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Secondary Markets for Runway Capacity

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1. Introduction

In view of the growing air traffic demand, efficient allocation of airport capacity, especially of runway capacity, becomes increasingly urgent, even more so since the possibilities to expand capacity are limited. The current system is generally based on administrative procedures and, thus, leads to substantial misallocations on a growing scale. Therefore, many economists have proposed to replace them by market mechanisms. Several of them are available, but some can only be implemented on a longer time scale. Our discussion focuses instead on mechanisms which are efficient and straightforward to implement.

In the following section we are describing the current regulatory framework for the allocation of slots in the EU. A slot is defined as the concession or the entitlement to use runway capacity of a certain airport on a specific date and at a specific time. The third section illustrates in brief the different mechanisms which are available for the allocation of runway capacity. In section four the paper emphasises the developments in the US and the consequent lessons which can be learned from them. Furthermore, the current EU and US slot policy will be evaluated. The paper concludes with some final remarks.

2. Allocation of Runway Slots in the EU

The regulation of the international allocation of scarce runway capacity is dominated by the Worldwide Scheduling Guidelines of the International Air Transport Association (IATA), an inter-airline and non governmental organisation. Most importantly, these guidelines establish grandfather rights for runway slots, which permit airlines to use those slots in the future which they have already used in the past. Accordingly, this rule results in cost free reservations of runway capacity for the respective airlines. However, airlines lose grandfather rights if they do not operate them for at least 80% of the time of the respective flight period (use-it-or-lose-it)—one flight period is six months. Furthermore, it is possible to exchange slots on a one-to-one basis. Slot trading in combination with monetary transactions is not intended. To compensate newcomer airlines for disadvantages that result from grandfathering, the guidelines state that 50% of free or new slots should be primarily allocated to them.

In the European Union the allocation of runway slots is subject to a common regulatory framework under European Council Regulation No. 95/93 of 18 January 1993. It largely adopts the described IATA-Guidelines. However, whether slot exchanges accompanied by monetary side payments are allowed or not is a controversial issue. Although (former) members of the European Commission consider this kind of side payment as illegal, a British Court did allow them in March 1999 (Kilian 2001). The proposal for a new regulatory framework for the allocation of slots at Community Airports from 20 June 2001 does not

include remarkable changes in relation to slot trading or other market mechanisms compared to the status quo.

In contrast to the current regulatory framework and the suggestions of the European Commission we will argue that slot trading is an efficient way to organize markets for runway capacity. To underpin this opinion we will analyse the market for runway slots at the four slot constrained US Airports.

3. Primary vs. Secondary Markets

Primary and secondary allocation mechanisms can be used to allocate runway slots. While primary allocation refers to the distribution of runway slots from the regulator or the airport¹ to airlines and others, e.g. brokers and market makers, secondary allocation refers to the redistribution of slots among airlines and others (Figure 1). Brokers provide coordination services, they do not buy or sell things, whereas market makers purchase and resell goods (Spulber 1996). They are market intermediaries which improve welfare by reducing the uncertainty associated with making a satisfactory match. Therefore they should be integrated into a market for secondary trading.

The instruments for the (re-)allocation of slots can be administrative, e.g. grandfathering and use-it-or-lose-it, or market oriented using the price mechanism. Different market instruments are conceivable for the realisation of a primary slot allocation:

1. setting charges² and achieving a market equilibrium by re-adjusting the slot quantities,
2. setting slot quantities and achieving a market equilibrium by re-adjusting the charges and
3. setting slot quantities in combination with minimum and maximum levels for charges. A market equilibrium will be achieved by flexible charges within the specified interval and quantity adjustments if charges fall outside the interval otherwise.

