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Airport Regulation:
Tackling Congestion and Environmental Problems [1]

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Airport Regulation: Tackling Congestion and Environmental Problems [1]

Hartmut Wolf

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[1] This is a revised version of the paper I presented at the conference „Airport and Air Traffic. Regulation, Privatisation and Competition" held at the HWWA - Institute of Economic Research in February 1998. I thank the participants for fruitful comments on the original paper. Of course, any errors remain mine.

Abstract:

This paper deals with alternative policy options for tackling congestion and environmental problems in the German airport sector. The starting point of the discussion is the planned privatisation of several airports in Germany, which is normally justified on productive efficiency grounds. However, when designing an appropriate airport policy, allocative efficiency must also be regarded, which means the efficient usage of existing facilities and timely investment in new capacity. Airport charges must not only reflect operational costs of infrastructure supply but also take account of the social costs of airport usage. This paper shows the inefficiency of the current regulatory rules for solving congestion and environmental problems and proposes alternative solutions, taking into account the need for planning stability not only for the airlines but also for the airports, which is a prerequisite for lowering the transaction costs of the air transport and infrastructure system.

JEL Classification: D 6, H 1, L 5, L 9

I. INTRODUCTION

The economic landscape for air transport in Germany has changed remarkably since the liberalisation of the European transport markets. The abolishment of former entry restrictions and price controls saw new carriers emerging which forced prices down at least on competitive routes and in discount price segments. Also new routes were developed. All this gave demand for air travel, which had already been growing at a rapid pace before, further stimulus. It is expected that air transport in Germany will see annual growth rates of 3 - 5 per cent in the next 15 years, resulting in an increase in passengers from 111 mio. to 200 - 220 mio. (e.g. Vill 1998, p. 76).

Now the focus shifts to the infrastructure sectors with airport privatisation being on the forefront of the agenda of national air transport policy. The Federal Government has already announced that she will sell her shares in the airports of Berlin, Cologne, Frankfurt, Hamburg and Munich. Also some Länder and local communities plan to privatise; with Hannover Airport being a recent example. Yet 50 per cent of Düsseldorf Airport had been transferred to the private sector in December 1997.

Airport privatisation is normally justified on productive efficiency grounds. It is expected that the stronger profit orientation of private investors compared with public management will bring supply costs for airport services down and thus will enhance the competitive strength of regional locations which depend on excellent air transport links. However, productive efficiency is just one factor which has to be regarded when designing an appropriate airport policy. The other is allocative efficiency, which means the efficient usage of existing facilities and timely investment in new capacity. With regard to the utilisation of airports user charges must not only reflect operational costs of infrastructure supply but also take account of the social costs of air transport. It is well known that market prices do not reflect externalities due to congestion and environmental damage if left to their own. Therefore the challenge is, how to get the prices right.

II. CONGESTION

1. Efficient Pricing of Airport Services and Regulatory Practice

As a result of the rapid growth of demand for air transport services some of the most frequented German airports have already reached their capacity limits at least at times of peak demand. Today the situation is most serious at Frankfurt and Düsseldorf, which suffer from congestion for most of their daily operational hours, but other airports are expected to reach saturation in the next 10 - 15 years, too. On most airports the limiting factor for further growth is scarce runway capacity.[1] For environmental policy reasons and political pressure and also for long lead times before construction of new runways can start there is little prospect that pressure on airport capacity will be relieved in the near or midterm future.[2] Therefore efficient rationing of available capacity is important for enhancing the productivity of the air transport system.

In well functioning markets prices secure that users who are willing to pay most gain access to ressources. If prices are unbiased by externalities, efficient allocation can be expected. Furthermore prices which reflect accurately the social opportunity costs give investors the correct signals for investment. But things differ in the infrastructure sector, where airports are deemed to possess some degree of market power (at least at the regional level), which can be exploited at the expense of users. For this reason German airports are subject to economic regulation, with the Länder being responsible for price control. As an effect the airports are constrained in setting market clearing prices.

The regulatory system is based on the principles of cost recovery and of non-discrimination between users, although the last criterion is misinterpreted in practice, at least from an economic perspective. Airlines have to pay landing fees which are related to the maximum take off weigth of the aircraft in use and to the number of passengers they actually carry on the flight. As it is well known from welfare theory such a pricing scheme may be efficient as long as an airport remains uncongested. Due to the existence of economies of scale and density in operating a runway system pricing according to short run marginal costs will inevitably lead to deficits in such a situation, so that optimal deviations must be allowed in order to cover fixed costs.[3] Efficient allocation of common costs requires price differentiation, with those users who react less sensible to price increases have to pay higher fees than others (Ramsey 1927).

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[1] Sometimes the limiting factor is terminal or environmental capacity. However, I will concentrate this part of the paper on scarce runway services.

