V940013

COMMISSION AUTHORIZED

BEFORE THE
FEDERAL AVIATION ADMINISTRATION
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C.

In The Matter of	)	
	)	Docket No. 27664
Study of the High Density Rule	)	

Comment of the Staff of the
Bureau of Economics
of the
Federal Trade Commission*

November 23, 1994

* This comment represents the views of the staff of the Bureau of Economics of the Federal Trade Commission. They are not necessarily the views of the Commission or any individual Commissioner. Inquiries regarding this comment should be directed to Laurence Schumann (202-326-3359) of the FTC's Bureau of Economics.

BEFORE THE
FEDERAL AVIATION ADMINISTRATION
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C.

In The Matter of	)	
	)	Docket No. 27664
Study of the High Density Rule	)	

Comment of the Staff of the
Bureau of Economics
of the
Federal Trade Commission[1]

I. Introduction and Summary

The staff of the Bureau of Economics of the Federal Trade Commission (FTC) appreciates this opportunity to respond to the Federal Aviation Administration's Notice of Study and Request for Comments (NSRC). The FAA is conducting a comprehensive study of the High Density Traffic Airports Rule (HDR) and requests comments on the effectiveness and viability of the HDR and any potential alternatives to the rule.[2]

The FAA adopted the HDR to help alleviate delays caused by congestion at certain high density traffic airports (HDTAs). The HDR set the total number of operations—takeoffs and landings—allowed during certain restricted time periods at the HDTAs and distributed this quota of operating privileges to incumbent carriers. The HDR currently affects operations at four airports: Kennedy, LaGuardia, O'Hare,

---

[1] This comment represents the views of the staff of the Bureau of Economics of the Federal Trade Commission. They are not necessarily the views of the Commission or any individual Commissioner. Inquires regarding this comment should be directed to Laurence Schumann (202-326-3359) of the FTC's Bureau of Economics.

[2] *See* "Study of High Density Rule," FAA Docket No. 27664, 59 *Fed. Reg.* 15332 (April 1, 1994), and "Notice of Public Meeting," FAA Docket No. 27664, 59 *Fed. Reg.* 48165 (September 30, 1994).

and Washington National. The number of operations allowed under the HDR is based on the estimated capacity of each airport. The HDR requires carriers wishing to land or take off during restricted periods to obtain the privilege to do so. These landing and takeoff privileges, commonly referred to as "slots," can be traded, sold, or leased.

The HDR serves an important economic role. By establishing a market for rights to land or take off at capacity-constrained airports, the HDR helps ensure that a scarce resource, airport capacity, is allocated to its most highly valued use. The FAA may wish to consider extending the HDR to other airports that might be prone to congestion and delays due to excess demand for limited capacity during peak time periods.

The HDR has been criticized for setting artificial constraints on airport operations; however, as long as the number of slots reflects the airports' actual capacity, this criticism is inaccurate. Another criticism has been that the HDR, by limiting entry, fosters the exercise of market power by incumbent carriers.

Several observations are relevant to the above criticisms. The binding constraint on net increases in operations has been the HDTAs' physical capacity, not the use of the "slot" system. If the slot system were eliminated, the constraint on net operations would remain. And though increases in operations are constrained by the HDTAs' physical capacity, recent (1992) amendments to the HDR created preferences in slot lotteries that made it easier for new carriers to obtain slots at HDTAs and for incumbent small carriers to expand the number of slots they control. These slot reallocations do not increase the total number of operations, but they may act to reduce concentration somewhat. Fundamentally, the HDR promotes, rather than limits, new entry, because it creates a market in which potential new entrants can obtain operating privileges. Before such a market was created in 1986, large incumbent carriers could unilaterally prevent entry at the HDTAs by vetoing grants of operating privileges to carriers wishing to provide new service. Moreover, the findings of empirical assessments conducted by Bureau of Economics

staff of slot usage in May-June 1990 (prior to the 1992 amendments) and in September-October 1993 (after the 1992 amendments) do not support the hypothesized exercise of market power.

The use of peak and off-peak landing and takeoff fees may be an alternative to the present form of slot-based regulation. The FAA may wish to study this alternative. The information requirements needed to implement peak-load pricing to allocate capacity efficiently could exceed the information requirements needed to implement slot-based regulation. The benefits of peak-load pricing over slot-based allocation are not apparent.

II. Expertise of the Staff of the Federal Trade Commission

The Federal Trade Commission is responsible for enforcing the Federal Trade Commission Act,[3] which, among other things, prohibits "unfair methods of competition." The staff of the Federal Trade Commission, upon request from federal, state, or local governmental bodies, comments on regulatory proposals that may affect competition, consumers, or economic efficiency. In the course of this work, as well as in antitrust and consumer protection research, nonpublic investigations, and litigation, the staff applies established principles and recent developments in economic theory to competition and consumer protection issues.

The staff of the Bureau of Economics has a longstanding interest in slot allocation and transfer methods, as well as more general interest in issues involving competition and regulation in the airline industry. This interest has been reflected in comments submitted by the Bureau of Economics staff in previous FAA administrative proceedings on slot allocation and transfer methods, and in previous FAA

[3] 15 U.S.C. 41 *et seq.*

proceedings involving other aspects of airline competition and regulation.[4] In addition, the staff has issued research reports on slot allocation and airline deregulation.[5]

III. Background

Effective April 27, 1969, the FAA designated five airports—Kennedy, LaGuardia, Newark, O'Hare, and Washington National—as HDTAs and established the High Density Rule (HDR) to govern operations there.[6] The HDR, originally a temporary measure to reduce delays caused by congestion, established limits on the total number of hourly "slots"—takeoffs and landings—during certain hours of the day. The hourly slot quotas were based on the operating capacity of each airport as determined by the FAA's Engineering Performance Standards ("EPS"). Slot quotas at Newark were suspended indefinitely in 1970, although the airport is still classified as a HDTA. Slot quotas at the four other HDTAs were made permanent in 1973.

Before 1986, the incumbent airlines at each HDTA decided how slots would be allocated, with any reallocation requiring their unanimous consent. The incumbent airlines could trade slots among

---

[4] *See* the comments of the staff of the Bureau of Economics of the Federal Trade Commission, *High Density Traffic Airports: Slot Allocation and Transfer Methods*, FAA Docket No. 25758 (November 15, 1991); *Slot Allocation Alternative Methods*, FAA Docket No. 24110 (July 27, 1984). Comments on other aspects of airline competition and regulation include, *Elimination of Airport Delays*, FAA Docket No. 24206 (August 30, 1994); *Discussion Authority for Agreement to Shift Schedules*, Department of Transportation, Docket No. 44634 (February 17, 1987); and *Charges for the Use of Metropolitan Washington Airports*, FAA Docket No. 25204 (April 13, 1987). *See also* Comments of the Bureaus of Economics, Competition, and Consumer Protection of the Federal Trade Commission, *Mossport Program for Airport Capacity Efficiency* (February 29, 1988).

[5] *See* D. Koran and J. Ogur, *Airport Access Problems: Lessons Learned from Slot Regulation by the FAA*, Bureau of Economics Staff Report to the Federal Trade Commission (May 1983), and J. Ogur, M. Vita, and C. Wagner, *The Deregulated Airline Industry: A Review of the Evidence*, Bureau of Economics Staff Report to the Federal Trade Commission (January 1988).

[6] Federal Aviation Regulations Amendment No. 93-13, 33 *Fed. Reg.* 17896 (December 3, 1968).

themselves, one-for-one.[7] Increasing competition in the post-1977 deregulated era strained this system severely;[8] in many cases it broke down completely, freezing the previous allocation in place and denying slots to new entrants.[9] The FAA's summary of the situation in 1985 stated:

> As a result of the unanimity requirement and the lack of deadlock-breaking provisions, the air carrier scheduling committees have found it difficult in recent years to reach agreement on a schedule in full compliance with the High Density Rule ... . Overall, the scheduling committees are not currently functioning in a manner which provides for the efficient allocation of slots, for rapid adjustment to market conditions and shifting carrier needs and preferences, for adequate opportunity for expansion of operations, or for new carriers to serve high density airports.[10]

Starting in 1986, revised FAA regulations have encouraged development of a market-based slot transfer system.[11] The initial allocation of slots was determined by "grandfathering"—that is, giving the right to a slot to the carrier that had been operating it.[12] Subject to certain exceptions and procedures, slot holders are permitted to sell, trade, or lease their slots. The FAA retains the right to repossess slots, which the regulations describe as operating privileges, not property rights.[13] Slots may be withdrawn for such reasons as making necessary allocations for international flights and implementing competition

---

[7] *See* Department of Transportation, Federal Aviation Administration, High Density Traffic Airports: Slot Allocation and Transfer Methods, Final Rule, 14 C.F.R. Parts 11 and 93, 50 *Fed. Reg.* 52180, 52185 (1985) ("FAA 1985 Final Rule").

[8] *See* D. M. Grether, R.M. Issac, and C.R. Plott, "The Allocation of Landing Rights by Unanimity Among Competitors," 71 *American Economic Review* 166 (1981).

[9] *See* FAA 1985 Final Rule, *supra* note 7. *See also* Comments of the Department of Justice, *Slot Allocation: Alternative Methods and Slot Transfer Methods, Notice of Proposed Rulemaking*, FAA Docket No. 24110 and 24105 (August 6, 1984), pp. 11-12.

[10] *Supra* note 7 at 52181.

[11] *See* FAA 1985 Final Rule, *supra* note 7, p. 52180, and 14 C.F.R. Parts 93.211 - 93.229.

[12] According to the 1985 Final Rule (*supra* note 7, p. 52190), air carriers and commuter operators holding permanent slots on December 16, 1985 were allocated those slots subject to certain withdrawal provisions. *See* 14 C.F.R. Part 93.215.

[13] *See* 14 C.F.R. Part 93.223 (a).

goals.[14] Further, slots will be recalled for reallocation if used less than a minimum specified percent of the time.[15]

Amendments to the slot allocation and transfer regulations became effective November 1, 1992.[16] These amendments were adopted, in part, "to promote the availability of slots to new entrant and limited incumbent carriers at the high density airports, and thereby enhance competition."[17] Among other things, these amendments created the classification of "limited incumbent carriers," defined as carriers and commuter operators holding fewer than 12 slots. New entrants and limited incumbents benefit from preferences in the lotteries of unallocated slots. The 1992 amendments also restrict the transfer of slots obtained in a lottery. During the 24 month period following a lottery, lottery-assigned slots can only be traded for others at the same HDTA and cannot be sold to other slot-holders (or obtained through sale or merger) if the carrier obtaining the slots would, as a result, hold more than 12 slots. The 1992 amendments also raised the minimum slot usage requirement to 80 percent.

IV. The Benefits of Market-based Slot Reallocation

The HDR was originally adopted as a solution to the problem of congestion and backup delays at five (now four) of the busiest airports in the country.[18] Airport congestion can result from a common-

---

[14] *See* 14 C.F.R. Part 93.223. For example, in March of 1986, the FAA withdrew 5 percent of the slots from incumbent carriers for distribution via lottery to new entrant carriers.

[15] Originally, the minimum slot usage requirement was 65 percent.

