ELSEVIER

Journal of Air Transport Management 11 (2005) 417–425

Journal of
AIR TRANSPORT
MANAGEMENT

www.elsevier.com/locate/jairtraman

Solving airside airport congestion: Why peak runway pricing is not working

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Abstract

The paper examines why peak runway pricing has never been effectively implemented. Some of the literature discussing the theory is examined to show the basis for the theory and the potential for flaws in practice. Three cases where airports attempted to implement peak runway pricing are analyzed. The findings indicate that there may be some institutional barriers to peak pricing theory that prevent effective implementation. Airports and others seeking to reduce congestion might consider focusing their efforts on working towards providing alternatives for passengers, rather than attempting to use peak pricing as a congestion-reduction mechanism in isolation.

Keywords: Airports; Peak pricing; Congestion

1. Introduction

The airport congestion problem, temporarily stifled by the effects of the tacks of September 11th and an economic downturn, appears to be returning. Late arrivals, defined as arrivals that are more than fifteen minutes late, declined from an all-time high of 1.36 million in 2000 to only 0.87 million in 2002. However, in 2003 that trend began to reverse itself, as late arrivals climbed to 1.06 million (Federal Aviation Administration, 2004a). We see 2004 even worse, as the percentage of delayed flights has climbed to almost 21%, which is almost as bad as 2000 (23%) and worse than 2002 (17%) (Federal Aviation Administration, 2004b). Moreover, airside congestion problems are returning to airports that are now additionally dealing with substantial delays in processing passengers. New security regulations are responsible for a higher level of uncertainty for passengers, who must now arrive at airports much earlier than they used to ensure that they have time to go through long security lines and board their flights. These two delay issues work in tandem to make air travel more frustrating and time consuming. This discourages air travel and reduces productivity, potentially damaging the health of the national and world economies.

Most of the scholarly research on this subject that has been conducted up to this point focuses on one plausible solution to this problem: airport runway peak pricing. Perhaps because of its lack of implementation, some more recent literature on airport congestion has moved on from pure peak pricing to slot auctions (De-Waal et al., 2003; Mehndiratta and Kiefer, 2003), however, airport peak pricing theory is still being refined (e.g. Pels and Verhoef, 2004; Zhang and Zhang, 2003; Brueckner, 2002a). Peak pricing theory proposes to charge aircraft operators the marginal cost of landing on a given runway at a given time (most airports charge a weight-based landing fee independent of time of day), and it has been the prevailing theory for how to reduce congestion since the 1960s. Although it has shown theoretical promise since its inception, pricing has seen little practical implementation. Where it has been implemented to some degree, at very few airports, it has not been particularly successful; most airports that implemented

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doi:10.1016/j.jairtraman.2005.05.007

some form of peak runway pricing have since scaled back their programs or eliminated them entirely.

This paper determines why peak runway pricing, despite being supported by theory, has failed in practice. Admittedly, the lack of implementation may be because, as comparative game theory explains, airlines internalize congestion costs at monopoly airports (Brueckner, 2002b). However, comparative game theory does not provide an explanation for why pricing proved unsustainable at the non-monopoly airports where it has been implemented. This article attempts to do so. First, the literature on airport peak pricing is briefly examined for potential flaws that might help explain the theory's practical difficulties. Second, three known cases of peak pricing are briefly examined to show specifically what went wrong in each case. Boston, New York, and London all implemented variations of peak pricing at their airports, and later modified or eliminated those programs. Suggestions for modifications to the theory are presented in the hope that scholars might more effectively contribute in the future to the discussion of how to solve the airport congestion problem.

2. Examining the literature

Levine (1969) describes the airport congestion problem and shows that the way landing fees are assessed could be changed to fix it. He notes that the typical structure of landing fees, based on weight, encourages smaller general aviation aircraft to land at virtually no cost. Levine assumes that people would be able to switch their arrival times without a measurable loss. However, as has been pointed out (Button and Reynolds-Feighan, 1999), there is a very low cross elasticity of demand between peak and off-peak periods for air travelers. This makes the assumption that people can switch their arrival times at minimal societal cost rather tenuous. Although low-cost carriers flying point to point routes may have changed demand elasticity recently, many airports in the US, especially the congested ones, are hub airports that rely on peaking hub and spoke networks.

