Peak Pricing As It Might Apply to Boston-Logan International Airport

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Delay, a chronic problem at many airports, results from an imbalance between airfield capacity and demand. This problem traditionally is addressed through efforts to increase physical capacity. Market-based approaches have been discussed but not yet implemented in the United States. Ways in which peak-period pricing might apply to Boston-Logan International Airport and in which it might affect delay are demonstrated through five steps. First, peak period is identified through analysis of hourly demand and delay data. Second, a cost allocation system dividing airfield costs into three categories—operations, weight, and capacity—is developed. Third, an air service model to predict flights and markets affected by fee changes is generated. Fourth, the expected delay reduction is projected, and fifth, cost savings for airlines and passengers are forecast. Results defined the peak period for delay and congestion to be 2:00 p.m. to 8:00 p.m. weekdays. The cost-allocation method produced a capacity fee just under $100 during the peak period. The air service model estimated a 15 percent reduction in peak-hour flights. Reductions were predicted primarily in high-frequency regional markets with competing airlines. No community was expected to lose access to Logan, even during the peak period. Peak-period delay was predicted to be reduced by 10,000 hr annually, resulting in about $13 million in airline savings and $15 million in time savings for passengers.

Airport congestion and its resulting delay have been a chronic problem at many major U.S. and international airports. The prevalence of airport delay became such a high-visibility public issue during the 1980s that the U.S. Department of Transportation (DOT) began requiring airlines to provide "on-time performance" statistics that confirmed the severity of the problem. Even the downturn in the economy and flight activity during the early 1990s did not eliminate the trouble with delay. Furthermore, now that aviation activity levels have begun to rise again, public awareness and impatience with increasing delays can be expected to rise as well.

Delay results from an imbalance between airfield demand and capacity: delays occur when more aircraft are scheduled into an airport than can be accommodated safely within a given period. Because delay is determined largely by these two parameters, increasing physical capacity (i.e., adding runways) and managing demand are two remedies. Attempts to solve the delay problem traditionally have focused on increasing physical capacity, although that frequently is difficult because of environmental, legal, and political impediments. FAA, which has regulatory authority over U.S. airspace, has managed demand at four U.S. airports by imposing fixed hourly operations limits, or "slots," at Kennedy, LaGuardia, O'Hare, and Washington National airports. Although much has been discussed in transportation and economic literature, no purely market-based approach to peak-period pricing has been implemented at U.S. airports. This paper describes an analytical approach to developing a peak-period pricing system for Boston-Logan International Airport. The proposal, however, has not been implemented.

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BOSTON-LOGAN INTERNATIONAL AIRPORT

Boston-Logan International Airport is an example of a facility with frequent unacceptable levels of delay. Although some limited possibilities for increasing physical capacity may exist at Logan, they cannot be implemented immediately and may not be sufficient to reduce congestion to acceptable levels. Thus, "peak-period pricing," a method to reduce delay through differential pricing, has been investigated as a market-based response to Logan's chronic delay.

Physical Characteristics

Logan Airport is located on a peninsula jutting into Boston Harbor in Massachusetts. Surrounded by water and century-old urban neighborhoods the airport's 2,300-acre area has been fixed for decades. Logan has four major runways (ranging from 7,000 to 10,000 ft in length) and a very short commuter runway (2,450 ft). Two of the four runways are parallel but separated by only 1,600 ft, making the runways too close for simultaneous instrument approaches. Several of the major runways cross each other, thus offering flexibility for operations in varying wind conditions but limiting the maximum number of operations that can be handled when they are used in combination.

Airport Services

Despite Logan's small size (Dallas/Forth Worth Airport has 18,000 acres and the new Denver airport has 30,000 acres in comparison), Logan accommodates an unusually high number of both services and operations. Logan provides six major types of aviation services: both international and domestic commercial passenger flights, all-cargo service, commuter flights, charters, and general aviation. Each of these users has different aircraft types, operating patterns, and facility requirements. For example, international passenger services requires a customs and immigrations hall; cargo services needs buildings with both truck and aircraft access; general aviation operations has its own terminal and aircraft apron; and international, domestic, charter, and commuter carriers require multiple passenger terminals, aprons, and gates of different sizes. Although other airports, such as Washington National and LaGuardia, handle comparable passenger volumes for similar land areas, each of these airports is supplemented by one or more large airports for long-haul and international services. By contrast, Logan is the major short- and long-haul airport for the six-state New England region. As a result, the pressure on Logan's facilities is great, especially at certain times during the day.

Whereas most airports serve as either primarily a hub or an origin and destination (O&D) point, Logan is both a domestic and cargo O&D airport as well as an international and commuter hub. As a result of this dual modality, Logan has 40 competitive airlines for just under 500,000 operations annually. Logan has developed, rather uniquely, as a major commuter-hub airport with three competing regional airline systems that are each associated with a code-sharing affiliate. Several smaller code-sharing and independent regional carriers also serve the market.

These highly competitive regional services are unusual. First, there are often as many as four separate airlines, both jet and nonjet, competing in the same regional markets. Second, regional carriers frequently compete with jet carriers, which are their own code-sharing affiliates sometimes, on major city routes not traditionally considered as "regional" markets.