[16] *See* Department of Transportation, Federal Aviation Administration, "High Density Traffic Airports: Slot Allocation and Transfer Methods, Final Rule," 14 C.F.R. 93, 57 *Fed. Reg.* 37308 (1992) ("FAA 1992 Final Rule") .

[17] *See* FAA 1992 Final Rule, *supra* note 16.

[18] At the time that the HDR was first proposed, the FAA noted that congestion related delays of varying magnitude were also found at airports in Boston, Miami, Los Angeles, San Francisco, and Atlanta. The situations at New York, Chicago, and Washington, however, were described as "the most (continued...)

property resource problem, which has the essential element that no one controls access to a resource that is available in a fixed supply. In the absence of property rights for the fixed resource, competing users overuse it. Here, the resource that is available in fixed supply is the capacity of the airport. Physical and technological constraints, such as the number of runways and terminals and the capability of the air traffic control system, limit the density and frequency of operations. Overuse of the scarce resource manifests itself in congestion and delay as the number of airplanes attempting to land or take off during the same period exceed the airport's physical capacity.

An economically efficient solution to a common-property resource problem would limit the use of the resource and allocate rights of use to those who value them highest. The HDR, as amended in the FAA 1985 Final Rule,[19] largely accomplished this by creating a slot market. Slot quotas in place since 1969 had already set limits on landing and takeoff privileges at the HDTAs. By creating a largely unfettered market for slots, the FAA allowed slots to be transferred to carriers with the most highly valued flights. Other things equal, the value of a given flight rises as consumer demand for the flight rises. Thus, the slot market—that is, the ability of carriers to buy, sell and lease slots freely—helps ensure that the flights offered are those that consumers value the most.

The FAA's 1992 Final Rule[20] places some restrictions on the transfer of slots, which may reduce the economic efficiency of the slot market. The 1992 Final Rule limits for a two-year period the transfer of the slots obtained through a lottery. The rationale for adopting this two-year mandatory operating period was "to assure that slots obtained in a lottery are likely to be used for operations by new entrants

---

[18](...continued)
critical." The FAA did leave open the possibility that if congestion and delay became more of a problem at these other cities, the HDR could be extended as appropriate. *See* High Density Traffic Airports: Notice of Proposed Rule Making and Notice of Public Hearing, 33 *Fed. Reg.* 12580 (1968).

[19] *Supra* note 7.

[20] *Supra* note 16.

and limited incumbents and not sold back to other slot-holders."[21] But because slot transfers likely represent efficient transfers of resources, absent any antitrust concerns,[22] the restrictions on transfers following a lottery would perpetuate for two years allocations that might be inefficient. The staff of the Bureau of Economics suggests that the FAA consider amending the HDR in order to rescind the two-year restriction on the sale of newly-acquired slots following a lottery.

Critics of the HDR have described it as artificially constraining capacity at the HDTAs. For example, the National Commission To Ensure a Strong Competitive Airline Industry[23] recommended in its report, *Change, Challenge and Competition: A Report to the President and Congress*, that the "FAA review the rule that limits operations at 'high density' airports with the aim of either removing these artificial constraints or raising them to the highest practicable level consistent with safety requirements."[24] As noted above, the hourly quotas at each of the HDTAs have been set by the FAA based on the hourly capacity of each airport as determined by the EPS. According to the FAA,

> The hourly quotas are set at the predominant IFR [Instrument Flight Rule] capacity, as determined by the FAA. The predominant IFR capacity for each airport is the airport's capacity under circumstances and configurations most frequently encountered when

---

[21] *Supra* note 16 at 37309.

[22] Slot transfers that confer market power or otherwise lessen competition would, of course, not represent efficient transfers of resources. Nonetheless, antitrust concerns would not be limited to the 2-year period following a slot lottery. Slot transfers are already scrutinized by antitrust authorities (see, for example the discussion in footnote 36 below), and there is no reason to expect that transfers conducted in the 2-year period following a lottery are more likely to be anticompetitive than slot transfers conducted at other times.

[23] The National Commission To Ensure a Strong Competitive Airline Industry, created by Congress (Pub. L. No. 103-13, April 7, 1993), consisted of 15 voting and 11 non-voting members appointed by the President, the Senate and the House of Representatives. The bipartisan Commission issued its report in August, 1993.

[24] *Supra* note 23, p. 9. The National Commission studied and made recommendations on a large number of issues affecting airline competition and efficiency.

> weather conditions preclude Visual Flight Rule (VFR) operation. *The limitations in the rule are predominately determined by groundside constraints.* [emphasis added][25]

If there is evidence that the FAA underestimated the capacity of the HDTAs or if capacity at the HDTAs has increased since the HDR was adopted, then the FAA may wish to consider raising the slot quotas.[26] As long as the slot quotas reflect each airport's capacity, the slots are not "artificial" constraints on airport operations. As long as the HDR slot quotas reflect the capacities of the HDTAs, the HDR promotes an efficient allocation of this limited capacity by creating a market for slots.

In general, market determined prices provide important signals about resource reallocation. In the context of the HDR, the prices at which slots trade inform decision makers of the social benefits of additional investments in capacity. Slots for peak demand time periods, when capacity will be fully utilized, ordinarily will be more expensive than slots for off-peak periods. By encouraging the shifting of lower-valued flights to off-peak times, this cost differential delays the need to make expensive additions to capacity.

These benefits of market-determined slot prices suggest two implications for the FAA's present proceeding. First, rules restricting the transfer of slots, by constraining this market, may diminish its efficiency. Second, if airports other than the four now covered may regularly experience delays due to congestion, then extending the HDR to cover these additional airports may be a more efficient method of rationing their capacity than the current method, of rationing by the queue (that is, by requiring airplanes to wait in line for long periods, whenever the demand for landing or takeoff privileges exceeds an airport's capacity).

---

[25] FAA 1985 Final Rule, *supra* note 7 at 52181.

[26] We express no opinion about how accurately the slot quotas correspond to the HDTAs' capacities.

V. The Competitive Implications of Slot Usage

The 1992 amendments to the HDR were adopted to promote competition at the HDTAs by facilitating the entry of new carriers and by fostering the growth of smaller "limited incumbent" carriers.[27] The rulemaking proceeding that led to the 1992 amendments was initiated under the Aviation Safety and Capacity Expansion Act of 1990, which directed the Secretary of Transportation to initiate rulemaking to consider more efficient methods of allocating capacity at HDTAs in order to provide improved opportunities for operations by "new entrant carriers."[28]

Critics of the HDR had suggested that it restrained competition at the HDTAs by impeding the entry of new carriers and by limiting the ability of smaller carriers to expand and become more formidable competitors to the larger carriers.[29] "Since there are only a few carriers offering slots for

---

[27] FAA 1992 Final Rule, *supra* note 16 at 37308.

[28] The "Aviation Safety and Capacity Expansion Act of 1990" was enacted as Title IX, § 9126(a) of the Omnibus Reconciliation Act of 1990, Public Law 101-508 (104 Stat. 1388-371).

[29] *See*, for example, *Airline Competition: Effects of Airline Market Concentration and Barriers to Entry on Airfares* (General Accounting Office Report to Congressional Requesters, RCED-91-101). According to this report, "Since an airline must obtain a slot to serve [the HDTAs], slot restrictions can be a barrier to entry at these airports." (p. 22) Economists do not typically consider the need to purchase an input, such as the ability to land or take off, to be a barrier to entry. Nonetheless, government imposed constraints can be barriers to entry to the extent that they harm, rather than promote, consumer welfare. *See* H. Demsetz, "Barriers To Entry," 72 *American Economic Review* 47 (March 1982). Taxi medallions, for example, are often cited as barriers to entry since they place artificially low constraints on the number of taxis operating in a city, causing harm to consumers (due to the inefficiently low number of taxis) that far exceeds any benefits that they may confer. On the other hand, government-imposed constraints can also promote entry by establishing property rights. For example, patents can prevent new entry in existing markets, but they can also encourage new entry into newly developing markets. Since existing markets that are protected by patents might not have been developed without this protection, patents can accurately be described as facilitating rather than barring entry.

As long as the number of slots set at each of the HDTAs reflects each airport's capacity, it is the limited capacity that acts as a constraint, not the need to purchase a slot. When viewed in this light, the slot market does not constrain entry, but instead it facilitates entry. If the slot market did not exist, then, given the limited capacity at the HDTAs, a potential new entrant might be unable to obtain rights to land or take off. Indeed, prior to the adoption of the FAA's 1985 Final Rule (*supra* note 5), incumbent carriers were often able to bar the entry of new carriers at the HDTAs by denying them operating

(continued...)

sale at any given time, securing the necessary operating rights might be extremely difficult."[30] As evidence of the anticompetitive effects of the HDR, critics have pointed to the higher concentration[31] and higher ticket prices at HDTAs relative to other airports.[32]

Although markets that are noncompetitive may show high concentration and high prices, these characteristics do not, by themselves, necessarily imply the existence of anticompetitive behavior. Even if markets were perfectly competitive, fares at capacity-constrained airports would be higher, all other things equal, than at airports without capacity constraints. Equilibrium competitive prices for air travel at capacity-constrained airports would reflect the "scarcity rents" associated with the constraint on

---

[29](...continued)
privileges. *See*, for example, the discussion in Koran and Ogur, *supra* note 7, p. 16.

Some critics have suggested that, since slots were originally distributed for free, potential new entrants are at a competitive disadvantage because they have to purchase slots in order to begin service. The relevant concept of cost in determining economic decisions, however, is that of *opportunity cost*. The cost the current owner incurs to use a slot is the revenue that the owner would receive if the slot were sold or leased to another carrier, because that amount of money is foregone every time the owner uses it. This cost is identical to the cost that a new entrant must pay in order to buy or lease it. Although the original distribution of slots increased the value of the firms that received slots for free (and the wealth of their shareholders), now the relevant economic decisions concerning output, prices, entry, or exit are based on the opportunity costs, which are the same whether a firm is currently operating a slot or considering purchasing or leasing it.

[30] *Policies for the Deregulated Airline Industry*, Congressional Budget Office (1988), p. 55.

[31] Based on slot holdings, each of the HDTAs were either moderately or highly concentrated in 1990, according to the standards of the 1984 Department of Justice *Merger Guidelines* (although newly revised *Merger Guidelines* were issued by the DOJ and FTC in 1992, the relevant classification of market concentration is the same as that in place in 1990). *See* Comment of the Staff of the Bureau of Economics of the Federal Trade Commission, *High Density Traffic Airports: Slot Allocation and Transfer Methods* ("1991 Comments"), FAA Docket No. 25758 (November 15, 1991), Table 1.

