market structure and competitive environment in the given city pair.

In terms of demand characteristics, it is assumed that long- and short-haul passengers will be affected differently depending on the customer segment and airline business model in question. The share of business and leisure travellers that fly a route determines to large degree how much an airline can increase fares without incurring revenue losses. Low-cost and charter airlines, which cater first and foremost to the price-sensitive group of leisure travellers, would be particularly limited in their ability to pass additional costs to passengers. Therefore, compared to FSCs, they would have to bear a large proportion of increased costs themselves, which also means they would be faced with a competitive disadvantage (for an analytical and simulative analysis, see e.g. Fu et al., 2006).

Differences may also arise in the ability to shift costs in relation to route distance. Given the fixed character of airport charges, a peak premium will affect ticket prices very differently. First, in the case of long-haul flights, supplementary charges represent a lower percentage of the overall ticket cost, and there are possible advantages due to economies of size and fill. Apart from this, flight distance is a key determinant of demand elasticity, which is lower for long-haul flights because of the limited number of alternatives (see e.g. Brons et al., 2002, p. 172). As a result, in long-haul markets the potential to pass on costs is much larger than in short-haul ones. For short-haul operations, it is crucial to consider both the degree of competition with other modes of transport as well as the ratio of business to leisure passengers on a certain route. The higher the share of business travellers, the easier it is to shift additional costs. In domestic markets with a low share of business travellers, cost shifting is apparently difficult to implement. Here, complete cost shifting to passengers would imply that the required price premium per passenger is sufficiently high enough to offset both the peak charge and losses due to decreased demand. If the cost increase is really high (and this can be expected in short-haul markets), then a result would be the phasing out of some routes, especially point-to-point flights without a commuter function.

Aside from demand related issues, factors like market structure and competitive behaviour can considerably affect an airline's scheduling and pricing policy. The oligopolistic market structures and tendencies towards collusive behaviour that often characterize the airline sector (see Starkie, 2002, p. 64) seem in general to provide carriers with possibilities for fare increases. Depending on the commercial importance of a route and the intensity of competition, certain strategic relationships among the actors can also limit the potential for a rise in prices. If there is a leader–follower situation, the follower would prefer a limited scope for cost shifting, because this would compel the leader to maintain fare levels. Such a dynamic can be observed in the case of feeder flights (see Stangl, 2008. pp. 75–88). In addition, the current slot allocation system in Europe seems to enhance airlines' opportunities for increasing fares. Quite in contrast to other situations of scarcity, the slot allocation system has the ability to weaken competition among carriers, thus offering a certain leeway for price increases (see Lüking, 1993, p. 271).

The complete transfer of savings to passengers in the off-peak period also seems to be an unlikely outcome. A carrier has little motivation to reduce fairs if sufficient load at current fares can be achieved. In this regard, competition takes place predominantly with regard to non-pricing criteria such as flight frequency and service amenities. However, market entries can change such an equilibrium (e.g. when low-cost airlines enter the market; see Forsyth & Niemeier, 2003, p. 11). Furthermore, if sub-markets are characterized by low passenger volumes, then a partial pass-through of cost savings would seem to be reasonable in order to capture additional demand. In-house capacity policies as well as strategic interactions among market actors are thus significant determinants of airline behaviour. The extent to which an airline is ultimately able to pass on cost increases to customers in the medium to the long term therefore varies according to the structure of the market and demand factors, which vary in relation to the sub-market.

For this reason, conclusions about the degree of cost shifting that will be possible can only be drawn for the different sub-markets. Conceivably, carriers might prefer to first exploit internal cost-saving potentials on short-haul routes instead of adopting pricing measures that risk a decrease demand and loss of market share. This would result in an increase in market concentration (due to relocation or market entries and exits), in turn encouraging higher fares (especially those charged by the hub carrier). The attendant increase in competition in other markets could encourage fare reductions (see De Wit & Burghouwt, 2007, p. 111). Such displacement effects are possible across specific routes or flights, as carriers seek to fully tap price-inelastic customer segments. This is confirmed by experiences at Heathrow airport, where peak passenger charges were redistributed not directly but passed on to all passengers (see Doganis, 1992, p. 97). Finally, the degree to which cost shifting is possible determines the ability of a scarcity-based charging policy to enhance relocation and the more efficient use of airport capacity. Particularly in long-haul segments and for routes with a large share of price-inelastic business travellers, the effectiveness of peak-load pricing seems to be very limited. The low time sensitivity of passengers and the necessity of changes within the hub and spoke scheduling facilitate the shifting of costs to ticket prices, which already tend to be very high in the absence of opportunities for market entry (see Lüking, 1993, p. 123f.). We therefore conclude that peak-load pricing will have only limited effects with respect to a change in supply behaviour.