Because of its unusual service pattern, Logan has very high service frequencies, often using small commuter aircraft. More than 60 percent of regional flights at Logan are in aircraft with 19 or fewer seats. Logan also has the highest overall percentage of nonjet aircraft operations at more than 50 percent and the smallest average aircraft size among major U.S. airports. Serving just below 23 million passengers in 1992, Logan ranked 10th among U.S. airports in total passengers but 5th in total aircraft operations. As a result of this combination of factors, Logan ranks fourth in delay nationally.

MEASURING DELAY

Even under ideal conditions, capacity at Logan is often insufficient to meet demand during peak periods. In reality, capacity often is restricted by factors that include the specific runway combination in use, wind and weather conditions, mix of aircraft types, and ratio of arrivals to departures. Depending on the combination of conditions, Logan's capacity ranges from about 40 to 120 operations per hour. Because demand does not vary much with the hourly capacity of the airport, when high demand coincides with periods of less-than-maximum capacity, delay at Logan can be, and historically has been, extremely high.

FAA classifies an airport as congested if it experiences more than 20,000 hr of aircraft delay a year. Although precise delay statistics for the nation's airports are difficult to obtain, there is no doubt that Logan Airport's threshold has been exceeded greatly for a long time. Estimates of aircraft delay at Logan for 1992 are near 100,000 hr a year, or five times the FAA threshold for a congested airport.

The cause for increasing delay at Logan is the constant increase in the number of scheduled airline operations without a comparable growth in the number of passengers. Logan's passenger volume dropped at the beginning of this decade, and, although now returning to previous levels, passenger volume has not yet reached the historic 1988 peak of 23.7 million passengers (Figure 1).

Growing numbers of operations and a declining or unchanging or flat volume of passengers indicates fewer passengers per aircraft operation. Indeed, Logan today ranks at the bottom of the world's 25 busiest airports in passenger volume per aircraft operation with an average aircraft size of 85 seats per operation. Figure 2 demonstrates the source of the increase in operations and decrease in average aircraft size. Whereas jet operations have increased by only 9 percent since 1986, nonjet operations have increased by more than 75 percent. Figure 3 indicates that Boston is the busiest commuter airport in the country and had the highest overall percentage of scheduled regional carrier flights (as a share of total scheduled departures), 54 percent, in August 1993. Figure 4 shows the growth in regional airline activity at Logan; data include only nonjet aircraft.

A high volume of operations with relatively few passengers on each operation puts enormous pressure on the airfield, especially during the busiest period of the day. Indeed, comparing Logan with other large airports raises interesting questions about efficiency. Most of these airports enplane between 65 and 135 passengers per flight, whereas Logan enplanes 56 passengers per flight.

Thus, the operational congestion and delay at Logan are driven not only by total passenger demand but also by a combination of factors, including the fleet that serves the airport. Furthermore, because delay is very sensitive to changes in demand when an airport is congested, reducing operations by even a relatively small number during the most congested period may reduce delay at Logan significantly. Reducing the number of peak-period operations could, in fact, allow Logan's total passenger volume to increase without additional delay, resulting in accommodating both current and future demand.

DEFINING PEAK PERIOD

The first step in developing a peak-period pricing method is to determine when congestion can be expected to be most intense. For Logan, hourly demand profiles were obtained for weekdays, Saturdays, and Sundays, and a delay estimation model was created using a combination of analytic techniques and simulation. Figure 5 shows the profile for average weekday demand for FY 1993 at Logan Airport. Although demand is high during both the morning and late afternoon/early evening, the duration of these peaks differs. Duration is important because the presence of high demand during a single hour is not sufficient by itself to cause serious delay. If an hour of high demand is preceded and followed by hours of low demand, severe congestion may not occur. On the basis of queuing theory, it is reasonable to define a peak period as one that has at least three contiguous hours of high demand. Similarly, practical experience indicates that it would make little sense to declare a "peak period" for pricing purposes of 2 hr or less. Users could then simply make minor schedule adjustments to avoid the peak period, which would have little effect on airfield congestion.

At a congested airport, a reasonable criterion for considering an hour of airfield activity to be in the peak period is that the number of operations demanded during that hour exceeds the average airfield activity for the day by 20 percent or more. This peak-period hour occurs when congestion and delay can be expected to be at their worst. Drawing from the reasoning of the preceding paragraphs, the following criterion reasonably defines peak period at Logan Airport for rate-setting purposes: a peak period will consist of a group of 3 or more contiguous hr; within this group any set of