[32] The report *Airline Competition: Effects of Airline Market Concentration and Barriers to Entry on Airfares* (General Accounting Office Report to Congressional Requesters, RCED-91-101), concludes that slot restrictions increase average or median fares eleven percent on short haul routes and four percent from all routes to and from HDTAs.

capacity.[33] Indeed, the absence of higher airfares at slot constrained airports would imply (again, all other things equal) that landing rights at HDTAs were not a valuable resource, and slots would not trade at positive prices.[34] Thus, higher fares at HDTAs may merely reflect scarcity rents, not monopoly rents.[35]

Finally, the concentration levels at the HDTAs may overstate the potential for anticompetitive behavior because the HDTAs are not necessarily relevant antitrust markets. In antitrust analysis, a relevant market must be defined before concentration can be measured. For each of the HDTAs, the relevant market may include more than the capacity-constrained airport. For example, each of the four airports governed by the HDR is near one or more regional airports that are not slot constrained: Newark

---

[33] Scarcity rents arise when competition for a resource causes the price of that resource to rise above the marginal cost of "inframarginal" units. Although at the margin the price of the scarce resource will equal its marginal cost, this price will exceed the marginal cost of all other units of the resource. Hence, the inframarginal units will earn a "profit" (or, more precisely, an economic rent) generated by the scarcity. Here, scarcity rents reflect the limited capacity and, in turn, the limited number of slots available. In contrast, monopoly rents result from anticompetitive output restrictions. Here, monopoly rents would be additional rents due to slot holders' decisions to exercise market power by restricting slot use in a way that prevents existing slots from moving to their highest valued uses.

[34] In a competitive market, a slot's value would equal the net present value of its associated scarcity rents. Thus, the GAO's conclusion, that it is slot restrictions that cause higher fares at HDTAs, may be imprecise. Fares at HDTAs will reflect the cost of purchasing slots just as they will reflect the costs of other inputs. Fares may be higher at HDTAs simply because at other airports that are not capacity constrained, capacity is not a scarce, and consequently costly, input. If there are airports other than the HDTAs that are capacity constrained, then scarcity rents will be reflected in higher costs for air travel from these airports. Not all of the rents, however, will necessarily be reflected explicitly in airfares. Some of the rents may be "paid" through diminishing the welfare of travelers who face added congestion and delays at these airports.

[35] Several studies have concluded that high fares at concentrated hubs represent the exercise of market power, in addition to whatever scarcity rents may be generated by capacity constraints. *See*, for example, S. Borenstein, "Airline Mergers, Airport Dominance, and Market Power," 80 *American Economic Review* 400 (1990) and W. Evans and I. Kessides, "Localized Power in the U.S. Airline Industry," 75 *Review of Economics and Statistics* 66 (1993). Others have argued that higher fares at hub airports are consistent with competitive behavior. *See* Kleit and Maynes, "Airline Networks as Joint Goods: Implications for Competition Policy," 4 *Journal of Regulatory Economics* 175 (1992). Despite these differing interpretations, none of these authors identifies the system of marketable slots as a source of competitive problems in airline markets.

in the New York metropolitan area, Midway in the Chicago area, and Dulles and Baltimore-Washington International in the Washington, D. C. area. If flights using other local airports are in the same antitrust market as flights from an HDTA (for example, because consumers can choose to fly from Dulles, National, or BWI),[36] the competitive presence of the other airports can constrain the prices of flights using the HDTA.[37] In that case, the relevant concentration levels would be those for the larger airport market, not for the HDTA alone.

Thus, higher concentration and higher fares at HDTAs relative to other airports could be consistent with either competitive or anticompetitive behavior. When the FAA was considering the proposals that ultimately became the 1992 HDR amendments, the Bureau of Economics submitted comments on those proposals that tested a number of the implications of anticompetitive theories of the effects of the HDR.[38] Using slot usage data supplied by the FAA's Office of Slot Administration, the

---

[36] An illustration of how the HDTAs and their regional competitors could be considered in the same antitrust market is provided by the positions the Department of Justice ("DOJ") took in Eastern Airlines' bankruptcy proceedings. The DOJ opposed United's proposed purchase of Eastern's National Airport slots and facilities on the grounds that it would "lessen competition" for flights between Washington and other cities since United was already the dominant carrier at Dulles International Airport and the acquisition would have given it control of 20 percent of the slots at National. *See* "Justice Dept. to Dispute Deal for Eastern Slots," *Washington Post*, February 15, 1991, p. B2; 60 *Antitrust & Trade Regulation Report* 152 (January 31, 1991), 186 (February 7, 1991), and 272 (February 21, 1991). The DOJ, however, did not object to Northwest Airlines' purchase of Eastern's slots and facilities at National even though Northwest had more slots than United at National prior to the Eastern bankruptcy sale, because Northwest's share at Dulles was less significant than United's. The DOJ analysis is consistent with a relevant antitrust market consisting of at least both National and Dulles. What is pertinent, therefore, is how the sale of Eastern's National assets affected concentration in this antitrust market, not how it affected concentration at just National. Similarly, even though United was the largest carrier at O'Hare, the DOJ did not object to United's purchase of Eastern's O'Hare slots, a position consistent with considering flights to and from Midway Airport to be in the same antitrust market as flights to and from O'Hare.

[37] The fact that slots are scarce at one airport and thus sell at positive prices, while they are not scarce at another airport in the same region, is not alone an indication of whether or not the two airports are in the same antitrust market. Two regional airports can be in the same antitrust market even if prices for slots vary between the airports. The primary factor in determining market definition is not price, but the degree to which travelers will switch from one airport to another in response to changes in relative prices.

[38] *See* 1991 Comments, *supra* note 31.

1991 Comments tested two principal hypotheses. The first hypothesis was based on the standard analysis of market power in which dominant firms have a greater incentive to reduce output than do fringe firms. Standard theory predicts that smaller fringe firms will increase output in response to a contraction of output by the dominant firm.[39] It has been suggested that larger carriers will attempt to restrict output by reducing the number of days on which a slot is used.[40] In the context of an airport slot market, this implies that larger carriers would use their slots less intensively than the smaller fringe carriers would. If larger carriers have market power and exercise it in this manner, slot usage would be negatively related to the market share of the carrier using the slot.

The second hypothesis that was examined in the 1991 Comments was that dominant carriers would be unwilling to sell slots to potential new entrants at competitive rates but instead would lease their slots to selected other carriers, with the purpose of deterring entry by carriers likely to increase overall slot use. In this scenario, dominant airlines would choose their competitors by leasing slots to them. In this way, the dominant firm(s) could both ensure that less efficient firms will be competing with them for the same passengers and simultaneously deter the entry of more efficient firms.[41] The testable implications of this hypothesis are: (1) that the dominant air carriers will be net lessors of slots; and (2)

---

[39] *See* A.A. Alchian and W.R. Allen, *Exchange and Production: Competition, Coordination and Control*, 3d. ed. (1983), pp. 266-268.

[40] *See High Density Traffic Airports: Slot Allocation and Transfer Methods: Supplemental Notice of Proposed Rulemaking*, 56 *Fed. Reg* 4667 (September 13, 1991), at 46678.

[41] *See* U.S. General Accounting Office, *Airline Competition: Industry Operating and Marketing Practices Limit Market Entry*, U.S. General Accounting Office Report to Congressional Requestors, RCED 90-147 (1990). For a theoretical discussion of this effect, see K.E. Rockett, "Choosing the Competition and Patent Licensing," 21 *RAND Journal of Economics* 161 (1990), which examines a single incumbent (with a patent) facing a limited number of potential entrants. For a general discussion of the fragility of entry deterrence models, see D. Malueg and M. Schwartz, "Preemptive Investment, Toehold Entry, and the Mimicking Principle," 22 *RAND Journal of Economics* 1 (1991), and M. Waldman, "The Role of Multiple Potential Entrants/Sequential Entry in Noncooperative Entry Deterrence," 22 *RAND Journal of Economics* 446 (1991).

that these leased slots will be used relatively less intensively than slots held and operated by the dominant carriers.

The empirical analyses contained in the 1991 Comments were largely inconsistent with these two anticompetitive theories. Slot usage for all carriers at the four HDTAs tended to be very high—typically above 90 percent—and the data indicated no relationship between market share and slot usage. That is, the negative relationship between market share and slot usage predicted by the anticompetitive hypothesis did not emerge from actual slot usage data. Further, rather than being net lessors of slots, the largest firms at each of the four HDTAs were consistently net lessees of slots. This result, together with the high degree of slot usage, is inconsistent with the implications of the anticompetitive theories.

Modelling slot usage as a function of multiple factors, the 1991 Comments also used multiple regression analysis to test the anticompetitive hypothesis.[42] At O'Hare, the most concentrated of the four HDTAs, regression analysis indicated a positive and statistically significant relationship between slot share and rate of use. Further, slots leased by large carriers to others were used at a higher rate than large carriers' owned and operated slots. Both of these results are inconsistent with the anticompetitive hypotheses.[43]

---

[42] The dependent variable in these regressions was the number of days the slot was operated in the two month study period. The explanatory variables were: (1) the slot holder's share of slots at the HDTA; (2) the slot holder's national market share; (3) the FAA withdrawal priority number; (4) a dummy variable set equal to one if the slot was operated by a single operator other than the slot holder, and zero otherwise; (5) a dummy variable set to one if the slot was operated by more than one operator, and was not traded in the two month study period, and zero otherwise; (6) a dummy variable set equal to one if the slot holder changed during the two month period, and zero otherwise; and (7) a set of dummy variables each set equal to one for the particular hour or half-hour period for which the slot existed, and zero otherwise.

[43] During the period covered by the 1991 Comments (May-June 1990), United Airlines controlled 658 slots at O'Hare (44 percent). Later, United obtained more slots at O'Hare when it acquired Air Wisconsin, which had controlled 44 slots (3 percent). This acquisition prompted a private antitrust suit by American Airlines, which had controlled 491 slots (33 percent). To settle the case, United sold 12 of the Air Wisconsin slots to American. Since Air Wisconsin already had a close operating relationship with United and since Air Wisconsin's market share had been relatively modest, the likelihood that these

(continued...)

At National and LaGuardia, the 1991 Comments found no discernible relationship between market share and usage rate in May-June 1990. The relationship between leasing and slot usage was also inconsistent with the anticompetitive leasing hypothesis. An exception was Kennedy, where the 1991 Comments found that firms with larger market shares tended to show lower slot usage. This result would be consistent with the anticompetitive usage hypothesis; however, it could also be explained by special circumstances at Kennedy. The largest slot holder at Kennedy, with 31 percent of the slots, was a bank that had entered a purchase-lease arrangement with TWA. The second largest slot holder was Pan Am. Both TWA and Pan Am had been experiencing financial difficulties on transatlantic flights, which ultimately led to bankruptcy.[44] Thus, the negative coefficients on market share may have simply reflected these largest carriers' reduced output due to operating difficulties, rather than a monopolistic output reduction.

For O'Hare, National, and LaGuardia, the May-June 1990 slot usage data are generally inconsistent with hypotheses that the HDR allows carriers to exert market power. The only result that might support the anticompetitive hypotheses, the negative and significant relationship between slot share and slot use at Kennedy, is probably explained by the operating problems experienced by the largest carriers at that airport during the study period. In addition, the data did not suggest that slots leased by

---

[43](...continued)
transactions had a significant impact on competition at O'Hare appears small, though this is an empirical matter. Section VI below analyzes more recent slot data to assess whether the changes in shares of slots controlled at O'Hare and the other HDTAs have had any effect on competitive behavior there.

