# Congestion, Concentration, and Contestability: The Case of the Airline Industry

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**When the contestability theory was first developed, it was believed that the airline industry represented the ideal case of ultra free entry. As empirical evidence mounted, it became clear that only the weak form of the theory applied. A major reason for this change was the recognition that, while entry was free in the regulatory sense, at the level of practice, problems still remained. A major contributor to restricted entry was airport capacity limitations. These shortages of capacity bestow a variety of competitive advantages on incumbent carriers. The auctioning of airport capacity is suggested as a means of increasing the contestability of the airline markets, given that it levels the playing field. The paper demonstrates that it is not feasible for financially strong carriers to attempt to use the auctions to exclude potential rivals, nor to expel competitors from the market.**

Following deregulation in 1978, the number of carriers in the airline industry increased sharply. Easy market access and the ready availability of surplus jet-powered aircraft attracted new competitors. Although the pattern was not uniform across the nation, the overall supply of services increased and fare yields fell. The increased competition, coupled with the inherent tendency toward head-to-head (or service) scheduling, resulted in increased congestion at a variety of airports in the system. In turn, this fueled demands for airport expansion and other changes in the air transport system such as changing the separations between landings thereby increasing the number of slots available per hour (*1*, p. 70). It is fair to say that these congestion problems have not yet been resolved (*2,3*).

It is argued elsewhere (*4*) that the need to maximize the efficiency of airport infrastructural facilities exists and that an auction mechanism easily accommodates this need. Also, decreasing returns to flights exist, which, in turn, results in increased costs on a per passenger basis. The rising cost partly explains the increased concentration in the industry. Because the problems of congestion remain, the conclusion is that no parallel decrease in flights occurred as the concentration increased. (It should be noted that the consolidation of the industry and the hubbing activities of the participants reduced the number of flights at the 22 slot-constrained airports in 1987 (*5*, p. 81).

The renewed vigor of the oligopoly market structure in the airline industry reestablishes a sellers market, permitting increased fare yields and economic profits. These developments make the contestability of the industry important. At the same time, there are institutional barriers that greatly reduce the contestability, at least at the busiest hubs. A solution to this problem must be found.

The nature and extent of the contestability of the industry under present airport capacity allocation rules are reviewed. Other problems with the notion of perfect contestability are also discussed. The rationale for the adoption of the auction approach as a means of increasing the contestability of the industry is discussed next. The auction process, together with its benefits to the airport authorities and potential entrants, is then discussed. Finally, the conclusions from the analysis are presented.

## CONTESTABILITY OF AIRLINE MARKETS

In the early stages of the evolution of the contestability hypothesis, deregulated airline markets were initially seen as representing the ideal case. Carrier-owned capital was highly mobile and the costly fixed capital facilities were provided by others. As empirical evidence has mounted, these attitudes have changed. At the present time, airline markets are viewed as only "partly" contestable. A variety of factors lie at the root of this revised position. From the perspective of the present research, the problem of airport access is considered the most important. But other problems associated with such competitive tools as frequent flyer programs and computer reservations systems also exist.

### Problems of Airport Access

In order to *operate* flights on any given link in an air transportation system, an airline must have access to landing slots, gates and holding rooms, and airport counter space at both ends of the link. Thus it must have, or at least have ready access to, such facilities at both ends of the specific link that it wishes to *contest*. If that is not the case, the potential entrant will have to incur sunk costs of entry, reducing the contestability of the market, at least where only accounting costs—and not full economic costs—are incorporated into the analysis. The value of the landing slots to an incumbent must be imputed into its cost structure. Otherwise, there is the illusion that the incumbents can earn an element of monopoly rent.

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Contestability theory is most applicable to a situation in which a carrier, possessing all of the requisite facilities, wants to initiate service on that link. There are few difficulties here. Aside from an advertising campaign designed to attract passengers to the new service, the sunk costs of entry are zero. This position abstracts from the opportunity costs of an airline's using its airport capacity in one fashion rather than another. For example, to contest a new link, it may have to forego profit opportunities on some other link. Brander et al. discuss the impact of this situation (*4*).