As pointed out previously, the introduction of peak-load pricing schemes at airports can reduce profits if the airlines are unable to offset additional capacity costs in the peak period by means of operational cost reductions or pricing measures. Yet the fact that airlines oppose the introduction of peak-load pricing might also be driven by additional competitive considerations. Under a peak-load pricing scheme, airport capacity during off-peak periods is priced only at marginal costs. Airlines may fear that this will encourage additional carriers, particularly low-cost airlines, to enter the market.

We hypothesize that airlines face tough competition over passengers in off-peak periods. Consequently, each airline will react to a competitor’s price adjustments. If so, we should observe significant pricing interdependencies in off-peak periods, with this effect weakening during peak periods. To test our hypothesis, we investigated the pricing behaviour of Lufthansa (LH) and Air Berlin (AB) for the airport-pair Berlin-Tegel (TXL) – Frankfurt/Main (FRA). For this purpose, we collected the lowest offered fares of both airlines in a peak and an off-peak period starting three months prior to departure.[11] The main elements of the chosen flights can be seen in table 3.

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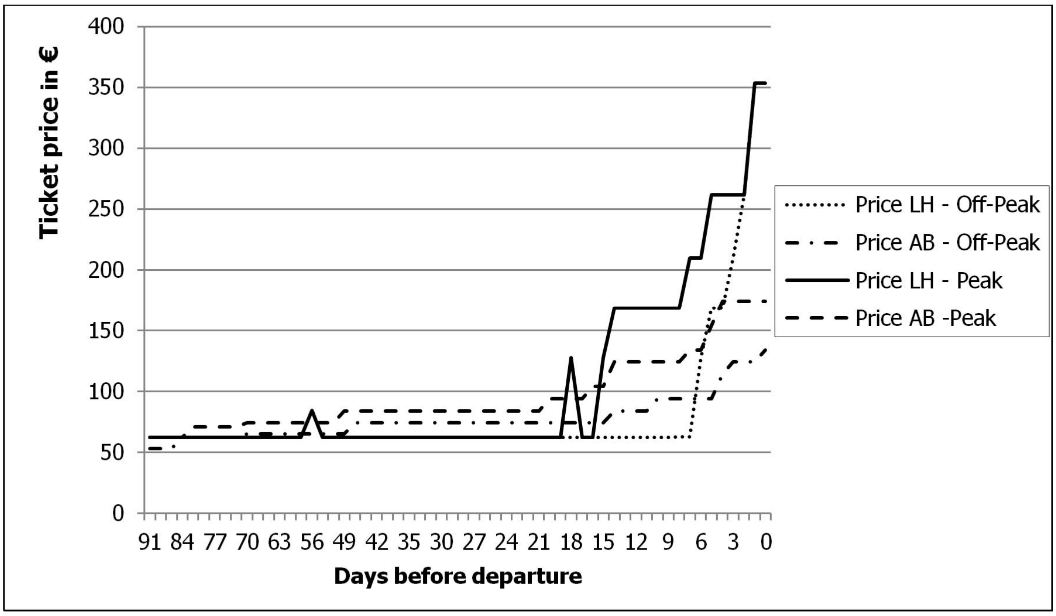
[11] More precisely, we collected prices over 91 days prior to departure for flights on 25 August 2008.