[44] Both carriers faced problems at various times due to fears of terrorism and increased competition on transatlantic flights. *See* "Secretary's Task Force on Competition in the U.S. Domestic Airline Industry: International Air Service," U.S. Department of Transportation, February 1990. International flights use restricted international slots that are not allocated in the same way as slots for domestic flights, and hence were not in the data used in this study. Passengers from these flights were an important source of traffic for these airlines' domestic flights, though, and slots used for those domestic flights were included in the data.

large carriers to others were used at a significantly lower rate, but suggested instead the opposite, that the largest slot holders at HDTAs tended to be net lessees.

VI. Slot Usage at the HDTAs in 1993

A. Slot Usage Rates and Leasing Patterns

In this section, we reexamine the relationship between market shares and slot usage using slot usage data for the period September-October 1993.[45] Since the May-June 1990 period analyzed in our 1991 Comments, patterns of slot usage at the HDTAs may have been affected by the bankruptcies of a number of different carriers or by other factors.[46] As in our 1991 Comments, the statistical analysis is based on the set of slots meeting three criteria: (1) the slots were operated by a domestic airline on a domestic route; (2) use of the slots was not restricted by the FAA; and (3) the slots were not exempt from the FAA's "use or lose" rules.

---

[45] Ideally we would have preferred to examine May-June 1993 slot usage data for comparison to the results based on May-June 1990 data reported in our 1991 comments. Unfortunately, this data had already been archived and was, therefore, not readily available when we began work on this comment. The slot usage data that was available to us was from the September-October 1993 period and the November-December 1993 period. We used the September-October data for this study because we felt that it would represent more typical or average slot usage than would the November-December data, which would include slot usage during the Thanksgiving and Christmas holiday periods.

[46] Carriers that held slots at one or more HDTA and filed for bankruptcy protection since June 1990 include Continental, Pan Am, Midway, America West, and TWA. Midway, Pan Am, and Eastern, which was still operating while in bankruptcy proceedings during the May-June 1990 period, have since been liquidated.

Table 1[47] lists the slot holdings and the Herfindahl-Hirschmann Index (HHI) of concentration at the four HDTAs as of October 31, 1993.[48] All remain either moderately or highly concentrated under the standards contained in the Department of Justice and Federal Trade Commission Horizontal Merger Guidelines;[49] however, the level of concentration has risen considerably at all four airports. Both LaGuardia and National were moderately concentrated as of October 1993, just as they were in June 1990. LaGuardia's 1993 HHI of 1747 exceeds its 1990 HHI (1241) by 506, and National's HHI of 1657 exceeds its 1990 HHI (1282) by 375. Kennedy and O'Hare were highly concentrated as before; Kennedy's 1993 HHI of 2233 exceeds its 1990 HHI (1816) by 417, and O'Hare's 1993 HHI of 3731 exceeds its 1990 HHI (3122) by 609.

---

[47] The tables discussed in this section are generally numbered so as to correspond to similar tables in the 1991 Comments. That is, Table 1 is comparable to Table 1 in the 1991 Comments, Table 2 is comparable to Table 2 in the 1991 Comments, and so on. Tables that do not correspond to tables found in the 1991 Comments are denoted by letters following the number of the preceding table (e.g., Table 1A, Table 2A, and so on).

[48] In Table 1, slots held by American Airlines include slots held by AMR Slot Holdings (FAA code 0033), a subsidiary of American's parent firm, AMR. USAir's slots include slots held by USAir Shuttle, Inc. (FAA code USS), a subsidiary of Shuttle, Inc. USAir manages and operates the USAir Shuttle for Shuttle Inc. Finally, United's slots include slots held by Air Wisconsin Inc. (FAA code AWI), which was purchased by United in 1992.

[49] The Department of Justice and Federal Trade Commission jointly released horizontal merger guidelines on April 2, 1992. Under the Guidelines, markets are "moderately concentrated" if their HHIs are between 1000 and 1800 and "highly concentrated" if their HHIs exceed 1800.

TABLE 1
DOMESTIC SLOT HOLDINGS AND CONCENTRATION

		O'HARE (ORD)		NATIONAL (DCA)	
HOLDER	CODE	NUMBER OF SLOTS	SHARE	NUMBER OF SLOTS	SHARE
FAA	0001	0	0	0	0
SHAWMUT BANK N.A.	0004	0	0	32	5.9
STATE ST. BANK & TRUST.	0020	0	0	0	0
WILMINGTON TRUST CO.	0023	14	1.0	0	0
BT COMMERCIAL CORP	0026	5	0.4	0	0
CITIBANK	0030	0	0	26	4.8
FIRST BANK NATIONAL ASSOC.	0034	39	2.8	0	0
CONTINENTAL SLOT TRUST	0035	33	2.3	43	8.0
AMERICAN AIRLINES	AAL	533	37.7	67	12.4
DELTA AIRLINES	DAL	57	4.0	88	16.3
FEDERAL EXPRESS	FDX	5	0.4	0	0
BUSINESS EXPRESS	GAA	0	0	0	0
MIDWEST EXPRESS	MEP	0	0	1	0.2
NORTHWEST AIRLINES	NWA	19	1.3	87	16.1
TRANS WORLD AIRLINES	TWA	0	0	1	0.2
UNITED AIRLINES	UAL	674	47.7	42	7.8
USAIR	USA	35	2.5	152	28.2
TOTAL		1414		539	
HHI			3731		1657

TABLE 1 CONTINUED							
		KENNEDY (JFK)		LAGUARDIA (LGA)		ALL HDTAs	
HOLDER	CODE	NUMBER OF SLOTS	SHARE	NUMBER OF SLOTS	SHARE	NUMBER OF SLOTS	SHARE
FAA	0001	0	0	13	2.5	13	0.5
SHAWMUT BANK	0004	44	39.3	20	3.9	96	3.7
STATE ST BANK & TRUST	0020	3	2.7	0	0	3	0.1
WILMINGTON TRUST	0023	0	0	0	0	14	0.5
BT COM'L CORP	0026	1	0.9	0	0	6	0.2
CITIBANK	0030	0	0	53	10.4	79	3.1
FIRST BANK NATIONAL ASSOC.	0034	0	0	0	0	39	1.5
CONTINENTAL SLOT TRUST	0035	0	0	23	4.5	99	3.8
AMERICAN AIRLINES	AAL	22	19.6	67	13.1	689	26.7
DELTA AIRLINES	DAL	12	10.7	112	21.9	269	10.4
FEDERAL EXPRESS	FDX	0	0	0	0	5	0.2
BUSINESS EXPRESS	GAA	1	0.9	0	0	1	0.0
MIDWEST EXPRESS	MEP	0	0	0	0	1	0.0
NORTHWEST AIRLINES	NWA	9	8.0	41	8.0	156	6.1
TRANS WORLD AIRLINES	TWA	4	3.6	0	0	5	0.2
UNITED AIRLINES	UAL	7	6.3	35	6.8	758	29.4
USAIR	USA	9	8.0	148	28.9	344	13.3
TOTAL		112		512		2577	
HHI			2233		1747		

One factor that makes the analysis of the 1993 slot usage data somewhat more complicated than the analysis of the 1990 slot usage is the increased prevalence of noncarrier slot holders. The growth in noncarrier holders of slots since 1990 is due, in large part, to the severe financial difficulties faced by many carriers in recent years. In the May-June 1990 period, only one noncarrier institution, the Shawmut Bank, held any slots. The Shawmut Bank held slots in trust that were formerly held by TWA, and Shawmut leased these slots back to TWA on a long-term basis.

Table 1 indicates that six financial institutions in addition to the Shawmut Bank held slots during the September-October 1993 period. The slots held by these institutions as part of bankruptcy proceedings were generally leased back to the airline that previously held the slots. Other slots held by noncarriers represented collateral for secured obligations and, again, these slots were generally leased back to the airline that previously held the slots. Because slots held by noncarriers were typically leased back to carriers on a long term basis, we have recalculated slot market shares and concentration under the assumption that slots held by noncarriers should, in most cases, be treated as being held by the relevant carrier.[50] Table 1A contains the results of this analysis. This adjustment raises further the HHI at each of the HDTAs, moving each into the "highly concentrated" range as defined in the 1992 Merger Guidelines. In our analyses that follow, we examine whether, in these conditions of higher concentration, carriers utilized their slots in an anticompetitive manner.

---

[50] Generally the carriers transferring slots to trusts have received long-term leases on the transferred slots. Continental, for example, has ten-year leases on the slots held by the Continental Slot Trust; the USAir Shuttle has ten year leases on the slots held by the Shuttle Slot Trust (Citibank); and Business Express has ten-year leases on slots transferred to the State Street Bank. BT Commercial Corp., a subsidiary of Banker's Trust, held slots originally held by America West and transferred as collateral for secured obligations. First Bank National Association holds slots originally held by Northwest Airlines and transferred as collateral for certain secured obligations. The one exception to this general rule is that the slots of the Wilmington Trust are not allocated to any carrier because many of its slots were transferred from Pan Am, which no longer exists. Also, we have kept separate the slots held by the FAA and Federal Express.

TABLE 1A
DOMESTIC SLOT HOLDINGS AND CONCENTRATION
WITH NONCARRIER SLOTS ASSIGNED TO CARRIERS

		O'HARE (ORD)		NATIONAL (DCA)	
HOLDER	CODE	NUMBER OF SLOTS	SHARE	NUMBER OF SLOTS	SHARE
FAA	0001	0	0	0	0
WILMINGTON TRUST CO.	0023	14	1.0	0	0
AMERICAN AIRLINES	AAL	533	37.7	67	12.4
AMERICA WEST AIRLINES	AMW	5	0.4	0	0
CONTINENTAL AIRLINES	COA	33	2.3	43	8.0
DELTA AIRLINES	DAL	57	4.0	88	16.3
FEDERAL EXPRESS	FDX	5	0.4	0	0
BUSINESS EXPRESS	GAA	0	0	0	0
MIDWEST EXPRESS	MEP	0	0	1	0.2
NORTHWEST AIRLINES	NWA	58	4.1	87	16.1
TRANS WORLD AIRLINES	TWA	0	0	33	6.1
UNITED AIRLINES	UAL	674	47.7	42	7.8
USAIR	USA	35	2.5	178	33.0
TOTAL		1414		539	
HHI			3741		1930

TABLE 1A CONTINUED							
		KENNEDY (JFK)		LAGUARDIA (LGA)		ALL HDTAs	
HOLDER	CODE	NUMBER OF SLOTS	SHARE	NUMBER OF SLOTS	SHARE	NUMBER OF SLOTS	SHARE
FAA	0001	0	0	13	2.5	13	0.5
WILMINGTON TRUST	0023	0	0	0	0	14	0.5
AMERICAN AIRLINES	AAL	22	19.6	67	13.1	689	26.7
AMERICA WEST AIRLINES	AMW	1	0.9	0	0	6	0.2
CONTINENTAL AIRLINES	COA	0	0	23	4.5	99	3.8
DELTA AIRLINES	DAL	12	10.7	112	21.9	269	10.4
FEDERAL EXPRESS	FDX	0	0	0	0	5	0.2
BUSINESS EXPRESS	GAA	4	3.6	0	0	4	0.2
MIDWEST EXPRESS	MEP	0	0	0	0	1	0.0
NORTHWEST AIRLINES	NWA	9	8.0	41	8.0	195	7.6
TRANS WORLD AIRLINES	TWA	48	42.9	20	3.9	101	3.9
UNITED AIRLINES	UAL	7	6.3	35	6.8	758	29.4
USAIR	USA	9	8.0	201	39.3	423	16.4
TOTAL		112		512		2577	
HHI			2520		2347		

Table 2 examines the hypothesis that carriers with large slot holdings will attempt to restrict output by reducing the number of days on which those slots are used. The table shows for each slot holder and each HDTA the proportion of total days that the holder's slots were used (TPCT) and the proportion of weekdays (WPCT) that the slots were used during the September-October 1993 period.[51] As was the case in the 1991 Comments, slots are typically utilized at very high rates.[52] Virtually all of these slots were used at rates exceeding 90%, and the highest rate of slot utilization actually occurred at O'Hare, the most concentrated of the four HDTAs. Further, the pattern of slot use does not support the anticompetitive hypothesis. As a general matter, slots held by firms with larger slot market shares appear to be used no less intensively than slots held by firms with smaller shares.

