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The Role of Advertising Costs in the Airline Industry

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Introduction

Economists have long recognized that there are different types of costs having different economic significance. This paper discusses the particular type of cost referred to as selling cost. While one finds some discussions of this type of cost in the literature, these are almost invariably oriented toward questions of a theoretical nature, such as optimum firm behavior, or the effects of selling costs on the allocation of resources. The latter generally associate expenditures on one important type of selling cost, advertising, with waste or inefficiency, although some value is often recognized for its informative aspects. Beyond these broad considerations economists have given little or no attention to the role of selling costs in specific situations. In particular, questions of public policy with regard to selling expenditures have been largely ignored. Establishment of standards for selling cost levels by the regulatory agencies have left much to be desired from both a theoretical viewpoint and a quantitative understanding. The basic objective of these costs, to shift the demand curve, is not explicitly considered. The lack of quantitative understanding of their behavior is an especially critical problem in the realm of economic regulation of industry, particularly in industries provided with publicly financed subsidy, such as the airline industry.

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In airline regulatory proceedings, great weight is often placed on evidence regarding cost-output relationships. Little consideration, however, is devoted to the relationships between output or revenue and selling costs.

This paper focuses on some of the considerations that should be given to advertising, an important component of selling costs, in the airline industry, and presents the results of a general study of airline advertising expenses. The paper begins with a discussion of the uses and effects of advertising and presents an historical review of Civil Aeronautics Board policies with respect to airline selling costs.

The Uses and Effects of Advertising

The primary purpose in advertising is not simply to alter the demand curve, but to shift it upward and to the right. For the industry as a whole, this requires that it either bring consumers into the market who who would not otherwise use the service, or encourage people who use the service to use it more frequently, or more intensively on longer hauls. For an airline in a competitive market, an increase in its demand may also accrue from a shift of passengers away from its competitors. This result of competitive advertising may lead to a requirement that all firms in the market advertise merely to retain their share, and such advertising, not creating new demand in appropriate amounts, leads to economic waste.

The bulk of airline advertising is directed toward, or at least results in, providing the potential traveler with specific information of a scheduling or price nature. Some is institutional, stressing the reliability, dependability, comfort, and convenience of air travel; some is almost purely competitive, stressing a sometimes nonexistent advantage, such as an alleged superiority of one aircraft or service over that of competitors. In a recent speech before the Airline Finance and Accounting Conference, CAB Chairman Alan S. Boyd said "Any day of the week we can open the morning newspaper and be assured that carriers A, B, and C will carry you to designated destinations in less time than their competitors. I fail to see how such an approach sells air transportation."

The intraindustry effects of advertising are perhaps most wasteful. Airlines competing for traffic on the same routes are compelled to advertise simply to maintain their share of the market. The question arises as to the possible effect on joint airline revenues of an over-all reduction of such advertising by all competing carriers. Could the potential savings be translated into reduced fares that might be a

genuine stimulus to demand, perhaps leading to increased revenues, accompanying lower advertising expenditures? It will not be easy to arrive at a definitive answer to this question, but its answer has important implications for regulatory policy.

Another intraindustry use of advertising may occur when airlines serve different places through a common city. Here it is used to stimulate travelers to go to a place on one carrier's routes, rather than to one on the routes of a competing carrier. Although it is doubtful that such advertising has any effect on the business traveler, it may influence the pleasure traveler. The wastes of this type of advertising are not so clear-cut. Through it, new vacation spots are stimulated, which in the long run may be generally beneficial to the industry and to society; the short-run effects may appear uneconomic.

In addition to competing with other airlines for a share of the consumer's dollar, airlines advertise in competition with other transportation industries, and with other industries generally. If the market for air transportation is carefully considered, this interindustry effect shows great long-term promise for the airlines. Recent studies show that only 25 per cent of the population has ever flown, while only 8 or 9 per cent take an annual air trip.[1] At the same time, it is estimated that during the year 1961 over 50 per cent of the population took an automobile, bus, or train trip of at least 400 miles round trip, and thus could be considered logical members of the market for air transportation.[2]

To the extent that airline advertising diverts consumer expenditures from other industries, it is difficult to evaluate the economic implications. The study by Opinion Research indicates that a large proportion of the people interviewed were uninformed or poorly informed about the relative costs of travel by air and by auto. Often the respondents believe air transportation to be substantially more expensive than it actually is, and particularly they believe it to be more expensive than travel by auto, when the total costs may, in fact, be comparable. Unfortunately, it is very difficult for the airlines to change these beliefs. The price of an airline ticket is well established. The cost of traveling by auto, on the other hand, is not so easily determinable by the traveler. Some aspects of automobile operating expenses, for example, are not

[1] Opinion Research Corporation, *The Domestic Travel Market with Emphasis on Prospects for Diversion from Auto to Air*, Princeton, N.J., 1962; E. Mueller, J. Lansing, and T. Lorimer, *The Travel Market 1959–1960* and J. Lansing, *The Travel Market 1957*, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor.

[2] Opinion Research Corporation, *Domestic Travel Market*.

directly associated by the traveler with the trip. In the Opinion Research survey, only 17 per cent of the auto traveler respondents indicated that they account for tire wear; 11 per cent accounted for servicing; and, somewhat surprisingly, only 69 per cent accounted for oil. Prices for train or bus transportation are also well established, but certain extra costs may be incurred such as enroute eating expenses. These different modes of travel may have economic and noneconomic compensating attractions to the traveler, such as enroute sightseeing, joy of driving, and having a car at the destination.

Since the price comparisons between forms of transportation are difficult to convey to the general public, the airlines often use other means to create psychological impact. They use advertising to stimulate the potential traveler by depicting glamorous vacations and exciting adventures in distant places, and they emphasize that these places are only a few hours away by air. There is also reason to believe that an image has been created that air travel is a measure of social status. Some indication of this lies in the results of most personal interview surveys of air travel. There seems to be a strong tendency for interviewees to exaggerate their air travel. Expansion of sample survey results to population estimates reveals more travel by air than reliable airline statistics indicate.[3] Although these results could be due to poor sampling techniques or to sampling variations, the reputability of the surveying organizations and the extraordinarily consistent overestimation makes respondent exaggeration more likely.

To the extent that people consider air travel a measure of social status and a luxury, they may tend to correlate it with high prices. In the past fifteen years there has been an attempt on the part of the airlines to transform flight as a mode of transportation for a select few to one available to the masses. This has been done largely through the introduction and development of coach services, family fare plans, and recently by special emphasis on no-reservation and air bus experiments.