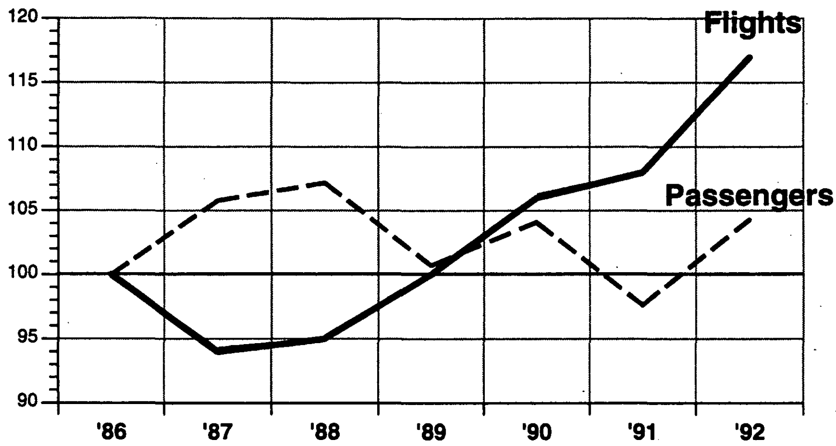

FIGURE 1 Growth in scheduled airline activity at Logan Airport by annual passengers and yearly August schedules (*sources*: *Aviation Department, Massachusetts Port Authority and* ABC World Airways Guide, *Reed Travel Group*).

3 contiguous hr will have a typical demand whose average (during the 3 hr) is at least 20 percent above the average for the day.

Congestion at Logan is heaviest during weekdays. The average number of weekday operations per hour during the 18-hr period from 6:00 a.m. to 11:59 p.m. is approximately 86, ranging from a low of 19 operations between 11:00 and 11:59 p.m. to a high of 115 between 5:00 and 5:59 p.m. Applying the preceding criterion yields a peak-period threshold of about 103 operations per hour. With a threshold of 103 hourly operations, the peak period at Logan would become the period from 2:00 to 7:59 p.m. on weekdays.

Figure 6 uses the maximum 3-hr average demand for each hour to illustrate the weekday profile at Logan. The figure also presents the distribution of total delay throughout the day from a simulation of the FY 1993 Logan demand with 10 years (1981–1990) of actual weather observations at the airfield. The figure clearly illustrates the significant increase in both demand and delays during the afternoon.

The peak period defined using this method is consistent with the current pattern of delays at Logan as reported by DOT. Figure 7 shows DOT on-time (i.e., arrivals/departures within 15 min of scheduled flight time) performance data for Logan by time of day as well as for the combined total of the top 29 U.S. airports (data for midmonth of each quarter, 1992). Both arrival and departure performances deteriorate beginning at about 2:00 p.m. These poor performances occurred despite an average 10-min increase in published flight times that the airlines have allowed during the past decade to account for expected delays at Logan. Although these statistics include effects external to Logan, they clearly confirm the existence of an afternoon/evening peak period at Boston. Therefore, the proposed peak period at Logan Airport would be from 2:00 to 7:59 p.m. on weekdays.

DEVELOPING A COST-ALLOCATION SYSTEM

The peak period having been established, the next analytical step was to articulate a structure for a time-differentiated rate for the peak period.

New Landing-Fee Structure

U.S. airports traditionally have charged landing fees based solely on weight—a fixed charge per 1,000 lb, sometimes with a minimum charge. This "weight only" charge fails to reflect two additional

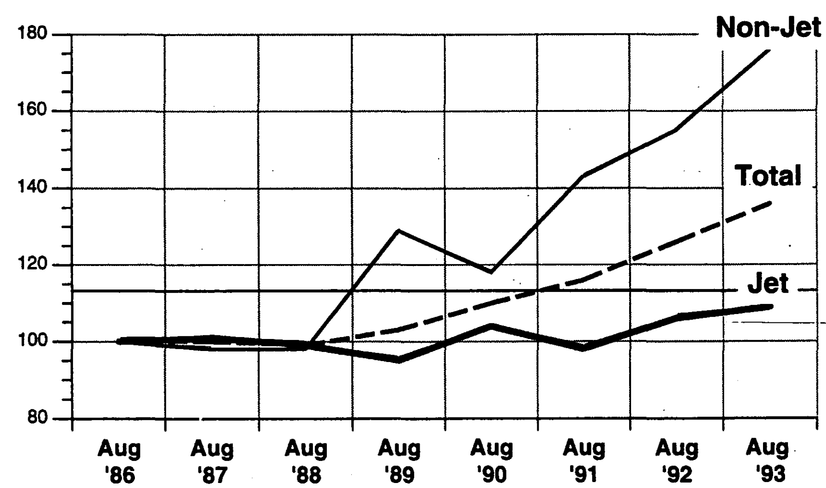

FIGURE 2 Growth in scheduled operations at Logan Airport (*source*: ABC World Airways Guide, *Reed Travel Group*).