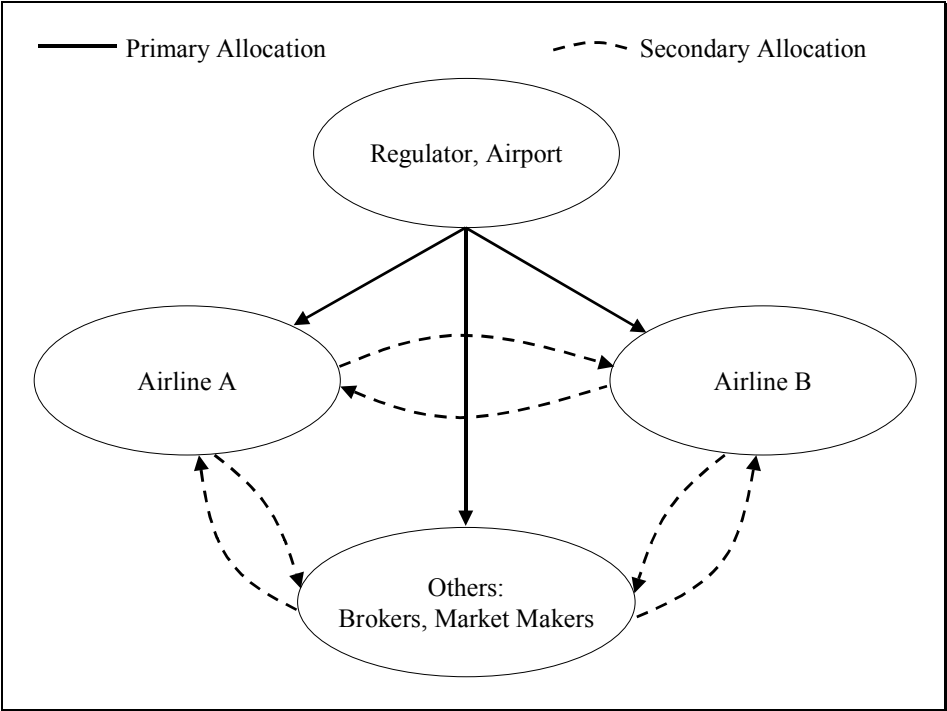
If the willingness of airlines to pay for runway slots is unknown by the regulator, the third option is likely to increase expected social welfare (Brenck/Czerny 2002). This results

¹ Theoretically airport charges are able to affect the primary allocation of slots. However, at present they do not achieve market clearing levels and thus have only little or even no impact on the development of scheduled routes from airlines (Doganis 2002).

² Keeping in mind that these charges are only for the reservation of runway capacity, they should not be confused with the existing airport charges, which are levied for capacity use only.

because the setting of minimum and maximum charges requires quantities to be re-adjusted to achieve a market equilibrium if the willingness of the airlines to pay is very different from regulators expectations. This model prevents exaggerated marginal social (congestion) cost, due to a reduction of the available slot quantity if willingness of airlines to pay is much lower than expected. It also prevents large profit losses, due to an increase of the available slot quantity if willingness of airlines to pay is much higher than expected.

Figure 1 Primary vs. Secondary Allocation of Runway Slots.



Secondary market mechanisms can work through slot exchange (barter trade) and monetary trading. The latter minimises transaction costs and thus is the most efficient way to re-allocate a given number of slots (Jones/Viehoff 1993, Knieps 1996).

Since administrative procedures for allocating goods are expected to result in inefficient outcomes they will not be considered below. Furthermore, reforming the current regulatory framework into a market oriented system of primary allocation requires grandfather rights to be abolished. Due to fiducial protection such a change of the system needs a period of transition or compensation payments (Ewers et al. 2001). In comparison slot trading, including the leasing of slots, can be based on the existing grandfather rights of airlines and thus relieves a rapid implementation of market mechanisms. Hence we will focus our discussion on the trading of runway slots.

4. Secondary Markets for Runway Slots

Because of the experiences at the slot constrained airports in the US the positive effects of slot trading are often questioned. The European Commission criticises that slot trading does not ease market entry but, to the contrary, reinforces the dominant position of incumbent carriers at congested European airports (EC 2001). To weaken this argument we will analyse the development of the US market for runway slots as follows.

Table 1 Percentage of Domestic Air Carrier Slots Held by Selected Groups.

Airport	Holding entity	1986	1991	1996	1999
O'Hare	American and United	66	83	87	84
	Other established airlines	28	13	9	10
	Financial Institutions	0	3	2	3
	Postderegulation airlines	6	1	1	3
Kennedy	Shawmut Bank, American, and Delta ^a	43	60	75	84
	Other established airlines	49	18	13	14
	Financial Institutions	0	19	6	1
	Postderegulation airlines	9	3	7	1
LaGuardia	American, Delta, and US Airways	27	43	64	70
	Other established airlines	58	39	14	14
	Financial Institutions	0	7	20	10
	Postderegulation airlines	15	12	2	6
Reagan Washington	American, Delta, and US Airways	25	43	59	65
	Other established airlines	58	42	20	18
	Financial Institutions	0	7	19	14
	Postderegulation airlines	17	8	3	3

^a In 1999, First Security National Bank replaced Shawmut Bank. First Security National Bank holds those slots pursuant to a trust as security for a loan to TWA, which uses some and leases others.