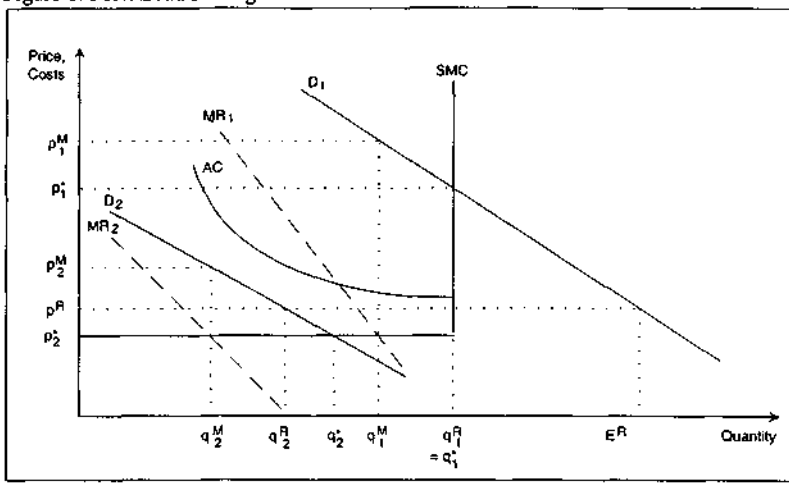
[2] To illustrate this point: The construction of the Munich Franz-Josef-Strauß Airport, which began to operate in 1993, lasted for more than 20 years.

[3] Of course short run marginal pricing can be employed without driving the airport operators in bankruptcy, if deficits are covered through subsidies from the state budget. However, because such a solution would bring its own problems, which I will leave aside here, self-financing is mostly to be preferred.

This is broadly consistent with the existing charging practice, where weight of planes and number of passengers serve as indicators for users' price elasticities.

However, when an airport gets overloaded, externalities from congestion must also be taken into account. This requires peak-load pricing, with landing fees being higher at times of dense demand than in periods of low demand. Up to now no German airport has introduced a peak-load pricing structure, although currently Frankfurt makes some attempts to introduce lower fees for freight carriers at times of very low demand. But until now no permission was given by the regulator, who claims that different prices for the same (physical) infrastructure services would be unfairly discriminating between users.

Figure 1: Peak Load Pricing



The absence of peak-load pricing has serious consequences for the productivity of the air transport system. Let me illustrate this by figure 1 which shows average (AC) and short run marginal costs (SMC) for a price regulated airport operating with a fixed capacity which can not be expanded; let say for environmental reasons. Demand at peak time is denoted D_1 and at off-peak time D_2. If landing fees would be set according to the short run marginal cost principle, than demand at peak time would be charged p_1^* (taking the full opportunity costs of occupying the runway system into account) and off-peak demand would have to pay a price p_2^*. D_1 would be rationed efficiently (q_1^*) according to the willingness-to-pay criterion, whereas D_2 is served up to the quantity q_2^*, so that it pays all of its ressource costs. However,

the practice today is to charge p^R in both periods.[4] This leads both to excess demand ($E^R - q_1^R$) at peak time and also to inefficient utilisation of capacity in the off-peak period. Although at times of low demand no shortage of runway capacity exists at all, demand is rationed to q_2^R, resulting in idle capacity despite the fact, that some unserved demand ($q_2^* - q_2^R$) is willing to pay the full opportunity costs to be served. Furthermore, airlines which are served at peak time receive a scarcity rent at the expense of D_1. In fact, off-peak demand subsidizes demand at the premium time.

Regulatory practice may be even more inefficient than the stylized figure suggests as the existence of the so-called single till principle is neglected. Because regulators consider revenue from non-aviation activities when deciding on airport charges, landing fees — other things equal — have to be lower the more income an airport receives from such activities. This might lead to a situation, where revenue from runway charges will not cover direct costs of operating the runway, although congestion remains.

From figure 1 it should have become clear that current regulatory practice, although claimed to be based on the principle of non-discrimination in fact does discriminate in favour of peak demand and to the detriment of off-peak users, resulting in inefficient utilisation of airport capacity. Furthermore, the inefficiently low prices at peak time create excess demand, which must be rationed by another mechanism in order to reduce congestion costs due to waiting lines in the skies.

Currently this is done by defining slots and allocating them to airlines according to a mechanism which is based on guidelines set by the International Air Transport Association (IATA), and which has become law in Germany with the 10th amendment of the Air Transport Law in June 1990. A system of prespecified priorities is used against which competing demands for slots are weighted. The most important of these priorities is the historical precedence (grandfather right). An airline having used a slot last year will receive it again in the future as long as it does not sacrifice it on a voluntary basis. According to the bureau of the German slot coordinator today about 95 per cent of slots at Frankfurt are claimed to be grandfather rights. In order to introduce flexibility into the grandfather system the airlines are allowed to barter with slots. Most bartering takes place at scheduling conferences which are held twice a year and which are open for all interested airlines. However, regular slot trading which involves monetary payments is not allowed.