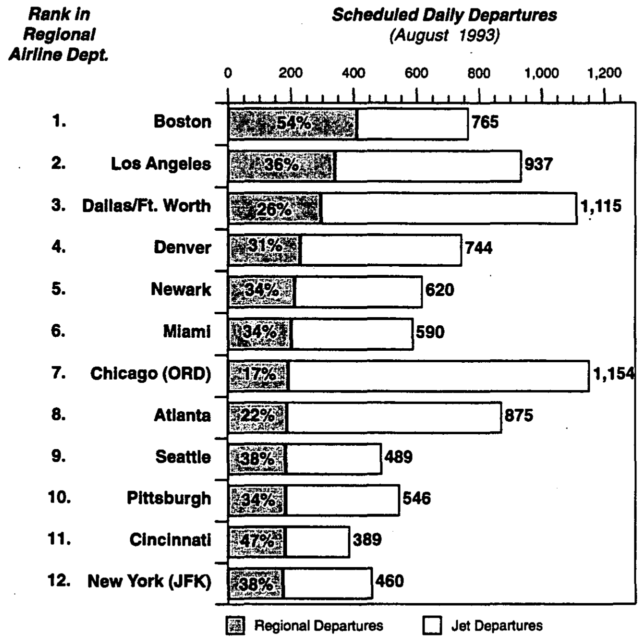

FIGURE 3 Comparison of regional airline departures among major U.S. airports, August schedules (1993 based on July advance schedules) (*source*: ABC World Airways Guide, *Reed Travel Group*).

dimensions of airport costs: first, some costs are "operations related"; that is, they are incurred for each operation, independent of the plane's weight, and second, certain operations-related costs are time dependent. Recognition of these factors produced a landing-fee structure that encompassed three components: a weight-based fee (per 1,000 lb), an operations fee (per landing, independent of weight), and a time-dependent operations or capacity fee, charged only during peak hours.

The three-part rate structure, drawn from different types of airfield costs, creates two incentives: the operations fee encourages carriers to choose larger aircraft because the same operations charge applies to all sizes, and the time-dependent peak-period fee encourages carriers to schedule operations outside of peak periods. Both incentives will reduce delay, first by reducing the total number of operations and then by further reducing the number of peak-period operations.

Whereas airport rate makers have not implemented similar pricing methods in the past, they can follow abundant precedents for them in utility rates. The electric utility industry is one that has an established history of variable pricing by time of day for managing peak demand. Not only do these utility rates recover costs, but the rates also send a signal to users about how their activities affect costs. The demand for services, which is influenced by the prices charged, affects the costs that the utility must incur to provide the desired services, thus affecting total costs. Regulators have encouraged innovative utility rate structures (e.g., time-differentiated pricing) that reflect the effect of peak-period use on a utility's costs.

Utility cost analyses, therefore, provide a useful model for setting cost-recovery airport rates. Whereas peak-period pricing allocates an airfield's costs differently than the traditional weight-based method, both are designed only to recover the costs of the airfield. The choice between methods, therefore, is unaffected by revenue.

Cost-Allocation Method

After establishing the three cost categories—weight, operations, and capacity—each airfield cost item can be assigned (in whole or in part) to these categories according to functional or causal relationships. The steps of this method, as applied to Logan Airport, follow.

To develop a rate structure that reflects cost relationships, it is necessary to identify qualitatively the main factors that drive a facility's costs. Next, the specific costs associated with each factor must be measured quantitatively. Finally, cost differences between classes of users (jets and nonjets) should be recognized. Thus, a three-step procedure commonly used in utility cost-analysis was followed: functionalization, classification, and allocation.

Functionalization

Functionalization is the process of identifying distinct functions of the airfield and grouping together the costs related to each function.

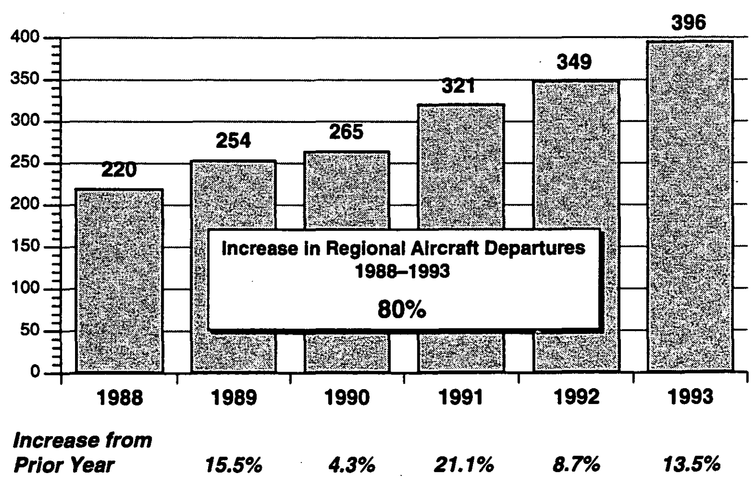

FIGURE 4 Recent increases in regional aircraft departures at Logan, August schedules (1993 based on July advance schedules).

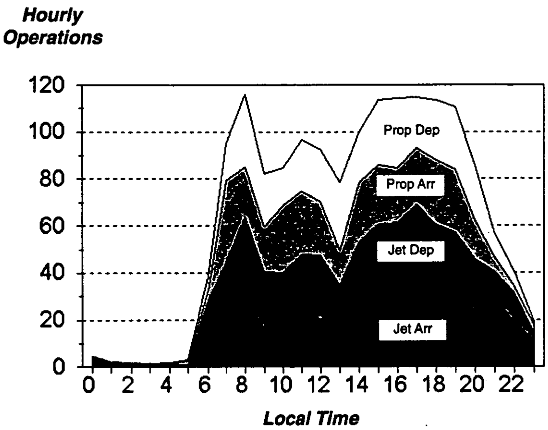

FIGURE 5 Average weekday demand, Logan Airport, FY 1993.