Source: GAO 1999.

4.1 The development of the US Market for Runway Slots

Until now slot allocation at airports in the US is generally based on the first-come-first-serve principle. However, to combat flight delays the US Federal Aviation Authority (FAA) introduced the high-density rule in 1969 which restricted the number of slots at the designated high density airports LaGuardia, Reagan Washington³, Kennedy Airport and Chicago O'Hare (Starkie 1994). Since 1986 these slots have been allowed to be traded or leased among

³ On February 6, 1998, Washington National Airport was renamed Ronald Reagan Washington National Airport.

airlines and non-airlines. The only restriction for the trading of slots are due to the “ring fences”. The large carriers’ slots can be freely traded, however, large carriers are not allowed to buy commuter slots. Other slots, e.g. for international flights, are not permitted to be traded or leased. Furthermore, a use-it-or-lose-it rule exists and new or free slots are allocated using a lottery after 25% of them have been offered to newcomer airlines.

Table 2 Differences in Average Fares in Cents Per Passenger Mile for Constrained Airports Relative to Fares at Other Airports Serving Communities of Comparable Size, 1998.

	Length of trip	1998 average fares	Percent difference to non-constrained airports^a
Chicago O’Hare	Short	30.7	42
	Medium	15.9	15
	Long	N/A	N/A
	Overall	20.4	29
LaGuardia	Short	38.3	78
	Medium	17.2	25
	Long	12.5	11
	Overall	21.4	50
Kennedy	Short	27.8	29
	Medium	12.0	-13
	Long	11.9	5
	Overall	12.5	4
Reagan Washington	Short	39.3	83
	Medium	15.8	15
	Long	10.6	-6
	Overall	21.9	55
nonconstrained airports	Short	21.6	0
	Medium	13.8	0
	Long	11.3	0
	Overall	14.7	0

^a Overall percent differences represent weighted averages reflecting passenger distributions at the non-constrained airports.

Source: GAO 1999.

Table 1 shows that after the introduction of slot trading, established airlines significantly expanded their slot holdings at the high density airports. Only at Chicago O’Hare did the number of slots held by American and United Airlines slow down somewhat in 1999 compared to 1996. In contrast to this, the slot shares of airlines which started after deregulation usually dropped. To endorse new entrants in 1999 the US Department of Transportation (DOT) granted several slot exemptions to them at Chicago O’Hare, LaGuardia, and Kennedy Airport (GAO 1999). Due to local concerns about noise, slot exemptions did not take place at Reagan Washington Airport. Furthermore, Table 2 shows that in 1998 the overall average fares per passenger mile at slot constrained airports were

consistently higher than at other airports serving communities of comparable size, especially in short haul markets.

Due to this development, critics in the US claimed that the slot constraints should be eliminated and replaced with congestion pricing (Morrison 1997). On June 15, 1999, the US House of Representatives passed H.R. 1000, the Aviation Investment and Reform Act for the 21st Century (Air-21) which provides the lifting of all slot constraints at airports in Chicago and New York to permit new competition. Hence the slot regime is going to be replaced by the first-come-first-serve principle at airports in New York in January 2007 and at Chicago O'Hare in July 2002 (DOT 2000). In addition, Air-21 exempts flights operated by new entrant carriers or flights that serve small hub and non-hub airports with aircraft with 70 or fewer seats from the slot rule (FAA 2001). Congestion pricing is not considered.

4.2 “Market Failure or Market Efficiency?”