Looking at each airport individually, the lowest rates of total use (TPCT) at O'Hare were for slots held by the carriers with the smallest shares, and weekday use rates (WPCT) were all very high and appear unrelated to share. A similar pattern occurred at National: usage rates are typically very high, especially on weekdays, and slot usage appears unrelated to share. At LaGuardia, neither the values of TPCT nor the values of WPCT suggest a relationship between slot use and the number of slots held. At Kennedy, the holders with the fewest slots have the highest values of both TPCT and WPCT; however, these firms hold only one slot each, so it is difficult to infer much from this result. Among holders with multiple slots at Kennedy, no particular pattern relating slot usage to the number of slots held emerges.

---

[51] The distinction between total and weekday use of slots was an issue pertinent to the proposed regulations that gave rise to our 1991 Comments. The results reported here continue to distinguish between total and weekday slot usage in order to facilitate comparisons with the slot usage patterns previously reported.

[52] A comparison of Table 2 in this comment with Table 2 in our 1991 Comments indicates that slot usage rates were slightly higher in the September-October 1993 period than they were in the May-June 1990 period.

TABLE 2
AVERAGE SLOT USE

O'HARE				
SLOT HOLDER	CODE	NUMBER OF SLOTS HELD	TPCT	WPCT
UNITED AIRLINES	UAL	674	.95	.98
AMERICAN AIRLINES	AAL	533	.96	.98
DELTA AIRLINES	DAL	57	.97	.99
FIRST BANK NATIONAL ASSOC.	0034	39	.93	.96
USAIR	USA	35	.97	.98
CONTINENTAL SLOT TRUST	0035	33	.95	.98
NORTHWEST AIRLINES	NWA	19	.95	.97
WILMINGTON TRUST CO.	0023	14	.97	.98
BT COMMERCIAL CORP	0026	5	.91	.94
FEDERAL EXPRESS	FDX	5	.91	.98
NATIONAL				
SLOT HOLDER	CODE	NUMBER OF SLOTS HELD	TPCT	WPCT
USAIR	USA	152	.91	.97
DELTA AIRLINES	DAL	88	.95	.97
NORTHWEST AIRLINES	NWA	87	.92	.96
AMERICAN AIRLINES	AAL	67	.94	.97
CONTINENTAL SLOT TRUST	0035	43	.90	.96
UNITED AIRLINES	UAL	42	.92	.96
SHAWMUT BANK	0004	32	.95	.98
CITIBANK	0030	26	1.00	1.00
MIDWEST EXPRESS	MEP	1	.80	.98
TRANS WORLD AIRLINES	TWA	1	.89	.98

TABLE 2 CONTINUED				
LAGUARDIA				
SLOT HOLDER	CODE	NUMBER OF SLOTS HELD	TPCT	WPCT
USAIR	USA	148	.93	.98
DELTA AIRLINES	DAL	112	.95	.98
AMERICAN AIRLINES	AAL	67	.93	.98
CITIBANK	0030	53	1.00	1.00
NORTHWEST AIRLINES	NWA	41	.91	.95
UNITED AIRLINES	UAL	35	.93	.98
CONTINENTAL SLOT TRUST	0035	23	.91	.97
SHAWMUT BANK	0004	20	.95	.97
FAA	0001	13	.94	.98
KENNEDY				
SLOT HOLDER	CODE	NUMBER OF SLOTS HELD	TPCT	WPCT
SHAWMUT BANK	0004	44	.93	.95
AMERICAN AIRLINES	AAL	22	.97	.98
DELTA AIRLINES	DAL	12	.93	.92
NORTHWEST AIRLINES	NWA	9	.95	.96
USAIR	USA	9	.96	.95
UNITED AIRLINES	UAL	7	.94	.93
TRANS WORLD AIRLINES	TWA	4	.98	.98
STATE ST BANK & TRUST	0020	3	.92	.94
BT COMMERCIAL CORP	0026	1	.98	1.00
BUSINESS EXPRESS	GAA	1	1.00	1.00

As in our 1991 Comments, our primary interest is to test the implications of hypotheses predicting anticompetitive behavior of *carriers* controlling large shares of slots at the HDTAs. Table 2A contains average slot use for the slots *operated* by each carrier. Particularly notable is the generally high level of slot usage. Only one carrier (Business Express at National) operated its slots less than 90% of the time, and weekday usage is commonly as high as 98%. As in Table 2, there does not appear to be an obvious pattern supporting the anticompetitive hypothesis. Slot usage rates among the carriers operating at each of the HDTAs does not appear to be inversely related to the number of slots operated by each carrier.

TABLE 2A
AVERAGE SLOT USE BY OPERATOR

O'HARE

CARRIER	CODE	NUMBER OF SLOTS OPERATED	TPCT	WPCT
UNITED AIRLINES	UAL	712	.95	.98
AMERICAN AIRLINES	AAL	540	.96	.98
DELTA AIRLINES	DAL	48	.97	.99
NORTHWEST AIRLINES	NWA	45	.93	.96
USAIR	USA	30	.98	.98
CONTINENTAL AIRLINES	COA	30	.94	.98
TRANS WORLD AIRLINES	TWA	6	.99	1.00
SIMMONS AVIATION	SYM	3	.98	.98

NATIONAL

CARRIER	CODE	NUMBER OF SLOTS OPERATED	TPCT	WPCT
USAIR	USA	211	.93	.98
DELTA AIRLINES	DAL	86	.95	.98
AMERICAN AIRLINES	AAL	68	.94	.97
NORTHWEST AIRLINES	NWA	56	.92	.96
CONTINENTAL AIRLINES	COA	49	.90	.96
UNITED AIRLINES	UAL	31	.94	.97
TRANS WORLD AIRLINES	TWA	31	.93	.97
BUSINESS EXPRESS	GAA	7	.88	.92

TABLE 2A CONTINUED
AVERAGE SLOT USE BY OPERATOR

LAGUARDIA

CARRIER	CODE	NUMBER OF SLOTS OPERATED	TPCT	WPCT
USAIR	USA	197	.94	.98
DELTA AIRLINES	DAL	112	.96	.98
AMERICAN AIRLINES	AAL	67	.93	.98
UNITED AIRLINES	UAL	37	.93	.97
NORTHWEST AIRLINES	NWA	34	.92	.95
CONTINENTAL AIRLINES	COA	26	.91	.96
TRANS WORLD AIRLINES	TWA	19	.97	.99
PENN COMM	PCA	11	.94	.96
BUSINESS EXPRESS	GAA	7	.92	.96
TRANS WORLD EXPRESS	RBD	1	.95	.95
NORTHEAST EXPRESS	NEE	1	.92	.95

KENNEDY

CARRIER	CODE	NUMBER OF SLOTS OPERATED	TPCT	WPCT
TRANS WORLD AIRLINES	TWA	43	.93	.95
AMERICAN AIRLINES	AAL	22	.98	.99
DELTA AIRLINES	DAL	12	.93	.92
TRANS WORLD EXPRESS	RBD	10	.94	.94
BUSINESS EXPRESS	GAA	9	.96	.97
USAIR	USA	7	.96	.95
UNITED AIRLINES	UAL	6	.93	.92
CARNIVAL AIR LINES	CAA	1	.98	1.00
NORTHEAST EXPRESS	NE	1	.92	.93
PENN COMM AIRLINE	PCA	1	.93	.93

Table 3 compares the usage rates of slots held and operated by each carrier with slots leased by the carrier to other carriers.[53] The anticompetitive leasing hypothesis suggests that slot holders' owned and operated (O&O) slots will be used at a higher rate than the slots leased to other firms. Accordingly a positive difference between the usage rates of O&O slots and leased slots would be consistent with this hypothesis. Table 3 lists for each HDTA (1) the number of O&O slots for each carrier that owns and operates at least one slot; (2) the number of slots that each carrier leased to other carriers; (3) the total and weekday usage rates for the O&O slots and the leased slots; (4) the difference (Δ) between the O&O usage rate and the leased usage rate for total days and weekdays; and (5) two measures of the statistical significance of this difference, tu and te. tu is a t-statistic calculated under the assumption that the variances of O&O and leased usage rates are different. te is a t-statistic calculated under the assumption that the two distributions have the same variance.

[53] For purposes of Table 3, a carrier's "held" slots include those leased to it from noncarrier slot holders (i.e., financial institutions) on a long term basis and held in trust by noncarrier slot holders as collateral for secured obligations. See footnote 50.

TABLE 3
RATES OF USE IN OWNED AND OPERATED VERSUS LEASED SLOTS

O'HARE													
		OWNED AND OPERATED			LEASED TO OTHERS								
SLOT HOLDER	CODE	N	TPCT	WPCT	N	TPCT	WPCT	Δ	tu	te	Δ	tu	te
								$TPCT_{O\&O} - TPCT_{L}$			$WPCT_{O\&O} - WPCT_{L}$		
AMERICAN AIRLINES	AAL	459	.956	.980	74	.957	.977	-.0004	-.09	-.11	.003	1.00	1.07
CONTINENTAL AIRLINES	COA	13	.951	.977	20	.956	.978	-.0049	-.28	-.32	-.0012	-.13	-.15
DELTA AIRLINES	DAL	33	.969	.992	24	.961	.984	.0076	.70	.69	.009	1.84	1.88
NORTHWEST AIRLINES	NWA	32	.928	.962	26	.948	.972	-.021	-1.39	-1.34	-.0010	-.99	-1.01
UNITED AIRLINES	UAL	613	.952	.977	61	.956	.979	-.004	-.54	-.70	-.001	-.32	-.36
USAIR	USA	19	.981	.982	16	.949	.980	.0322	**2.93***	**3.04***	.002	.26	.25

