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ECONOMIES OF SCALE AND THE QUESTION OF “NATURAL MONOPOLY” IN THE AIRLINE INDUSTRY

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I. INTRODUCTION

THIS PAPER will provide a review and analysis of the available evidence concerning the question of economies of scale and the possibility of “natural monopoly” in the American airline industry. A review and analysis of this sort is directly relevant to the two major public policy issues presently facing the airline industry: mergers and the general deregulation of fares and eventually of entry.

Economies of scale are frequently claimed as a justification for mergers: the larger merged organization will have lower per-unit operating costs than either of the smaller pre-merger firms. Does the available evidence indicate that this is likely to be the case for airline mergers?

At the same time, questions of economies of scale and natural monopoly are crucial to the issue of deregulating fares and entry. We wish to know whether scale economies are relatively unimportant, so that there is room in the industry for a large enough number of efficient-size airline companies to make the industry workably competitive, that is, so that we can rely on the forces of competition to keep prices at the minimum levels consistent with normal profits and do not need direct regulation to achieve this

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goal;¹ or whether economies of scale are so substantial that there is room in the industry for only one or two efficient size companies, so that the industry would present serious monopoly or oligopoly problems that would require regulation to achieve our pricing goal. If the latter were the case, we might question the wisdom of an experiment in deregulation. If, at the end of the experiment, only one or two firms were still standing and regulation must be reimposed to prevent monopoly abuses, would the experiment be worth the effort? The remaining firms might have lower unit costs and be more efficient in a static sense, but we would have lost a number of centers of initiative for innovation and new ideas. The gains might not be worth the losses, and regulation would still be with us.

As we shall see, however, the available evidence clearly points in a more optimistic direction. There does seem to be room for a number of efficient-size airlines in the industry—surely at least as many as the current number of domestic trunk and regional (local-service) carriers, and quite possibly for a yet larger number. While their number—eighteen or twenty at a minimum—may not be the economist's picture of "perfect competition," it is surely large enough to characterize the industry as workably competitive and free of serious oligopoly problems that would warrant economic regulation at the national level. And, when entry restrictions into individual city-pair markets are eased, monopoly-oligopoly problems that might otherwise arise in individual city-pair markets should be successfully kept in check by the threat of entry into those markets by the (efficient-size) firms operating in other city-pair markets, or even by *de nouveau* entry.

This evidence, then, also indicates that the efficiency gains from airline mergers, especially in a deregulated context, are likely to be slight. Prospective merger partners will likely have to offer some other justification.

The remainder of this paper will be organized as follows: Part II will define and discuss the general concepts of economies of scale and natural monopoly. Part III will describe the methods that are used to measure economies of scale. Part IV will review and analyze the available evidence on economies of scale in the airline in-

¹ To the extent that competition also provides an incentive for a firm to keep its costs at the minimum level consistent with the output it chooses, this is an added benefit from the competitive process.

dustry. Part V will briefly discuss the role of entry, and Part VI will offer some conclusions from this study.

Before proceeding further, we provide here a brief glossary of abbreviations used frequently in the text: MES=Minimum efficient size; ATM=Available ton-mile; ASM=Available seat-mile; RTM=Revenue ton-mile; RPM=Revenue passenger-mile.

II. ECONOMIES OF SCALE AND NATURAL MONOPOLY

In trying to measure economies of scale, we are seeking to determine whether there is a cost advantage (in the sense of lower unit or average cost) associated with size. Does a larger firm, solely because of the technology of the industry, enjoy lower unit costs relative to those of a smaller firm? If so, are these differences sizeable? (If a firm that was twice the size of another enjoyed only a half percent cost advantage, we might well conclude that the cost differences were not substantial enough to affect the ability of the two firms to compete in the market; that the ability of each firm to hustle, to control costs, to guess correctly about future trends in the industry would be the important determinants of success in the marketplace, rather than the small cost differential.) Further, what is the range of output (size of firm) over which any cost advantages might prevail? And is there a size level at which these cost advantages are virtually exhausted, so that firms which are larger than this critical size enjoy no cost advantage over firms of this critical size, or possibly even suffer cost disadvantages?

This last size point—the point of minimum efficient size (MES)—when divided into the overall size of the market or industry, provides us with an estimate of the maximum number of efficient size firms that the market will support;³ i.e., if the MES is x and the size of the market is y , then the maximum number of efficient size firms the market can support is y/x .

Clearly then, if, for a given technologically determined MES, the relevant market is small enough, there will be room for only one efficient-size firm. If two or more firms were to be present in the market and they were to compete actively, the lower costs of any firm that became larger than the others should allow it to offer

³ See F. SCHERER, *INDUSTRIAL STRUCTURE AND ECONOMIC PERFORMANCE* Ch. 4 (1970), for further discussion.

lower prices and out-compete the other firms; the end result should be only a single (efficient-size) firm remaining in that market. This is the situation which is technically termed "natural monopoly." Its most frequent representation is in the form of local public utilities, such as local electricity or natural gas distribution or local telephone service. It provides the best justification for public utility regulation, to prevent the monopoly from exploiting its monopoly power.

It is worth noting, however, that regulation may not be necessary to prevent monopoly abuses, even in this "natural monopoly" situation. If the barriers to entry into this market are relatively low, then the existence of a number of potential entrants (most likely existing firms serving other markets, but quite possibly new firms), ready to enter the market if profitable opportunities arise, can keep the natural monopolist's prices and profits close to competitive levels. The effectiveness of this threat of entry will depend on such factors as the size of the capital investment necessary to establish oneself in the market, the time period involved, and the cost disadvantage suffered by a small firm compared to a large firm. These potential entry possibilities are probably not great for the local utilities.³ But, as will be argued below, the barriers to entry in airline markets (in the absence of legal restrictions) appear to be quite low, and the number of potential entrants quite high. Thus, there may well be little room for monopoly abuse, even in small airline markets which can support only one carrier at efficient scale.⁴

To summarize, then, we are interested in measuring the extent

³ But local competition between distribution of electricity and natural gas seems to be significant. See Weiss, *Antitrust in the Electric Power Industry*, in *PROMOTING COMPETITION IN REGULATED MARKETS* 135 (A. Phillips ed. 1975).

⁴ Further, as Demsetz has argued, even if entry is not easy once a producer is established, regulation of natural monopolies might still be avoided by periodic auctioning by the government of the monopoly franchise. If the product or service is simple, the winner would be the bidder that promises the lowest price to the public, e.g., the lowest parking fee at a municipal stadium. If the product is complex or there are many products jointly produced, the winner would be the bidder who pays the largest fee to the government for the franchise. In this case, the public will still be paying the monopoly price (with the consumers' surplus dead-weight loss that is associated with it), but the monopoly profits are recaptured for the public treasury. Though this kind of bidding system may not currently be legally feasible, it is an alternative worthy of future consideration. And it does have current application in the areas of local franchises for garbage collection, turnpike concessions, municipal stadium services, etc. See Demsetz, *Why Regulate Utilities?*, 11 J.L. & ECON. 55 (1968).

and range of scale economies and in trying to determine if there is a point at which they are exhausted, so as to determine whether a number of competitive firms are economically viable in an industry or market. Even if we should determine that only one firm can efficiently serve a market, we may still have little fear of monopoly abuse if the large firm's advantages are slight and/or the barriers to entry are low.