Of more interest is the capability of a new airline carrier to penetrate a new market. Here, the effectiveness of contestability can be likened to the effectiveness of competition in the neoclassical model. It is the entry of a new carrier into the industry—not the expansion of an existing carrier—that has the most profound impact in the marketplace. (Consider the impact of Freddie Laker.) However, given existing airport capacity allocation practices, a new entrant faces a variety of sunk costs. Most important are the costs of obtaining landing slots and the requisite internal airport space, if, in fact, these were available at all. Contestability of the market may be lowered as a result. Much of this is, of course, already known. For example, Baumol and Willig (*6*, p. 24) have noted that recent experience in the industry has "revealed several elements of the structure of supply that conflict significantly with the conditions necessary for the pure theory of contestability to apply." According to Morrison and Winston (*7*, p. 61, *8*) one of these elements is airport access. They argue that newcomers must incur sunk costs to obtain airport capacity and to recruit passengers.

Further discussion of these supply elements is given by Cohen (*9*) who reports on a Civil Aeronautics Board (CAB) study related to antitrust policy for a deregulated airline industry. That study suggests four potential barriers to the entry of new carriers:

- Systemwide scale economies,
- Control of feeder traffic,
- Equipment and financial constraints, and
- Airport access.

Cohen suggests that the power of incumbent carriers might be such as to contribute to a reduction in the contestability of specific city-pair markets. One important aspect here is the long-term leases of internal airport space which is controlled by the lessee regardless of whether it is actually in use. A second, relevant aspect is the potential incumbent influence over airport management decisions. According to Cohen (*9*, p. 144) taken together, these could permit carriers to "both block new entry to existing facilities and prevent the airport operator from expanding to accommodate additional entry or growth by small incumbents."

Schedule committees are a third aspect of the problem. The potential for actions to limit new entry by the incumbent carriers does exist and is likely to increase as the level of congestion increases. This potential, together with other possible exclusionary anticompetitive actions have raised congressional concern to the extent that one trade publication (*10*, pp. 34–37) has suggested that Congress "may well legislate the industry back into regulation." Part of this concern for reregulation is due to an increasing number of consumer complaints and part of it comes from the increasing concentration of the industry (*11*).

There are serious access problems in the industry. These occur because although there is freedom of entry into the industry, there is not necessarily freedom of entry into the individual city-pair markets. The cause is the set of accumulated institutional arrangements for the allocation of capacity. In effect, these arrangements constitute a new form of industry regulation. The new regulation is different from the old in that it is less visible, stemming from lease arrangements and slot allocation procedures. It also affords less protection for the consumer given that there is no forum in which they can air their views. A return to the past is a second best solution, one that trades one set of deadweight welfare losses for another. Public policy would be better directed toward improving the contestability of the airline markets by ensuring that the playing field is level.

The exact effect of these limitations on contestability is a function of the amount of excess capacity at the airports involved. Where the airports are highly congested, there will be sunk costs of entry because it will be necessary to purchase the requisite facilities from incumbents. Thus the direct (cash) costs of the entrant will be higher than those of the incumbent. It should be noted that economic costs (i.e., the sum of the cash costs and imputed costs) will be the same for incumbents and new entrants. Where there is substantial excess capacity at both airports, the sunk costs of entry would be much less.

### The Question of Sunk Costs

The question of sunk costs is usually raised with respect to potential entrants. However, there is some evidence that, during the transition to a deregulated environment, incumbent carriers may encounter sunk costs that new entrants into the industry—not entrants into a particular market in the industry—do not face. Meyer and Tye (*12*, p. 277) note that "individual prices seemed to have little to do with the costs of individual services." They enumerate choice of aircraft, labor contracts, and excess capacity among legacies of the regulatory period, which impose sunk costs on incumbents, at least in the short run.

