Pricing to Reduce Airport Congestion

JOSEPH V. YANCE, Department of Economics, Boston University

•INTUITIVELY, it seems clear that congestion is wasteful—that having people and capital tied up in commuter rush hours and in long delays at airports waiting to land or take off does not represent a useful employment of these resources. Yet, in spite of this, congestion continues.

The trouble lies in the nature of the costs and incentives that are presented to the traveler or common carrier. For example, as the hourly movement rate at an airport increases, the average delay increases. The individual airline feels the cost of the average delay; however, what it does not feel is the increase in delay that an additional movement imposes on others. In other words, part of the cost of an additional movement is an "external" cost not felt by the user himself, but imposed on other users. An individual will, therefore, continue to use the facility even though the total extra cost to himself and society is greater than the value of the trip.

Economists pointed out this problem at least as long ago as 1924 and indicated a solution: Charge a "congestion toll" equal to the cost of the delay that the marginal user imposes on others. If the individual has to pay a toll equal to the external cost, then he will not use the facility unless the value of use is at least as great as the incremental cost to society. The use of the facility will then be "economically efficient."

APPLICATION TO WASHINGTON NATIONAL AIRPORT

To get an empirical idea of movement rates, average delays, and marginal external delays, consider Table 1. The table is based on a regression analysis of delay data at Washington National Airport obtained during a one-week survey in 1967 (1). The data are for a typical combination of aircraft that use the airport, 60 percent carrier aircraft and 40 percent general aviation (small planes). The average delay refers to the average delay for planes waiting to take off, or the time spent in holding patterns waiting to land. The marginal external delay shows the delays that a single movement imposes on other users. Thus, at a movement rate of 75 aircraft per hour, which is considered to be about the capacity of the airport, the average delay is estimated to be 3.6 min; the delay a carrier movement imposes on other aircraft is 14.3 min (considerably larger than that the aircraft itself incurs). Other figures pertain to general aviation movements, and to delays and external delays at night.

At Washington National a partial quota system has been in effect for two years. It affects mostly scheduled flights; extra sections of shuttle flights are permitted beyond the quota, and the restrictions have never really been applied to general aviation. But as a result of the restrictions, the number of flights is undoubtedly much less than it would be if the scheduled air carriers were permitted free access to the airport.

I think the external costs under present conditions give some indication of the congestion fees that would be appropriate under a pricing solution. Before discussing the figures, I might mention that the present landing-fee policy is based on the gross landing weight of the airplane—30 cents per thousand pounds for jet aircraft, and 15 cents per thousand pounds for propeller aircraft with a minimum fee of $4.00. Thus the landing fee ranges from $6 for an F-227 to $40 for a B-727, and averages about $20 for carrier aircraft. The landing fee covers both the landing and takeoff, so the average fee per movement is about $10.

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TABLE 1

AVERAGE DELAY AND MARGINAL EXTERNAL DELAY (MED)
(Minutes)

Movements/hour	Daylight			Dark		
	Avg. Delay	MED/Movement		Avg. Delay	MED/Movement	
		Carrier[a]	Gen. Av.[a]		Carrier[a]	Gen. Av.[a]
40	0.78	1.69	0.86	1.47	3.19	1.62
50	1.21	3.27	1.67	2.29	6.18	3.15
60	1.86	6.04	3.09	3.52	11.41	5.84
65	2.32	8.16	4.17	4.38	15.41	7.88
70	2.88	10.90	5.58	5.44	20.59	10.54
75	3.585	14.31	7.32	6.78	27.03	13.83
80	4.46	18.76	9.60	8.43	35.44	18.13
90	6.89	38.41	19.65	13.02	72.56	37.12

[a]60 percent of aircraft that use airport is carrier; 40 percent is general aviation.

Let us compare this with current external costs. Table 2 gives the amount of traffic on an average weekday and the external costs caused by a carrier movement. In estimating these costs, we have assumed that carrier aircraft cost $300 per hour to operate and that each aircraft carries 50 passengers, whose time is worth $4 an hour, for a total cost of plane and people of $500 per hour. For general aviation planes, a total cost figure of $50 per hour has been used.