III. THE METHODS OF MEASURING ECONOMIES OF SCALE

There are three major methods that can be used to try to measure scale economies.⁵ Each has its strengths and weaknesses. First, one can try to measure company costs directly and, through cross-section and/or time series statistical techniques, try to fit a cost curve to the available data. This requires good, uniform cost data on a cross-section (data for a number of firms at one point in time) or time series (data for one or a number of firms over several time periods) basis. It also requires firms that are producing a relatively uniform output; we would not learn much by comparing apple producers and orange producers. An alternative approach, which should measure virtually the same effects, is to try to measure company profits on a cross-section or time series basis and to fit an appropriate statistical function. If a group of firms are in the same market, those with lower costs should be reporting higher profits. Yet another alternative approach which ought to measure the same phenomena is to try to fit a production function—a relationship between physical output and the physical inputs that are necessary for the production of that output. If one firm has lower unit costs than another and both face the same prices for their inputs, the first must be using less inputs per unit of output.

Besides the need for appropriate cost categories and uniform output, another problem with the cost-profit-production function method has been raised by Milton Friedman.⁶ Suppose that there is a size of firm which has the lowest unit costs and that firms larger or smaller than this size have higher costs; firms of that low-cost

⁵ A broader review is found in F. SCHERER, *supra* note 2, at Ch. 4.

⁶ Friedman, *Comment*, in BUSINESS CONCENTRATION AND PRICE POLICY 230 (1955).

size ought to be able to outcompete the firms of the "wrong" sizes. The latter firms (which may have attained those sizes due to errors of judgment) would begin to run losses. The original entrepreneurs might wish to sell out. Any potential new owner, however, would only buy a "wrong" size firm if he could acquire it cheaply enough so that even with its higher operating costs he could still earn a competitive profit; the new owner's capital investment costs will be lower than the original owner's capital investment costs. Thus, if we were to examine the costs of the "wrong" size firm a year or two after it is bought by a new owner, we will discover that it has the same apparent cost levels as the optimum size firm. In effect, the financial market has capitalized away the errors of the "wrong" size firm. And, Friedman argues, there may be a tendency for balance sheet adjustments (write downs) by "wrong" size firms to take place even if they are not sold to a new owner. The consequence is that, after these adjustments have taken place, cost or profit studies will tend to indicate uniform unit costs for all size firms.⁷ Thus, cost-profit-production function studies relying on reported company data may incorrectly indicate that size does not affect unit costs, whereas the true underlying cost situation might be one of economies of scale prevailing up to some point (and possibly diseconomies of scale prevailing beyond that point).

A second method of measuring economies of scale, largely developed to deal with the criticism just mentioned, is the "survivor technique."⁸ If there is a lowest cost range of sizes this approach theorizes, company sizes ought to gravitate toward that range. Smaller firms ought to grow, larger firms ought to shrink, and new firms which arise ought to aim for that range. Thus, over time, in the absence of serious changes in technology, the percentage of an industry output that comes from that size range ought to increase. Observations, then, of the changing distribution of firm sizes over time may be able to indicate the minimum cost range.

The survivor technique, though, is not without its problems. In an industry with growing demand that also has substantial barriers to entry, actual company size changes may not reveal meaningful

⁷ In production function studies, the same problem arises in trying to measure the capital inputs of the firm. Their valuation may reflect the balance sheet adjustments that Friedman describes.

⁸ See Stigler, *The Economies of Scale*, 1 J. L. & ECON. 54 (1958).

information on the minimum cost range of company size. Actual attempts at using the survivor technique for empirical measurement of efficient company size have not met with great success.⁹

A third method is the "engineering approach." An investigator can talk with engineers, plant managers, and other experts in an industry to try to get estimates of the efficient (low cost) size for a company. The estimates clearly must be judgmental in nature, and estimates by engineers in particular tend to be overly optimistic as to the low cost nature of large plants, since they tend to neglect the costly management problems associated with large scale operations.

As we shall see in the next section, most of the scale economy estimates for the airline industry are based on cost curve efforts. Fortunately, the criticisms of this method have less force for the airline industry than they might for other industries. First, the airlines produce a fairly uniform, standardized output. The necessary adjustments for diversity of output (primarily the distance between city-pairs served and the density of traffic) are easily achieved. And, second, reasonably well defined cost categories for reporting are required by the Civil Aeronautics Board (CAB). There should be few of the balance sheet adjustment problems mentioned above.

Since so much of the effort on airline scale economies involves the estimation of cost curves, a very brief summary of the concept and method is probably worthwhile. The usual approach postulates that a firm's costs of producing output are related to the level of output chosen, the costs of the inputs into the production process, the nature of the output mix, etc. If we choose to measure costs as average costs per unit of output, we can formally express their relationship as

$$Y = f(X_1, X_2, X_3, X_4, \dots)$$

where Y is the average cost per unit of output and the X_1, X_2, \dots are the elements, such as the volume of output itself, the input prices, etc., which help explain the level of average (unit) costs.

To actually estimate this relationship empirically, investigators usually postulate a linear relationship (either linear in the actual

⁹ See Saving, *Estimation of Optimum Size Plant by the Survivor Technique*, 75 Q.J. ECON. 569 (1961); Weiss, *The Survival Technique and the Extent of Suboptimal Capacity*, 72 J. POL. ECONOMY 246 (1964); Shepherd, *What Does the Survivor Technique Show About Economies of Scale?*, 34 S. ECON. J. 113 (1962).

numbers or linear in logarithms) between Y and the X 's; i.e.,

$$Y = a + bX_1 + cX_2 + dX_3 \dots$$

With data on individual company costs, output volumes, input prices, etc., from a cross-section and/or time series, the coefficients (a , b , c , etc.) can be estimated through econometric (statistical regression) methods.

In the airline context, Y (the left hand or dependent variable) is usually expenses (costs) per ATM, per RTM, per ASM, or per RPM. The X 's (the right hand, or independent or explanatory variables) usually include an output measure (such as ATM, RTM, ASM, or RPM) which should capture the scale effect we are seeking, plus other variables such as flight length, traffic density, input prices, etc., which we wish to correct for (or hold constant) while trying accurately to measure the scale effect. The coefficient on the output term is usually the crucial one for our purposes. If there are economies of scale, then larger outputs should be associated with lower unit costs; i.e., the coefficient on the output terms should be negative. If economies of scale are negligible, this coefficient should be very close to zero; that is, output levels should have no appreciable effect on unit costs. And we can apply the usual tests of statistical significance to determine if the coefficient is or is not significantly different from zero.

IV. ACTUAL ESTIMATES OF AIRLINE SCALE ECONOMIES

A. *The Choice of Measurement Level*

There are three alternative levels at which economies of scale might be measured. At one end of the range, one might choose the city-pair as the relevant market and ask how an airline's costs vary with the number of passengers carried annually between the two cities. At a broader level, one could ask if there are further advantages (or disadvantages) to operating a local network of routes; i.e., a set of interconnecting city-pairs. Finally, one might try to measure scale economies at the national or regional level of operation at which most airline companies function; i.e., to measure economies of scale for the range of output over which the current airlines are operating.