Another relevant sunk cost of incumbents is the liabilities built up over time as a result of the use of frequent flyer programs as competitive tools. This is an interesting subject, although not a well-researched one. Some believe that this competitive bonding technique significantly reduces the contestability of a market (*13*). Others express growing dismay over the programs. Ott reports concern in both the industry (*14*) and accounting groups because estimates of liabilities run up to $1 billion (*15*, p. 131). Closely related is the question as to whether "the industry as a whole has gained any additional passengers as a result of the frequent flyer programs" (*16*). Estimates here vary widely, but analysts agree that the contingent liabilities are substantial. One can only conclude that incumbents have substantial sunk costs in this area as well as others.

In discussing the issue of sunk costs, two opposing forces must be considered. That a new entrant may incur sunk costs is obvious. As the previous discussion shows, landing slots or internal airport space, or both, must be purchased by new entrants from incumbents. There are, however, sunk costs that incumbent carriers must bear as well. Most, if not all of these, are legacies from the regulatory period. The impact of

sunk costs on contestability is presumably the net result when these are offset against one another.

Coursey et al. (*17*, p. 71) consider contestability in the presence of sunk costs. As is customary in the contestability literature, they distinguish between fixed and sunk costs, defining the latter as costs that "can be avoided by a decision not to enter a particular market." In that analysis, entry permits (valid for five periods) were required. The cost of these was the sunk entry cost in the model. Coursey et al. concluded that (*17*, p. 82–83)

> the effect of an entry cost is to weaken support for the strong form of the contestable markets hypothesis. . . . [However] the disciplining power of market contestability remains impressive even where entry cost weakens that power.

Although generalization from a single analysis is risky, the results imply that where the entry barriers are financial in nature, a weaker form of the contestability hypothesis remains valid.

### Access, Entry, and Rents in Specific Markets

Artificial entry barriers permit incumbents to earn monopoly rents even in deregulated industries. Bailey and Williams (*18*) argue that "local monopoly rents reflect the benefits of sunk costs at a strategically located facility." Although they argue that these rents arise because of the ability to develop a hub-and-spoke network, the rents appear to be more generalized. A central question is the dominance of certain carriers at single airport facilities.

This dominance arises through control of the critical groundside and airside facilities at such airports. In other words, the rents are not intramarginal, arising from the greater efficiency of individual carriers at specific airports. They are monopoly rents stemming from the fact that, in the presence of airport congestion, control of airport capacity is important. It is the possession of landing slots or the requisite airport terminal facilities, or both, that generate the economic rent for the carrier. It is also this dominance over the airport facility that permits the development of the hub-and-spoke system. These outcomes will occur regardless of the network configuration involved.

Also of relevance in the present discussion is Bailey and William's assertion that (*18*, p. 184)

> deregulation was premised on the ability of local governments, which operate the airports, to maintain competitive entry at their facilities and on the ability of U.S. antitrust laws to prevent full control of an airport by an air carrier.

Given that the supply curve of airport capacity is not perfectly elastic, competitive entry into an airport can be accomplished only through a freely functioning market. That such a market does *not* exist was clear for at least a decade before deregulation. Arbitrary administrative allocative mechanisms have been used for at least that long.

The Bailey and Williams argument leans strongly toward the position that entry into the industry was to be accomplished—or at least facilitated—by shifting the problems of new entry to local government. Local government would have the responsibility for ensuring that adequate infrastructural facilities were available. Other problems were given to the U.S. Department of Justice which would ensure that no violations of the antitrust laws occurred. The efficacy of deregulation is a function of the ease of entry. Although it is true that entry is free in an administrative sense, it is less than free in a practical sense because of the inability of local government to provide the necessary airport facilities. By extension, it also means that it is necessary to focus attention on the ability of a new entrant to obtain the requisite airport facilities needed to make contestability meaningful. If those facilities cannot be obtained directly from the airport, then they must be obtained from rival carriers. Because this situation strengthens the competitive position of incumbents, it becomes necessary to consider the entire question of ease of airport entry, and, in particular, the associated mechanisms for the allocation of the scarce airport capacity.