This system has worked for more than 40 years. It has some merits, but also clear disadvantages. On the positive side stands the fact, that carriers become de facto owners of

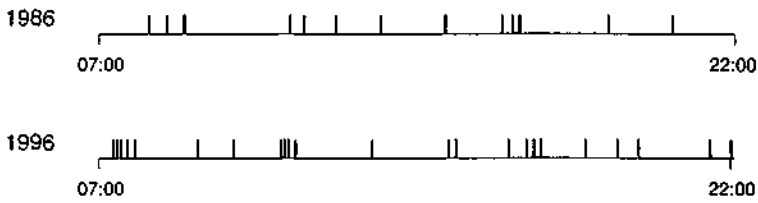
[4] The regulated price p^R lies below the level of the intersection of the average and short run marginal cost curve because is assumed that price regulation leaves the airport no profit. Therefore as long as the price in the off-peak period is above SMC, the price in the peak period must be below average costs.

slots once they have obtained them, getting planning stability so that transaction costs in air transport are reduced which may encourage the development of integrated (hub and spoke-) route networks (Langner 1996). However, the prohibition of monetised slot trading means that property rights remain incomplete, as the right to transact is restricted. This has not only serious consequences for the utilisation of scarce infrastructure but also reduces competition both in the transport and also in the airport markets.

Inefficient utilisation of overloaded airport capacity results from the fact, that due to the underpricing of runway services the grandfathers obtain scarcity rents. The existence of such rents itself creates no problem for slot usage. What is problematic, however, is the fact, that they cannot be traded, so that the value of a slot cannot be capitalized when leaving the market. As a result airlines will be very reluctant to give up grandfather rights, not taking into account the social opportunity costs of their own operations. The perverse outcome can be illustrated by pointing to small aircrafts as an example. Although these planes occupy the runway system for a time above average due to low speed and problems of turbulence (which necessitates longer safety distances between aircraft movements) as a result of their relative light weight they have to pay lower charges even at peak times than bigger airplanes have to pay at times of excess capacity. Because giving up slots will not be compensated by monetary payments the opportunity costs of occupying the runway become external and inefficient production decisions occur. As a result incentives to bundle demand on fewer flights using bigger airplanes are reduced, so that congestion increases.

Figure 2 shows the number and timing of scheduled flights on the Frankfurt-London route before and after full liberalisation of the market. As can be seen not only the number of flights has increased, but there was also a tendency of bunching flight schedules by competitors, thus leaving fewer slots at peak times for connecting destinations. Probably the result might be that hub and spoke route patterns will not be exploited to their full advantage, thus rising costs of air transport. More schedule differentiation will simply not pay for airlines, as landing fees remain constant all over the day so that a move to other times will result only in an competitive disadvantage, leaving rents to rivals.

Figure 2: Timetable of Scheduled Flights on the Frankfurt - London Route



Scheduled Flights for Wednesday for the first week of July
Source: ABC World Airways Guide

For the same reason competition is reduced not only on the transport markets, where access for new entrants is restricted as long as they do not already possess attractive slots on high density airports which they can barter, but also on the infrastructure markets. Because of the fact that scarcity rents cannot be capitalized when leaving an airport, and also because it can be very difficult for airlines to obtain slots again once they had been given up, inefficient low landing fees coupled with grandfather rights create a lock-in effect for airlines and therefore reduce competition between airports. Moreover even uncongested airports might profit, because of the fact that overloaded airports do not have any influence on slot allocation and therefore cannot offer inefficiently used slots to attract carriers from other airports.

2. Modifications of the Current System

The anti-competitive effects of the allocation mechanism currently in use have been recognized among others by the Commission of the EU, who pressed for better access opportunities for new entrant airlines to high density airports. In 1993 a code of conduct was implemented and slot pools created, into which voluntary sacrificed slots of incumbent carriers have to be put in (Europäische Gemeinschaft 1993). According to the rule, which has become part of the IATA-priorities, 50 per cent of unused slots at an airport will be given to airlines with only little presence at this place. Furthermore, in order to reduce incentives for incumbent carriers to hoard slots as a means to prevent market entry by potential competitors, the then already existing use-it-or-loose-it rule was extended to an 85 per cent use of allocated slots. If an airline fails to reach this limit it will get rid of the grandfather right. However, these modifications of the current system suffer from the fact, that the system of historical precedence were left untouched.

It must be stated that the use-it-or-losse-it rule cannot be an effective remedy against anti-competitive slot hoarding. On the contrary the rule itself might create inefficiencies. Because of the little chances to obtain a slot again which was sacrificed in the past and because of the value of scarcity rents grandfathers will be very reluctant to give up slots. Indeed the creation

of slot pools and the 50 per cent rule decrease the chances for incumbents to get a slot which they sacrify today back in the future. Additional incentives occur to use slots even for flights which actually do not cover their operational costs in order not to lose them once and for all. As a result the airlines might engage in rent seeking for future scarcity rents, which leads to poor utilisation of airport capacity and increases transport costs.

Unsurprisingly, a study by Coopers and Lybrand (1995) found a very limited effect of the use-it-or-loose rule and of the installation of slot pools, so that entry opportunities for new entrants proved to remain very limited. Empirical evidence showed that only very few slots were given up by incumbent carriers, and those slots which got into the pools lay mostly in unattractive times.