The distinction between these three levels—particularly between the first two and the last—is crucial to the understanding of the

problem of measuring scale economies in the airline industry. As George C. Eads has pointed out, there are two basic ways in which an airline can increase in size: by traffic increasing on an existing set of routes (i.e., by traffic density increasing); or, by the airline acquiring an additional set of routes that have more or less the same traffic density as the existing set.¹⁰ Suppose that there are economies of scale up to some point for the former process, that more densely traveled routes have lower unit costs. This by itself tells us nothing about possible economies of scale for the latter process. Since all of the domestic airlines, trunk and local-service alike, consist of fairly extensive networks of varying densities, it is vital to keep these two components of scale separated. It makes eminently good sense to ask, first, are there economies of scale to greater density over a city-pair or a small local network, and then, second, are there further economies achieved by having a larger airline which consists essentially of a collection of these local networks.

Most of the quantitative estimates of scale economies in airlines are focused on this last, company-wide level. Fortunately, it is at this level that we can answer the important policy questions raised at the beginning of this paper. Are mergers of these companies likely to achieve appreciable economies of scale? What is the structure of the airline industry likely to be on a national basis after substantial price competition is permitted? Will only one or two firms survive, or is there room for enough efficient-size firms so that the competitive process can be left largely unregulated?

We will first review and discuss these company-wide estimates of scale economies. We will then focus on the more limited evidence available on local network effects and individual city-pair markets.

B. *Estimates of Scale Economies at the Company-Wide Level*

As we indicated above, and as most investigators have realized, one cannot simply use an output measure, such as ATM's or RTM's, and then relate costs to these output measures without further adjustments. Given the current technology of the industry, it appears to be more costly per passenger-mile to serve thinly traveled and

¹⁰ Or, as Eads also includes, by a carrier dropping thinly traveled routes and adding more heavily traveled routes. This has the same effect as increasing average traffic density. See G. EADS, *THE LOCAL SERVICE AIRLINE EXPERIMENT 72-73* (1972).

shorter distance routes than to serve heavily traveled and longer distance routes. The fixed terminal costs per passenger at each end of the trip and the lower costs per seat mile of the larger long distance jets versus the smaller short distance jets are responsible for these cost differences. Since the current airline companies are restricted by the CAB in the particular markets they can serve, their cost levels are at least partly determined by the characteristics of the markets that they serve.

If one were to ignore this market characteristic phenomenon, one might immediately conclude, for example, that the local-service airlines were less efficient and below minimum efficient size compared to the trunk airlines, since the former consistently have higher unit costs than do the latter. Hence, this conclusion may not be justified or at least cannot be reached just by looking at the cost and output data alone. Indeed, this is a general problem in making these cost comparisons. There is a general pattern prevailing across the airline industry, including the trunks and the regionals, that the larger carriers tend to fly the thicker, longer routes, while the smaller carriers tend to fly the thinner, shorter routes.

This pattern can be seen in Table 1. The trunks uniformly are larger, fly longer flights, and enplane more passengers per route served than do the local-service carriers. And they have uniformly lower costs per ATM. The consistency in the rankings is seen in the first part of Table 2, where all of the rank correlation coefficients for the combined truck and local-service industry are positive and significant at the five percent level. Within each carrier category, the correlation coefficients still tend to be positive (except for the trunks with respect to operation costs), though only two are statistically significant.

This comparability problem, which is basically the problem mentioned in Part III of ensuring that the firms in our sample are producing comparable outputs, is important to keep in mind as we review the scale economy estimates below. We will take special note of those studies which do or do not try to adjust for this comparability problem.

We now turn to these studies. We will present them in chronological order, starting with the earliest that may still have relevance for today's airline industry.

Table 1: TRUNK AND LOCAL SERVICE CARRIER CHARACTERISTICS,
DOMESTIC OPERATIONS, YEAR ENDED SEPTEMBER 1975

<i>Carrier</i>	<i>RPM's (in millions) (rank)</i>	<i>Stage Length (rank)</i>	<i>Daily En- planements per Station Served (rank)</i>	<i>Operating Cost per ATM^a (rank)</i>
United	27,051 (1)	670 (3)	945 (4)	30.2¢ (6)
American	17,980 (2)	746 (2)	1,166 (1)	30.1 (5)
Delta	15,404 (3)	426 (10)	954 (3)	32.9 (9)
Eastern	13,914 (4)	492 (7)	916 (5)	38.2 (10)
Trans World	13,811 (5)	766 (1)	1,028 (2)	30.2 (7)
Northwest	6,619 (6)	551 (6)	632 (6)	20.9 (1)
Western	6,164 (7)	567 (4)	609 (8)	32.2 (8)
Continental	5,918 (8)	567 (4)	574 (10)	24.9 (2)
Braniff	4,817 (9)	470 (9)	585 (9)	28.4 (3)
National	4,201 (10)	472 (8)	623 (7)	29.4 (4)
Allegheny	3,238 (11)	229 (12)	442 (11)	47.9 (12)
Airwest	1,454 (12)	233 (11)	210 (13)	48.9 (14)
Frontier	1,411 (13)	193 (14)	107 (18)	46.0 (11)
Piedmont	1,040 (14)	162 (16)	218 (12)	50.2 (15)
North Central	1,006 (15)	131 (18)	180 (14)	51.7 (16)
Ozark	895 (16)	158 (17)	176 (15)	51.7 (16)
Southern	818 (17)	172 (15)	146 (16)	48.3 (13)
Texas Internat'l	795 ^b (18)	213 (13)	131 (17)	59.8 (18)

a. Calendar year 1974.

b. Year ending September 1974; 1975 affected by strike.

Source: II and III SIMAT, HELLIESAN AND EICHNER, AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS REGULATED ENVIRONMENT, Appendix Tables (1977).

(1) *Caves*.¹¹ Richard E. Caves examined the cost data for the airline industry for the late 1950's. He combined simple cost compilations, cost curves fitted by eye to a scatter of routes, and econometric regressions. He recognized the problem of market characteristics and even provided a table¹² indicating how costs per RPM vary with stage length (length of flight). But he did not make specific adjustments for varying market characteristics when he provided his scale estimates.

Caves concluded that the domestic trunklines had all reached

¹¹ R. CAVES, AIR TRANSPORT AND ITS REGULATORS Ch. 3 (1962).

¹² *Id.* at 76.

Table 2: RANK CORRELATION COEFFICIENTS

	RPM's	Stage Length	Daily Enplanements per Station Served	Operating Cost per ATM
<i>Trunks and Local-Service Combined</i>				
RPM's	1.0			
Stage Length	0.84*	1.0		
Enplanements	0.93*	0.81*	1.0	
Operating Costs	0.75*	0.76*	0.70*	1.0
<i>Trunks Only</i>				
RPM's	1.0			
Stage Length	0.35	1.0		
Enplanements	0.80*	0.34	1.0	
Operating Costs	-0.30	-0.10	-0.45	1.0
<i>Local-Service Only</i>				
RPM's	1.0			
Stage Length	0.45	1.0		
Enplanements	0.60	0.12	1.0	
Operating Costs	0.68*	0.37	0.39	1.0

* Indicates statistical significance at the 5% level.
Source: Table 1.

an output consistent with minimum efficient size (MES). This critical point appeared to lie between 100 million and 200 million ATM's annually. Since total domestic airline ATM's in 1958 were 5,379 million,¹³ this would indicate that an MES firm was between two percent and four percent of the total industry. Caves did not offer any specific conclusions concerning the local-service carriers but left the distinct impression that he believed they were below MES.