The effects of advertising manifest themselves in both the short and the long run. In terms of intraindustry competition, an airline can at best only hope to use advertising as a means of increasing market share in the short run. Once its competitors become aware of their loss or potential loss of demand, they will retaliate, with the general

[3] In an unpublished memorandum of Systems Analysis and Research Corporation, reconciling actual air travel with the Survey Research Center's *Travel Market Surveys*, the following is indicated: The 1955 Survey overstates air travel by 84 per cent, the 1956 Survey by 115 per cent, the 1957 Survey by 110 per cent, and the 1959–1960 Survey by 135 per cent.

result that the total level of advertising in the market will be raised. The tendency for airlines to incur heavy advertising expenditures during their peak seasons may indicate some desire to capture the market, but it may also be appropriate for stimulating the use of air transport at a time when a particular type of trip is being considered. For example, airlines serving North-South markets spend considerable amounts on advertising in the winter months to attract travelers to the South.

Probably the most important effects of advertising to the airlines are its long-run influence on interindustry market shares. Continued advertising has a cumulative response. It produces an increased awareness of air transportation through constant exposure, and may create an identification of a particular carrier or carriers with a route, market, or region.

Appropriate policy and good decision making by both the regulatory agencies and by the firms in the industry require knowledge of the relative significance of advertising in both the short and the long run.

Regulatory Policy Concerning Advertising

In order to appraise regulatory policies concerning advertising expenditures, consideration must be given not only to the effect of the policy on the industry and its member firms, but also to the effect on the entire economy through the allocation of resources. The best case that could be made for airline advertising would be to show that it results in increased output while price is held constant or is reduced (without disturbing rates of return); and that the best allocation of resources for the movement of people is to provide air transportation. The determination of this last factor is not simple. There are formidable difficulties in determining the full cost of each service. Some services pay for the entire right-of-way directly; for other services, the right-of-way is provided by the public, and user charges are assessed. The evaluation of the appropriate level of user charges and of the proper allocation of charges to the individual users is a question too complex to be undertaken in this paper.

We must focus on the problem of the airline industry alone, in determining the importance that must be given to advertising expenditure in appraising rate levels. The Civil Aeronautics Board considers cost, among other factors, in evaluating rate proposals. The Board is required by law to take into consideration "the need of each air carrier for revenue sufficient to enable such air carrier, under

honest, economical, and efficient management, to provide adequate and efficient air carrier service." [4] What items should be considered in establishing the carrier's need? In particular, what items of selling cost or advertising should be considered?

Appraisal of Board policies regarding selling costs and the establishment of standards requires a review of proceedings that took place during the era of subsidy and mail pay determined by need. Although subsidy is now restricted to the local service carriers, and revenue from the carriage of mail has declined in importance, historical review of Board policy can help to demonstrate the regulatory issues, the precedence established for their resolution, and the problems inherent in the type of standards developed.

In general, the Board has recognized selling expenditures as an important cost area for the airlines and has established and applied standards for them. Advertising expenses are almost always considered within the broader scope of selling expenses; consequently, the Board's views on advertising itself can be inferred only from its views of the broader cost category. It is important to recognize in these inferences, though, that the aggregate of selling expenses is three or four times the size of the advertising component.

The Board has recognized that higher-than-normal selling expenses are important in developing new markets, but that such levels of expenditure should not persist for very long. However, the Board has had a varying standard to apply. In an early mail rate case it stated ". . . expenditures in the past for advertising, publicity, solicitations, and the like were proper as a development program, but a continuance of the expenditures should be made only in the light of what past experience has indicated may provide a profitable return." [5] In establishing mail rates for American Overseas Airlines, which claimed costs for extension and development that included expenditures on advertising and public relations, prior to the inauguration of their new service, the Board stated "While we recognize the need for expenditures of this type in order to bring the name of a new member of the industry before the public, we also are of the opinion that such expenditures are not warranted until a reasonable period of time before the date on which service to the public is expected to begin." [6]

[4] Civil Aeronautics Act of 1938, Title X—Procedure, Rule of Rate Making.

[5] Mid-Continent Airlines, Inc., Mail Rates, I CAA 45 (52) Docket No. 1 3-406-(A)-1, 1939.

[6] American Overseas Airlines, Inc., Mail Rates, 9 CAB 695 (704) Docket No. 1666, 1948.

The CAB has used several standards in its appraisal of selling expenditures. These are most often of a comparative nature and generally measure the volume of these expenditures in terms of their ratio to revenue. In the Transatlantic Final Mail-Rate Case, the Board took the position "Since the selling-expense ratio is fixed in relation to revenues, and selling expenses are largely incurred in station activities affected by traffic volume, the significance of this factor of comparability is obvious." [7] The Board thus indicates a belief that the ratio is related to load factor and capacity. "At a given capacity, realization of a high load factor permits reduction of 'selling' expense." [8] It is undoubtedly true that the major portion of selling expenses does relate to traffic volumes as the Board indicates; however, advertising, if it is effective, has a different causal nature, i.e., it creates the volumes. Other discretionary cost portions of selling expense behave in the same way as advertising, affecting traffic volumes rather than being affected by them. The standards have been applied with caution, however. Comparisons have been made only between carriers with relatively homogeneous circumstances, or for a single airline over different time periods.

In a case deciding the mail rate for Colonial Airlines, the Board disallowed a portion of expense in the traffic and sales account in an amount ". . . based on excess of ratio of combined traffic and sales and advertising and publicity expenses to nonmail revenues over 17 per cent, which we consider reasonable for a carrier the size of Colonial." [9] In addition to the 17 per cent standard, consideration was given to the change that had taken place in Colonial's ratio of selling expense to revenue, from 14.9 per cent in an earlier period to 19.5 per cent in the then current period. In a subsequent case involving mail rates for Colonial, the Board applied the standard used for the other trunklines.[10]

At other times, the CAB has made comparisons within smaller groups for purposes of establishing a standard. For example, a ratio of selling expense to commercial revenue of 18.25 per cent, based on intra-Alaska carrier experience, was used as a standard for disallowing expenses of Wien Alaska.[11] The policy of group comparisons has not always been followed, however. In a case involving a local service