It seems that the Commission itself has recognized the poor effects of this „reforms". Nowadays she pursues a new strategy to open slot-restricted airports to new entrants and to reduce the anti-competitive effect of the grandfather principle. Hers' growing concern about the effects of the emergence of global air transport alliances in combination with locked airports led to a policy of connecting permission to establish e.g. code sharing agreements with pressures for the would-be alliance partners to sacrifice slots. But doubts remain whether this will enhance the productivity of runway usage. Instead such a policy may have adverse effects in terms of allocative efficiency. First incumbents may get incentives to engage in slot hoarding merely for the fact to keep enough slots even after (anticipated) confiscation, thus reducing chances for new entrants to get free slots. Second administrative allocation of runway capacity cannot ensure that it will be allocated to airlines which have the best production plans. As it is always in competition policy which tries to influence market structure by direct interference it seems at least to be problematic to penalize successful companies only for their size. Instead slots should be given to those airlines which use them most efficiently.

3. Full Deregulation of Slot Allocation?

Full deregulation of slot allocation would mean that airports are allowed to set market clearing prices or instead are responsible for the allocation of slots if excess demand occurs. The first would necessitate a complete reform of regulatory practice. However, a complete abolishment of price regulation would be inappropriate in cases where airports possess strong market power. As unregulated airports can earn monopoly profits, prices will be above opportunity costs both at high and low demand leading to underutilisation of infrastructure and to too few investment.[5]

[5] In figure 1 marginal revenue for peak demand is denoted MR_1 and for off-peak demand MR_2. Unrestricted price setting by the airport company would result in prices p_1^M and p_2^M correspondingly, resulting in underutilsation of capacity in both periods,which quantities q_1^M supplied at times of high demand and q_2^M at times of low demand.

However, as has been already shown some rebalancing of charges according to the time of use is asked for. The latest proposal of the EU-Commission on airport charges must be welcomed in this respect. Although it is claimed that airport revenues must be related to the cost of supply it leaves room for setting market clearing peak charges, if the condition is fullfilled that airports do not directly gain more income from scarcity pricing. Although at least in principle the door is open now for introducing time-related charges at German airports it might be a difficult task for a regulator to set prices right. Therefore a further step might be to introduce slot auctions. I will come back to this point later.

Airport operators claim that they should be given full responsibility for allocating slots. It is argued that (at least profit maximising) airports themselves are interested in the efficient use of their facilities, and therefore leaving slot allocation to them would pose no problem of inefficiency. Although this would be true if airport markets could be assessed as well functioning, this strand of argumentation however neglects the existence of airport regulation. If a price controlled airport is subject to rate-of-return regulation incentives might exist to weaken regulatory constraints by using disposal rights over slots to discriminate against airlines.[6] By this means the structure of related markets might be manipulated and thus market power might be transferred from the airport level to the transport sector, creating rents which could be skimmed by the airports through their contractual relationships with the airlines or their own affiliated companies without violating regulatory constraints on runway pricing. To give just two examples for possible strategies, those airlines could be preferred which buy ground handling services by the airport companies instead of being served by independent ground handlers. Or decisions on slot allocation could be conditioned on the willingness of airlines to sign contracts for use of facilities which would otherwise be deemed unnecessary. By this way the airport can increase its capital base and therefore, because of the rate-of-return character of regulation, enhance its profits. Productive inefficiency would occur.

4. Slot Trading

Slot trading has been discussed since many years, although until now only at four airports in the United States a buy-sell regime was implemented. It would be beneficial in terms of efficiency to allow for monetary side payments and therefore regular slot trading. Restrictions on slot transactions would be abolished, and entry as well as exit barriers would be removed. As long as the slot market remains competitive efficient allocation of infrastructure services can be expected, even if trading starts on the basis of current grandfather rights.[7] All carriers must take the market price for slots into account thereby internalizing congestion costs. Slot hoarding as a means to secure future scarcity rents will no longer be appropriate because those rents can be capitalized by selling slots.

[6] Regulatory practice has shown, that price-cap regulation differs not fundamentally from rate-of-return regulation. The main difference is the longer and institutionalized regulatory lag.

[7] Of course grandfathers will receive big windfall profits. But these would not influence allocation.

However, there is also the danger that airlines would try to engage in strategically trading in order to get control over access to high density airports. The monopolization of slots might prove to be very attractive for airlines, because of the fact that sunk costs are of little relevance on the route level of air transport. Controlling airport access is thus one of the very few strategies which can be used to create sustainable entry barriers against potential competitors.

Sometimes it is argued that slot monopolization should not cause much concern. The high costs of slot hoarding would make it unattractive for the airlines, because many slots are more or less suitable to use for a potential entrant in starting up a new service on a particular route. In order to prevent market entry the incumbent would have to buy all slots the entrant could use. Therefore if n slots are suited for the potential competitor, who just needs one of them, the incumbent must outbid his rival n-times, leaving no monopoly rent in the case of success.[8] Furthermore slot hoarding itself would result in higher slot prices, as slots become more and more scarce for other carriers.