(2) *Gordon*.¹⁴ Robert J. Gordon analyzed cost data for the domestic trunklines for 1961. He adjusted various cost categories for length of hop through econometric regressions and hand-fitted curves, and he determined a standardized most efficient (mini-

¹³ This covers domestic service, including the intra-Alaskan and Hawaii services.

¹⁴ Gordon, *Airline Costs and Managerial Efficiency*, in *TRANSPORTATION ECONOMICS* 61 (1965).

mum) cost level. He then computed the cost saving that each carrier could have achieved had it attained the most efficient cost level.

Gordon found that it was the larger trunklines which were the farthest away from these minimum costs, and he argued that this was because the larger trunklines were over-manned. Thus, not only did the larger trunklines fail to achieve any economies of scale compared to the smaller trunklines, but they even appeared to have higher unit costs.

(3) *Straszheim*.¹⁵ Mahlon R. Straszheim analyzed international airline (U.S. and foreign) cost data for 1962. He computed a set of econometric regressions which explained carrier costs as a function of variables such as flight length, traffic density, and input prices. The cost variable was direct costs per ASM. The equations yielded sensible coefficients and generally had good fits.

When Straszheim then attempted to relate the residuals from the equations (that is, the extent to which a carrier's costs exceeded or fell short of the "expected" level of costs indicated by the equation which best fitted the available data) to the size of the carrier, he found no relationship.¹⁶ Thus he concluded that there were no economies of scale for the thirty-one carriers in his sample. Their sizes (in 1962) ranged from fifty-eight million ASM's flown (Aden Airways) to 11,395 million ASM's flown (Pan American Airways); the mean for the sample was 1,467 ASM's. In that same year, the American domestic airline industry (trunks plus local-service) flew 63,867 million ASM's; the smallest trunkline, Northeast Airlines, flew 1,382 ASM's, and the smallest local-service carrier, Lake Central Airlines, flew 176 million seat-miles. Thus, all of the American carriers were larger than the smallest firm in Straszheim's sample, and all but the smallest of the American trunks were larger than the average firm in the sample.

(4) *Eads, Nerlove, and Raduchel*.¹⁷ George C. Eads, Marc Nerlove, and William Raduchel examined the cost data for twelve local-

¹⁵ M. STRASZHEIM, *THE INTERNATIONAL AIRLINE INDUSTRY* 90-101, App. B (1969).

¹⁶ *Id.* at 96.

¹⁷ Eads, Nerlove & Raduchel, *A Long Run Cost Function for the Local Service Airline Industry: An Experiment in Non-Linear Estimation*, 51 REV. ECON. STATISTICS 258 (1969).

service carriers on a quarterly time series basis from 1958 through 1966. They developed a non-linear cost model which assumed that the stock of pilots and co-pilots was the fixed input factor in the short run. Their output (scale) measure was total aircraft miles.

Using non-linear econometric estimation techniques, they found a returns-to-scale factor for this sample of nearly 1.3; thus, one local-service carrier which was twice the size of another would be expected to have unit costs which were almost thirty percent lower. This estimate, if it were accurate, would be evidence of substantial economies of scale at the local service level. But, as the three authors point out, this estimate was biased away from 1.0 (constant returns to scale) because of the particular procedures they used. Further, they provided no statistical confidence interval on this estimate, so a reader cannot tell if the estimate was or was not statistically different from 1.0. Further, as Eads later pointed out, the 1958-1966 period was one of increasing traffic density for the local-service carriers, achieved largely by the CAB permitting the carriers to drop low density routes and expand to higher volume markets.¹⁸ Since the Eads-Nerlove-Raduchel model did not correct for this phenomenon, there was a further bias which pushed their estimate away from 1.0.¹⁹ Finally, though this study did take into account the different technologies of piston and jet aircraft, there was no other correction for any technological improvements and productivity increases that may have been taking place over the 1958-1966 period. Since productivity improvements and increases in the scale of operations were both taking place at the same time, the absence of the former in the regression estimations meant that the coefficient on the latter may partly have incorporated effects that were due to productivity improvements; if there were a tendency for unit costs to fall over time because of productivity improvements and also for the scale of operations to increase, then there may be a tendency improperly to attribute to the increasing scale all of the credit for the lower unit costs. In the end, one is inclined to agree with the three authors that "no evidence has been discov-

¹⁸ EADS, *supra* note 10, at 72-74.

¹⁹ This was pointed out to this author in a telephone conversation with George Eads, Apr. 21, 1978.

ered that the local-service airline industry is subject to substantial increasing returns to scale."²⁰

(5) *Jordan*.²¹ William A. Jordan described the experience of the California intra-state carriers in the 1950's and 1960's. He found that, despite their smaller sizes, they were able to offer fares for service in the California market that were lower than those of the existing interstate carriers, and some were able to grow and prosper. He concluded from this rough "survivor" study that there were no economies of scale beyond the point at which a carrier had acquired four or five aircraft and could use them appropriately. This would imply a very low MES indeed.

(6) *U.S. DOT*.²² As part of its filing for the CAB's Domestic Passenger Fare Investigation, the U.S. Department of Transportation analyzed cost data for the trunks and for the local-service carriers for 1963-1968. Pooled cross-section and time series regressions were run for the overall industry, for the trunks separately, and for the local-service carriers separately. Operating expense (total, direct, and indirect) per ATM were the cost variables. The right-hand variables included ATM's, average stage length, and market density, all in logarithms. Dummy variables (0, 1) for each year were also included; these provide a combined correction for increasing input factor costs and improving productivity over these years. All of the equations showed a good fit and sensible coefficients.²³

For the overall industry, the scale effect was statistically insignificant and quantitatively negligible in absolute terms for the total operating expense per ATM regression. The same was true of the regression for the trunklines only. For the local-service carrier regression, the scale effect was statistically significant. But the quan-

²⁰ Eads, Nerlove & Raduchel, *supra* note 17, at 268.

²¹ W. JORDAN, *AIRLINE REGULATION IN AMERICA: EFFECTS AND IMPERFECTIONS* Ch. 10 (1970).

²² U.S. Dep't of Transp., *Testimony and Exhibits of the Department of Transportation in Phase 7 of the Domestic Passenger Fare Investigation*, Exhibit No. DOT-T-1, CAB Docket Nos. 28166 and 28167 (August 25, 1970).

²³ One drawback to the procedure used in this study is that there is no correction for the effects of rivalry in individual markets. To the extent that rivalry extends beyond scheduling to such things as advertising, fancy food, or plush upholstery, a carrier's costs per ATM will be higher. Some correction for the percentage of competitive routes flown by each carrier would have been desirable. This criticism also applies to both the Douglas and Miller studies below.

titative impact was not great; a ten percent increase in the size of a local-service carrier yielded only a 0.6 percent decrease in unit costs. This part of the DOT study ends with the sentence, "For all practical purposes, then, we can conclude that the industry is characterized by constant returns to scale."