[7] Transatlantic Final Mail-Rate Case, 21 CAB 484(489), Docket No. 1706, 1955.
[8] Transatlantic Final Mail-Rate Case, 19 CAB 464 (545), Docket No. 1706, 1954.
[9] Colonial Airlines, Inc., Mail Rates, 15 CAB 279 (305), Docket No. 2724, 1951.
[10] Colonial Airlines, Inc., Mail Rates, Domestic Operations, 16 CAB 578, Docket No. 5497, 1952.
[11] Wien Alaska Airlines, Inc., Mail Rates, 18 CAB 130 (134), Docket No. 5800, 1953.

carrier, decided one year after the Wien Alaska case, the Board adjusted the carrier's forecast of advertising and publicity expense to the level it had experienced during the previous year.[12]

The prevailing opinion has been to apply a standard, but in addition, to consider other factors that may be significant in a particular situation. Special care has been taken in cases involving subsidized carriers. In the establishment of mail rates for the Latin American Division (LAD) of Pan American, the Board explicitly recognized that selling costs are an area "which is most susceptible to the control of management and which subsidy carriers must keep within reasonable bounds." [13] The Board went on to adopt the standard: "For this reason, the standard of 19 per cent of appropriate nonmail revenues is adopted as the benchmark from which to test the reasonableness of selling expenses for LAD and for the larger American-flag carriers in general. Any upward departures from the 19 per cent level will have to be specifically justified." [14] In applying the standard to Braniff operations in the same area of the world, the Board decided that the carrier's smaller size warranted a higher ratio.[15] For a local service carrier, the Board allowed a 55 per cent ratio on the grounds that there is a "fixed cost element inherent in selling expenses," and the carrier's experienced low passenger revenue.[16]

The Board clearly recognized the use of selling expenses, and particularly advertising, to affect a change in relative market shares. It has gone so far as to suggest the possibility, for example, of an airline with vast resources competing in this manner with less endowed carriers. In the All American Certificate Renewal Case, it stated ". . . the extent to which Eastern will suffer depends almost entirely upon the carrier itself for Eastern has not only greater advertising facilities, prestige, and resources than All American but also has unlimited authority schedule-wise." [17] Replying to arguments by Colonial for a larger allowance for advertising and publicity to support its competition with Trans Canada's then recent introduction of Montreal-New York service, the Board decided that the amount allowed was ample "for

[12] Southwest Airways Company, Mail Rates, 19 CAB 328 (337), Docket No. 6230, 1954.

[13] Pan American World Airways, Inc., Latin American Division, 17 CAB 775 (812), Docket No. 3308, 1953.

[14] *Ibid.*

[15] Braniff Airways, Inc., Latin American Operations, Mail Rates, 18 CAB 752 (758), Docket No. 2886, 1954.

[16] Lake Central Airlines, Inc., Mail Rates, 18 CAB 426 (434), Docket No. 4156, 1954.

[17] 17 CAB 400 (456), Docket No. 5053, 1953.

any measure Colonial's management reasonably had to take to meet the new competition." [18]

When TWA decided to use greater sales promotion effort, rather than a more attractive service, to combat the competition from Pan American's better equipment, the Board considered this "a sound action of economic management which resulted in a lower mail-pay claim." [19] It consequently allowed TWA a special increment over the standard of 19.5 per cent established in the case. In this situation the Board did take an important precaution by not allowing the increment for future periods, clearly indicating its fear of wasteful competitive advertising. It stated "Increased expenditures by one carrier in a competitive market start a vicious cycle of increased outlay by all to maintain prior shares of the traffic. Such uneconomic practices would unduly impede the industry's progress toward self-sufficiency." [20]

While the standards developed were crude and undoubtedly arose out of pragmatic considerations, the Board either implicitly or explicitly recognized many of the uses and effects of advertising. Nevertheless, its failure to recognize the explicit relationship between advertising and revenue or demand raises some question as to the validity or possibility of implementing standard ratios of selling expenditures to revenue in all cases. Situations might arise where application of the standard and its acceptance by the carriers could result in severe hardship for the carriers. The Board has applied a standard that implicitly assumes that the average carrier in the group is fully aware of the revenue-advertising relationships and behaves optimally. The application of the standard through disallowance of costs for the determination of mail rates is one thing; the implementation by the airline, another. Consider an airline whose selling expenditure ratio is "too high" according to the standard. It may be that a reduction in this expenditure category will so impair revenues that the cut will actually produce an even higher ratio. Application of the standard does not indicate the direction which airline management should vary their selling expenditures. If selling expenditures were very effective in stimulating revenue, they would have to be increased to reduce their ratio to revenue.

The policies discussed are largely of historical interest. In the early period of the airlines, when they were supported through subsidy or mail pay determined by need, the Board took a great deal of care in establishing the extent of need. During that period, subsidy and mail

[18] Colonial Airlines, Inc., Mail Rates, 15 CAB 279 (345), Docket No. 2724, 1951.
[19] Transatlantic Final Mail-Rate Case, 19 CAB 464 (486), Docket No. 1706, 1954.
[20] *Ibid.*, p. 487.

pay were determined largely on a carrier-by-carrier basis. So long as the carrier had a "closed" rate fixed by the Board, it could operate any way it pleased. Any level of selling costs was permitted, the only use of the standard being the setting of subsidy, and there was no direct provision for the government to recapture earnings considered in excess of normal, or for the carrier to recover losses incurred. When a rate is open, however, the carrier's earnings are subject to Board policy; the Board sets a final rate that will apply to the entire period in which the rate is open, and thus has the power to create profits or losses for the carrier. During these periods, Board policy had a powerful influence on airline management decisions, and these periods were both frequent and long.[21]

Since the early 1950's, the trunklines have not been subsidized, mail pay has been considered separately, and, recently, subsidy for the local service carriers has been based on a class rate which considers needs in terms of factors that apply to the entire group of carriers. In addition, mail revenues are now of little significance to the airlines. Nevertheless, the Board must still consider costs in many of its regulatory decisions, and its power to define "honest, economical, and efficient management," provides it with an important tool that could be used to influence management policies.