But these arguments fail for two reasons. First, while it is true that sequentially buying slots would rise prices, therefore possibly makes it by far too costly to buy all slots (Gale 1994), an airline which tries to monopolize airport access might instead make a one-shot offer to the current slot holders to buy all slots at a fixed and ex ante prespecified price with this offer terminating if it shows that the raider will be unsuccessfull in obtaining all slots at the announced price. Such a strategy might considerably lower the costs of getting complete control over airport access. Second, restricting market access by slot hoarding will prove to be a relative inexpensive means to reduce competition on the transport markets once the raider had obtained all slots. In order to reduce the costs of holding slots which he himself cannot actually use without running into deficits, he would be free to lease them to other airlines. In order to secure monopoly rents for him it would be enough to lease them only for short periods. Potential competitors must then be aware that lease contracts would not be renewed if they attack the landlord.

In fact, although a clear picture of the allocative and competitive consequences of the US-buy-sell rule is still not at hand, the empirical picture of the patterns of trade shows that airlines are reluctant to sell off slots or to give them to leaseholders for longer periods. Most uneven slot trades are based on lease contracts which terminate after 12 months or even on shorter notice.

[8] See for this kind of reasoning e.g. McGowan and Seabright (1989, p. 319).

Table 1: Patterns of Slot Trading at US-Airports 1986-1992

	1986	1987	1988	1989	1990	1991	1992
Air Carriers							
Lease for up to 3 months	124	484	465				
Lease for 3–6 months	39	133	147	1 259	1 294	1 468	1 178
Lease for 6–12 months	72	5	51				
Lease for over 12 months	7	0	7	0	0	0	0
Sales	375	152	64	290	403	477	310
Total	617	774	734	1 549	1 697	1 945	1 488

Source: Brachmann (1994, p. 198).

If in the extreme slot trading will result in one airline controlling access to a high density airport, a double negative effect will arise and the regulation of airport charges will become counterproductive. On the one hand the landlord of the slots will gain all those monopoly rents which the airport is denied for. On the other side the negative incentives for productive efficiency, which inevitably follow from any form of economic regulation, still occur.

Therefore safeguards must be implementented against such outcomes. It might be wise to limit the total proportion of slots one airline (and its affiliated companies) can hold. In order to avoid new inefficiencies no strict limit should be introduced. Instead market dominance and the danger of reduced competition on the air transport markets should be judged according to concrete circumstances.

5. Slot Auctions

As it was already discussed an alternative to implement a slot trading regime would be to introduce congestion charges at market clearing levels. The problem is however, that it might prove difficult to set the right charges because of demand uncertainties. If charges are set too low, congestion continues. On-time allocation by waiting lines would complicate the scheduling task for airlines and might be a barrier for the building of integrated route networks therefore rising costs of air transport. In order to avoid such costs slot trading would be asked for as an complementary mechanism. If instead charges are set too high, underutilisation of runway capacity occurs. The problem might accelerate because it would be inappropriate to experiment with different levels of congestion charges by changing landing fees each flight period as the airlines would lose much of their planning stability which also might have adverse effects on the development of route networks. These problems might be avoided however, if the pricing issue is left to the market by introducing slot auctions, and granting auctioned slots to the airlines for longer periods. Although today no slot auction

regime exists anywhere, I will lose some words on the practicability of this allocation mechanism.

Slot auctions would differ from familiar auctions of e.g. arts because of the fact, that the value of a single slot cannot be determined in isolation but instead depends critically on the availability of complementary slots. To give an example the value of a takeoff slot for an airline depends on the landing slot available. In practice complementarities are even more complicated because the value of a single slot depends of the whole network of which it is part of. Therefore it is claimed that slot auctions will never be able to take account of such complementarities and therefore must result in destructed route networks.

However, although this argument is undoubtedly correct if slots are auctioned in isolation one by one, this might be avoided by introducing auctions for slot packages, or what auction theorists call combinatorial auctions. To be precise an auction could be designed where incumbent slot holders define packages of their slots which have to be auctioned off. Two kinds of bids might be accepted: Bids might either be given for a whole package, or for single slots out of a package. If the highest bid for the package as a unit outperforms the sum of bids for single slots, than the package as a whole will be given to the sucessful bidder, otherwise it will be broken up and single slots will be given to the then sucessful bidders. This might ensure that efficient slot combinations are not destroyed because of „wrong" bidding of airlines which have to value slots without having the relevant information about the prices of complementary slots at the time of bidding. It must be acknowledged, that such an auction design would favor incumbent slot holders, because the right to define packages will give them an advantage in solving network problems over bidders for single slots. However, compared with the current IATA-system and also with slot trading this would pose no serious problem, because such problems exist anytime for airlines which try to get slots which are as yet not part of their actual portfolio.

The second argument against slot auctions is that the implementation of such an allocation mechanism will reduce planning stability for airlines and therefore will be detriment to the development of integrated route networks which allow to realize economies of density in air transport. This argument depends on the relevance of sunk costs in air transport. Indeed, although sunk costs at the route level are low, at the network level they might not be negligible, because building route networks requires at least specialized human capital as well as the timely combination of other ressources, which cannot be redeployed at short notice. However, it would not be necessary to auction all available slots each year or flight season. Instead it will prove to be enough to auction a few slots every year, leaving the cores of airlines networks intact. If as an example at Frankfurt 150 - 200 slots will be auctioned every week, than slots might be allocated to airlines for about 30 years.