(7) *Eads*.²⁴ George C. Eads analyzed the cost data for the local-service carriers for the late 1950's and mid-1960's. He computed a set of econometric cost equations and then concluded his chapter with a three page discussion of economies of scale.²⁵ Though the statement was never made outright, it was clear from this discussion that he believed that economies of scale for the local-service carriers were non-existent or minimal. He stated clearly that the cost disadvantages that the local-service carriers suffer compared to the trunklines were due primarily to the short-haul, low density nature of the former's routes and not to overall scale effects.

(8) *CAB Office of Plans*.²⁶ This study examined the cost data for the domestic trunklines and local-service carriers for the years 1962-1969. Cost curves were estimated through econometric regressions on a combined cross-section and time series basis. Both stage length and traffic density (the latter by means of a variable measuring aircraft size) were taken into account.²⁷ The cost variables used were operating expense per ATM and operating expense per RTM, with most emphasis given to the latter. The scale variable was the number of annual departures per carrier.²⁸ The regressions provided sensible coefficients, and the overall fits of the equations were quite good.²⁹

²⁴ G. EADS, *supra* note 10, Ch. 3.

²⁵ *Id.* at 72-74.

²⁶ CIVIL AERONAUTICS BOARD, OFFICE OF PLANS, ECONOMIES OF SCALE IN THE DOMESTIC AIR TRANSPORT INDUSTRY (1972).

²⁷ The explanatory variables included in the regression were aircraft utilization, unit labor costs, passenger load factor, and percentage of traffic generated in monopoly markets.

²⁸ The choice of departures as a scale variable is a curious one and, unfortunately, it was not defended in the report. Though departures are surely correlated with ATM's and RTM's, a more satisfactory procedure would have been to have used either of the two directly.

²⁹ Unlike the Eads-Raduchel-Nerlove study, this study did implicitly correct for improving productivity over time by including a unit labor cost variable as a right hand variable.

When the data were pooled for the trunks and local-service carriers together, the cost per ATM equation indicated a statistically insignificant scale effect. The cost per RTM equation, however, did yield a statistically significant scale effect. The absolute magnitude of this effect, however, was not large; the predicted unit cost advantage for the largest airline compared to the smallest airline in 1969—the former had seven times as many departures as the latter—was only 7.5 percent. This was far smaller than the actual range of unit costs observed across the entire airline industry.

Further, the estimation of cost per RTM equations for the trunks and for the local-service carriers separately indicated no statistically significant scale effects for the former and statistically significant (though mild in absolute terms) scale effects for the latter. Further analysis indicated that the critical MES point appeared to be at 10,000 annual departures, with no further decreases in unit costs beyond this point. By 1969 all carriers except Northeast Airlines had achieved this size. Thus, the scale effects which were found to be statistically significant for the local service airlines were occurring through a comparison of their experience in the early 1960's, when they had fewer than 10,000 annual departures and thus experienced higher costs, and their experience in the late 1960's, when they largely exceeded 10,000 annual departures and were thus experiencing the lower costs consistent with that larger scale.

The study concludes that, as of the early 1970's, all of the existing carriers, trunk and local-service alike, had reached MES, and there were no further economies of scale to be achieved from more extensive operations.

(9) *Keeler*.³⁰ Theodore E. Keeler's effort was aimed at constructing a true long-run cost function for airline services. Much of the construction was based on engineering data, but Keeler did use econometric regression techniques to estimate a cost function for airline indirect costs (e.g., expenses for sales, reservations, aircraft cleaning and fueling, airport rentals, cabin service, and administration). He used quarterly data for 1967-1969 for eight trunklines. His cost variable was total indirect costs per ATM. His righthand variables are ATM's, the load factor, and average stage length.

³⁰ Keeler, *Airline Regulation and Market Performance*, 3 BELL J. ECON. & MGT. 399 (1972).

Keeler found that the scale effect, though statistically significant, was negligible in absolute terms. Again, constant returns to scale appeared to be the best empirical description of the data.

(10) *Reid and Mohrfeld*.³¹ Samuel R. Reid and James W. Mohrfeld examined domestic trunk cost and profitability data for the period 1960-1970. They estimated a set of pooled time series and cross-section regressions for this period, using cost per RPM and profit per RPM as their left-hand variables and using only a scale variable as their right-hand variable. They used total operating revenue and total assets as alternative measures of scale.

Reid and Mohrfeld concluded that there were *diseconomies* of scale beyond the size of the smaller trunk airlines; that is, that the larger trunks suffered cost disadvantages compared to the smaller trunks. Unfortunately, this study was marred by a number of serious methodological flaws. First, there was no correction for traffic density or flight length. This is just as important for the profitability regressions as for the cost regressions. And second, the study provided no corrections for the increased costs of inputs and the technological improvements that were taking place over these eleven years.

The best one can say about this study, then, is that the authors' claims could not be upheld from the evidence they provided.

(11) *Douglas and Miller*.³² George W. Douglas and James C. Miller provided two analyses of trunklines cost data. The first used cross-section and time series data for 1964-1970.³³ Their cost measures were total operating expense per ATM and direct operating expense per ATM. Their output (scale) measure was ATM. They computed a set of econometric regressions which also took into account stage length and traffic density (by means of a variable for aircraft capacity).³⁴ They also included dummy variables (0, 1) for the observations in each calendar year. The fit of the equations was good, and the coefficients were reasonable.

The regression model chosen traced out a statistically significant

³¹ Reid & Mohrfeld, *Airline Size, Profitability, Mergers, and Regulation*, 39 J. AIR L. & COM. 167 (1973).

³² G. DOUGLAS & J. MILLER, *ECONOMIC REGULATION OF DOMESTIC AIR TRANSPORT* 13-17, 146-149 (1974).

³³ *Id.* at 13-17.

³⁴ The percentage of flight departures from major hubs was also included.

parabola relating total operating expense per ATM to ATM's. This parabola peaked at four billion ATM's per carrier, slightly below the size of the largest four trunklines for 1970.³⁵ The expected differences in unit costs predicted by the equation for the complete range of trunklines were quite small, and, because the largest trunks were not yet far enough on the right hand (falling unit cost) side of the parabola, the smaller trunks were expected to have lower unit costs (as a function of scale effects) than were the larger trunks.

The second Douglas and Miller analysis essentially duplicated the U.S. DOT study,³⁶ but with a slightly longer time period (1962-1970). The focus was exclusively on the trunk airlines. As did the DOT study, Douglas and Miller found that the scale variable had a statistically insignificant effect on unit costs. Overall, Douglas and Miller concluded that there were no significant economies of scale operating at the level of the trunk carriers.