At first sight the above results do not seem to be encouraging. However, the question is whether they are a result of market failure or the opposite of market efficiency. The former could be reasonable if large airlines bought or hoarded slots just to keep competitive airlines out of the market and to raise passenger fares. In contrast to the slot hoarding hypothesis the study of Kleit and Kobayashi (1996), based on 1990 data, found out that “there is a positive and significant relationship between the rate at which a carrier uses a slot and the carrier’s market share” at Chicago O'Hare. Especially for hub airports this is plausible bearing in mind that adding another destination to a hub creates remarkable positive network effects. It exponentially expands the number of connections that can be served by the respective carrier and thus increases the profitability of the whole network (Mayer/Sinai 2002). Newcomer airlines will not be able to generate such network effects and for this reason their willingness to pay for slots at congested hub airports is bound to be lower compared to the established airlines. Additionally, Sened and Riker (1996) performed statistical tests, based on 1972-1981 and 1985-1989 data, to reveal the relation between slot ownership and actual load factors at Reagan Washington Airport and Chicago O'Hare. They conclude that “the higher the percentage of occupied seats in each of its planes, the more likely a carrier was to purchase new slots”. Thus, due to slot trading the more profitable airlines were able to expand their slot shares.

There is evidence that slot trading produces an efficient utilisation of the constrained airport capacity. But what about the higher passenger fares? Starkie (1994) argues that these fares add value to the network of airline services. Remembering the economic functions of fares or prices will make this point clear. Their objectives should be, firstly, to balance passenger demand with the constrained supply and, secondly, to grant airline capacity to those passengers who value it the most. To fulfil these objectives, prices have to increase, if the passenger demand is high compared to the slot constrained supply of the air carriers. Thus, high fares can be the result of an efficient allocation of scarce airline capacity.

Overall, runway slots should be used by those airlines which make the most efficient use of it. If profits result, on the one hand, from an efficient use of scarce airport capacity, and, on the

other hand, from yielding higher fares due to serving passengers who value airline capacity most, then the overall welfare of the economy will be maximised. The US market for runway slots suggests that these objectives have been attained. There is no evidence for slot hoarding behaviour of the incumbent airlines, and the higher passenger fares do not automatically signal market power.

Still it could be criticised that these fares lead to “windfall” profits for the established air carriers, because they had obtained scarce and valuable slots on the basis of grandfather rights without making adequate payment. In addition, one could claim, that instead of leaving the incumbent carriers with “windfall” profits, these should be transferred to the corresponding airport to finance the expansion of runway capacity. Such transfers could easily be managed by increasing the airport charges to more market clearing levels, e.g. congestion pricing. This seems to be meaningful, but Morrison (1983) and Oum and Zhang (1990) revealed that “windfall” profits are not necessarily a well defined indicator for optimal investment. Thus, investing all the “windfall” profits into new runway capacity could produce over or under investment. Another possibility to reduce “windfall” profits for incumbent air carriers is to provide them with time limited slots before slot trading is introduced (Lévêque 1998). The time limits are due to fiducial protection, nonetheless, they grant that after a certain period all air carriers are obliged to buy their slots. In that way financial inequity for new entrant carriers could be minimised and the “windfall” could be transferred to the airport or the state by primary allocation mechanisms, e.g. auctions. However, it should be emphasised that the distribution of the “windfall” profits is primarily a problem for equity and not for efficiency.

4.3 Consequences of the Current EU and US Slot Policy

The consequences of prohibiting an efficient secondary market for scarce runway capacity for the EU are evident. To rely on slot exchange and barter trade increases the transaction costs and thus reduces the possibilities for an efficient re-allocation of runway capacity. Probably this is a model to preserve the current market structure, but the resulting costs for the economy are expected to be high. Furthermore, to prevent slot hoarding the current slot regulation relies on the use-it-or-lose-it principle. Because it can easily be evaded by utilising smaller aircraft or the supply of a loss making service, the effectiveness of this principle is questionable. In comparison, slot trading reduces the incentive to hoard slots, because this is no longer financially viable.

However, is it possible to benefit from secondary trading of slots and at the same time to address the concerns of the European Commission about increasing slot concentration? One answer to this problem could be to combine slot trading with the strict application of EU and national competition law. The British Civil Aviation Authority confirms that the application of competition law relating to the abuse of a dominant position can adequately guard against anticompetitive behaviour in a slot market (CAA 2001). Capping the number of slots an airline is permitted to hold at a specific airport (slot cap), is considered to be only the second best method, because the practicality of optimally determining slot cap levels across EU Airports is questioned.