The third argument against slot auctions claims that such a mechanism will result in higher costs for airlines and thus will increase prices for passengers. However, this argument fails because it does not distinguish between short and long run marginal costs of air transport. Slot auctions would only rise long run marginal costs, as slot prices would represent fixed cost. In liberalized markets carriers do price according to short run marginal costs and the price elasticity of demand. The price for slots therefore is only relevant for decisions on scheduling and not for price setting on transport markets. Rising slot prices thus would result in rescheduling existing flight patterns but might not inevitably lead to higher prices. On the contrary prices for air transport services might even be expected to fall, because of the fact, that the abolishment of grandfather rights will give the carriers new opportunities to optimize route networks even at high density airports and also increases competition on the transport as well on the airport markets.

Closely related to the third argument is the claim, that slot auctions would disadvantage carriers which operate at high density airports because supply costs would rise. However this might not disadvantage those airlines, but instead will end the privilege to get scarcity rents for free and therefore would end an advantage they are granted today.

Although it must be acknowledged first that slot auctions would bring only limited advantages if they would be restricted to the national airport system, while it seems unlikely that international consensus will be reached in the near or midterm future about auctioning slots, and second, that some questions remain yet as to the exact design of slot auctions, it might be worth to think further about it.[9]

6. What to do?

The slot allocation mechanism currently in use not only leads to an inefficient allocation of scarce infrastructure services but also creates significant barriers for potential competition both on the air transport as well as on the airport markets. Therefore it's time for reform. Of course the first step should be that national regulatory authorities will allow the airports to rebalance their charging structures and to introduce peak load pricing, so that airlines must take the social opportunity costs into account when deciding on occupying runway time. This should be accompanied by the abolishment of the single till principle, which might otherwise prove to be a barrier for efficient peak pricing.[10]

[9] Auctions have been conducted in the United States and elsewhere to allocate spectrum rights, for which similar problems of complementary occur. For the design see McMillan (1994) and McAffe and McMillan (1996).

[10] The single till principle is also inappropriate in terms of economic efficiency, as its existence might cause biased incentives for investment decisions of regulated airports. However, this aspect is the topic of another paper in this book. So I will refrain from going into details.

However, it might be that rebalancing charges at the most overloaded airports will not promise to be enough to guarantee that best use is made from available airport capacity, as long as airport revenues are restricted as to cover the costs of supplying infrastructure services. As the abolishment of economic regulation itself can lead to efficiency, regulation of airport prices must be accompanied by some other slot allocation mechanism. Slot trading would be beneficial compared with the IATA-system and should therefore been introduced. However it must be safeguarded in order to prevent any airline to gain full control over access to high-density airports. Slot auctions might be another means of allocating scarce runway capacity.

III. ENVIRONMENTAL DAMAGE

1. Instruments for Reducing Environmental Damage

Airport activities might produce environmental problems, with noise pollution being probably the most prominent issue. Environmental damage may be reduced by various measures, including active as well as passive ones. As for the example of noise reduction an airport may invest in sound absorbing buildings either at the airport site or in the neighbourhood, he may introduce noise related landing fees as well as a general ban on certain types of aircrafts or on night flights. All of these measures either increase the costs of airport operation or reduce the airport's revenue. On the contrary are the social costs of environmental damage. Efficient use of infrastructure therefore requires that environmental costs are internalized. As the reduction of (noise) pollution is a public good, state intervention is asked for to get the right limits for pollution activities.

Today, environmental problems are tackled by various means, which can be divided into detailed administrative restrictions on operational activities of airports (as the already mentioned bans on night flights) and economic instruments which aim at the internalisation of (former) environmental externalities. The first group of instruments might be quite effective from a technical point of view, if chosen restrictions are closely related to environmental damage.[11] However, they restrict the choice of alternative instruments by the airport operator and therefore often result in productive inefficiency. As an example putting a limit on the number of aircraft movements during an airport's daily operational hours will result in idle runway capacity, which might increase congestion at high density airports. The same environmental standards will probably be reached at lower costs by introducing noise related landing fees thus inducing the airlines to use less loud airplanes, so that underutilisation of runway capacity might be reduced.

[11] Probably there might be no other instrument to ensure a calm sleep for airport neighbours than a strict night flight ban. Of course, their life would be even more delicious if air transport movements would be forbidden all over the day. Because I am not willing to go into struggle with airport companies, I will leave the last aspect now.