### A Look Back

In the period since Baumol's pathbreaking work on contestability, a large number of empirical tests have been completed. Current opinion leans toward the airline markets being only partially contestable. One issue that has arisen in examining the literature relates to the nature of the cost data used. The appropriate costs for inclusion in such an analysis are economic costs—including a variety of imputed costs, for example, the value to the incumbent of currently held airport capacity. In many of the studies the focus appears to have been on accounting costs.

Runway capacity allocation procedures, as well as use of long-term leases of internal airport space, force new entrants to incur expenditures not borne by incumbents. To find the economic cost to incumbents, the imputed value of such factors must be incorporated into the cost structure (i.e., be added to the received accounting costs). If one is interested in the optimal allocation of resources, as in the case of the contestability analysis, economic costs rather than accounting costs must be employed. If one is interested in increasing the efficiency—productive and allocative—of air transportation, it is apparent that the contestability of the airline markets must be improved.

## IMPROVING MARKET CONTESTABILITY

Access to the infrastructural facilities required by new entrants contesting specific city-pair airline markets is limited. This situation offers competitive advantage to carriers already in the market, permitting them to earn monopoly rents. Although reregulation of the industry is one possible way out of the difficulty, it is a nonmarket solution. Before it is adopted, it is necessary to decide if there is another solution that would permit market forces to allocate available capacity so that the contestability of specific markets is improved and deadweight losses reduced or eliminated. Auctioning of available capacity is one technique that would produce this effect. In the absence of existing auctions, it is necessary to simulate the auction prices that would emerge. Although, in principle, the process

is equally applicable to landing rights and internal airport space, only the slot prices are considered in the following discussion.

### Auction Mechanism

The public provision of airports allows airlines to earn economic rents by capturing the available passenger stock. If the industry is unregulated, congestion may emerge. The presence of congestion necessitates the establishment of some mechanism to allocate the scarce airport capacity. Different allocative techniques will, of course, have different impacts on incumbents, new entrants, airport revenues, and society as a whole.

Under administrative types of allocation procedures, an incumbent carrier typically possesses a number of landing slots, and given the usual attitudes toward the disruption of the system, is likely to retain most of them in the long-run. The airline pays a price for the landing slots determined by the airport authorities on the basis of the financial requirements of the airport and aircraft size and weight. Such a price bears no relationship to the value of the slot to the carrier. It is this spread between the value of the slot—or any other measure of a unit of airport capacity that might be employed in an analysis—to the carrier and the price paid for it that generates the economic rent for the firm. A new entrant or, for that matter, a firm wishing to expand, must purchase a slot at a price at least equal to its value to the seller. In the extreme, incumbents could forestall entry by refusing any offer to purchase though they would not do so under the usual assumptions of profit maximization. Existing carriers therefore have both a competitive and a cost advantage over new entrants. The contestability of the market is therefore reduced. The introduction of an auction mechanism would place both groups on the same competitive footing, enhancing the contestability of the market in question.

Preferences for particular slots are related to potential profit, which in turn is related to market demand conditions. Congestion and the value of specific landing slots are therefore both time and location specific. Elsewhere, it is argued that an auction mechanism using discriminatory bidding—a system in which the highest bidder wins and makes a payment equal to the maximum bid of the second highest bidder—is the preferred means of dealing with congestion. From an economic perspective, it is important to deal with the congestion issue. Congestion, as is well-known, generates social costs. In the absence of peak-load pricing, carriers are able to externalize these social costs and so generate deadweight losses. Congestion pricing corrects this distortion, and, from this study's perspective at least, an auction mechanism is the easiest means by which to implement it.