Carlin and Park (1970) picked up on Levine's ideas and looked at the potential of marginal cost pricing at airports. After demonstrating how effective full marginal cost pricing might be in theory, they also argued that it was not applicable in the real world. They argued that equilibrium marginal cost pricing could be effective, but they did not demonstrate its effectiveness. Some (e.g., Fisher, 1989) have disagreed with Carlin and Park and noted that for an airport pricing scheme to work, prices must be set at the full marginal social cost, although more recent research has contradicted this finding (Brueckner, 2002a; Pels and Verhoef, 2004). This disagreement within the literature is emblematic of the larger problem—the fact that the political difficulty inherent in peak runway pricing is likely to limit its effectiveness in practice.

In the most thorough attempt to quantify the benefits of airport peak pricing, Morrison and Winston (1989) found that the delay one aircraft imposes on another can be substantial, and therefore argued that landing fees should be charged to account for that delay. Then they calculated the benefits from implementing such fees with and without associated investment in airport capacity increases. They found that optimal airport pricing, even without any infrastructure investment, would generate $3.82 billion in benefits (1988 dollars). Combined with efficient infrastructure investment, it could generate $11.01 billion (see Table 1). Unfortunately, their assumption of what constitutes efficient infrastructure investment is probably out of line with what is realistic for modern airports. Many airports today have no land available for expansion and even some airports that have land face serious opposition in moving their expansion projects forward. However, even the results for pricing without efficient infrastructure investment show questionable benefits. Morrison and Winston treat airport revenues and consumer surplus changes as equivalent costs and benefits. Airport revenues increase dramatically with efficient pricing (+$11.50 billion) while consumer surplus plummets (−12.53). In other words, travelers would have to pay more to airports, which would benefit enormously. Not only does this demonstrate why congestion pricing has found limited political acceptability, but also it may not be fair to consider these increases and decreases equivalent. Consumers would pay $12.53 billion annually for a $3.62 billion annual delay reduction under this scenario. This is a questionable exchange for passengers, even if society benefits overall.

Daniel (2001) takes on the political issue by arguing that pricing airport runways will actually improve equity by forcing private aircraft operators out of the peak period. This would create a net welfare transfer from

Table 1
Annual economic effects of efficient infrastructure policy for airports

Item	Efficient pricing and runway investment	Efficient pricing, current runway investment
Consumer surplus change from landing and takeoff fees	1.10	−12.53
Reduced delay to travelers	7.91	3.62
Carriers' operating cost savings	2.77	1.23
Airport revenues less costs	−0.77	11.50
Total welfare change	11.01	3.82

Note: Change is relative to current practice, in billions of 1988 dollars, positive values indicate an improvement.
Source: Morrison and Winston, 1989.

Table 2
Top ten destinations for peak flight cancellations from Logan airport

Destination	Daily peak flights cancelled	Seats cancelled
Portland, ME	15	355
New York, NY–JFK	6	240
Bangor, ME	9	225
Philadelphia, PA	3	98
Newark, NJ	4	79
Manchester, NH	4	71
Baltimore, MD	2	68
Hyannis, MA	4	67
Nantucket, MA	3	66

Source: Barrett et al., 1994.

private aircraft operators and their high-income passengers to common travelers on commercial aircraft. Unfortunately, if eliminating private operators were politically possible most airports probably would have done so already. Pricing does not necessarily make that any easier.

One of the few articles to actually examine the practical effects of peak pricing on a particular airport is by Barrett et al. (1994). Using a model of peak pricing for Logan Airport in Boston, these scholars estimated the effects of a runway-pricing scheme. Table 2 shows the top ten destinations affected by flight cancellations in the model used by Barrett et al. Barrett et al. note that no community would lose its air service entirely because Boston has a sufficient quantity of air service to these communities. This suggests two important points. First, other airports implementing peak pricing might find that service to some communities would be eliminated, which raises questions about the societal benefits and political viability of such a policy. Second, neither Barrett et al. nor any other scholar pays adequate attention as to what to do with these misplaced passengers from cancelled flights. One could argue that in the long run, airlines would increase their aircraft size to accommodate these passengers. However, if this did not happen, or in the short run, public policy would have caused a dramatic cut in intercity transportation services to certain cities. Discussion of how to deal with affected passengers and mitigate political issues is necessary.