*** Statistically significant at the .05 level.**

TABLE 3 CONTINUED
RATES OF USE IN OWNED AND OPERATED VERSUS LEASED SLOTS

NATIONAL													
		OWNED AND OPERATED			LEASED TO OTHERS								
SLOT HOLDER	CODE	N	TPCT	WPCT	N	TPCT	WPCT	Δ	tu	te	Δ	tu	te
								$TPCT_{O\&O} - TPCT_{L}$			$WPCT_{O\&O} - WPCT_{L}$		
AMERICAN AIRLINES	AAL	55	.941	.976	12	.929	.961	.0120	.61	.77	.015	1.36	1.30
CONTINENTAL AIRLINES	COA	32	.888	.980	11	.940	.928	-.052	**-2.87***	**-2.41***	-.023	**-2.56***	**-2.14***
DELTA AIRLINES	DAL	78	.951	.980	10	.903	.928	.0482	**2.21***	**2.89***	.052	2.14	**4.55***
NORTHWEST AIRLINES	NWA	35	.912	.956	52	.922	.966	-.010	-.58	-.58	-.010	-.82	-.87
TRANS WORLD AIRLINES	TWA	19	.951	.979	14	.950	.975	.0012	.07	.06	.004	.27	.30
UNITED AIRLINES	UAL	20	.931	.966	22	.918	.961	.013	.82	.80	.005	.44	.43
USAIR	USA	162	.924	.979	16	.943	.967	-.018	-1.13	-0.88	.013	1.08	1.11

*** Statistically significant at the .05 level.**

TABLE 3 CONTINUED
RATES OF USE IN OWNED AND OPERATED VERSUS LEASED SLOTS

LAGUARDIA													
		OWNED AND OPERATED			LEASED TO OTHERS								
SLOT HOLDER	CODE	N	TPCT	WPCT	N	TPCT	WPCT	Δ	tu	te	Δ	tu	te
								$TPCT_{O\&O} - TPCT_L$			$WPCT_{O\&O} - WPCT_L$		
AMERICAN AIRLINES	AAL	38	.931	.987	29	.925	.974	.0057	.38	.37	.013	**2.41***	**2.36***
CONTINENTAL	COA	12	.904	.961	11	.912	.970	-.008	-.25	-.25	-.009	-.47	-.48
DELTA AIRLINES	DAL	83	.961	.981	29	.921	.971	.0404	**3.05***	**3.87***	.010	1.49	1.61
NORTHWEST AIRLINES	NWA	14	.906	.939	27	.905	.952	.0016	.07	.07	-.013	-.57	-.65
TRANS WORLD	TWA	6	.967	.977	14	.940	.967	.0269	1.18	1.06	.0100	.56	.55
UNITED AIRLINES	UAL	16	.940	.974	19	.921	.977	.0189	1.17	1.14	-.003	-.29	-.28
USAIR	USA	161	.948	.985	40	.950	.970	-.002	-.18	-.14	.014	**2.56***	**2.82***

*** Statistically significant at the .05 level.**

TABLE 3 CONTINUED
RATES OF USE IN OWNED AND OPERATED VERSUS LEASED SLOTS

KENNEDY													
		OWNED AND OPERATED			LEASED TO OTHERS								
SLOT HOLDER	CODE	N	TPCT	WPCT	N	TPCT	WPCT	Δ	tu	te	Δ	tu	te
								$TPCT_{O\&O} - TPCT_{L}$			$WPCT_{O\&O} - WPCT_{L}$		
AMERICAN AIRLINES	AAL	17	.975	.988	5	.974	.967	.0012	.06	.06	.0202	1.13	1.74
DELTA AIRLINES	DAL	12	.929	922	0	.	.	.	.	.	.	.	.
BUSINESS EXPRESS	GAA	4	.943	.946	0	.	.	.	.	.	.	.	.
TRANS WORLD AIRLINES	TWA	35	.930	.948	13	.948	.948	-.019	-1.32	-1.21	.0001	.00	.00
UNITED AIRLINES	UAL	6	.932	.919	1	.984	.977	-.052	.	-1.27	-.058	.	-.92
USAIR	USA	7	.96	.95	2	.959	.965	-.001	-.04	-.04	-.015	-.37	-.36

*** Statistically significant at the .05 level.**

At O'Hare, the two largest airlines (in terms of slot share), United (47.7% share) and American (37.7% share) used their O&O slots just as intensively as other carriers utilized slots that these two carriers leased to them. The differences are very small and in all cases statistically insignificant. In one case — USAir in the all days analysis — the difference between a carrier's usage of its O&O slots and lessees' usage of its leased slots is positive and significant. Although this finding is consistent with the anticompetitive hypothesis, USAir's modest share at O'Hare (2.5%) indicates that its practices would be unlikely to raise competitive concerns.

At National, one carrier, Delta, leased slots to carriers that used the slots a smaller percentage of the time than it used its O&O slots. Delta was the second largest carrier at National (16.3% share). By contrast, for the largest carrier at National, USAir (28.2% share), there is essentially no difference between its usage of its O&O slots and lessees' usage of its leased slots (the differences are either very small or negative, and not statistically different from zero at the five percent level of significance.) Thus, the carrier with the largest share of slots at National does not lease its slots in a manner consistent with the anticompetitive hypothesis.[54]

The findings at LaGuardia are somewhat more problematic. USAir also is the largest carrier at LaGuardia (28.9% share of slots). Based on total-days usage, USAir leased slots to carriers that used the slots just as intensively as USAir used its O&O slots; however, based on weekdays-only usage, USAir leased slots to carriers that used the slots significantly *less* often than USAir used its O&O slots. This result is consistent with the anticompetitive leasing hypothesis. Delta, the second largest carrier at LaGuardia (21.9% share), and American, the third largest carrier at LaGuardia (13.1%), also appear to lease slots to carriers that use the slots less often than Delta or American use their O&O slots. Thus, at LaGuardia some leasing patterns appear consistent with the anticompetitive leasing hypothesis.[55] At Kennedy, the differences in slot use of O&O slots and leased slots are all statistically insignificant.

---

[54] In our 1991 Comments, we found that USAir leased its slots at National in a manner consistent with the anticompetitive leasing hypothesis.

[55] In our 1991 Comments, we found that leasing patterns at LaGuardia were not consistent with the anticompetitive leasing hypothesis.

Overall, the patterns of use of O&O slots and leased slots are somewhat mixed with regard to the anticompetitive leasing hypothesis. At O'Hare, the most highly concentrated of the four HDTAs, and at Kennedy, the differences in slot usage are inconsistent with anticompetitive leasing hypothesis. At National and LaGuardia, the competitive implications of the differences in O&O and leased slot usage rates are less clear. At National, the largest carrier, USAir, appears to lease slots to carriers that use them at least as intensively as USAir uses its O&O slots. This finding is contrary to the predictions of the anticompetitive leasing hypothesis. Nonetheless, Delta, the second largest carrier at National, tends to use its O&O slots at a significantly higher rate than the carriers that lease slots from it. At LaGuardia, where USAir is again the largest carrier, USAir, Delta, and American lease slots to carriers that use them less intensively than these carriers use their O&O slots. This result, which passes standard tests of statistical significance, is consistent with the anticompetitive leasing hypothesis.

Table 4 lists the net leasing positions of the carriers holding slots at each HDTA in September-October 1993. The anticompetitive leasing hypothesis predicts that carriers with a large share of the slots at an HDTA will tend to be net lessors. Accordingly, this anticompetitive hypothesis would be supported if the difference between the number of slots operated and the number of slots held is negative.[56] The results in Table 4 are somewhat mixed, but do not generally support the anticompetitive hypothesis. At O'Hare and National, the largest carriers are net lessees—they operate more slots than they hold, counter to the prediction of the anticompetitive hypothesis. At LaGuardia, the largest carrier, USAir, operates four fewer slots than it holds, while the next two largest carriers, Delta and American, operate the same number of slots that they hold. At Kennedy, because Shawmut Bank's 44 slots are treated as being held by TWA, TWA holds 48 slots and operates 43, making TWA the largest holder at Kennedy and a net lessor of slots. The next two largest carriers at Kennedy, however, American and Delta, are not net lessors of slots.

---

[56] As was the case with Table 3 (see footnote 53), in Table 4 a carrier's "held" slots include those leased to it from noncarrier slot holders (i.e., financial institutions) on a long term basis and held in trust by noncarrier slot holders as collateral for secured obligations. See footnote 50 above. The regression analysis in the next section allocates the slots held by noncarriers in the same manner.

TABLE 4
SLOTS OWNED, OPERATED, AND NET LEASING POSITION

O'HARE

SLOT HOLDER	CODE	SLOTS HELD	SLOTS OPERATED	SLOTS OPERATED - SLOTS HELD
UNITED AIRLINES	UAL	674	712	38
AMERICAN AIRLINES	AAL	533	540	7
DELTA AIRLINES	DEL	57	48	-9
USAIR	USA	35	30	-5
NORTHWEST AIRLINES	NWA	38	45	-7
FEDERAL EXPRESS	FDX	5	0	-5

NATIONAL

SLOT HOLDER	CODE	SLOTS HELD	SLOTS OPERATED	SLOTS OPERATED - SLOTS HELD
USAIR	USA	178	211	33
DELTA AIRLINES	DAL	88	86	-2
NORTHWEST AIRLINES	NWA	87	56	-31
AMERICAN AIRLINES	AAL	67	68	1
UNITED AIRLINES	UAL	42	31	-11
MIDWEST EXPRESS	MEP	1	0	-1
TRANS WORLD AIRLINES	TWA	33	31	-2

TABLE 4 CONTINUED
SLOTS OWNED, OPERATED, AND NET LEASING POSITION

LAGUARDIA

SLOT HOLDER	CODE	SLOTS HELD	SLOTS OPERATED	SLOTS OPERATED - SLOTS HELD
USAIR	USA	201	197	-4
DELTA AIRLINES	DAL	112	112	0
AMERICAN AIRLINES	AAL	67	67	0
NORTHWEST AIRLINES	NWA	41	34	-7
UNITED AIRLINES	UAL	35	37	2

KENNEDY

OWNED AND OPERATED

SLOT HOLDER	CODE	SLOTS HELD	SLOTS OPERATED	SLOTS OPERATED - SLOTS HELD
TRANS WORLD AIRLINES	TWA	48	43	-5
AMERICAN AIRLINES	AAL	22	22	0
DELTA AIRLINES	DAL	12	12	0
USAIR	USA	9	7	-2
NORTHWEST AIRLINES	NWA	9	0	-9
UNITED AIRLINES	UAL	7	6	-1
BUSINESS EXPRESS	GAA	1	9	8

B. Regression Analysis

As in our 1991 Comments, we further examine the anticompetitive hypotheses regarding slots using multiple regression analysis to analyze the more recent (September-October 1993) slot usage data. The dependent and independent variables used in these regressions are generally the same as those used in the 1991 Comments.[57] In the regressions, the dependent variable is the number of days a slot was used, NDOPER. The dependent variable is measured by using either all 61 days in the sample period or only the 43 weekdays in the period.

The independent variables in the regressions consist of (1) SLMS, the slot holder's share of the total number of nonrestricted and nonexempt slots at the HDTA at the end of the two-month period; (2) NAMS, the slot holder's national market share (based on Revenue Passenger Miles) for the two month period; (3) WITHD, the FAA withdrawal priority number; (4) LEASE, a dummy variable equal to one if the slot is operated by a single operator other than the slot holder and zero otherwise; (5) MULTO, a dummy variable equal to one if the slot is operated by more than one operator, and was not traded in the two month period and zero otherwise; and (6) P_t, a dummy variable equal to one if the slot's hour or half-hour period starts at time t. The dummy variable P_T is dropped, where T is the last hour or half-hour period of the day for which slots are allocated at each airport.