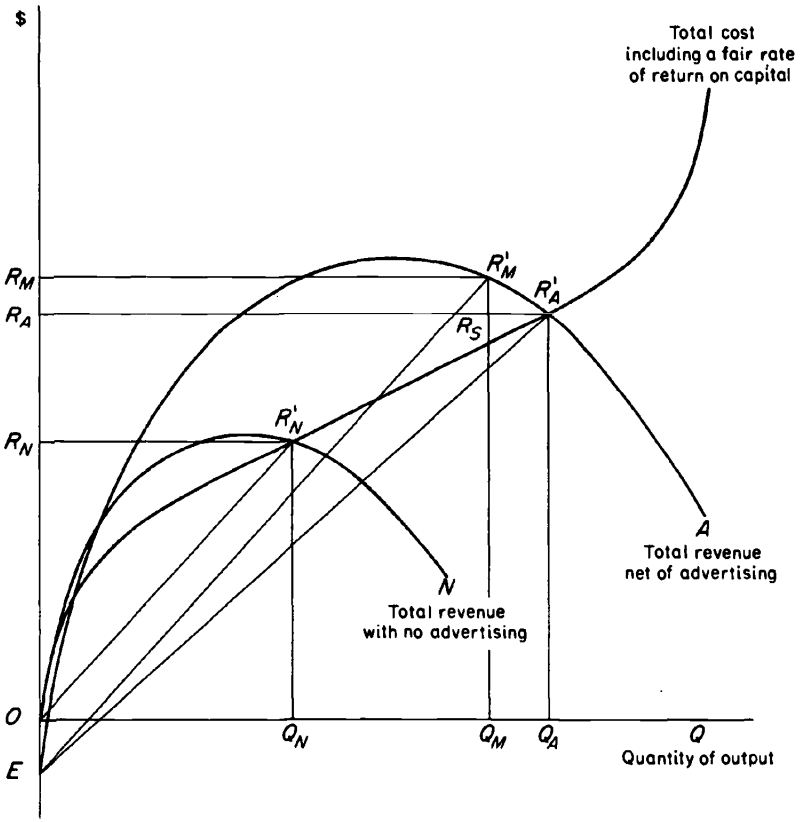
In order to demonstrate the possible potential for advertising that should be considered in regulatory policy, let us consider a hypothetical situation. Figure 1 shows a curve describing the relationship between output and total cost, including return on capital, but excluding advertising costs.[22] Curve *ON* shows a total revenue curve assuming no expenditures for advertising.[23] If such expenditures are incurred, the total revenue relationship can be expected to shift upward, indicating that purchasers of air travel are willing to purchase larger quantities at each price, or pay higher prices for the same quantity. This upward shift of the total revenue curve corresponds to a shift of the demand curve upward and to the right. In the illustration, it is assumed that an amount *EO* is expended on advertising, and that the resulting total revenue curve is shifted downward by distance *EO* to construct a total

[21] R. E. Caves, *Air Transport and Its Regulators*, Cambridge, 1962, Chapter 11.

[22] Figure 1 is taken from Systems Analysis and Research Corporation, *The Cost of Air Cargo Service*, Boston, 1962. The total cost curve is assumed to include a normal rate of return as considered by the regulatory agency.

[23] This assumption is unnecessary, but simplifies the illustration. Some standard or average level of advertising expenditure could be assumed and added to the total cost function, in which case the analysis is directed to the effect of adding increments to the standard assumed, rather than to the effect of total advertising expenditures.

Figure 1
Illustration of the Effect of
Rates and Advertising on Profit



revenue net of advertising, curve *EA*. Consequently, at zero output, the total revenue with advertising is negative by an amount *EO*. Accepting the general policy that the Board "is unlikely to allow fares that will yield profits much above a normal level," [24] it is assumed in the example that Board rate decisions equate total cost, including a

[24] Caves, *Air Transport*, p. 360; and E. Troxel, *Economics of Transport*, New York, 1955, Chapter 19. In industries where entry is severely restricted by regulatory agencies, profit maximization is rarely permitted. The Civil Aeronautics Board restricts the entry of firms into the commercial airline industry, and, even for firms in the industry, controls the number operating any route and the conditions of service.

normal rate of return, and total revenue. In the absence of advertising, total cost and total revenue are equated for an output of OQ_N. This output will be produced if the price is set equal to OR_N/OQ_N, i.e., equal to the slope of the line from the origin to the point of intersection of the total cost curve with the total revenue curve, R'_N. The line OR'_N represents the total revenue curve when the price is fixed at OR_N/OQ_N.

When an advertising expenditure of EO is incurred, an output OQ_A, greater than OQ_N, will equate total revenue with total cost (advertising expense having been deducted from total revenue). The line ER'_A has a smaller value of slope than the original line, indicating that a lower price will equate total revenue and total cost under a system with advertising than one without. This occurrence is only possible when a certain relationship exists between the scale economies and demand response to advertising.

If a price is established without consideration of the potential of advertising, the firm can increase its profits beyond a fair rate of return by advertising. In the circumstances illustrated, an expenditure of EO on advertising, under the established price in the no advertising case, will yield an additional profit of $R'_M R_S$. The line represents the firm's total revenue curve net of advertising under the established price OR_N/OQ_N. The output would be OQ_M, an amount greater than OQ_N.

Although the illustration may appear to be only a demonstration in graphics, the possible consequences of advertising have important policy implications. If there are any economies of scale and if there is some positive response of demand to advertising, the possibility is open that more output could be generated at reduced prices while maintaining normal returns. Study of airline cost behavior indicates that there are some economies of scale, although they are relatively small and have a significant effect only on the local service carriers.[25] Establishment of the usefulness of advertising thus depends upon a determination of the effect of advertising on revenue.

Empirical Analysis

In an attempt to establish quantitative measures for the various effects of advertising on revenue, a limited empirical analysis was performed. Unfortunately, data in sufficient detail are not available for analysis of some of the more important aspects of airline advertising, particularly its effects on market shares. In addition, there has been no recent

[25] See the discussion in Caves, *Air Transport*, pp. 56–63; and Systems Analysis and Research Corporation, *Cost of Air Cargo*.

period in which the industry has remained relatively stable for long. Throughout the post-World War II years, there have been vast improvements in equipment, speed, capacity, and passenger comfort. Prices and services have been continually varied and promotional programs have been initiated. In addition, the period has seen a reduction in the number of carriers through merger, or through the Board's cancellation of operating authority, such as occurred with certain local service carriers. Important changes in airline route structures have been made also as a result of Board action. Finally, the trunk carriers have gone off subsidy, and the local service carriers now have their subsidies determined by a class rate. In addition to these internal industry changes, the economic environment has, of course, changed also. Undoubtedly all these factors have played a role in the growth of the airline industry and its revenues.