3. Case studies

Pricing theory, as described in the literature, has been applied quite sparingly. It is well understood that congestion pricing policies, which by their nature change who is paying and how much, are typically unpopular.[1] However, these cases aim to probe deeper into that unpopularity to determine how pricing theory might be modified for better results. Although none of these cases are examples of true peak pricing as proposed by economic theory, they do help to illustrate some of the theory's potential inadequacies.

3.1. Boston Logan airport

No other airport in the US has had more experience with runway pricing alternatives than Boston Logan International. Since the 1980's, Boston has proposed at least five pricing schemes intended to reduce congestion, and implemented two of those schemes (SH&E and FTA, 1996). Logan is, and has been for many years, among the most congested US airports. Despite ranking 12th in the country in terms of passenger traffic, the airport ranked 5th in the country in delays in 2000. In adverse weather, traffic exceeds capacity for 8 h of the day at Logan (Federal Aviation Administration, 2001). Adverse weather in Logan's case can include specific wind directions that preclude the simultaneous use of two of Logan's parallel runways (22R/4L and 22L/4R). These conditions occur approximately 30% of the time (Venkatahrishnan et al., 1993).

When peak pricing theorists refer to the implementation of runway pricing at Logan Airport, they are usually talking about the 1988 Program for Airfield Capacity Efficiency (PACE). However, PACE was not, strictly speaking, a peak pricing program. There was no distinction under PACE between any particular hours of the day. PACE simply changed the way that landing fees were assessed from a primarily weight-based formula to a primarily operations-based formula. This was accomplished by increasing the fixed cost for landings. Under PACE, a fixed cost of $91.00 per landing was assessed, plus $0.45/1000 lbs. for each aircraft (SH&E and FTA, 1996). The previous weight-based fee was recomputed every year to keep total revenues at the cost of airport operations. The new fee was also computed with the intention of remaining revenue neutral and only accounting for the costs of the airport operations. Therefore, the new fee in effect raised landing fees significantly for commuter and GA aircraft while lowering fees significantly for larger commercial aircraft (US DOT, 1988).

Examples of the differences in landing fees can be seen in Table 3. The first three aircraft listed are all commuter aircrafts; the other three are jet aircrafts. While the prices for the commuter aircraft tripled or quadrupled, the prices for the jet aircraft in this example dropped significantly. The largest aircraft, the Boeing 747-300, shows the greatest drop in price.

Smaller aircraft users, including commuter carriers and GA, challenged PACE in court, arguing that the new charges did not represent a fair allocation of costs

[1] As Pucher and Hirschman (1993) have pointed out, people typically do not want to make sacrifices for the betterment of their transport network without a social and/or environmental crisis.

Table 3
Examples of price changes resulting from Massport's PACE initiative

Aircraft type	Before PACE	Under PACE
Cessna 402	$25.00	$95.19
Beechcraft 1900	$25.00	$110.45
Shorts 360	$34.06	$105.86
Boeing 727-200	$200.43	$174.66
Boeing 747-300	$823.99	$432.51
Boeing 757	$259.38	$199.04

Source: Port Authority of New York and New Jersey. Guidelines for constructing an economically defensible peak-hour flight fee.

to small aircraft users. They pointed out that PACE was intended and designed to exclude GA from Logan Airport. The administrative law judge who reviewed the case found that PACE was "a system of airspace management and economic regulation using fees as its proxy." He wrote that the fee structure was lacking in economic justification. However, he noted that just because a fee structure might result in a lower level of GA or commuter aircraft use at Logan did not in itself make it inherently discriminatory. The PACE structure was found to be discriminatory because there was no acceptable alternative airport for diverted users, and the fees were clearly designed to exclude certain users. As a result of the court's ruling, Massport was forced to rescind PACE. All of their subsequent appeal attempts failed.

Massport was trying to find a way to charge more per operation because excessive operations were causing congestion. The DOT decision disagreed with their method of calculation. In part, this was because Massport did not take into account the greater marginal costs imposed by larger aircraft, which require larger terminals, more airport personnel, and a greater reserve of Fire Safety Rescue Operations. However, it was also because Massport did not attempt to distinguish by time of day. The administrative law judge noted in his written decision that "peak period pricing structures" might be a better cost-allocation method. Therefore, PACE might not have been overturned in court, had it more closely resembled the pricing policies recommended in theory.