Table 3: Flight times and aircraft types for the Berlin-Tegel – Frankfurt/Main route

Airport Pair	Peak Flight Time (Aircraft)	Off-Peak Flight Time (Aircraft)	Carrier
TXL - FRA	17:20 (A 321) 16:55 (B 737-800)	21:15 (A 321) 21:25 (B737-800)	Lufthansa (LH) Air Berlin (AB)

Figure 2: Plotted peak and off-peak prices of Lufthansa and Air Berlin



The gathered peak and off-peak ticket prices for Lufthansa and Air Berlin are plotted in Figure 2. From the figure it is evident that the peak and off-peak prices follow nearly the same trend line until three weeks before departure. Furthermore, as the departure date comes closer, peak prices rise faster than off-peak prices. In terms of differences, Lufthansa's prices increase very sharply as the departure comes closer, while Air Berlin increases its prices more gradually. The summarized statistics in table 4 shed light on the average price and distribution. Average peak prices are higher than average off-peak prices. Lufthansa's average prices and price dispersion are generally higher than Air Berlin's.

Table 4: Descriptive statistics of peak and off-peak prices for Lufthansa and Air Berlin

Variable	Arithmetic Average	Coefficient of Variation
Lufthansa off-peak price (p_{off}^{LH})	83.54	0.76
Air Berlin off-peak price (p_{off}^{AB})	77.19	0.22
Lufthansa peak price ($\mathrm{p}_{\mathrm{peak}}^{\mathrm{LH}}$)	106.62	0.73
Air Berlin peak price (p_{peak}^{AB})	96.71	0.33

With the help of an econometric model, we analyse if carrier price-setting behaviour is substantially different between peak and off-peak periods. For our analysis we employ a seemingly unrelated regression model (SUR) analogous to the one used by Pels and Rietveld (2004) to analyse the London—Paris market. Our econometric model is described by the following SUR equations.

$$(1)\ p^{AB}_{off_t} = \alpha^{AB}_{off} + \beta^{AB}_{off_1} days_t + \beta^{AB}_{off_2} {days^2}_t + \beta^{AB}_{off_3} p^{AB}_{off_{t-1}} + \beta^{AB}_{off_4} p^{LH}_{off_{t-1}} + \beta^{AB}_{off_5} p^{AB}_{peak_{t-1}} + \beta^{AB}_{off_6} p^{LH}_{peak_{t-1}}$$

$$(2)\ p^{LH}_{off_t} = \alpha^{LH}_{off} + \beta^{LH}_{off_1} days_t + \beta^{LH}_{off_2} {days^2}_t + \beta^{LH}_{off_3} p^{AB}_{off_{t-1}} + \beta^{LH}_{off_4} p^{LH}_{off_{t-1}} + \beta^{LH}_{off_5} p^{AB}_{peak_{t-1}} + \beta^{LH}_{off_6} p^{LH}_{peak_{t-1}}$$

$$(3)\ p^{AB}_{peak_t} = \alpha^{AB}_{peak} + \beta^{AB}_{peak_1} days_t + \beta^{AB}_{peak_2} {days^2}_t + \beta^{AB}_{peak_3} p^{AB}_{off_{t-1}} + \beta^{AB}_{peak_4} p^{LH}_{off_{t-1}} + \beta^{AB}_{peak_5} p^{AB}_{peak_{t-1}} + \beta^{AB}_{peak_6} p^{LH}_{peak_{t-1}}$$

$$(4)\ p^{LH}_{peak_t} = \alpha^{LH}_{peak} + \beta^{LH}_{peak_1} days_t + \beta^{LH}_{peak_2} {days^2}_t + \beta^{LH}_{peak_3} p^{AB}_{off_{t-1}} + \beta^{LH}_{peak_4} p^{LH}_{off_{t-1}} + \beta^{LH}_{peak_5} p^{AB}_{peak_{t-1}} + \beta^{LH}_{peak_6} p^{LH}_{peak_{t-1}}$$

The variables $p^{i}_{off_t}$ and $p^{i}_{peak_t}$ denote the price charged by carrier i in time period t for an off-peak and a peak flight, respectively. Each single price is regressed on the number of days until departure as well as on the lagged off-peak and peak prices of the considered carrier and its competitor. This allows us to investigate the airline's price responses in the short-run. The estimation results are shown in table 5. A regression of the residuals on the lagged residuals and the other explanatory variables does not reveal any autocorrelation.[12] The high values for the adjusted R² imply a good fit of the model.