The main functional categories used in this analysis were (a) runways and taxiways, (b) aprons and ramps, (c) navaids and air traffic control support facilities, (d) general airfield costs, and (e) overhead. All airfield costs were functionalized into these five categories.

Classification

Classification is the process of analyzing causal relationships to determine which usage factors affect each functional category of costs. Each cost (or group of costs) was classified into three categories reflecting the main usage factors responsible for airfield costs: peak demand (i.e., aircraft operations during peak period), total aircraft operations, and aircraft weight. In many cases costs were divided among two or three usage categories rather than classified exclusively by one aspect of usage.

- *Capacity-related* costs are incurred to provide and maintain airfield capacity so as to manage peak demand. Capacity-related costs are considered to be attributable to and recoverable from facility users during peak periods.

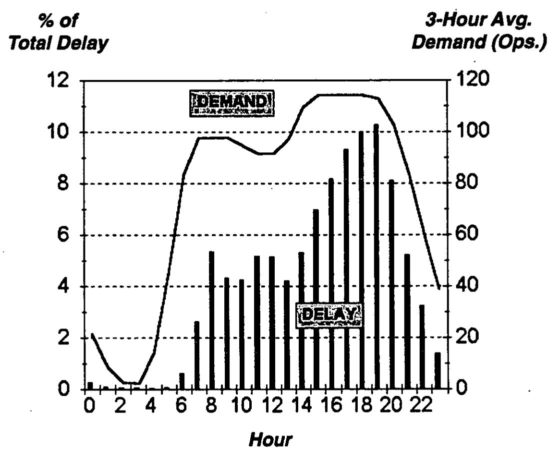

FIGURE 6 Average demand and simulated delays, Logan Airport.

- *Operations-related* costs are incurred for each operation regardless of the time when the operation takes place or the weight of the aircraft. Thus, these costs are the same for peak and off-peak users but are not, however, always the same for jet and nonjet users.
- *Weight-related* costs vary with the weight or size of the aircraft.

Allocation

The final step in cost disaggregation is allocation, which separates users into two or more groups and assigns costs appropriately. This step recognizes qualitative differences among users according to how they affect a particular category of costs. Table 1 demonstrates how costs are assigned by this method.

The allocation process recognizes differences between jets and nonjets, such as by the levels of noise and air pollution they create.

Application to Logan

Applying this cost-allocation method to Logan Airport required disaggregating the total airfield costs according to the three-step system. Table 2 presents the effect of analyzing Logan's Airport FY 1993 airfield budget according to the cost-allocation method.

Table 3 indicates the changes that would result from applying these fees to different-sized aircraft operating at Logan. All aircraft operators would be charged the basic fee (i.e., for operations and weight) whenever they arrived at Logan. During peak hours a separate charge would be added for both landings and departures, a reflection of the time-dependent nature of capacity-related costs. Aircraft with slightly more than 100 seats would pay about the same average cost per operation as they do under the weight-based system. On average, smaller aircraft would pay more and larger aircraft would pay less than they do now. Larger aircraft, however, would always pay higher total fees than smaller aircraft.

AIR SERVICE IMPLICATIONS OF PEAK-PERIOD FEES

Developing Peak-Period Air Service Model

With the ultimate goal of delay reduction in mind, the next important analytical step in developing a peak-period pricing method is to assess air service implications from several perspectives. For example, how many flights would be affected during the peak period? Which markets and airlines likely would be affected? Would fares be expected to increase, and, if so, in which markets? Would smaller communities that rely on regional airlines for service to Logan be significantly affected by either service reductions or fare increases? What effects would service changes have on expected levels of delay, and what cost savings would be expected for airlines and passengers as a result of the predicted delay reduction?

To address these questions, an analytic model was developed for estimating the effect on profitability for each regional airline by market. The model also predicts, by carrier and market, the probability of flight cancellations or rescheduling to avoid peak-hour fees. A schematic of the model appears as Figure 8.