Since, without a substantial increase in scope, it is not possible to isolate the effect of economic factors other than advertising on revenue, our models assume that revenue is explained entirely on the basis of advertising expenditures and on a seasonal pattern. Many problems exist in obtaining reliable estimates under this single variable assumption. In particular, while advertising expenditures were increasing during the period analyzed, 1948–61, significant increases also took place in population, national income, and personal income (both total and per capita). The problems inherent in analyzing time series data are well known; and it is also well known that to the extent that independent variables excluded from the model are correlated with the included variables, statistical relationships between the dependent and the excluded variables will be reflected through the included variables.

It might be argued that all increases in airline revenue during the period 1948–61 are due to increases in national or personal income. On the other hand one might argue that advertising is directed toward creating, preserving, or changing the relationships between income and expenditure, and that in the absence of advertising the growth in income would not have resulted in the growth of airline revenue. Consideration of such arguments presents very complex identification problems. Because of its correlation with income, the statistical measure of the effect of the single variable on revenue will include that of income (to the extent that there is an independent effect). Consequently, such measures might be overestimates, or perhaps upper bounds on the effectiveness of advertising.

While it is likely that the effect of a given level of advertising on airline revenues is dependent on the income level, it is also likely that

revenues would be responsive to changes in advertising expenditures. Revenue would probably suffer severe deterioration if an airline ceased all advertising, but would not be expected to disappear entirely, in the short run, for several reasons: previous air travelers would continue to fly, word-of-mouth advertising would not cease, and the long-term effects of previous advertising would probably help sustain some level of revenue. Nevertheless, much airline advertising provides the prospective traveler with essential information on schedules and prices, leading one to believe that revenue could fall nearly to zero after some time.

Prices and service are other important factors influencing revenues. Although service characteristics improved considerably during the period under analysis, the behavior of passenger revenue per revenue passenger mile for the domestic trunks has been mixed, ranging from 5.73 and 5.75 cents in 1948 and 1949, respectively; declining to 5.25 cents in 1957; and then rising sharply to 6.19 cents in 1961.[26]

Although precise measurement of the effect of advertising on revenue requires a complex analysis of demand behavior and of the influence of the excluded variables (discussed earlier, and considered beyond the scope of this analysis), it was felt that gross measurements indicating the magnitude of these effects would be useful.

It is assumed that advertising has both short- and long-run effects on revenue and that the latter are cumulative over time. Hence, a distributed lag model was used. The general model takes the form

$$R(t) = K + b_0A(t) + b_1A(t-1) + b_2A(t-2) + \cdots; \qquad (1)$$

where $R(t)$ = Passenger revenue, in quarter t, in dollars,

$A(t)$ = total advertising and publicity expense, in quarter t, in dollars,

K = a constant, and

b_i = the effect of advertising in period $t - i$ on revenue in period t $(i = 0, 1, 2, \ldots)$.

Estimating the model in the form of Equation 1 presents two serious difficulties: First, if advertising has any very long-term effect, a large number of parameters have to be estimated; second, the intercorrelations between the independent variables are very high, presenting a severe multicollinearity problem. To overcome the first problem, the model is simplified by assuming a pattern to the b_i. It is specifically assumed that the effect of advertising on revenues in successive periods declines at a geometric rate, i.e.,

$$b_i = b\rho^i, \qquad 0 < \rho < 1, \qquad (2)$$

[26] *Handbook of Airline Statistics*, Civil Aeronautics Board, 1962, p. 103.

where ρ is the geometric ratio. This results in a simpler form of Equation 1 which can be written as

$$R(t) = K + bA(t) + b\rho A(t-1) + b\rho^2 A(t-2) + \cdots, \quad (3)$$

which is our Model I.

The method used in the analysis for eliminating much of the multicollinearity is attributable to L. M. Koyck.[27] Consider Equation 3 for $R(t-1)$ and multiply the equation by ρ giving

$$\rho R(t-1) = \rho K + b\rho A(t-1) + b\rho^2 A(t-2) + \cdots. \quad (4)$$

If Equation 4 is subtracted from Equation 3 and terms rearranged we obtain

$$R(t) = K(1-\rho) + \rho R(t-1) + bA(t). \quad (5)$$

Equation 5 is used to estimate the parameters of Equation 3. In the empirical analysis, seasonal dummy variables were appended to Equation 5 to eliminate the effect of seasonal variation. Equations 3 and 5 assume that the geometric series begins with the first period and do not allow for any separate short-term effects of advertising. Therefore, an alternative model was used to measure special short-term effects. Model I was slightly modified to begin the geometric series at the first lag, by introducing a separate long-run coefficient, c. The mathematical development is similar; the equation resulting is Model II:

$$R(t) = K + bA(t) + cA(t-1) + c\rho A(t-2) + c\rho^2 A(t-3) + \cdots, \quad (6)$$

and the equation used for estimating the parameters is

$$R(t) = K(1-\rho) + \rho R(t-1) + bA(t) + (c - b\rho)A(t-1), \quad (7)$$

again with appended seasonal dummy variables. This model has an even greater problem of multicollinearity than Model I.

The analysis was carried out for the domestic operations of U.S. trunk airlines on quarterly data for the years 1948 through 1961. Since the airlines, as well as the Board, seem to gear advertising expenditures to revenue in their budgeting, the problem arises as to which is the independent variable. To the extent that advertising expenditure is budgeted on prior-period revenues and is modified to reflect experience, annual data will tend to smooth, reflecting the modifications to a greater extent than would be expected in quarterly data. In the quarterly data, the period of time available for recognition of the need for and implementation of an adjustment is very limited. This is particularly true in advertising, where expenditures are often contracted for

[27] The methods have been described recently in H. Theil, *Economic Forecasts and Policy*, second revised edition, Amsterdam, 1961, pp. 217–219; and in J. Johnston, *Econometric Methods*, New York, 1963, pp. 216–217.