Table 5: Estimation results for price setting behaviour

Equation (TXL-FRA)	AB Off-Peak	LH Off-Peak	AB Peak	LH Peak
Variable	Estimate (Standard Error)			
Constant	18.9033 (6.23)***	-124.094 (29.32)***	35.8761 (10.67)***	-34.7766 (41.96)
Days until departure	0.0998 (0.10)	-0.0216 (0.48)	-0.2874 (0.17)	-1.2550 (0.68)*
(Days until departure)^2	-0.0016 (0.001)	0.0055 (0.004)	0.0016 (0.002)	0.0146 (0.01)**
AB Off-Peak	0.3728 (0.11)***	1.1838 (0.48)**	-0.4101 (0.17)**	-0.6141 (0.68)
LH Off-Peak	0.0488 (0.01)***	0.9472 (0.07)***	0.0235 (0.02)	0.1823 (0.09)*
AB Peak	0.2431 (0.08)***	0.5984 (0.04)	0.9724 (0.13)***	1.6349 (0.52)***
LH Peak	0.0269 (0.02)	-0.2320 (0.10)**	0.0527 (0.04)	0.3405 (0.15)**
R^{adj}	0.9752	0.9589	0.9774	0.9432

* significant at 10%; ** significant at 5%; *** significant at 1%

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[12] For details on the methodology, see Pels & Rietveld, 2004. Results are not presented here but are available upon request.

The constants are highly significant except for Lufthansa in the peak period. The number of days until departure and its squared value are significant only for Lufthansa in the peak period. However, the p-value for the respective parameter of Air Berlin is close to the 10% significance level. Therefore, it seems that Air Berlin and Lufthansa significantly adjust their prices in the peak period but not in the off-peak period according to the number of days before departure. Even though, this adjustment process is different for the two carriers; Lufthansa increases its price in a quadratic fashion as the departure day comes closer while Air Berlin follows a more linear price trend.

While in the peak period the number of days before departure but not the lagged prices of the competing carrier seem to be the predominant influence on price setting, this picture reverses in the off-peak period. In the off-peak period Air Berlin adjusts its price in period t according to its own prices in the former peak and off-peak period as well as in response to the off-peak price of Lufthansa. Moreover, Lufthansa reacts to the off-peak price of Air Berlin and to its own peak and off-peak prices. In the peak period Air Berlin independently sets its own peak and off-peak prices and does not react to Lufthansa's price while Lufthansa takes both Air Berlin's peak price and its own lagged prices into account. Apart from the two exceptions ${\beta^{LH}_{off}}_6$ and ${\beta^{AB}_{peak}}_3$, all significant price reactions on the lagged variables are positive.

We can draw three major conclusions from these results. First, in the peak period Lufthansa as well as Air Berlin increase their prices significantly as the departure date comes closer. This effect is reinforced by the positive reactions to their own lagged peak-period prices. Second, both carriers are close competitors in the off-peak since they react on each other's prices positively, e.g. if Lufthansa reduces its price in the off-peak period Air Berlin will follow and vice versa. But this effect is less significant in the peak period, when only Lufthansa reacts to Air Berlin's price but Air Berlin does not react to Lufthansa's price. Third, interpreting the negative impact of the Lufthansa's lagged peak price on its off-peak price and the negative impact of Air Berlin's off-peak price on its peak price is less obvious. These price trends are an indication of cross-subsidization between off-peak and peak flights.

The results support our thesis that airlines try to attract passengers in off-peak periods by adjusting prices according to the prices of their competitors. This effect is less evident during peak periods. Furthermore, the results indicate that tickets during off-peak periods might be cross-subsidized by higher prices during the peak period. Hence, we can infer from this result that if airlines face competition in the off-peak period, they will tend to cross-subsidize between peak and off-peak periods. Yet to do so, an increase in peak prices is probably necessary. Particularly in the case of routes with a high proportion of price sensitive customers,[13] airlines will struggle to increase prices substantially without incurring significant passenger losses. For this reason, carriers may fear that peak-load pricing schemes will induce increased competition during the off-peak periods.