Noise related landing fees are already in use at German airports. However it shows to be difficult to introduce the right noise surcharges, which assure that environmental goals will be met exactly. Therefore the introduction of tradable emmission licenses is discussed as an alternative means, leaving the pricing issue to the market.[12]

2. Policy Options After Privatisation

As long as the airports remain in public ownership, state authorities can use property rights to induce airport managements by order to realize tighter environmental standards and even can gain influence on the choice of instruments. After privatisation such direct influence is no longer possible. However, this poses no problem at least if future requirements for environmental standards are known at the time of privatisation. If this special case holds, it would be enough to write a sales contract which binds private investors to ex ante specified emmission standards, without referring to specific instruments. Buyers would have an incentive to choose those activities which enhance environmental quality at minimum costs. As for the example of a reduction of the overall noise level an airport could choose between the imposition of an upper limit for the number of air transport movements, the rebalancing of landing fees in order to give noise surcharges greater weight or investing in noise absorbing facilities.[13] All alternatives will lead to different costs or revenue losses, which an airport has an incentive to minimize.

However, after privatisation it might be quite difficult for state authorities to tighten environmental standards if no provisions are made for this case in the sales contract. Today German airports are protected to a high degree by law against discrete aggravation of standards, so that chances for regulatory intervention without consensus of the airport operator are very limited.[14] Also buying enhanced environmental standards from private airports by compensating the companies for higher costs and lower revenue may be problematic, as airports are for some emmissions by far the most important regional source (e.g. noise) in

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[12] The introduction of tradable licenses for NO_X - and HC-emmissions was discussed for Zurich Airport. For details see Schmidt (1994, p. 178-182). However, there might be some problems with introducing environmental licenses. The first might result from the emergence of hot spots at peak times, so that the tradability has to be restricted to certain classes of periods. But such restrictions will lower the advantages which could be expected from license trading. Second, if new entrants need to buy not only slots but also licenses as a prerequisite to gain access to an airport, serious problems of complementarities might result. Third, the introduction of environmental licenses will pose the same problems of potential market foreclosure on air transport markets as were already discussed for slot trading, because licenses might be traded strategically, so that safeguarding is needed to prevent license monopolization.

[13] Of course safeguards are required to prevent airports to choose measures which discriminate against certain users. Incentives to discriminate may evolve if an airport is subject to economic regulation. The same holds for incentives to choose economically inefficient instruments in order to soften regulatory constraints. As these problems refer to the problem of how to design economic regulation of airports, which is not adressed in this paper, I will not touch such aspects here.

[14] This information is based on interviews with experts of the Ministry of Economics of the Free State of Hamburg and with the Ministry of Economics, Technology and Transport of Northrhine-Westphalia, which are responsible for regulation of airports.

most cases and thereby may exploit their information advantages about minimum costs and maximum revenue losses of emmission reducing activities against state authorities, so that problems of monopoly might occur.

Nowadays some state authorities try to tackle these problems by putting a limit on the duration of operating licenses which they grant to the airport operators. To give just one example the operating licence for Cologne Airport states that the current order for night flight restrictions will run out in the year 2002 with an earlier termination being possible if this is deemed necessary by the Ministry of Economics, Technology and Transport of the Land of Northrhine-Westphalia (Ministerium für Stadtentwicklung und Verkehr des Landes Nordrhein-Westfalen 1993).

Although such contract clauses may give state authorities means for discrete intervention even after privatisation, a high degree of planning uncertainty emerges for investors which might have adverse consequences for the further development of infrastructure, detriment to the interests of regional locations. The same holds for the idea that state authorities should insist on the introduction of environmental licenses in order to facilitate getting higher environmental standards simply by buying licenses back from the market thereby reducing environmental capacity for air transport without running into problems of monopoly.[15]

3. What to do?

Of course these problems must not lead to the pessimistic conclusion that public owners have to choose between the two options whether to privatise an airport or to pursue a policy of reaching better environmental standards in the future by retaining public ownership. Instead the only thing which has to be kept in mind when designing the sales contract is to give private investors those planning stability they need for the further development of infrastructure.

To reach this aim several strategies might be pursued. First, public owners might refuse to sell off all assets of an airport, but instead only franchise out management contracts to private operators for a prespecified period, while holding immobile assets in public ownership. New environmental standards might then be enforced at the time when the franchise contract is to renew. Because immobile assets would be in public ownership, competitive tendering would be possible at the time of renewal so that problems of monopoly might be avoided. However, although such a strategy allows state authorities active management of environmental

[15] The reason holds, because buying licenses from the airlines in order to reduce emmissions would also reduce the traffic potential of airports without compensate them for revenue losses. Either incentives to invest in long-lived immobile assets are rduced, or probably strong incentives for the airport operators might be expected to hold all licenses in his own pocket in order to enforce compensation. However, if the latter case would realize, the monopoly problem would still occur, leaving no advantage to this policy instrument. If on the other hand the airport will be denied to buy licenses much of the first sight appeal of this instrument vanishes.

problems at the time of contract renewal, franchising has also clear disadvantages, as it opens the door again for political influence on other aspects of airport operations, too, therefore reducing the prospect of enhanced productive efficiency through privatisation.

The second strategy is to design a system of economic regulation for the airport sector, that gives private investors confidence about not loosing quasi-rents after costs have been sunk in irreversible investments. Thus a regulatory system is asked for, that promises private investors to recoup at least to some degree higher costs or lower revenue due to changes of environmental policy by higher charges.