However, the auction mechanism is more powerful, and more useful, than this. Because of the relationship between the desirability of particular slots and their shadow (auction) price, it is also the best means of allocating scarce capacity so as to increase the contestability of the individual city-pair market. It does so by removing one of the impediments to the contestability of a market. With the system fully implemented, all competitors, actual or potential, would have identical access to airport capacity, and what is more, would have that access on the same basis. Thus one of the preconditions for ultra-free entry into a given airline market would be better satisfied.

### Toward an Auction Mechanism

The auction mechanism would function as follows. As an initial step, the airline would formulate a draft schedule. This would determine the specific landing slots and related airport capacity it required. Because the airline is able to estimate the contribution that each flight (or perhaps segment) would earn, it is possible for it to develop a set of bids for the capacity in question. These bids would be submitted in sealed tender form. At the appointed time, the bids would be opened by the airport authorities, and the bids for each unit of capacity would be ranked. The successful bidder would be the carrier submitting the highest bid in each instance, and that bidder would pay the amount indicated by the second highest bidder. In any auction, no one bids against himself, thus, the auction price paid is fractionally above that at which the second last bidder withdraws. If the carrier was successful in obtaining the slots required, it would proceed to complete its schedule.

It is anticipated that not all carriers will be fully satisfied with the outcome of the auction. Inevitably, some carriers will have only one of the two slots necessary to provide the service on the link. Thus some airlines will have slots that they wish to sell whereas others will want to acquire missing slots. In all likelihood, a slot aftermarket, similar in nature to the over-the-counter stock market, would develop. Once transactions in this market have been completed, all carriers would be in a position to complete their schedules.

In principle, the same approach can be followed with respect to internal airport facilities such as counter space, lounges, and loading gates. In practice, however, it would appear preferable to establish bundles of facilities at each airport and to auction these packages. The process would be the same as described for both the initial auction and for the aftermarket.

In theory, the auction approach is workable. It deals with the congestion problem, and at the same time, increases the contestability of the airline markets. The transitional difficulties in implementing such a scheme are discussed below. Also, the question of the length of time that an airline could hold property rights to a slot purchased at auction remains unanswered. The answer here is a function of the frequency of the auctioning, and the fraction of slots to be auctioned each time. If auctions were to be held twice per year, with, perhaps 20 percent of the slots being auctioned each time (peak and off-peak being considered separately), then the property right would extend for a 30-month period.

### Simulating the Auction

Given the absence of the sort of auction envisaged here, it was necessary to develop a simulation model in order to give some credence to this discussion. That model consisted of four carriers operating different sized aircraft into a single congested hub airport from a number of smaller airports. The demand was specified in such a way that all of the available landing slots at the hub were used, both peak and off-peak. A small sample of the results of the simulations is given in Table 1. The first line of the table provides the output for the

TABLE 1 IMPACT OF ADDITIONAL ENTRY ON SLOT VALUES

| | Slot Prices ($) | | Revenues (×10) ($) | |
|---|---|---|---|---|
| Carriers | Peak | Off-peak | Airport | TFP[a] |
| 4 | 47,327 | 2,587 | 892 | 2,789 |
| 5 | 54,822 | 3,067 | 1,037 | 2,599 |
| 6 | 58,654 | 3,250 | 1,107 | 2,480 |
| 7 | 59,159 | 3,477 | 1,127 | 2,402 |
| 8 | 60,490 | 3,548 | 1,152 | 2,374 |

[a]TFP is the total contribution to profit by all firms taken together.

four-carrier case, with the fourth carrier employing an aircraft of 200 seats. The other three carriers employ aircraft of 50, 100, and 150 seats, respectively. The carriers were related to their aircraft size for analytical tractability. In reality, mixed fleets are employed, and the carriers would then differ in average aircraft size. All new entrants were deemed to use a 100-seat aircraft. This size was chosen for the example because it was the aircraft that carried the burden of the expansion of the industry following deregulation. The slot prices in the table are for the period under review, presumably a schedule period. Airport and airline revenues net of operating expenses are also shown.