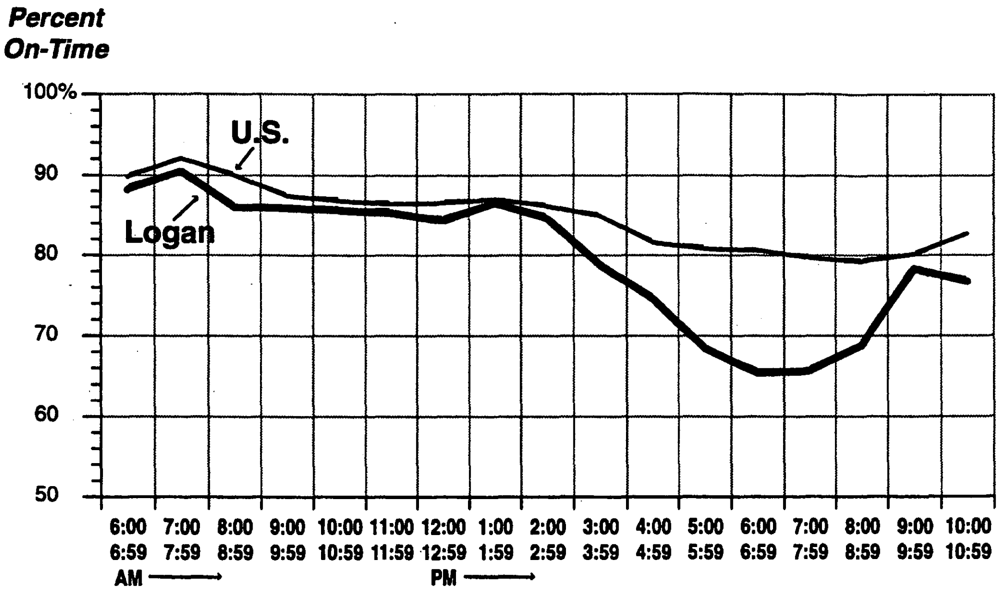

FIGURE 7 On-time performance at Logan Airport versus U.S. average for major airports.

Description of Model and Underlying Assumptions

The first step of the model is to estimate the change in carriers' costs of providing service according to actual schedules (i.e., summer and winter) in each market, assuming peak-period pricing is in effect.

As a rule, all major jet carriers would have cost savings in all markets. There would be savings because these carriers operate aircraft of 100 or more seats on average, which means lower fees according to the average Logan distribution of 35 percent peak and 65 percent off-peak operations. However, the magnitude of cost savings, even for the largest widebody aircraft, would be less than $1.00/passenger and would not be sufficient to induce either more flights or lower fares. Therefore, the peak-hour pricing fees are expected to have no material effect on the flight schedules of jet airlines at Logan.

TABLE 1 Illustrative Airfield Cost-Allocation Methodology for Logan Airport (millions)

Function Classification	Total	User Group Allocation Jets	Non-Jets
Runways & Taxiways			
Capacity	$29.3	$18.4	$10.9
Operations	11.0	6.3	4.7
Weight	17.5	16.2	1.3
Total	57.8	40.9	16.9
Aprons & Ramps			
Capacity	0.0	0.0	0.0
Operations	0.0	0.0	0.0
Weight	22.8	21.1	1.7
Total	22.8	21.1	1.7
Navaids			
.	.	.	.
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Note: These figures are net investments.

Regional airline flights, on the other hand, would experience higher average costs on virtually all routes. The model assumes that regional airlines would, if possible, pass these higher costs on to passengers as fare increases, as is the case with other costs of operations, such as higher fuel prices. In some market situations, however, competitive forces will prevent carriers from increasing their fares. For example, a regional airline operating a 19-seat aircraft, which may require it to charge a $10 fare increase (accounting for the price elasticity of passengers) to maintain the same profit in a market, would not be able to increase its fares if it were competing with a jet carrier that would not need to increase its fares or with another regional carrier that required only a $5 fare increase to operate a 50-seat aircraft.

Therefore, the model assumes that in any given market a carrier could increase fares only to the extent of the least affected competitive carrier in the market. When regional aircraft are competing with jet service, no fare increase is assumed. Cost increases that cannot be offset by fare increases because of competitive circumstances are assumed to be absorbed by the carrier as reduced profitability.

The effect on profitability model considers, to the extent possible, the specific economic characteristics of each regional carrier route, including the mix of local and connecting traffic, average fares and prorations of fares for connecting traffic, and the type of aircraft and time of day of the flights. In estimating the effect on traffic due to a fare increase, a −0.7 price elasticity was assumed. This price elasticity means that the required fare increase due to higher airfield user fees will exceed the amount of the cost increase, since some passengers will not travel at the higher fare level.

The model then estimates the probability of peak-period flight cancellations according to the percentage reduction in the profit margin for each carrier market. For example, with a profit reduction of 2.5 to 5.0 percent, 30 percent of a carrier's peak-period flights are assumed to be canceled. The cancellation rate rises to 50 percent, with a 5.0 to 7.5 percent reduction in profit margin, and to 75 percent if the profit margin is reduced by more than 10.0 percent.

TABLE 2 Logan Airport Airfield User Charges, Existing and Illustrative Rates, Using Peak-Period Pricing

Existing Rates	
Weight Charge	$1.69 per 1,000 lbs. (landed weight) (with a minimum $25 landing fee)
Illustrative Rates	
Weight Charge	$.55 per 1,000 lbs. (per landing, all aircraft types)
Operations Charge	$56.09 per jet landing $40.58 per nonjet landing
Peak-Period Charge	$99.94 per landing and per takeoff in the peak period

The peak period is defined as 2:00 p.m. to 7:59 p.m., Monday through Friday.