TABLE 1

SUMMARY OF REGRESSION RESULTS FOR MODEL I[a]

Airline	p[b]	b[b]	Degrees of Freedom	R^2
American	.8563	5.2253	49	.97
	(14.26)	(2.37)		
Braniff	.8867	4.4260	50	.99
	(21.82)	(3.26)		
Capital	.8954	6.0637	46	.96
	(18.53)	(2.92)		
Continental	.6130	8.6380	50	.99
	(8.36)	(5.71)		
Delta	.9021	3.8895	50	.99
	(13.17)	(1.95)		
Eastern	.7287	10.3927	49	.96
	(7.82)	(2.95)		
National	.6346	7.9139	45	.91
	(5.90)	(3.38)		
Northeast	.9052	2.3185	50	.95
	(18.90)	(2.92)		
Northwest	.6758	12.1481	49	.95
	(12.79)	(7.08)		
Trans World	.8936	4.8452	49	.97
	(20.43)	(2.87)		
United	.9212	5.4080	50	.97
	(16.35)	(2.19)		
Western	.4012	14.2590	45	.97
	(7.22)	(11.40)		
Total[c]	.8115	7.2592	50	.99
	(11.18)	(2.79)		

[a]The actual equations fitted also have a constant term and coefficients for the seasonal dummy variables.

[b]Figures in parenthesis below coefficients are t ratios and *not* standard errors of the regression coefficients.

[c]The total represents a regression based on total trunkline revenue and total trunkline advertising.

in advance. As a consequence, for quarterly data the budgeted relationship can be described as

$$A(t) = qR(t-1), \tag{8}$$

where q = the proportion of previous quarter revenue expended on advertising. In this relationship, $R(t-1)$ can be regarded as a predetermined variable; but in a similar expression using annual data the following relationship would be more appropriate:

$$A(t) = qR(t), \tag{9}$$

and $R(t)$ is certainly not predetermined. If quarterly data are used, the models are then recursive and ordinary least-squares estimates,

TABLE 2

SUMMARY OF REGRESSION RESULTS FOR MODEL II[a]

Airline	ρ[b]	b[b]	$(c-b\rho)$[b]	c	Degrees of Freedom	R^2
American	.8034	2.8753	4.4600	6.7700	48	.97
	(12.02)	(1.12)	(1.69)			
Braniff	.8818	4.3881	.2188	4.0882	49	.99
	(16.42)	(3.14)	(.14)			
Capital	.8320	5.2028	3.8994	8.2281	45	.96
	(13.72)	(2.48)	(1.68)			
Continental	.4897	8.7639	2.6187	6.9104	49	.99
	(3.63)	(5.78)	(1.09)			
Delta	.8030	1.7851	5.3383	6.7717	49	.99
	(10.52)	(.86)	(2.49)			
Eastern	.6668	9.5791	3.3400	9.7273	48	.96
	(5.83)	(2.64)	(.94)			
National	.6700	8.0783	-1.0175	4.3950	44	.91
	(4.83)	(3.37)	(.41)			
Northeast	.8284	.3570	3.8768	4.1725	49	.96
	(18.23)	(.43)	(4.18)			
Northwest	.6028	10.8599	3.8871	10.4334	48	.95
	(9.00)	(5.90)	(1.72)			
Trans World	.9229	5.8457	-2.3085	3.0865	48	.97
	(18.28)	(3.08)	(1.15)			
United	.9908	6.7693	-4.6689	2.0381	49	.97
	(14.31)	(2.65)	(1.67)			
Western	.4125	14.3960	- .4192	5.5192	44	.97
	(4.65)	(9.51)	(.16)			
Total[c]	.8769	8.6234	-3.7820	3.7799	49	.99
	(9.93)	(3.08)	(1.28)			

For notes a, b, and c, see Table 1 notes.

although not necessarily maximum likelihood, are consistent.[28] The sample size when quarterly data are used is significantly larger than would result from the use of annual data, and consequently the estimates have the asymptotic properties desired even though the predetermined variables are not completely exogenous.

The best single source of consistent and accurate data is the airlines' financial and operating reports to the CAB and the various CAB publications of these data. Detailed financial data regarding advertising expenses and revenue by market are not available from these sources.[29] As a consequence, the empirical results presented are based on data for entire airlines rather than for individual markets.

Ordinary least-squares regression estimates of the parameters for the two models are presented in Tables 1 and 2. In both models,

[28] If the covariance matrix of the system of equations made up of the budget relationship and the revenue relationship can be assumed to be diagonal, the estimates will be maximum likelihood. See L. Klein, *A Textbook of Econometrics*, Elmsford, N.Y., 1953, pp. 110–113.

[29] Revenue estimates for individual markets could perhaps be derived from available traffic data, but would be very crude.

estimates of ρ are highly significant, as might be expected in view of the high serial correlation of the revenue series. In addition, the estimates of b in Model I are all significant at the 95 per cent level, and nearly all the variance in revenue is explained. Estimates of the parameters b and c in Model II are not as good with respect to statistical significance, although comparison of the results for different airlines indicates that at least one of b and c is statistically significant for all airlines, except American, and for the total.

The limitations of the statistical estimation procedures indicate that significance tests may not be reliable. Other general tests of the results, relying on reasonableness, can be applied. If the results are compared among airlines, both models show that estimates of all the parameters appear to be reasonably similar for all airlines. Model I implies that a dollar of advertising will provide b dollars of revenue in the period of expenditure; $b\rho$ dollars of revenue in the first future period; $b\rho^2$ dollars of revenue in the second future period; $b\rho^i$ dollars of revenue in the i^{th} future period. If all the returns are discounted and summed, the present value of a dollar of advertising implied by the model can be determined. If we let P_{I} be the present value under Model I and r be the appropriate discount rate we obtain

$$P_{\mathrm{I}} = b + \frac{b\rho}{1+r} + \frac{b\rho^2}{(1+r)^2} + \cdots . \tag{10}$$

The value of this geometric series with ratio $\rho/(1+r)$ is

$$P_{\mathrm{I}} = b\,\frac{1+r}{1+r-\rho} . \tag{11}$$

For Model II the derivation is similar, resulting in

$$P_{\mathrm{II}} = b + c\,\frac{1}{1+r-\rho} . \tag{12}$$

Results of these calculations for Model I and Model II are given in Table 3, under the assumption that $r = 0.12$ annually ($r = 0.03$ quarterly). Both models give similar results for the value of a dollar of advertising. It is not clear that this similarity is entirely due to multicollinearity, since the method for obtaining the values is not strictly a linear transformation. With the exceptions of American, Delta, and Northeast, the estimates of the short-run parameter b are approximately the same in both models; similarly ρ does not change greatly between models. If multicollinearity were much more serious in Model II than

TABLE 3

PRESENT VALUE OF GROSS REVENUE GENERATED BY ONE DOLLAR OF ADVERTISING
($r = 0.03$ quarterly)