(12) *Mallet*.³⁷ Roger J. Mallet provided evidence on the concentration in the unregulated commuter airline segment of the industry. Concentration (the percentage of passengers nationwide carried by the top ten commuter airlines, the top twenty, the top thirty, etc.) declined substantially between 1970 and 1975. Table 3 reproduces these figures. During the same period, the overall commuter airline industry grew by fifty percent, so the absolute size of most commuter carriers, large and small alike, grew. But these concentration figures indicate that the larger firms grew more slowly than the smaller firms in the industry. If there were substantial economies of scale, we would expect the opposite to be occurring. Accordingly, this type of "survivor" evidence indicates

³⁵ Note that a parabola peaking in the mid-range of firm sizes is the opposite of the U-shaped cost curve of standard economic theory. The Douglas and Miller parabola was achieved by using ATM's and ATM's-squared as separate right-hand variables. Since these two variables are very likely to be highly correlated with each other, this inverted parabola may be simply a statistical artifact caused by the well-known econometric problem of high multicollinearity among right-hand variables.

³⁶ *Id.* at 146-149. See note 22, *supra*.

³⁷ Mallet, *The Commuter Carrier Industry—Growth and Stability*, in REFORM OF THE ECONOMIC REGULATION OF AIR CARRIERS, *Hearings before the Subcomm. on Aviation of the House Comm. on Public Works and Transportation*, 94th Cong., 2d Sess. 259 (1976).

that even at the small end of the airline industry, the commuter carriers, economies of scale do not seem very important.

Table 3: CONCENTRATION IN THE COMMUTER CARRIER INDUSTRY: 1970 AND 1975

Leading Carrier	Concentration Ratio	
	1970	1975
Top 10 carriers	51.0%	41.8%
Top 20 carriers	67.8	60.7
Top 30 carriers	77.9	73.7
Top 40 carriers	84.8	81.1
Top 50 carriers	89.2	86.9
Other	100.0	100.0

Source: Mallet, *The Commuter Carrier Industry—Growth and Stability*, in REFORM OF THE ECONOMIC REGULATION OF AIR CARRIERS, *Hearings before the Subcomm. on Aviation of the House Comm. on Public Works and Transportation*, 94 Cong., 2d Sess. 262 (1976).

(13) *A summary of the evidence.* The evidence that has been amassed in various studies of the airline industry points in one very clear direction: economies of scale are negligible or non-existent at the overall firm level. This is certainly true for firms that have reached the size of the smallest trunklines. The only disputed point in the literature is whether the MES for an airline is small enough so that the local-service carriers are also in the range of constant costs or whether the local-services carriers still bear a unit cost penalty because of their small size compared to the trunks. The preponderance of evidence points toward the former conclusion.

Further, it is worth noting that the most recent evidence available draws the bulk of its statistical weight from the mid-to-late 1960's. Even if we assume that the local-service carriers suffered a scale disadvantage at that time (whereas the trunks clearly did not), the local-service carriers have grown substantially since then. Table 4 shows the relative sizes of the four smallest trunks in 1966 and the local-service carriers in 1966 and in 1977. Through mergers and internal growth, the local-service carriers have grown to the point where they are all larger than the smallest trunkline of a decade earlier. The three largest local-service carriers are clearly of the same size level that Western, Braniff, and Continental were

a decade earlier. The basic technology of running an airline has not changed in this decade; there seems little reason for the determinants of the economies of scale in the industry to have changed. If the smaller four trunks were of a sufficient size to have reached MES in the mid-to-late 1960's, the local-service carriers had surely reached the MES point by the mid-to-late 1970's.

At the overall airline level, then, there are no unit cost advantages or disadvantages over the observed range of company sizes. The observed differences in unit costs are due primarily to route characteristics and to management differences, not to scale effects. When largely unrestricted price competition is permitted in this industry, it is highly unlikely that only one or two firms will emerge as the survivors. All eighteen of the current trunk and local-service carriers appear to be of sizes that put them on an equal footing

Table 4: REVENUE PASSENGER MILES (IN MILLIONS),
1966 AND 1977

1966			
<i>Four Smallest Trunklines:</i>			
Western	2,391	Continental	1,871
Braniff	2,236	Northeast	933
<i>Local-Service Carriers:</i>			
Allegheny	428	Bonanza	219
Mohawk	423	Southern	196
Piedmont	381	Pacific	172
North Central	349	West Coast	163
Frontier	331	Central	118
Ozark	295	Lake Central	116
Trans-Texas	277		
1977			
Allegheny	3,643	Piedmont	1,261
Air West	2,036	Ozark	1,221
Frontier	1,887	Texas Int.	1,167
North Central	1,281	Southern	1,045

Source: CAB

with the other firms in the industry. Indeed, if we were to take the size of the smallest local-service carrier as the MES point, then the domestic airline industry, which generated 154,817 million RPM's in 1977 would have room for over 100 efficient-size firms. The pos-

sibility of "natural monopoly" or even of serious oligopoly problems that might require regulation in the airline industry is extremely remote.

C. *City-pairs and Local Networks*

We now turn our attention to the evidence concerning scale effects in individual city-pairs and in local networks. Unfortunately, the evidence here is quite sparse.

Although most authors recognize that there must be some scale effects in serving a city-pair, none have been able to quantify these effects. Caves argued that the MES for serving a city-pair was such that four or five carriers may have been able to have offered service in high traffic, short- or medium-haul markets and two or three carriers could have offered service in high traffic long-haul markets.³⁸ Only the top 100 markets as of the late 1950's had the possibility of more than two carriers offering service. These conclusions were drawn from the evidence of a very limited number of city-pairs in which carriers were authorized to provide nonstop service but were declining to do so or were offering only token service. These conclusions are impressionistic in nature, but, unfortunately, there have been no other efforts to measure these scale effects.

The absence of such studies is not too surprising. With entry into individual city-pairs strictly controlled by the CAB, there has been little of the natural sorting of airlines into markets that might provide "survivor technique" inferences concerning MES in city-pairs. The best we can do is echo Caves in arguing that economies of scale at the city-pair level clearly do not extend over all ranges of output. There are over 200 nonstop city-pairs in which two or more carriers compete on a more or less stable basis. If economies of scale really did extend over the full range of observable output, we would expect the scheduling rivalry that currently exists in these markets to lead the larger firm, with the supposed lower costs and hence greater capacity to add flights, gradually to drive its rivals from the field. Such a tendency toward single carrier dominance and "natural monopoly" in these markets simply has not occurred.

Thus, there surely is an MES point, with small markets able to support only one carrier, larger markets able to support two car-

³⁸ See R. CAVES, *supra* note 11, at 95-97.

riers efficiently, yet larger markets able to support three carriers, etc. The location of these critical points will depend on the characteristics of particular markets. For example, the passengers in a short-haul market are likely to put a high value on scheduling frequency. This means it is worthwhile for a carrier or carriers to schedule smaller planes with more frequent flights than would be the case in a long-haul market with an equal number of passengers. But the larger number of flights probably means a greater number of carriers can be supported efficiently in the market. Beyond this general level of discussion, though, no precise location of these critical points exists.

A new issue concerning the possibility of "natural monopoly" in city-pair markets has recently been raised by William E. Fruhan.³⁹ He argues that there is a strong tendency for the dominant carrier in a market to attract a market share that is greater than its share of capacity offered.⁴⁰ A plotting of market share against capacity shares will yield an S-shaped curve. These apparent benefits to market dominance may lead firms in city-pairs with more than one carrier to try to achieve market dominance by scheduling more capacity. But if all carriers try simultaneously to attain this market dominance, the end result may be a low-profit or even a loss equilibrium for the firms involved. An implication of this possibility of joint over-scheduling is that competition may not be viable in the long run in these markets; losses may occur persistently when there is competition. Hence, if normal profits are to be earned in the long run in this market, a single carrier "natural monopoly" is the only solution.