Expected Changes in Peak-Period Service

The model predicts that if this peak-period pricing method were introduced at Logan, a total of 111 weekday operations would be expected to be moved out of the peak period. This peak-period reduction represents a reduction of approximately 30 percent of regional airline flights and about 15 percent of total scheduled air-carrier operations during the weekday peak, according to July 1993 schedules. The model estimates that 72 of the flights would be canceled (or an average of 12 operations per peak hour) and that 39 flights would be rescheduled off-peak. Most of these rescheduled flights are within 30 min of the beginning or end of the peak period.

The model estimates that the vast majority of flight cancellations are in markets that currently have exceptionally high flight frequencies. (Table 4 presents a summary of the predicted service and fare changes in each of the 49 nonstop markets served by regional airlines from Logan.) For example, more than half of the flight cancellations are predicted to be in five markets: Portland (Oregon), Bangor (Maine), New York (Kennedy Airport), Newark (New Jersey), and Philadelphia (Pennsylvania). Each of these markets currently has a minimum of 29 daily roundtrip flights; each market is served by three or more airlines and enjoys nonstop jet service. Clearly, the expected service reductions will not greatly reduce passenger travel options in these high-frequency markets, and frequent service will continue to be provided during the peak period.

With few exceptions, all other predicted flight cancellations are in well-served markets with 10 or more daily roundtrips. Some of these markets also have nonstop jet service. No community would be expected to lose access to Logan because of this peak-period pricing method.

Smaller communities and markets with monopoly service by regional airlines would be expected to have fare increases rather than service reductions. In fact, more than half of the 49 regional carrier markets served from Boston are not expected to lose any flights but may have fare increases near $5 to $15. In most of these markets, this increase would be less than a 10 percent increase in fares.

TABLE 3 Comparison of Existing and Illustrative Airfield User Fees Using Peak-Period Pricing at Logan Airport for Representative Aircraft Types

		Average Airfield User Fee per Operation		
Aircraft Type	Average Seats	Existing[1]	Peak Pricing Method[2]	Increase (Decrease)
B-747	400	$493.48	$223.62	$(269.86)
B-757	190	167.31	117.47	(49.84)
B-727	150	129.29	105.10	(24.19)
B-737	108	92.11	93.00	.89
ATR-42	47	29.58	64.89	35.32
Metro	19	12.50	59.12	46.62

[1]Existing landing fee divided by 2 for average fee per operation.
[2]Weighted average fee assuming 65% off-peak and 35% peak operations.

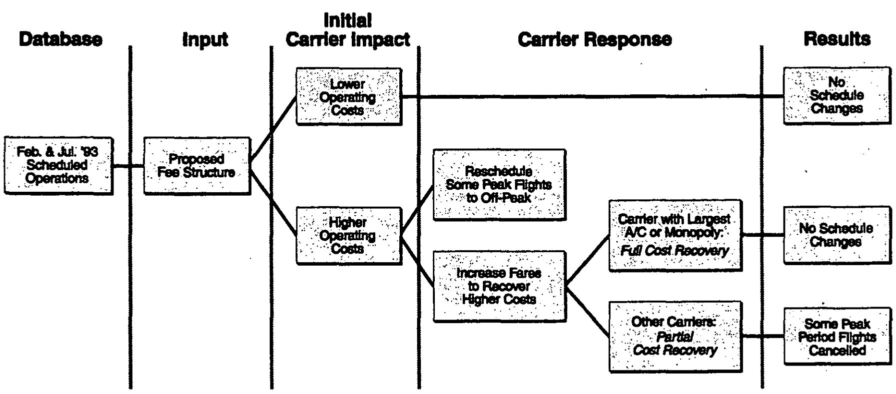

FIGURE 8 Model for estimating impact of revised fee structure.

TABLE 4 Summary of Predicted Service and Fare Effects by Market at Logan Airport with Peak-Period Airfield User Fees, July 1993