Airline	P_I (dollars)	P_{II} (dollars)
American	30.99	32.75
Braniff	31.81	31.97
Capital	46.40	46.76
Continental	21.34	21.55
Delta	31.32	31.62
Eastern	35.53	36.36
National	20.62	20.29
Northeast	19.14	21.05
Northwest	35.33	35.28
Trans World	36.59	34.66
United	51.20	58.76
Western	23.36	23.33
Total	34.22	33.31

in Model I, wide discrepancies would be expected between the parameter estimates of the two models, since the estimates would be extremely sensitive to small random variations.[30]

In view of the apparent stability of the relationship, Model II may be preferred to Model I for two reasons. First, it provides for an estimate of the short-run effect of advertising on revenue that is distinct from the assumed geometric decline in the long-run influence. Second, some airlines seem to have a slightly different lead time between advertising expenditure and the short-run response of revenue, and Model II permits such a distinction. Moreover, to the extent that the long-run relationships are of interest, the two models result in approximately the same values.

The results of the analysis were examined to determine whether any significant differences in the value of advertising to the carriers appeared to be correlated with carrier size, growth, or level of expenditure. Other than the fact that four of the smallest carriers in the sample, Northeast, Continental, Western, and National, have very low estimated values for advertising, no size-value relationships could be found. The four smallest airlines have values for advertising ranging between \$19 and \$24; the remaining carriers have values for advertising in the range between \$31 and \$37, except for Capital and United which have substantially higher values. The narrow range of variation precludes any statement regarding returns to scale of advertising.

[30] H. Wold and L. Jureen, *Demand Analysis*, New York, 1953, pp. 46–47.

One possible reason for the lack of any clear evidence on the correlation of advertising with carrier size may be the fact that larger carriers are generally larger in the sense that they serve more markets. The average advertising expenditure per market may be very similar for both large and small carriers. Furthermore, while the larger carriers have an advantage in that they can offer a wider variety of points served to potential travelers, this advantage is counteracted by the fact that they compete with each other in the most important markets. Analysis of advertising behavior in individual markets might provide better evidence regarding returns to scale.

A crude attempt was made to determine the effect of competitive advertising by using as a variable the proportion of total industry advertising provided by the carrier. The variable showed no significance. A better measure might have been the proportion of directly competitive advertising, but such data are not available.

One final important problem is the advertising budget relationship. The models imply that for a firm starting with zero revenue and introducing a constant quarterly expenditure on advertising, quarterly revenue will grow asymptotically to some determinable level. For Model I, a constant advertising expenditure of one dollar per quarter will provide revenues of $b/(1 - \rho)$ per quarter in the long run. On this basis, the long-run ratio of advertising expense to revenue can be calculated. The results, as shown in Table 4, are compared with the ratio of average advertising expense to average revenue for the period. The assumption of constant expenditures on advertising implies that,

TABLE 4

LONG-RUN AND AVERAGE RATIOS OF ADVERTISING EXPENSE TO GROSS REVENUE

Airline	Long-Run Ratio Implied by Model I	Average Ratio of Advertising Expense to Average Revenue
American	.027	.027
Braniff	.025	.029
Capital	.017	.032
Continental	.045	.043
Delta	.025	.035
Eastern	.026	.028
National	.046	.046
Northeast	.041	.053
Northwest	.026	.029
Trans World	.021	.027
United	.015	.024
Western	.042	.038
Total	.026	.030

in the short run, ratios of actual advertising expenditure to revenue will be higher than the limiting ratio. In all but two cases, Continental and Western, the observed ratio is greater than or equal to the asymptotic ratio.

Of course, advertising expenditures are not constant. In fact, they are generally budgeted as a proportion of revenue. To determine the steady state ratios of advertising expenditure to revenue, consider the budget relationship. Suppose that advertising expenditure in a quarter is budgeted at a fixed proportion of previous quarter revenue as in Equation 8, i.e.,

$$A(t) = qR(t-1). \tag{8}$$

If Equation 8 is substituted into Equation 5 for Model I we obtain

$$R(t) = K(1-\rho) + (bq+\rho)R(t-1). \tag{13}$$

The ratio of advertising to revenue that materializes from the expenditure is

$$\frac{A(t)}{R(t)} = \frac{qR(t-1)}{K(1-\rho) + (bq+\rho)R(t-1)} \tag{14}$$

The ratio that emerges from the budgeting policy will be equal to the budgeted ratio only if the right hand side of Equation 13 is equal to q. Some algebraic manipulation provides the result:

$$q = \frac{1-\rho}{b}\left[1 - \frac{K}{R(t-1)}\right]. \tag{15}$$

The first factor in Equation 15 is simply the long-run ratio of advertising expense to revenue when advertising expense is constant over time. If revenue is growing over time, the second factor of Equation 15 approaches unity and the long-run limit for the ratio in the case of budgeted advertising is the same as that for constant advertising as given in Table 4. The model thus yields results that are consistent with the hypothesized budget relationship.

Alternative models to the budget relationship were tested. Models explaining advertising expenditure as a function of fund availability, as measured by lagged profit, lagged depreciation, and working capital, were estimated. None of the relationships tested demonstrated statistically significant behavior.

The results presented here are merely to indicate the general behavior of the advertising-revenue relationship. The data do not warrant very sophisticated analysis in view of their highly aggregated

nature and the multitude of other factors, both within the industry and in the over-all economy, influencing revenue patterns. Consequently, the results must be used with caution.

As discussed earlier, there is reason to believe that the estimates of the value of advertising to the airlines may be regarded as upper bounds. They cannot be regarded in any way as conclusive proof that advertising is worthwhile. For example, during the period analyzed, both national and personal income grew at an average rate of between 5.5 per cent and 6.0 per cent annually. During the same period domestic trunk airline revenue from passenger service grew at an annual rate of 14.5 per cent annually. If the income elasticity of airline demand is between 2 and 3, the entire growth in revenue could be attributed to the change in income. It could be argued that, even if the income elasticity is in the required range, airline advertising creates and maintains the elasticity; nevertheless it could be as easily argued that had advertising expenditures remained at the 1948 level, the income changes would have produced the observed growth in revenue.

Furthermore, the model does not attempt to describe the profitability of advertising. Questions of the cost of services were not explicitly considered in the study. Subject to the cautions raised above, the results indicate that advertising does produce an upward shift in total revenue. This, coupled with the evidence of some economies of scale, leads to the conclusion that advertising can be used to generate more output at reduced prices while maintaining returns. Hence, it should be given explicit attention in regulatory rate proceedings.