This model—we shall call it the Fruhan "S"—needs immediately to be differentiated from the other models of non-price rivalry in regulated markets which have been developed by a number of economists.⁴¹ In the other models, scheduling can simply be inter-

³⁹ W. FRUHAN, JR., *THE FIGHT FOR COMPETITIVE ADVANTAGE* Ch. 5 (1972).

⁴⁰ The theory underlying the argument is simple: when seeking a reservation, potential passengers are most likely to call the airline offering the greatest number of flights. Caves had earlier raised this point. See R. CAVES, *supra* note 11, at 96.

⁴¹ See Stigler, *Price and Non-Price Competition*, 76 J. POL. ECON. 149 (1968); White, *Quality Variation When Prices are Regulated*, 3 BELL J. ECON. & MGT. SCIENCE 425 (1972); Yance, *Nonprice Competition in Jet Aircraft Capacity*, 21 J. INDUSTRIAL ECON. 55 (1972); G. DOUGLAS & J. MILLER, *supra* note 32; de Vany, *The Effects of Price and Entry Regulation on Airline Output, Capacity,*

puted as a form of non-price competition. Faced with a regulatory prohibition on price competition, potentially competitive firms turn to scheduling rivalry and continue to do so until any potential excess profits (due to a potential margin of regulated price over unit costs in the absence of scheduling rivalry) have been competed away and only normal profits are earned. These models do not predict loss equilibria, and the rivalry process is not considered destructive or necessarily socially undesirable. The Fruhan "S" model is clearly different. The scheduling rivalry process is seen as potentially destructive and undesirable.

Douglas and Miller and James C. Miller point out that the S-shaped curve is a necessary condition for a loss equilibrium to occur, but it is not a sufficient condition.⁴² Thus, even though the S-shaped curve is a generally observed phenomenon in the airline industry, this is no guarantee that loss equilibria are occurring.⁴³ They also require myopic behavior by airline managements, and they depend on management expectations of persistently high traffic responses to capacity additions.

Further, there is substantial evidence that the loss equilibria possibilities predicted by the Fruhan "S" model are not found empirically. First, the airline industry as a whole has earned more or less normal, competitive profits over sustained periods;⁴⁴ this is not consistent with serious loss equilibria. Second, a number of economists have provided evidence that the characteristics of most airline markets are such that loss equilibria are unlikely.⁴⁵ Third, the

and Efficiency, 6 BELL J. ECON. 327 (1975); Schmalensee, *Comparative Static Properties of Regulated Airline Oligopolies*, 8 BELL J. ECON. 565 (1975).

⁴² G. DOUGLAS & J. MILLER, *supra* note 32, at 47-49; Miller, *Airline Market Shares vs. Capacity Shares and the Possibility of Short-Run Loss Equilibria*, in RESEARCH IN LAW AND ECONOMICS (1978).

⁴³ For evidence on this point, see Eads, *Competition in the Domestic Trunk Airline Industry: Too Much or Too Little?*, in PROMOTING COMPETITION IN REGULATED MARKETS 32 (A. Phillips ed. 1975).

⁴⁴ See R. CAVES, *supra* note 11, Ch. 17; G. DOUGLAS & J. MILLER, *supra* note 32, at 50, 117.

⁴⁵ See J. Yance, *The Possibility of Loss Producing Equilibria in Air Carrier Markets* (unpublished thesis, Boston U., Dept. of Econ. (1971)); G. DOUGLAS & J. MILLER, *supra* note 32 at 49, 131-132; Eads, *supra* note 43 at 33-35; J. MILLER, *supra* note 42. Also, in the CAB investigation of carrier agreements limiting scheduling rivalry, both Administrative Judge Seaver and the Board itself rejected the notion that destructive competition was a serious problem in the airline industry. See Initial Decision, CAB Docket No. 22908 (November 18, 1974), at 53-56; CAB Order 75-7-98 (July 21, 1975), at 9-10.

evidence on scheduling rivalry is more consistent with the other models of scheduling rivalry than with the Fruhan "S." Douglas and Miller, Eads, and White have found that load factors (the ratio of passengers to available seats—a measure of scheduling rivalry) in city-pair markets decline as the number of carriers on a route increases and as the potential profits on a route (proxied by distance for the late 1960s) increase.⁴⁶ Both effects are significant statistically and quantitatively. Though the first effect is predicted by the Fruhan "S" model, the second effect is not; the potential profitability of a route should not affect the tendency toward heavier scheduling in the Fruhan "S" model. But the potential profitability of a route is an important determinant of heavier scheduling in the other models mentioned above. Third, recent preliminary evidence developed by Nancy Van Broekhoven⁴⁷ indicates that at least part of the S-curve phenomenon is due to the effects of an airline feeding passengers from its own connecting flights on to its own flights in the market subject to rivalry; that is, at least part of the reason why a carrier in a market is a dominant carrier and has a higher than proportional market share is that it schedules more flights to accommodate the passengers who are feeding in from its own connecting flights and who have a high likelihood of staying with that carrier. This explanation for the S-curve throws doubt on the possibilities of management expecting high traffic responses to extra capacity.

Finally, and perhaps most importantly for the purposes at hand, the Fruhan "S" model is one in which regulation prevents price competition. With the possibility of price flexibility, scheduling rivalry would no longer be the only major channel for competitive efforts. Even if the loss equilibria phenomenon is a serious one pointing toward "natural monopoly" in local markets under current conditions—and the evidence above indicates otherwise—an industry that had price flexibility would be unlikely to experience these problems.

Evidence concerning local network effects is yet more sparse.

⁴⁶ See G. DOUGLAS & J. MILLER, *supra* note 32, at 53; Eads, *supra* note 43, at 27-30; White, *Quality, Competition, and Regulation: Evidence from the Airline Industry*, in *REGULATING THE PRODUCT* 17 (R. Caves & M. Roberts eds. 1975).

⁴⁷ Telephone conversation with Nancy Van Broekhoven, Apr. 20, 1978.

There are clear *a priori* arguments for cost savings and marketing advantages to local networks, at least up to some point. Virtually all of the costs of terminal facilities can be shared if a number of low volume routes converge on a single point. A carrier is likely to retain a passenger on a high density, competitive route if that carrier has also provided that passenger with a connecting flight that feeds into the major route. But there is no published work which would indicate the magnitude of these effects. The preliminary work by Van Broekhoven,⁴⁸ indicates that there definitely are beneficial effects to a carrier from having feeder flights connecting with major flights, but the work is still too preliminary to yield specific quantitative results.

The only real evidence we have is of a negative sort—that there are limits to the advantages of network effects. Some carriers under some circumstances do decline to provide service between some city-pairs. As of 1975, there were thirteen out of the largest seventy-two city-pair markets in which one or more carriers were not offering nonstop service, though they were authorized by the CAB to do so.⁴⁹ Between the late 1940's and 1975, the trunk airlines abandoned service at 256 communities;⁵⁰ between 1965 and 1975, the local service airlines abandoned service at 107 cities.⁵¹ Thus, despite the possible advantages of local networks, the airlines have been willing to decline to serve large numbers of routes.