On the other hand, PACE illustrates the potential problems with making changes to current pricing structures at airports. There are strong political interests that will fight such changes in court, especially if it appears that pricing initiatives are directed particularly at them. This certainly does not mean that changing airport pricing structures is always poor policy, but it does suggest that changes targeted towards a particular group or constituency are likely to fail. PACE failed in two of the same ways as pricing theory itself—it did not adequately address the social and political problem, nor did it attempt to deal with transportation for displaced passengers. More recent Massport proposals, which probably have a better chance of being implemented, provide key exemptions for certain communities based on their need for air service (Schank, 2004). These may be examples of the type of modification to pricing theory that is necessary to make it effective.

3.2. New York

New York City has three major airports, JFK, LaGuardia, and Newark, which are all leased and operated by the same public authority. However, one airport that plays a large role in the regional airport system but is not well known is Teterboro Airport (TEB) in New Jersey. Just 12 miles from midtown Manhattan, TEB does not have any scheduled service, and is used exclusively by GA. TEB handles more GA flights for the region than the three major airports combined.

The Port Authority of New York and New Jersey (PANYNJ) is a bi-state agency responsible for the operation of Kennedy (JFK), LaGuardia (LGA), Newark (EWR), and TEB airports. Despite the existence of TEB, the PANYNJ was facing increased airside congestion in the late 1960s, and found that GA traffic at the three major airports accounted for 30% of the operations in peak hours, and 25% of operations overall (Odoni and Vittek, 1976). In response to this problem, they imposed the world's first peak runway pricing system in 1968, with a $25 fee for all operations during peak hours by aircraft with 25 seats or less. The peak hour was defined as 8:00 to 10:00 a.m. Monday through Friday, and 3:00 to 8:00 p.m. every day. However, exemptions were provided for GA aircraft operating as air taxis providing connections to operations at Kennedy and Newark, as long as a runway was used that was not in use by scheduled airlines. There were no exemptions at LaGuardia because there were never any such runways available during peak hours. The fee was explicitly targeted towards GA, and the Port Authority made no effort to hide this fact. They did, however, continued to provide surcharge-free landings at Teterboro for all GA aircraft.

Nonetheless, the Aircraft Owners and Pilots Association (AOPA) sued the PANYNJ over the new charges. In 1969, a US district court dismissed the complaint and held that the fee was a justified means of relieving congestion. The court agreed that allocating scarce runway capacity in a manner that favors larger aircraft is legitimate and legal. The court recognized that the Port Authority had the "professed intention of influencing General Aviation operators to transfer their operations where possible away from the runways and traffic control patterns at the three major airports during peak traffic periods". However, given the adequacy of Teterboro as an alternative airport for GA, and limited facilities for air service in the region,

the court found that it was reasonable for the Port Authority to give priority to mass transportation services. The court found that the fee was not discriminatory because even though it was targeted at a specific group of aircraft, the Federal Aviation Administration (FAA) and airport owners had the right to differentiate among different kinds of flights.[2]

The peak GA surcharge remained in effect at the New York airports through deregulation.[3] However, soon after deregulation, new congestion problems convinced the Port Authority to double the fee from $50 to $100. Later, in 1988, the Port Authority changed course somewhat and implemented a $50 minimum peak-hour flight fee for all operations (non-GA aircraft) during designated peak hours. This new charge was intended to discourage commuter airlines from landing during peak periods. It was intentionally set lower than the GA fee to give commuter aircraft, which carry more people and are public transportation, priority over GA aircraft. The fee was not considered to be substantial enough to have a significant impact on congestion at the New York airports, and the Port Authority did not report any major shifts in commuter aircraft landing times. Moreover, the ineffectiveness of this fee came to the forefront when congress mandated unlimited slots for regional jets at LaGuardia in 2000 with the passage of AIR-21. These new flights caused greater congestion than LaGuardia had ever experienced before, and pushed the airport to the brink of in-operability until the Port Authority temporarily rectified the situation by imposing a moratorium on new flights. The FAA then backed up the Port Authority's action by reducing the number of new flights allowed and reassigning the slots using a lottery system. The current system of landing charges is a somewhat random amalgamation of the policies described above. The system is summarized in Table 4.