4. CONCLUSIONS

In this paper we sought to identify the reasons for airline opposition to peak-load pricing. We first considered the effects of peak-load pricing on airline costs. Due to varying business models and differences in route networks, airlines have different cost structures. This, in turn, means the introduction of peak-load pricing will "hurt" carriers in different ways. Trip length (short haul vs. long haul), service quality (FSC vs. LCC) and the geographic base (European vs. non-European) are significant factors that lead to different cost structures. We subsequently reviewed possible airline reactions to peak-load pricing. Although airlines have a relatively strong ability to influence direct operational costs, they often face diverse external constraints, which hinder an effective response to pricing signals. Due to operational factors (e.g. fleet management and vehicle schedules), regulatory conditions, as well as company-specific restrictions, carrier freedom of action is constrained in the near term. However, in the medium to long run, airlines have a wide spectrum of opportunities to react effectively to the implementation of peak pricing structures at airports.

Given the very low marginal costs for the transport of additional passengers and the relevance of pricing policies that encourage high load, demand circumstances play a key role. They define not only the potential for price reductions, but also the extent to which price adjustments are feasible. Furthermore, carrier flexibility to introduce route and flight time changes varies considerably. It is assumed that carriers who offer international long-haul services are less flexible with respect to flight time adjustments. However, due to the lack of travel alternatives for passengers, there is greater flexibility for pricing measures in the long-haul market than there is in the short-haul one.

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[13] Here, for instance, we think of routes with a low share of business customers and a high share of leisure customers, respectively.

In contrast to the use of larger aircraft, there is little practical incentive to rescheduling operations to off-peak periods. The operational and commercial disadvantages of rescheduling to off-peak turn out to be higher than the operating cost savings. The disadvantages also tend to outweigh the benefits in the case of secondary airport use; only cost-oriented carriers, such as charter airlines or LCCs, can be expected to derive a net benefit from relocating flights to secondary airports.

A key constraint to the implementation of operational changes is the current slot allocation procedure. Because of the existence of so-called “grandfather rights” and resulting tendencies to strategically hoard slots, legacy carriers in particular have few incentives to adjust their operating schedules. If the monetary inducements of peak charges are not sufficient to mitigate hoarding behaviour, subsidiary measures such as a slot reservation fee, the tightening of the so called “use-it-or-lose-it” rule, as well as the allowance of slot trading would be beneficial. Such measures would augment the monetary incentives of peak charges.[14] Taking into account these difficulties, it is assumed that under the current regulatory environment, limited options are available to motivate carriers to change their operations. In this connection, additional important factors include the role of an airport in a carrier’s network as well as the availability and accessibility of adequate secondary airports.
The ability of carriers to implement price changes hinges to large extent on the sub-market in question. If increases in costs can be passed along to customers, carriers will probably prefer to do this rather than extensively re-structure their operations. Consequently, given the unchanged slot rents during peak periods, rescheduling to less usage intensive times probably won’t take place. The goal of peak charges – to force the effective rationing of demand – would not be achieved.

Furthermore, it is still an open question as to whether carriers oppose peak-load pricing schemes merely because of their potential to reduce profits, or whether additional competitive considerations play a role, for marginal-cost pricing during off-peak periods seems to be an invitation for low-cost carriers to enter the market. Using a simultaneous pricing model for a domestic airport pair in Germany, we showed that competition in the off-peak period may lead to cross-subsidization between peak and off-peak periods. Although this may not hold for all airport-pairs the finding remains that incumbent airlines will suffer

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[14] Furthermore, remuneration mechanisms are possible, e.g. certain discounts, bonuses, or a lowering of other charging elements would offer additional incentives towards a modification of operating patterns.

losses.[15] Precisely this finding seems to be in-line with Forsyth's (2008) conclusion that the introduction of peak-load pricing leads to higher consumer surpluses and lower airline profits.

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[15] This result also suggests that there are some possible demand interdependencies between peak and off-peak periods, an issue which is not touched in this paper, however.

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