The external costs under present conditions, therefore, range from about $24 during the 7:00 a. m. hour to $139 during the 5:00 p. m. hour. The figures indicate what I think would be good estimates of congestion tolls for an initial trial. Thus, in place of fees averaging $10 per movement for carrier aircraft, we might have fees of from $40 to $125 per movement for carrier aircraft. Fees of this magnitude would probably go a long way toward making the quotas unnecessary.

Figure 1 shows the pattern of external costs during the day along with a smoothed out version of the curve, which is a suggested fee schedule with three discrete levels—$40, $75, and $125 per carrier movement. According to our analyses, a small plane costs, in terms of the delays it imposes on other users, about half as much as a carrier plane. Small planes should, therefore, pay fees equal to half those of carrier planes.

TABLE 2

AVERAGE WEEKDAY MOVEMENT RATES AND EXTERNAL COSTS

Hour	Movements/Hour[a]			External Cost/ ACR Movement	Suggested ACR Fee/Movement
	ACR[b]	Non-ACR	Total		
7:00 a. m.	38.4	7.8	46.2	$23.97	$40
8:00 a. m.	39.6	28.2	67.8	48.66	40
9:00 a. m.	45.0	31.4	76.4	80.80	75
10:00 a. m.	44.2	16.4	60.6	48.69	40
11:00 a. m.	43.6	16.4	60.0	46.50	40
12:00 noon	42.8	19.6	62.4	48.13	40
1:00 p. m.	37.8	18.8	56.6	31.85	40
2:00 p. m.	38.4	19.4	57.8	34.01	40
3:00 p. m.	38.2	23.2	61.4	37.53	40
4:00 p. m.	43.8	31.2	75.0	73.40	75
5:00 p. m.	46.0	25.8	71.8	139.37	125
6:00 p. m.	45.6	21.4	67.0	118.66	125
7:00 p. m.	40.8	15.6	56.4	69.20	75
8:00 p. m.	42.8	11.6	54.4	71.63	75
9:00 p. m.	44.2	6.6	50.8	68.68	75
10:00 p. m.	35.6	4.8	40.4	33.00	40

[a]Average hourly movement rates, Monday through Friday, November 13 through 17, 1967.
[b]Carrier aircraft.

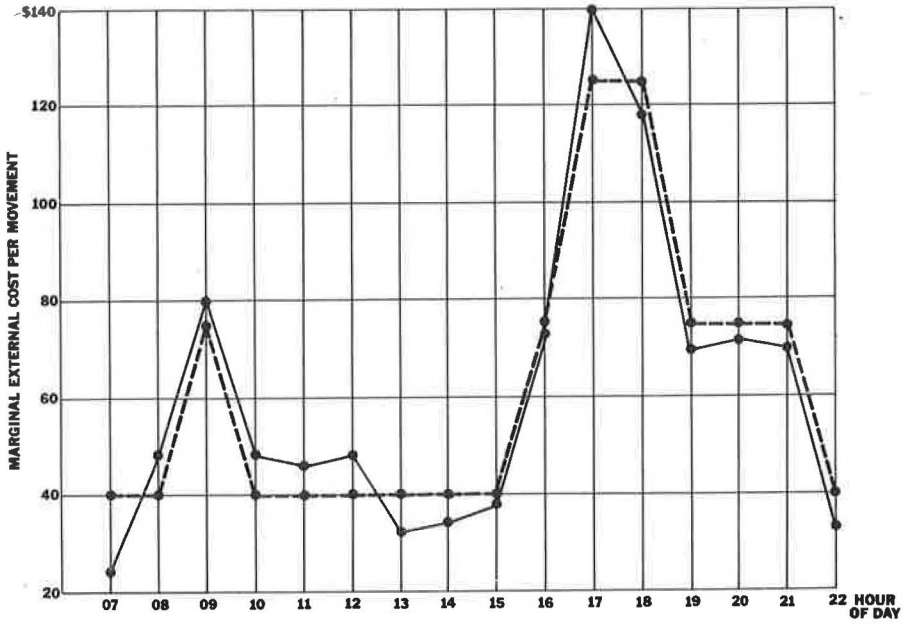

Figure 1. Marginal external cost per air-carrier movement and suggested fee per movement for congestion pricing.