Table 4 shows that the current structure, like the structures at LaGuardia that preceded it, is primarily intended to discourage GA aircraft. The New York case, like the Boston case, is not strictly speaking an example of peak pricing theory applied to practice, since (1) prices were never set close to marginal cost and (2) pricing was not market-based but rather directed at one particular group of airport users. The Port Authority intended to direct pricing at general aviation and later commuter aircraft. The strategy appears to have been effective in reducing the congestion caused by GA aircraft; however, the Port Authority could never have implemented such a policy without the presence of Teterboro Airport. This GA airport provided an alternative for those who did not wish to pay the extra fees installed at the major New York airports. Conversely, the commuter fee was too small to have forced any major changes in commuter airline schedules, and the PANYNJ cannot raise it to an effective level because there would be no alternative for the commuter aircraft.

Table 4
Current pricing structure at New York, LaGuardia Airport

Type of charge	Minimum charge
Operation during peak (8 a.m. to 9 p.m.), non-scheduled carriers	$100
Operation off-peak, non-scheduled carriers	$25
Operation during peak (8 a.m. to 9 p.m.), scheduled carriers	$50
Operation off-peak, scheduled carriers	$20

Source: Port Authority of New York and New Jersey, Aviation Dept, 2003. Schedule of charges for air terminals.

The fact that an alternative existed is the key point of this case study. Pricing theory does not account for the passengers who are diverted as a result of the new pricing structure. In New York there is what was determined by the courts to be an adequate alternative for GA aircraft. However, if Teterboro did not exist, New York would have run into the same problem as Boston in their attempt to target one group of aircraft and keep them from landing at their congested airport. There was no "Teterboro" equivalent for commuter aircraft, so the PANYNJ could not price commuter aircraft out of its congested airports. This case illustrates how important it is to consider the alternatives available when trying to reduce airport congestion through pricing.

3.3. London

The British Airports Authority (BAA) was a nationalized service enterprise that owned and managed all three London Airports along with major airports in Scotland. After it was privatized in 1987, BAA expanded its reach and now owns a significant stake in airports outside the UK and contracts with some US airports to provide management services. BAA implemented its first peak pricing policy in 1972, and this policy and the ones that followed were more in line with scholarly pricing theory than any other that an airport has tried before or since. Even today, BAA continues to have a pricing policy that attempts to control airside congestion by charging more during the peak period.

The BAA first moved away from the traditional weight-based landing fee in 1972. That year, they imposed a distance and per passenger element to the weight-based fee, plus a surcharge on operations that varied with season and time of day. Little and McLeod

[2]Aircraft Owners and Pilots Association vs. Port Authority of New York (1969), 305 F. Supp. 93; US District Court.

[3]The effect of the program on congestion prior to deregulation was examined by Odoni and Vittek (1968).

(1972) claim that prices were set by BAA based on the concept of ability to pay. Higher fees are assessed for those who are more able to pay them. For example, the distance element of the new fee charges more for longer flights. Flights were divided into three categories: domestic, European, and international, with international flights charged the most per metric ton and per passenger, and domestic charged the least. The per passenger element to this pricing strategy is similar in concept to the Passenger Facility Charge (PFC) imposed in the US However, the idea of charging different amounts per passenger and metric ton based on the origin of the flight is something that has not been proposed in the US.

While the passenger and weight elements of the new fee structure were supposed to be based on ability to pay, the peak element was not. The peak element of the new pricing strategy charged £20 (the equivalent of around $50 at that time) per operation between the hours of 8:00 and 11:59 a.m. The charge only applied from May through October, and in May and June it was only in effect on weekdays. In 1974, the fee structure was modified, and a £50 charge was applied to the peak of the peak, while the £20 charge was applied to the shoulder.

Changes have been made to this initial pricing structure virtually every year since it was implemented. Some of the important changes are detailed in Table 5. The table shows the frequent changes to the fee structure at Heathrow between 1976 and 1984. The table also suggests how difficult it was for BAA to arrive at a pricing structure that worked. Some elements, such as the distance-based fee, were introduced and eliminated within a few years. In the middle of all these changes, several airlines sued BAA.