Rank	Market		Weekday Flights (All Day) \1	Peak Period Weekday Flights Canceled		Weekday Seats (All Day) \1	Peak Period Weekday Seats Canceled		Fare Increase	
				Number	Percent		Number	Percent	Net	Percent
1	Newark	*	76	4	6%	7,730	79	1%	$0.00	0%
2	Portland	*	68	15	21%	2,585	355	14%	$0.00	0%
3	New York (JFK)	*	64	6	9%	3,677	240	7%	$0.00	0%
4	Philadelphia	*	60	3	6%	4,835	98	2%	$0.00	0%
5	Washington National	*	59	1	1%	6,666	25	0%	$0.00	0%
6	Bangor	*	58	9	15%	2,455	225	9%	$0.00	0%
7	Manchester		44	4	8%	954	71	7%	$4.64	3%
8	Islip		43	2	6%	1,055	46	4%	$8.53	7%
9	Burlington, VT		41	3	8%	1,007	60	6%	$5.10	4%
10	Baltimore	*	34	2	5%	2,713	68	3%	$0.00	0%
11	White Plains		34	1	3%	932	19	2%	$7.79	7%
12	Martha's Vineyard		33	4	13%	497	47	9%	$4.99	4%
13	Lebanon		32	3	8%	608	48	8%	$5.79	4%
14	Hyannis		31	4	11%	776	67	9%	$2.72	2%
15	Nantucket		31	3	11%	640	66	10%	$5.22	4%
16	Albany		29	1	2%	551	12	2%	$15.03	14%
17	Washington Dulles	*	25	1	2%	2,908	21	1%	$0.00	0%
18	Syracuse	*	22	2	9%	1,126	45	4%	$0.00	0%
19	Rochester	*	20	1	6%	1,324	34	3%	$0.00	0%
20	Hartford		18	2	9%	467	32	7%	$4.14	3%
21	Buffalo	*	15	0	2%	1,120	10	1%	$0.00	0%
22	Montreal	*	14	1	7%	1,585	35	2%	$0.00	0%
23	Ottawa, OT		14	0	0%	462	0	0%	$5.40	4%
24	Presque Isle		13	0	1%	311	2	1%	$5.10	3%
25	Portsmouth		12	0	0%	412	0	0%	$2.19	1%
26	Providence		11	1	9%	233	18	8%	$4.95	3%
27	Provincetown		11	0	0%	99	0	0%	$16.02	12%
28	Rockland, ME		10	0	0%	158	0	0%	$8.81	6%
29	Quebec, QU		10	0	0%	190	0	0%	$11.99	8%
30	Saint John, NB		9	0	1%	238	2	1%	$7.30	4%
31	Harrisburg		8	0	0%	296	0	0%	$7.15	5%
32	Bridgeport		8	0	0%	152	0	0%	$10.51	7%
33	Bar Harbor		8	0	0%	152	0	0%	$12.18	11%
34	Farmingdale, NY		8	0	0%	152	0	0%	$11.39	10%
35	Moncton, NB		8	0	0%	220	0	0%	$8.98	4%
36	Augusta		8	0	0%	152	0	0%	$6.81	5%
37	Richmond	*	7	0	2%	571	12	2%	$0.00	0%
38	Binghamton		6	0	0%	114	0	0%	$12.06	8%
39	Atlantic City		6	0	0%	108	0	0%	$16.84	17%
40	Newburgh		6	0	0%	156	0	0%	$7.85	5%
41	Allentown		6	0	0%	186	0	0%	$6.22	5%
42	Norfolk	*	5	0	2%	446	8	2%	$0.00	0%
43	Rutland		5	0	0%	75	0	0%	$11.90	9%
44	Wilkes-Barre		4	0	0%	76	0	0%	$16.94	13%
45	Ithaca		4	0	0%	76	0	0%	$15.54	13%
46	Yarmouth, NS		4	0	0%	148	0	0%	$0.33	0%
47	Laconia		4	0	0%	60	0	0%	$6.29	5%
48	Fredericton, NB		3	0	0%	54	0	0%	$15.51	9%
49	Keene		1	0	0%	15	0	0%	$16.86	12%
	Total		1,050	72	7%	51,523	1,743	3%	$1.66	1% \2

Note: Ranked by total weekday flights.
* Indicates a market with jet carrier service

\1 Includes regional and jet carriers.
\2 Weighted average based on seat distribution.

Effect on Carriers

Three major code-sharing regional airline systems (Delta, Northwest, and USAir) account for 85 percent of the total scheduled regional airline operations at Logan. These three carrier systems would also be the most affected by the predicted flight cancellations, accounting for about 90 percent of the expected canceled flights. Among these large regional carriers, the most affected operates the highest number of 19-seat aircraft, often in competition with larger turboprop and jet aircraft. Therefore, although these three major regional airline systems would be affected, they and their code-sharing jet partners (and their passengers) also would be among the primary beneficiaries of the reduced congestion and delays at Logan.

DELAY SAVINGS

In bringing the analysis full circle, the next step was to determine what the delay savings for Logan Airport would be if these peak-period service reductions took place. Feeding the predicted cancellations and flight shifts back into the delay estimation model yields the prediction that service changes of this magnitude likely would reduce delay at Logan by a minimum of 10,000 hr annually during peak periods.

All airlines operating at Logan, including the regional carriers, would experience significant cost savings from delay reductions of this magnitude. Assuming standard operating costs for each aircraft type, including fuel and wages, airlines at Logan would be expected to save $13 million annually, whereas their passengers would save about $15 million in lost time.

CONCLUSIONS

The potential benefits of airport delay reduction, airline cost savings, and passenger convenience resulting from peak-period pricing at Logan Airport are substantial. However, for these benefits to be realized at Logan, or at any other airport, certain circumstances must be present. First, real, measurable congestion must occur regularly. Second, the airport must not be subject to FAA slots or any other external regulatory scheme that would reduce the effect of market forces. Third, because the proposed method targets only cost recovery and not netting profits for the airport's operator, there is a limited differential between peak and off-peak fees. Therefore, the peak-period fleet mix must be sensitive to relatively small fee changes. Finally, an airport ideally would have a sufficient quantity of air service to affected markets so that the reductions in peak-period operations would not eliminate access to a particular community. With these criteria in mind, a peak-hour pricing program would offer immediate and tangible benefits for airports plagued by congestion and delay.

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