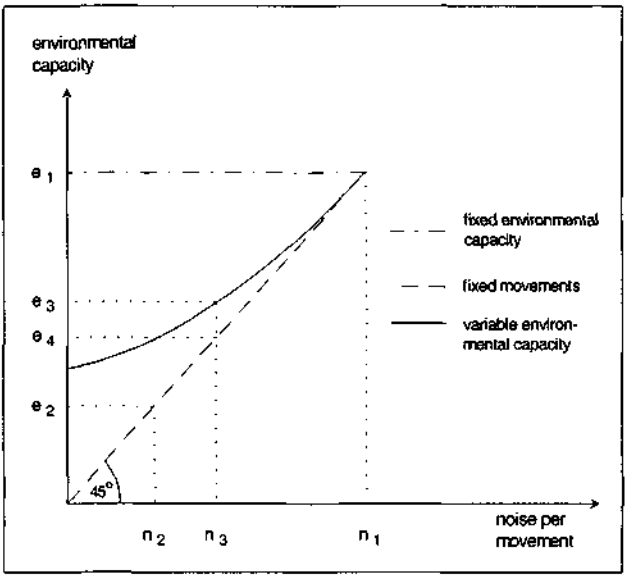
The third strategy is to design a sales contract, which has an in-built flexibility of environmental standards and gives private investors incentives to reduce environmental damage without explicit policy orders. For this a contract is needed which states a fair sharing of the gains of emmission reducing activities by the airport between state authorities and private investors, so that a reduction in emmissions opens new profit opportunities for the airport as well as less environmental damage for the society.

Figure 3 illustrates the mechanics of such a contract. It is assumed that the sales contract sets the airport a prespecified limit for overall noise pollution. I will call this limit the „environmental capacity" the airport might use.

Let me first point to a contract which allocates a fixed environmental capacity e_1 to the airport, which will not be adjusted regardless of the airport's decisions on activities for reducing emmissions, and which is based on an average noise level per air transport movement of n_1 („fixed environmental capacity"). Under this circumstances a reduction of noise per movement from n_1 to n_2 means that the same number of movements will occupy less environmental capacity (e_2) thus leaving room for more traffic.[16] Such a contract gives the airport strong incentives to lower the level of average noise, as more traffic means more profit. However, in terms of environmental capacity society gains nothing from the airport's activities, because all noise reductions will be absorbed by more air transport movements.

[16] At fixed movements idle environmental capacity would be the difference between e_1 and e_2.

Figure 3 — Contracts for Noise Reduction



If, on the contrary and second, the sales contract fixes the number of transport movements („fixed movements") any gains from a reduction of the average noise level must be passed to society because it will lead to a parallel reduction of environmental capacity the airport is allowed to use. In figure 3 a (hypothetical) reduction of the average noise level to n_3 would reduce environmental capacity immediately to e_4. Obviously, in practice the airport has no incentives to engage in noise reducing activities, so that in fact — other things equal — noise per movement will remain at n_1 forever.

The third contract („variable environmental capacity") is designed as a sharing mechanism, so that both the airport as well as society gains from noise reducing activities. Suppose a reduction of noise per movement from n_1 to n_3. Environmental capacity will be reduced automatically to e_3. Therefore society gains from better environmental quality. But as the same number of movements as before do only occupy a capacity of e_4, the airport might attract more traffic and therefore — other things equal — increase profits without violating the new environmental restrictions (e_3). Therefore the airport has incentives to engage in noise reducing activities, although his incentives are weaker than under a „fixed environmental capacity"-contract. For the same reason society gains from such a sharing regime, although the airport's incentives to increase environmental quality are not first best.

It should have become clear from figure 3 that the chosen sharing proportion has great influence on airport's incentives. The greater the profit the airport might gain from his own activities the greater his incentives to engage in environmental management. On the contrary, the less the gains for society from the airport's activities in terms of environmental quality. Of course the optimal contract depends on the concrete situation.

III. CONCLUSIONS

Airport privatisation might be beneficial both in terms of productive as well as allocative efficiency and thus might enhance the competitive strength of regional locations. However, to reap the full economic benefits from privatisation some institutional reforms are required. As expectations for enhanced productivity of infastructure supply must rely on the transfer of yet public airports to the private sector, so must expectations of better utilisation rely on giving the actors the freedom they need. Congestion as well as environmental problems call for internalization of social costs. The current system of slot allocation fails in this respect, because of inefficient charging for runway services and also because property rights of airlines remain incomplete. Therefore opportunity costs of runway usage are not taken into account. To introduce peak load pricing and to give the airlines full property rights by giving them the opportunity to trade slots, might be important steps to enhance productivity of airports, although some safeguarding is required in order to prevent anti-competitive outcomes. As regards to the problem of environmental damage a more pronounced shift from a policy of defining detailled technical restrictions on airport operations to a policy, which is more than today confined to the setting of environmental standards thus leaving it to the airports to decide about the actions to be taken would enhance environmental quality as well as the development of infrastructure and therefore would lie in the interests of society.

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