US carriers complained about the BAA charges for Heathrow from the very beginning, especially because of their distinction between international and European flights. This distinction was removed in 1976, and distance differentials were removed in 1978. However, a 40% to 50% increase in landing fees along with a greater focus on peak charges for all carriers accompanied these changes, rendering them less than popular. These changes were most likely linked to the high inflation rate and a government cash crisis (Toms, 1994). Pan American Airlines sued the BAA over the new fee structure, and 18 other airlines formed a "British Airport Users' Action Group" and refused to pay the higher fees. The suit was eventually settled out of court with a memorandum of understanding, but the crux of the problem was that US carriers felt as if they had no choice but to land at peak times when charges were highest.

Table 5
Significant changes in heathrow pricing structure, 1972–1984

Year	Change
1976	Peak passenger charge introduced
1976	Geographical classifications (domestic, European, international) changed to five distance-based classifications
1977	50% rebate during off-peak periods introduced
1978	Distance-related element eliminated
1978	Peak aircraft parking charges introduced
1980	Peak operations charge eliminated, replaced by fixed element in weight charge
1984	50% off-peak rebate eliminated

Source: Information is primarily from Starkie and Thompson, 1985. Backup and additional information from Toms, 1994, Odoni and Vittek, 1976, and MacDougall, 2001.

BAA attempted to prove their case by showing how the increased fees were calculated to pay for improved facilities. They carried out an analysis of the marginal costs incurred at Heathrow, and used the new Terminal 4 as the basis for the costing (Starkie and Thompson, 1985). The results indicated that the marginal cost of operating a flight in the peak at Heathrow was £125 and £50 at other times. This was substantially greater than the prices being charged at the time. If BAA had wanted to charge at marginal cost, they would probably have faced even more opposition from the airlines. It is notable that larger aircraft operators were the ones who sued about the landing fees at Heathrow. This provides a contrast to the Boston and LaGuardia cases, where the smaller aircraft operators were the ones suing. The settlement between the airlines and BAA only provided for the weight-based element in the landing fee to be reduced.

The British Airports Authority became a private company in 1987, but even before this, BAA was moving away from weight-based landing fees due to their settlement with the airlines. By 1985, the weight-related charge was completely eliminated, although a lower off-peak rate was still provided for smaller aircraft. This new structure was intended to create more efficient use of runway capacity during peak periods by encouraging the use of larger aircraft. As Table 6 shows, it appears that there was diminished use of smaller aircraft at Heathrow following these policy changes, although it is unknown whether this change was necessarily related to airport landing fees.

Two relevant points emerge from Table 6. First, the rapid loss of thousands of commuter flights from Heathrow is apparent. Between 1984 and 1988, there were around ten thousand commuter flights per year. By 1992, there were less than 100. This startling change is not likely to be solely the result of changes in pricing structure, although landing fees did increase significantly in 1990. One probable link to these changes is the new emphasis that was placed on Stansted Airport for commuter flights during this time. However, this table indicates another possible link. The major turning point

Table 6
Use of heathrow by smaller aircraft, 1984–1993

Year	Total air traffic movements	Movements by aircraft under 16 Tons	Percentage of movements by aircraft under 16 Tons
1984/85	267,675	9332	3.5
1985/86	280,046	8900	3.2
1986/87	292,323	11,257	3.9
1987/88	310,435	11,808	3.8
1988/89	310,376	7728	2.5
1989/90	351,307	2083	0.6
1990/91	361,235	1062	0.3
1991/92	373,890	112	0.03
1992/93	388,108	44	0.01

Source: Toms, 1994.

among these statistics appears to be right around the 1988/1989-time period, just after BAA was privatized.

BAA has tended to be very profitable. In part because, while landing fees cannot easily be raised and slots cannot be sold, it has made most of its profit from its retail sector. By 1994, retail at BAA airports accounted for 42% of their total profit, and began to exceed landing fees as the primary source of income. BAA thus has a growing incentive to get more people into its terminals. This may explain, in part, why it increased its landing fees significantly and circulated proposals to ban all aircraft with fewer than 80 seats from Heathrow and Gatwick in 1990.

Whatever the reasons, BAA was soon facing complaints from commuter carriers, such as Manx Airlines, that they would not be able to survive the increased landing fees. Between 1990 and 1993, routes to Norwich, Liverpool, Humberside, Dundee, and Carlisle were closed. In some cases there were reported economic effects from the loss of these air routes, such as major oil companies moving out of the Norwich area. The carriers appealed to the Civil Aviation Authority (CAA) for help, but it ruled that they could not create special slots for smaller carriers. Their reasoning was that as an aviation regulator, they were not responsible for the economic effects of air service, but instead for making runway use more efficient. The end result was, as Table 6 shows, the elimination of smaller jets from Heathrow.