Which consequences can be expected from lifting slot constraints at congested US airports? Could the US approach be a model for the EU? An obvious consequence of lifting the slot constraints is that it makes reservations for runway capacity impossible, and without them the allocation problem is solved on the basis of queuing. This has the potential to increase airline cost and reduce the quality of airline services for the passengers due to growing delays. Assuming that the airport has enough terminal and stand capacity, the level of delays depend on the level of demand compared to the available runway capacity. If little demand exists compared to large runway capacity, queues are going to be small or will not appear. In this case the first-come-first-serve model fits perfectly. If, to the contrary, demand is large compared to the runway capacity, then delays are expected to increase up to a non optimal level. The decision of a single airline to use runway capacity only takes account of its own additional costs and revenues. The airline will not consider the (external) congestion costs it is going to cause to all other airlines, and these costs could be substantial. Nonetheless, due to the absence of market entry barriers the first-come-first-serve method, indeed, can produce lower passenger fares. However, the corresponding growth in demand increases congestion costs and thus the overall welfare is not optimised. Hence, it does not seem to be a good model for the allocation of scarce runway capacity. Last years occurrences at LaGuardia confirm the potential of the first-come-first-serve procedure to contribute to high delays.

Table 3 Operations and Delays at LaGuardia.

	Pre Air-21, April 2000	Post Air-21, October 2000	Post Air-21 lottery, April 2001
Allocated Slot Reservations per Peak Hour	71	104	81
Monthly Operations	31,116	37,373	34,874
Monthly Delays	3,109	10,226	2,941
Average Daily ATC Operations	1,039	1,268	1,162
Average Daily Delays	104	330	98
Percentage of Operations Delayed	10	27	8
Average Delay Time (minutes)	44	40	41

Source: FAA’s OPSNET and FAA’s Slot Administration Office (FAA 2001).

Air-21 provided immediate slot exemptions for flights operated by new entrant carriers or flights that serve small hub and non-hub airports with aircraft with 70 or fewer seats. While these exemptions were at a manageable level at Chicago O’Hare and Kennedy Airport (Moorman 2000), air carriers filed exemption requests for more than 600 new flights a day at LaGuardia (FAA 2001). These requests led to about 300 exemption flights, which expanded the number of allocated slot reservations from 71 in April 2000 to more than 100 in October 2000 (Table 3). What followed was an increase of more than 300% in average daily delays. In response to this development the US Federal Aviation Administration (FAA) capped Air-21 slot exemptions at 159 per day, beginning in January 2001. These slot exemptions have been allocated by a slot lottery. The FAA is currently analysing different administrative and market based approaches to better allocate capacity at LaGuardia in the future.

The main effect that can be expected from congestion pricing compared to slot trading is in relation to equity. If airport charges are going to reach market clearing levels without

producing too much congestion, the resulting “windfall” profits are transferred to the airport. However, these airport charges are going to discourage less profitable air carriers from using the airport just as they were discouraged before by high prices on the slot market. Thus, the effect of congestion pricing on competition compared to the effect of slot trading on competition is not going to differ greatly.

5. Conclusion

The current regulatory framework for the allocation of runway slots in the EU neglects the positive effects of market mechanisms. The trading of runway slots is rejected with referral to the development in the US. However, the analysis of the US market for runway slots does not reveal evidence for market failure. To the contrary, there is evidence for an increase in the overall efficiency of the market due to slot trading. Even the high passenger fares of slot constrained airports compared to unconstrained airports can reflect an efficient allocation of scarce airport capacity to passengers. If passenger demand is large compared to the availability of airline services, then passenger fares have to increase to reach a market clearing level. Moreover, the resulting windfall profits for the airlines are primarily a problem for equity and not for allocation. To address the concerns of the European Commission about the concentration of slot holdings, slot trading should be combined with a strict application of competition law.

During the next years the slot constraints at Chicago O’Hare and the airports in New York are going to be completely replaced by a first-come-first-serve allocation of runway capacity. If passenger demand is low enough compared to the capacity of the respective airport, this model will produce an efficient result. However, if passenger demand is too high, then congestion cost are expected to increase until a non optimal level. The experiences with slot exemptions to new entrant carriers at LaGuardia has already confirmed this conjecture. Moreover, compared to slot trading, congestion pricing is not expected to change much with reference to the competition issue.

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