The slot prices for both peak and off-peak approach upper bounds asymptotically in this example. That is, the simulated auction prices rise by decreasing absolute amounts as the number of firms operating at the hub are increased. In other words, as the number of participants in the auction increases, the fraction of the total rents appropriated by the airport authorities through the auction mechanism increases. In the four-carrier case, airport revenues constitute 24 percent of the sum of airport revenues plus total carrier contributions. In the eight-carrier case, the airports earn almost 33 percent of that total. Finally, the total contribution to carrier profit declines as the number of participants rises. Intuitively, these are the outcomes one would expect.

The simulated auction approach can provide further information for those concerned about the contestability of the airline markets. With the simulated auction prices in hand, the simple subtraction of the current landing fee charged from that estimate would yield an approximation of the extent of the economic rents that are being earned by incumbents because of the difficulties of airport access. We would argue that much of the rents estimated by Bailey and Williams derive from this source (*18*). The estimated slot auction prices also indicate the minimum cash cost disadvantage that would be faced by a new entrant wishing to contest the markets at that particular airport.

### Implementation

Because the adoption of the auction mechanism as a means of allocating scarce airport capacity would fundamentally alter the face of the airline industry, some attention must be devoted to the question of implementation. The intent here is to point the way, not to provide definitive answers, to all potential questions. The objective of developing an implementation scheme is to reduce the amount of disruption in the system.

In the first place, it appears that auctions would have to be introduced into the airport system on a gradual basis in order to minimize the extent of disruption to activities by incumbents. This might be accomplished by phasing in the process over a two- or 3-year period. If a 2-year period were chosen, a quarter of the slots could be auctioned every 6 months, and successful bidders would retain the property rights to their slots for a 2-year period. Increasing the length of the phase-in period would reduce the fraction of slots to be auctioned each time, and lengthen the duration of the property right as well. It should be noted that care must be taken not to reduce the fraction too far, for this would defeat the objectives sought in the adoption of the auction process. Although a policy of gradualism is necessary, it should not be so slow as to defeat the policy initiative.

Second, a phase-in of the process would also allow time for adjustments by the incumbent carriers. Over time, they have made investments in airport facilities, and these capital assets should not simply be appropriated by the airport authorities. An alternative would be for the airports to purchase the assets at fair market value.

Third, it may be necessary to permit airlines to bid on packages of airport capacity. Landing slots, gates, and related facilities are necessary at both airports if a flight is to be completed. This is a simple administrative problem in the Canadian context because the major airports are all under the control of Transport Canada. It may be more of a problem in the United States, although aside from fee splitting, no real difficulties appear to exist. In fact, the simulation model has been extended to a "three-hub" case (*19*) and works there as well. The use of such bundles of airport capacity does complicate matters, but does not defeat the auction approach *as long as aftermarkets are permitted to function freely*.

A fourth problem that is sometimes suggested is the possibility that a large carrier would be able to preclude entry (or in the extreme, expel) weaker rivals. The authors in another paper in this Record, show that this is an unlikely scenario. A final objection is that small communities would suffer under such a capacity allocation process. This is admitted as a possibility for the peak period. However, unless the airport in question is congested all of the time, off-peak access by such communities remains possible.

## CONCLUSIONS

The contestability of airline markets is severely circumscribed by the lack of open and evenhanded access to critical airport facilities. In effect, the allocative techniques used implement a new and hidden form of regulation. In place of the requirement for the showing of public convenience and necessity administered by the CAB, one now finds entry control in the form of the administrative allocation of airport capacity. This approach bestows cost advantages on incumbent carriers, and in the extreme, gives them exclusionary power via their control of airport capacity.

Allocating airport capacity via an auction mechanism is a feasible alternative to the formal reregulation of the industry, and is preferable to it. Under such an allocative mechanism, carriers would be granted short-term, rather than perpetual, property rights to airport facilities with a certain fraction becoming available for competitive bidding two or three times per year. Because it results in fairness, the auction approach enhances the contestability of the airline markets.

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