The inclusion of SLMS allows us to test the anticompetitive hypothesis that slots held by carriers with a large share of the slots at the HDTA will be used less intensively than slots held by carriers with smaller shares.[58]

---

[57] One variable has been dropped because it is not applicable to the September-October 1993 data. MULTH, a dummy variable equal to one if the slot holder changed during the two-month period and zero otherwise, was dropped because no slot was transferred from one holder to another during the September-October 1993 period.

[58] The regressions include the interactions of SLMS with LEASE and MULTO; consequently, the coefficient on SLMS measures changes in NDOPER as SLMS changes only in those cases in which LEASE and MULTO equal zero. For cases in which LEASE equals 1 and MULTO equals 0, the effect of a change in SLMS on NODPER equals the sum of the coefficients on SLMS and LEASE*SLMS; when MULTO equals 1 and LEASE equals 0, this effect is the sum of the coefficients on SLMS and MULTO*SLMS; and when both LEASE and MULTO equal 1, this effect is the sum of the coefficients on SLMS, LEASE*SLMS, and MULTO*SLMS. For the majority of slots in our sample, both LEASE and MULTO are zero; consequently, our discussion of the effects of slot market share on the number of days a slot was used (i.e., our dependent variable NDOPER) generally concerns the coefficient on SLMS. We have, however, calculated the effects of changes in SLMS on NDOPER for those cases in which either LEASE, MULTO, or both equal 1. Those cases in which these effects are significant are discussed in footnotes.

The variables LEASE and LEASE*SLMS (which interacts these two variables) allow us to test the anticompetitive leasing hypothesis, which predicts that slots leased by large holders of slots to other carriers will be used at lower rates. The other variables in the regressions control for other factors that might affect usage rates, but which do not necessarily imply anticompetitive behavior. NAMS controls for differences in slot use resulting from the degree to which different carriers have more or less extensive route structures.[59] All other things equal, the more extensive a carrier's route network, the more flexibility the carrier will have to adjust routes and, consequently, the more efficiently a carrier will be able to utilize slots. The slot withdrawal number, WITHD, controls for possible differences in the strength of a holder's "property right" associated with a slot and any influence that this may have on usage rates. The dummy variables P_t are included in order to control for differences in slot use arising from differences in the time of day over which a slot is defined. A slot covering a period of the day in which air travel tends to be high will, all other things equal, be used at a higher rate than a slot covering a less busy time of day.

The larger number of noncarrier slot holders in the 1993 data makes the analysis here somewhat more complicated than in the 1991 Comments. In September-October 1993, as in May-June 1990, the Shawmut Bank held TWA's former slots in trust and TWA, in turn, had a long-term lease with Shawmut for use of the slots. Thus, Shawmut's slots were treated as held by TWA in the regression analysis. The slots held by the other noncarrier holders have been treated similarly.[60]

The results from the 1993 regressions are reported in Tables 5.1 through 5.4.[61] As explained below, they do not tend to support the anticompetitive hypotheses.

---

[59] The national market shares for the two slot holders that do not offer carrier service, Wilmington and Federal Express, are set to zero.

[60] See footnote 50 supra.

[61] For expositional convenience, the coefficients on the time-period dummy variables are not reported. Estimates of these coefficients are available upon request.

TABLE 5.1
REGRESSION RESULTS

O'HARE

DEPENDENT VARIABLE: NUMBER OF DAYS SLOT OPERATED, SEPT - OCT 1993
(t-statistics in parentheses)

VARIABLE	COEFFICIENTS	
	ALL DAYS	WEEKDAYS ONLY
CONSTANT	52.58 (51.94)*	40.49 (70.65)*
SLMS	-0.91 (-1.65)*	-0.52 (-1.66)*
NAMS	7.39 (3.18)*	4.66 (3.54)*
WITHD	$.18 \times 10^{-4}$ (0.17)	$.77 \times 10^{-4}$ (1.22)
LEASE	0.24 (0.77)	0.23 (1.25)
LEASE*SLMS	-0.40 (-0.45)	-0.37 (-0.74)
MULTO	-0.20 (-0.46)	-0.02 (-0.07)
MULTO*SLMS	0.42 (0.37)	-0.40 (-0.61)
N	1414	1414
MEAN DEP. VAR.	58.20	42.07
R-SQUARED	.325	.122
ADJ R-SQUARED	.308	.100
F	18.96*	5.4842*
LOG LIKELIHOOD	-2881.62	-2077.27

* Significant at less than the .05 level (one-tail test)

TABLE 5.2 REGRESSION RESULTS		
NATIONAL		
DEPENDENT VARIABLE: NUMBER OF DAYS SLOT OPERATED, SEPT - OCT 1993 (t-statistics in parentheses)		
VARIABLE	COEFFICIENTS	
	ALL DAYS	WEEKDAYS ONLY
CONSTANT	61.10 (24.85)*	43.64 (37.86)*
SLMS	-0.84 (-0.41)	2.03 (2.12)*
NAMS	6.47 (1.66)*	1.14 (0.62)
WITHD	-0.48×10^{-2} (-5.35)*	-0.12×10^{-2} (-2.83)*
LEASE	-0.97 (-1.02)	0.37 (0.83)
LEASE*SLMS	0.58 (0.11)	-4.71 (-1.87)*
MULTO	-1.30 (-1.31)	-0.21 (-0.46)
MULTO*SLMS	3.91 (0.70)	-1.11 (-0.42)
N	539	539
MEAN DEP. VAR.	56.65	41.80
R-SQUARED	.232	.144
ADJ R-SQUARED	.196	.104
F	6.48*	3.61*
LOG LIKELIHOOD	-1461.69	-1053.23
* Significant at less than the .05 level (one-tail test)		

TABLE 5.3 REGRESSION RESULTS		
KENNEDY		
DEPENDENT VARIABLE: NUMBER OF DAYS SLOT OPERATED, SEPT - OCT 1993 (t-statistics in parentheses)		
VARIABLE	COEFFICIENTS	
	ALL DAYS	WEEKDAYS ONLY
CONSTANT	76.39 (4.24)*	48.99 (3.80)*
SLMS	-0.52 (-0.16)	2.57 (1.14)
NAMS	10.57 (1.92)*	4.81 (1.22)
WITHD	-0.38×10^{-2} (-1.08)	-0.13×10^{-2} (-0.54)
LEASE	0.98 (0.48)	1.67 (1.14)
LEASE*SLMS	1.92 (0.32)	-3.47 (-0.80)
MULTO	0.12 (0.11)	0.13 (0.16)
MULTO*SLMS	0.37 (0.10)	-3.38 (-1.21)
N	112	112
MEAN DEP. VAR.	57.70	40.93
R-SQUARED	.181	.174
ADJ R-SQUARED	.043	.035
F	1.31	1.25
LOG LIKELIHOOD	-266.24	-228.68
* Significant at less than the .05 level (one-tail test)		

TABLE 5.4 REGRESSION RESULTS		
LAGUARDIA		
DEPENDENT VARIABLE: NUMBER OF DAYS SLOT OPERATED, SEPT - OCT 1993 (t-statistics in parentheses)		
VARIABLE	COEFFICIENTS	
	ALL DAYS	WEEKDAYS ONLY
CONSTANT	63.06 (20.72)*	43.29 (37.64)*
SLMS	2.24 (1.11)	2.47 (3.23)*
NAMS	-1.35 (-0.34)	4.06 (2.71)*
WITHD	-0.13×10^{-2} (-1.92)*	-0.37×10^{-3} (-1.42)
LEASE	-0.57 (-0.67)	0.53 (1.65)*
LEASE*SLMS	-1.22 (-0.35)	-4.50 (-3.41)*
MULTO	-1.07 (-1.25)	-0.23 (-0.70)
MULTO*SLMS	2.34 (0.71)	0.01 (0.01)
N	512	512
MEAN DEP. VAR.	57.30	42.00
R-SQUARED	.163	.179
ADJ R-SQUARED	.089	.105
F	2.18*	2.43*
LOG LIKELIHOOD	-1375.75	-887.44
* Significant at less than the .05 level (one-tail test)		

1. O'Hare

O'Hare is the most concentrated of the four HDTAs. The high level of concentration might suggest that the potential for anticompetitive behavior would be greatest here. In fact, the two coefficients on SLMS, the slot holder's market share, are negative and statistically significant at the .05 level using a one-tail test. While these findings are consistent with the anticompetitive hypotheses, these coefficients are very small.[62] The coefficients on LEASE and LEASE*SLMS also are statistically insignificant, as are the coefficients on the control variables except NAMS, national market share. Thus, this regression appears to indicate that slot usage at O'Hare is primarily a function of the extensiveness of a carrier's route structure.[63]

2. National

At National, the coefficient on SLMS is negative in the all-days regression, but it is statistically insignificant. In the weekdays-only regressions, the coefficient on slot market share is both positive and significant, which is inconsistent with the anticompetitive usage hypothesis. Both coefficients on LEASE are statistically significant a the .05 level using a one-tail test, and the coefficient on LEASE*SLMS is statistically significant at the .05 level in the weekdays only regression. For weekday use, the largest slot holder at National, USAir, leased

---

[62] In the ALL DAYS (WEEKDAYS ONLY) regression, the coefficient of -0.91 (-0.52) indicates that an increase in slot market share of 50 percent would decrease slot usage by 0.46 (0.26) days over a two month period. In the WEEKDAYS ONLY regression, the sum of the coefficents on SLMS and LEASE*SLMS equals -.89 (see footnote 58), which is statistically significant at the .05 level using a one-tail test (t-statistic equals -1.85). This result indicates that an increase in market share of 50% would decrease slot usage by 0.45 days for those slots that were leased. Approximately 14 percent of the 1414 O'Hare slots included in our sample were leased. In our 1991 Comments, we found a positive and significant relationship between SLMS and slot usage at O'Hare, a result inconsistent with the anticompetitive hypothesis.

[63] As indicated in Table 2, there is little variation in usage rates across the various airlines holding slots at O'Hare. Since the two largest carriers at O'Hare are also the two largest carriers nationally, NAMS may be capturing some of the relationship between slot use and market share. When NAMS is dropped from the regressions, the coefficient on SLMS falls to -.199 (t-statistic -.39) in ALL DAYS regression and -.072 (t-statistic -.25) in the WEEKDAYS ONLY regression.

slots to carriers who used these slots significantly less intensively than USAir utilized its owned and operated slots.[64] This finding is consistent with the anticompetitive leasing hypothesis, although the effect is offset by the positive, significant coefficient on SLMS in the weekdays-only regression.

The coefficient on WITHD is significant in both the all-days and weekdays-only regressions. In both regressions, this coefficient is negative, indicating that slots with higher withdrawal numbers (i.e., those *least likely* to be withdrawn) are used less intensively—a somewhat surprising result.

3. Kennedy

Virtually all coefficients estimated by both regressions are statistically insignificant at standard levels.[65] Accordingly, no relationships between slot shares and slot usage or leasing and slot usage are discernable. In fact, the F-statistic testing the joint significance of all the explanatory variables is statistically insignificant, which indicates that the explanatory variables, taken together, cannot explain the observed variation in the dependent variable.