Negative responses to BAA landing fees were not limited to smaller carriers. While smaller carriers felt squeezed out of the market, large US carriers continued to feel that high peak passenger fees were discriminatory against them and lobbied the US government to take action. They wound up taking the case to international arbitration in 1988. In its findings the tribunal recognized the legitimacy of peak pricing based on marginal costs, but they found that the BAA system was not sufficiently precise and complex. Their finding was that better calculations were needed to justify the charges, and therefore the US was able to argue that US carriers had suffered adverse effects. The UK government and BAA had to pay the US carriers $29.5 million in compensation.

They also had to determine a new policy for airport charges that would not bring about new lawsuits. One particular issue posed a problem—how to define the peak period? Since the passenger peak varied with landings and departures, and by terminal, and by year, it was very difficult to define. Moreover, the peak was rapidly spreading throughout the entire day. The parties could not reach any kind of consensus except that the peak passenger surcharge should be eliminated. It is to be phased out so that a flat fee will apply throughout the day.

As much as pricing at Heathrow has tried to implement theory and has come closer than anyone else, it has fallen short by not pricing at marginal cost. One of the main sources of controversy for the airport has been that it is very difficult to calculate marginal cost accurately. Marginal cost in this case might have been a much higher charge than the airlines would have accepted—even with BAA charging less than marginal cost, airlines withheld payments and initiated lawsuits. It is also unlikely that even if BAA had wanted to price at marginal cost, that they could have accurately calculated it. The disagreements over cost calculations with the airlines showed how difficult it was to define the peak period, and now the peak period is rapidly encompassing the entire day at Heathrow. As of now, the BAA is slowly phasing out peak runway pricing.

It is notable that BAA's pricing policy targeted both large and small aircraft operators. The policy was originally intended to smooth out the peak, primarily caused by large aircraft heading to and from the US, but it eventually wound up impacting commuter carriers who could not afford to pay the landing fees. Recall that this latter effect was the original intent of most of the Massport policies in Boston. The shift in the effects of the policy on commuter carriers seems to have occurred shortly after BAA privatization, when the number of passengers in the terminals became more important.

The London case shows another example of pricing being used to support the specific goals of the airport authority, not to fairly allocate runway capacity. The pricing scheme was used to target specific groups, who did their best to fight the policy and were successful in reducing its impact to some degree. It was commuter aircraft, for which there existed alternative transportation options (Stansted and rail), that became the group that could not defeat the pricing system. Targeting a group with available alternatives worked for BAA, while targeting a group without them did not.

4. Conclusions

The three case studies demonstrate the difficulty of effectively implementing peak pricing for airport runways. They also illustrate the problems inherent in the theory that were shown in the literature review above. The cases presented speak of two problems with pricing theory—the political and social equity problem, and the problem of displaced passengers. In every case presented the airport authority was attempting to discriminate against a particular group of aircraft. In each case that group was able to organize substantial opposition to the policy including legal challenges. In Boston and London the opposition forces eventually dismantled the pricing policy. In New York the policy was maintained only because there were available alternatives for the specific group that was displaced.

The case studies may help explain why peak pricing has not been effective where implemented. Pricing theory excludes passengers without providing alternatives. If peak pricing is to be implemented without creating unrest and court battles that ultimately leads to its dissolution, adequate alternatives for displaced passengers should be considered as part of the theory. Unfortunately, throughout most of the US, and most of the world outside of Western Europe and Japan, there are few adequate ground transportation alternatives outside of the private automobile. Without adequate substitutes for air travel, it is unlikely that an airport authority will be able to implement peak pricing, and one might question whether doing so is good policy.

The findings indicate that can be institutional barriers that prevent to peak pricing being used effectively. The inherent problem is that transportation policy is determined primarily by government and not by the free market. Peak pricing is a theory that attempts to insert an element of the free market into a government-regulated market. The market is distorted by decisions about where to build airports, roadways, and railways. We should not price one element of that system at marginal cost and then expect the rest of the system to function properly. If we want to combat airside airport congestion, one effective means of doing so could be to start providing adequate substitutes for air travel. Once that happens, policy makers will in a better position to consider actions that restrict airport access as needed.

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