A second piece of evidence bears yet more strongly on this issue. In the cost studies by DOT and Douglas and Miller reported above, the traffic density terms in the regressions had statistically significant *positive* coefficients for the trunk carriers and positive though statistically nonsignificant coefficients for the local-service and overall industry regressions; unit costs tended to *increase* as market density increased.⁵² The quantitative impact of these coefficients is

⁴⁸ *Id.*

⁴⁹ Snow, *The Problems of Airline Regulation and the Ford Administration Proposal for Reform*, in *REGULATION OF PASSENGER FARES AND COMPETITION AMONG THE AIRLINES* 26 (P. MacAvoy & J. Snow eds. 1977) [hereinafter cited as P. MacAvoy & J. Snow eds.].

⁵⁰ U.S. Dep't of Transp., Regulatory Policy Staff, *Air Service to Small Communities*, in *id.* at 83.

⁵¹ U.S. Dep't of Transp., Regulatory Policy Staff, *Air Service to Small Communities: Further Discussion of the Issues*, in *id.* at 112.

⁵² U.S. Dep't of Transp., *supra* note 22; G. DOUGLAS and J. MILLER, *supra* note 32.

not great.⁵³ But the fact that they are not significantly negative probably indicates that, for the range over which the current carriers—even the local-service carriers—operate, there do not seem to be unit cost savings from further increases in average traffic density.

It is also worth pointing out that even if local network effects were substantial, this need not mean that one carrier would naturally dominate a major local market. Suppose city-pair X-Y is otherwise large enough to support three carriers, but that there are local network advantages from cities A, B, C . . . feeding passengers into the X-Y market. Competition in the X-Y market may still be viable if each carrier has some of the feeder routes, allowing each to gain the advantages of a local network. Even here, “natural monopoly” need not prevail.

The limited evidence we have presented so far indicates that, though there probably are economies of scale at the city-pair and local network level at low levels of output, they likely do not extend over all observable ranges. Since the carriers currently have the possibility of scheduling rivalry open to them, any pervasive economies of scale would give a larger firm an advantage in this scheduling rivalry and lead eventually to single firm dominance in individual markets. But this has not happened, leading one to believe that constant returns to scale prevailing beyond some MES point best characterize these markets. The introduction of pricing flexibility is not likely to change this picture. It will simply provide another avenue for rivalry on the part of the carriers. The introduction of fare flexibility does, of course, introduce the possibility of predatory pricing. But, as Douglas and Miller and James L. Hamilton and Michael K. Kawahura have argued, current scheduling rivalry offers the possibility of predatory behavior, so nothing really new is being added on this score.⁵⁴ In the short run, continued CAB regulatory power to prevent predatory pricing is probably wise. In the long run, reduction of regulatory entry barriers into local markets is surely the best policy. A firm is less likely to

⁵³ A partial explanation for the positive coefficient is that the high density routes are those in which labor costs and rental rates are higher.

⁵⁴ G. DOUGLAS & J. MILLER, *supra* note 32, at 132; Hamilton & Kawahara, *Predatory Non-Price Competition: The Case of Hawaiian Inter-Island Air Transport*, 7 ANTITRUST L. & ECON. REV. 82 (1975).

engage in predatory actions if it knows that its attempts subsequently to reap the fruits of its predation are only likely to attract other entrants. And, as we argue below, those potential entrants are likely to be plentiful.

The absence of better evidence on scale effects in individual city-pairs and on local network effects is frustrating. It would be satisfying to have a more precise idea of the size market that can support only one carrier efficiently, the size market that can support only two carriers, etc. It would be nice to know more precisely how important local network effects are and when they stop being important. But for policy purposes, this determination may be much less important than the determination of economies of scale at the national, firm-wide level of the previous studies. As long as there are an appreciable number of viable firms at the national level, then if regulatory entry restrictions are removed at the city-pair level, we need not fear any long-term abuse by a "natural monopolist" in the local market. Any time a firm tried to exploit any monopoly position for a sustained period, another firm would see a profitable opportunity and enter the market. With eighteen trunk and local-service carriers, a dozen or so supplemental carriers, three or four intra-state carriers, two Hawaiian carriers, four Alaskan carriers, one international carrier (Pan American Airways), and over 200 commuter carriers, the number of potential entrants with at least some form of airline experience is quite high.⁵⁵ The non-regulatory entry barriers in the airline industry are not high,⁵⁶ so that even *de nouveau* entry would be a possibility. City-pair markets would not want for potential entrants.

The potency of potential entry in preventing abuse by "natural monopolists" is indicated by the following evidence. In the commuter markets, where entry is unrestricted by regulation, James C. Miller and Leroy Laney have computed the best-fit fare schedules (fares related to distance) for those markets with only one commuter carrier (i.e., monopolies) and those with competitive car-

⁵⁵ And, of course, if the United States were to lower its statutory "import barriers" against foreign airlines serving domestic routes, the number of potential entrants would be considerably higher.

⁵⁶ See R. CAVES, *supra* note 11, at Ch. 4; W. JORDAN, *supra* note 21, Chs. 2, 10; R. PULSIFER et al., REPORT OF THE CAB SPECIAL STAFF ON REGULATORY REFORM 107-116, 275 (1975).

riers.⁵⁷ *The fare schedules are not substantially different from each other*; the monopolies did not charge significantly higher fares than did the competitive carriers for comparable distances. This is quite consistent with the proposition that ease of entry was preventing the monopoly carriers from exploiting their power. This evidence is in interesting contrast with that provided by Douglas and Miller, Eads, and White.⁵⁸ Trunk carriers with monopoly routes, protected from entry by regulation, have consistently provided worse service (as indicated by high load factors) in these markets, compared to the service provided in competitive markets.

Easing regulatory entry barriers, then, is the best way of dealing with any potential problems of "natural monopoly" that might exist in local markets. The evidence at the firm level indicates overwhelmingly that there will be plenty of potential entrants to prevent monopoly abuses.

V. CONCLUSION

"Natural monopoly" is not a serious problem for the airline industry. The available evidence clearly indicates that all of the current trunk and local-service carriers have reached a size at which scale no longer affects unit costs. Thus, claims of economies of scale in support of proposed mergers deserve very close scrutiny. At the same time, the recent introduction of fare flexibility will surely *not* lead to the monopolizing of the industry because of scale effects. The structure of the industry may well change under the regime of fare flexibility—some firms may expand and others contract—but these changes will be due to the firms' management abilities to deal with a more competitive environment and not to any serious economies or diseconomies of scale. The end result will be a healthier, leaner, more competitive, and more flexible industry.

⁵⁷ This evidence is found in U.S. Department of Transportation, Regulatory Policy Staff, *Analysis of Commuter Airline Fare Structures*, in P. MacAvoy & J. Snow eds., *supra* note 49, at 72-78.

⁵⁸ G. DOUGLAS & J. MILLER, *supra* note 32, at 53; Eads, *supra* note 43, at 27-30; White, *supra* note 46.