4. LaGuardia

For the all-days regression, the constant term and WITHD are statistically significant at standard levels.[66] The weekdays-only regression appears somewhat more informative. The coefficient on SLMS, slot market share, is positive and significant, a result that is inconsistent with the anticompetitive hypothesis. On the other hand, the negative, significant coefficient on LEASE*SLMS indicates that slots leased by larger carriers to other carriers tend to be used relatively less intensively, a result consistent with the anticompetitive hypothesis (and with the

---

[64] By combining the coefficients on the LEASE and LEASE*SLMS variables with USAir's slot market share at National, the analysis indicates that the slots that USAir leased to other carriers were used 1.18 fewer days over this two month period than USAir utilized its owned and operated slots. This difference is statistically significant.

[65] In the case of the all-days regression, the coefficient on national market share, NAMS, would be significant at the .05 level using a one-tail test. This indicates that a carrier with a more extensive national route structure tend to use slots at Kennedy somewhat more intensively.

[66] The negative coefficient on WITHD suggests that slots less likely to be withdrawn by the FAA (i.e., those with higher withdrawal numbers) are less highly used—a somewhat counterintuitive result. The F-statistic for the regression is statistically significant.

results reported in Table 3).[67] According to this analysis. the two carriers with the largest slot shares at LaGuardia, USAir and Delta, leased slots to other carriers who utilized them less intensively, other things equal, than these two carriers utilized their owned and operated slots.[68]

5. Summary of Regression Results

Generally, the regressions using the September-October 1993 data do not indicate any consistent relationships between slot usage and either holders' slot market shares or holders' leasing behavior. The results, therefore, do not generally support the two anticompetitive hypotheses examined.[69] Many of the findings do not meet standard tests of statistical significance; in these cases, the hypothesis that the variables to which they apply had no effect on slot usage one way or the other cannot be rejected. The negative, significant coefficients on slot market share at O'Hare do support the anticompetitive hypothesis, but would account only for very small effects. The analyses that provide statistically significant results supporting the anticompetitive leasing hypotheses also contain offsetting results with regard to slot market share. At National and LaGuardia, the weekdays-only regressions produce negative, statistically significant results that are consistent with the anticompetitive leasing hypothesis, but these same analyses contain positive, statistically significant coefficients on market share that are inconsistent with the anticompetitive slot usage hypothesis.

---

[67] For those cases in which slots were leased (i.e., LEASE equals 1), the sum of the coefficients on SLMS and LEASE*SLMS is -2.02, which is significant at the .05 level using a one-tail test (t-statistic equals -1.86). This results indicates that an increase in market share of 50% would decrease the usage of leased slots by 1 day. This result is consistent with the results reported in Table 3. Approximately 22 percent of the 512 LaGuardia slots included in our sample were leased.

[68] The analysis indicates that the slots leased by USAir (Delta) to other carriers were used 1.24 (0.45) fewer days over this two month period than were the carrier's owned and operated slots. These differences are statistically significant.

[69] These results, of course, depend on the data and the model that was estimated.

VII. Peak and Off-peak Pricing as an Alternative to the HDR

Some critics of the HDR have suggested that the use of peak and off-peak landing fees may be a preferred alternative to the HDR.[70] In a previous analysis of the use of peak and off-peak aircraft operations fee structures,[71] the staff of the FTC concluded that properly structured takeoff and landing fees can be an important step toward more efficient pricing of operating rights.[72]

The marginal cost of an aircraft operation consists of: (1) the resource costs imposed on the airport; (2) the delay costs imposed on aircraft operations and passengers, including the delay costs imposed on other flights; and (3) the noise costs imposed on residents living near the airport. During peak periods, the first two, and possibly all three, of these marginal costs increase. Increased congestion during peak periods increases delay costs imposed on passengers and airlines using the airport during these times.[73] The resource costs imposed on the airport also increase (e.g., additional costs are imposed on the air traffic control system).

---

[70] *See*, for example, S. Morrison and C. Winston, "The Dynamics of Airline Pricing and Competition," 80 *American Economic Review* 389 (May 1990). They write, "Because slots limit the effect of competition on fares and the number of competitors, they should be eliminated and replaced by congestion-based takeoff and landing fees. Congestion pricing would reduce travel delays efficiently ... and could enhance competition." (p. 392).

[71] *See* Comments of the Bureaus of Economics, Competition, and Consumer Protection of the Federal Trade Commission, *Massport Program for Airport Capacity Efficiency* (February 29, 1988).

[72] Both peak-load pricing and the HDR have the desirable attribute of being market-based methods of allocating airport capacity. When resources are allocated by non-market methods, such as through administrative action, the benefit of the good or service is awarded as an economic rent. Economic theory predicts that private parties will make expenditures in pursuit of such gain until the gain is dissipated. *See, e.g.,* Posner, "The Social Costs of Monopoly and Regulation," 83 *Journal of Political Economy* 807 (1975), for a discussion of the proposition that pursuit of economic rents converts those rents into social costs. Thus, in order to obtain goods or services awarded by non-market methods, firms expend real resources—such as for attorneys, lobbyists, and consultants—until the expected gains are dissipated. These expenditures represent a social cost that is largely avoided by market-based allocation methods.

[73] Examples of these costs include the extra fuel used by aircraft waiting to take off and land and the additional time wasted by delayed passengers. For a more detailed discussion of this point, see the FTC Comments on the Massport Program, *supra* note 71, Appendix A, and Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, Cambridge: MIT Press (1988), pp. 87-116.

Economically efficient prices would cover all of these costs. Because the marginal costs of a landing will increase during peak periods, the economically efficient price of a landing also will increase during peak periods. Thus, using a peak/off-peak pricing structure would be consistent with economically efficient pricing.

Although economically efficient pricing will have a peak/off-peak structure, whether or not a regulatory body or airport administrator would (or could) choose the appropriate levels of peak and off-peak prices both to avoid congestion and to utilize capacity optimally is not clear. Some critics promote the use of price rather than quantity, that is, slot regulation, as the appropriate regulatory instrument. The underlying reason for this preference is not always clear, and the relative merits of a quantity-based versus price-based system are not clear *ex ante*. While *market* prices are superior economizers of information compared to administratively set output levels, *administratively set* prices do not necessarily possess the same advantage.[74]

The amount of information required to implement peak and off-peak pricing may be formidable. An airport's capacity is fixed, but the demand for air travel from a particular airport can fluctuate substantially. Not only does demand fluctuate between peak and off-peak periods during each day, but peak and off-peak demand can fluctuate from day to day and month to month. The demand for air travel (both at peak and off-peak times) will fluctuate with changes in the business cycle, seasonally, and as a result of purely random events such as terrorist threats and the weather. If administratively determined peak and off-peak prices cannot respond quickly to cyclical and random changes in peak and off-peak demand, then the welfare of air travelers may be reduced. If prices are set too low, travelers may be faced with congestion and congestion related delays; if prices are set too high, airport capacity may be under-utilized as the number of operations falls below levels necessary to control congestion.

The HDR was adopted in order to allocate existing capacity. If that capacity is known and reflected in the hourly slot quotas, the prices at which slots trade will fluctuate as demand fluctuates: higher prices during high-

---

[74] *See* F. A. Hayek, "The Use of Knowledge in Society," 35 *American Economic Review* 519 (1945), and M. L. Weitzman, "Prices and Quantities," 41 *Review of Economic Studies* 477 (1974).

demand peak periods, and lower prices during low-demand off-peak periods. Thus, given the level of capacity, market forces will lead naturally to peak and off-peak prices. To implement slot-based regulation, the only information that regulators or airport administrators need is an estimate of the capacity of the airport. Since airport capacity does not generally change from day to day or hour to hour, the degree of regulatory oversight necessary to implement slot-based regulation is modest.

Thus, while using peak/off-peak pricing of takeoff and landing fees would likely enhance efficiency compared to rationing airport capacity by the queue, it appears likely that such a pricing structure is not superior to slot-based regulation. The information required to set peak-load prices at levels that adequately discourage congestion may be considerable given the degree of cyclical and random fluctuations in the demand for air travel.

VIII. Suggested Areas for Study

To the extent the FAA might be concerned about the effects, if any, of slot market regulation on other dimensions of competition in the airline industry, the FAA might consider expanding its slot usage data base to include such information as the size and destination of the airplane using a particular slot, the prices at which carriers sell slots to one another, and rates at which slots are leased. Such data would allow a more refined analysis of how slot usage might affect or evidence competition among airlines.[75] If collecting this additional data is burdensome, the FAA might consider collecting the data for a limited study period or for a limited, representative sample of the slots. In addition, the FAA might want to consider, as part of its study of the HDR, a reexamination of the operating capacity at each of the HDTAs. Such a study would help to ensure that slot quotas still accurately reflect capacity and do not inappropriately constrain airport operations.

The staff of the Bureau of Economics supports the FAA's efforts to encourage the use of market-based systems to allocate scarce airport resources, including the use of price-based and quantity-based allocation schemes.

---

[75] The FAA may also wish to examine whether different airlines' financial circumstances affected their slot usage rates.

We suggest that the FAA consider under what conditions use of quantity-based regulation systems, such as the HDR, may be more efficient than price-based regulation systems.

IX. Conclusions

The high density rule was created in reaction to congestion and delays at the high density traffic airports. Although the rule has been criticized as imposing artificial constraints on operations at the four HDTAs, it is the limited capacity of these airports, not the HDR, that ultimately constrains their operations. The HDR is basically a mechanism for allocating the limited capacity of the HDTAs to competing carriers. By creating a market for slots, the HDR helps ensure that slots are allocated to the flights that are valued most highly by consumers.[76]

We concluded from our empirical examination of slot usage at the four HDTAs both before and after the 1992 amendments to the HDR were adopted that slot usage was not consistent with the exercise of market power by incumbent carriers. The 1992 amendments were designed specifically to promote entry by new carriers and foster the growth of smaller incumbent carriers at the HDTAs. Given the important economic function of the HDR as a mechanism for efficiently allocating limited capacity, the FAA may wish to consider rescinding one part of those amendments, the two-year restriction on the sale of slots obtained through a lottery. Further, the FAA may wish to study the feasibility of extending the HDR to include additional airports regularly prone to congestion and delays attributed to excess demand at peak time periods. Alternatively, the FAA may wish to consider allowing airports that are not slot-regulated to implement peak-load pricing of landing and takeoff fees as a means of allocating scarce capacity more efficiently than by simple rationing by the queue. As we have emphasized in our

---

[76] Markets are being used to allocate scarce resources efficiently in a number of regulatory settings. The 1990 Clean Air Act, for example, allows pollution emission credits to be purchased and sold. By allowing a market for pollution credits to exist, Congress created incentives that will help insure that air quality standards are met through the cheapest and most efficient means. As described in the *New York Times* (October 23, 1990, p. A18), "The idea in the legislation is that if one company can remove a ton of sulfur dioxide at its plant more cheaply than another company can do it at another plant, then the ton should be removed in the cheapest place, and the utility doing the extra work should be able to sell the credit to other utilities, thus reducing emissions at the lowest possible overall cost." More recently, the Federal Communications Commission has used an auction to allocate spectrum to firms providing "personal communications services."

comments, the HDR is not the problem—rather, the problems are the limited capacity, high demand, and resulting congestion and congestion-related delays at the HDTAs. The HDR is an attempt to solve these problems in an economically efficient manner.