ADVANTAGES OF A PRICING SOLUTION

A promising step toward the use of congestion pricing was taken in 1968 when the Port of New York Authority increased its minimum landing fee from $5.00 to $25.00 during peak hours at the three major New York airports. The fee increase has resulted in a decrease of about 25 percent in general aviation traffic at the three airports.

At the time the change was announced, Transportation Secretary Boyd issued a press release in which he tentatively approved the increase, but suggested that peak-hour fees should apply to carriers as well as to general aviation. The initiative for setting fees rests with individual airport authorities. The Federal Aviation Administration (FAA) and the U. S. Department of Transportation require that fees be nondiscriminatory, but the Secretary's statements indicate that congestion fees would not, on their face, be considered discriminatory.

Nevertheless, for various reasons (including the fact that some of the airports are tied to long-term contracts with the airlines) airport authorities have not moved very fast in adopting landing-fee policies to reduce congestion. When the delays at the major airports increased substantially, the FAA moved to introduce a quota system for reducing congestion.

The quotas, which were effective as of June 1, 1969, established hourly movement limits at the New York, Washington National, and O'Hare Airports. The quotas required large reductions in the number of general aviation flights and, to a smaller extent, carrier flights. The quota system that has been in effect at Washington National during the last two years has not worked too badly, but there are some objections to the new quota system that should be mentioned. I think that on three points a quota system is inferior to a pricing solution.

First, it is very difficult to implement a quota system. The one in effect at Washington National was relatively easy to work out because schedules are essentially the same for five days of the week. There are only about a dozen airlines involved, and they are able to effect changes in schedule slots through horse-trading. This sort of bargaining becomes increasingly difficult as the number of airports and number of airlines involved increase.

For example, the director of scheduling for American Airlines mentions the case of one of his planes that goes from Washington to Chicago to New York and back to Chicago. A change in schedule for this one plane might require the concurrence of scheduling committees in each of three cities (2). The committee of airlines in New York must attempt to allocate slots for 40 airlines whose schedules are variable during the week, requiring practically day-by-day allocation. There is, furthermore, no guarantee that such allocation will lead to efficient use of airport capacity. (For example, the shuttle was arbitrarily threatened by the quota system.)

Even if efficient schedules can be devised, a second question needs to be considered: Will the quota system lead to a distribution of income that we consider to be good? The scarce factor here is primarily airport capacity. When a factor is scarce, in a normal market situation, its price is bid up, and the "scarcity rents" go to the owners of the factor. Here, however, the rights to scarce airport capacity are being awarded to the airlines; they will get the scarcity rents. The question of who should obtain these rents is a matter of choice; I would prefer to see them go to the local communities, rather than to the airlines.

Finally, I think that alternative methods of allocating airport capacity should be examined in a long-run context. At present, it seems that New York and Chicago each need another airport. However, the demand is somewhat overstated; there is excess demand in part because the users of the present airport are not required to pay the costs they are imposing. But suppose that, taking this into account, there is need for another airport in each of the two cities. The new airports being proposed are 30 or 50 miles out of the city. If those airports are built, a way to ensure their utilization is through some sort of price policy where considerable rents are earned at the close-in airports. Otherwise, we can have a case similar to that in Washington, where congestion persists at the close-in airport while the outlying airports are underutilized.

In summary, with a fee schedule based on external costs, first, the most valuable uses of the airport could be sorted out with a minimum of government intervention and airline collusion; second, the local community would have, what I think is deserved, a new source of revenue; and third, we would have a market test of the need for new airports and a system that would guarantee that, if those airports are built, they will be used.

ACKNOWLEDGMENT

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