Before adequate attention can be given to advertising, further research into its quantitative nature is needed. Analyses of its intra- and interindustry competitive effects, its scale effects in individual markets, and the types of traffic changes it stimulates are required.

More disaggregated data than were used here will be needed, in the absence of detailed knowledge of the demand function and its behavior over time. If data can be obtained for individual markets, it may be possible to use cross-section analysis for market groupings in which the nonmeasurable factors are homogeneous. The greatest hope for disentangling the complex interrelationships of demand and advertising lies in the use of carefully controlled experiments, where factors external to the model can be held constant or randomized so that the required measurements can be made. Results of such studies will be useful for airline management decision making as well as for regulatory policy.

COMMENT

CHARLES J. ZWICK, The RAND Corporation

I will comment on two aspects of the Kraft paper: first, on his general discussion of selling costs and their implications for research methodology; and second, on his empirical study which focuses on the productivity of advertising expenditures in the air carrier industry.

With regard to the first of these, I must admit that I found Kraft's discussion to be as unsatisfactory as other discussions I have read on the distinction between selling costs and costs of production. Apparently we face a dilemma. Either we can develop logically distinct classes of costs, such as Chamberlain[1] provides, and find that they are operationally useless; or we can come up with an operationally useful classification of costs but then find that we have logically overlapping classes.

I see little, if any, utility resulting from spending much time trying to distinguish selling costs from other production costs. Almost all firms that are of interest to economists will be producing a variety of products, rather than one homogeneous product and will use a number of inputs for this product mix. Certainly the statistical problem of separating out the various influences of different inputs on the variety of outputs is a very complicated and tedious process. When faced with this formidable task, we only do ourselves a disservice by creating distinctions which are either not operationally useful or logically fuzzy.

The last section of the Kraft paper reports an empirical investigation of the impact of advertising expenditures on airline revenues. As we are not provided with sufficient information to judge the quality of the work, I find this section difficult to comment on. I must say quite frankly, however, that from the evidence presented I am most skeptical. Kraft assumes a model that relates passenger revenue to advertising expenditures and seasonal variations in demand. He argues that by using quarterly data he solves his identification problem; that is, that advertising decisions lag behind revenue and therefore the fact that advertising expenditures are usually a function of revenue may be ignored. I wish I were as convinced as he is of this. The data employed were for domestic operations of the U.S. trunk airlines for the years

[1] E. H. Chamberlain, *The Theory of Monopolistic Competition*, Sixth Edition, Cambridge, 1950.

1948 through 1961. Certainly over the thirteen-year period all major airlines had substantial increases in revenue, and I would suspect that this long-term trend completely dominated any quarter-to-quarter variation in the analysis. It is surprising that Kraft did not use some of the more simple methods available for handling trend, e.g., fitting a least squares line to the data and taking deviations from it, or taking first differences.

I find the high productivity figures that he derives not surprising given the underlying relationships. Kraft relates revenue in period t to advertising expenditures in t and previous time periods. But advertising expenditures are, by CAB edict, approximately 19 per cent of revenues. If we therefore say that $R(t)$ is not a function of advertising in t but that $R(t)$ is a function of $.19\ R(t-1)$, we are not surprised that the coefficients that Kraft estimates are in the general range that he finds. In fact, if one looks at Tables 1 and 2, they seem to fit my view of the world very nicely. Postulate that there has been a continuous increase over the period in revenue and advertising expenditures. And note that another way of viewing the relationship Kraft has is to say that $R(t) = b\ .19R(t-1)$. Since revenue in t is greater on the average than revenue in $t-1$, you would expect the regression coefficient to be on the average greater than 5. Certainly the data fit this very nicely.

All of this, of course, is troublesome. I believe the most prudent thing that can be said is that the empirical work does little to advance our knowledge about the productivity of advertising expenditures in the air carrier industry.

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In my opinion, Kraft's paper fails to be entirely convincing. That advertising is a potentially powerful competitive tool is surely reasonable. If his diagram of the potential profitability of advertising is accepted, and if one believes that there are economies of scale, then the larger airlines should have realized the greatest returns from advertising. Even if we accept Kraft's estimates, this result is not borne out. Furthermore, Gordon's work suggests that there are no significant economies of scale.

The distributed lag models of Koyck and Nerlove are extremely powerful analytic tools. Yet, as noted by Griliches (*Econometrica*, January 1961), they may sometimes lead to spurious conclusions. The high coefficients of determination reported in Tables 1 and 2 mean nothing. I am certain that equally high coefficients could have

been obtained by regressing revenues on lagged revenues and any other secularly growing variable such as Soviet industrial production. To be more precise, consider a slight modification of Kraft's basic model. Suppose that revenues in year t, R_t, is a linear function of accumulated advertising expenditures, A_t^*, and some other variable, X_t^*. The true model can be written:

$$R_t = a_0 + a_1 A_t^* + a_2 X_t^* + e_t. \tag{1}$$

If we adopt Kraft's method of declining weights, we may define

$$A_t^* = A_t + pA_{t-1} + \cdots + p^i A_{t-i} + \cdots$$
$$X_t^* = X_t + pX_{t-i} + \cdots + p^i X_{t-i} + \cdots.$$

By appropriate algebraic manipulation the reduced equation becomes

$$R_t = (1 - p)a_0 + a_1 A_t + a_2 X_t + pR_{t-1} + e_t - pe_{t-1}, \tag{2}$$

or in regression notation we have

$$R_t = B_0 + B_1 A_t + B_2 X_t + B_3 R_{t-1} + u_t, \tag{3}$$

where $u_t = e_t - pe_{t-1}$.

Kraft, however, ignores the influence of any other pertinent explanatory variate such as X_t which might have affected the time series behavior of R_t. Hence, he estimates the regression by Equation 4, which deletes X_t.

$$R_t = b_0 + b_1 A_t + b_3 R_{t-1} + v_t. \tag{4}$$

The parameters of Equation 4 are, however, uniquely related to those of the larger model (Equation 3), even for fixed sample size, through the familiar analysis of specification errors of Theil (*Economic Forecast and Policy*) and Griliches (*Journal of Farm Economics*, 1956). The link is provided by the auxiliary regression of the excluded variable, X_t, on the included explanatory variables, A_t and R_{t-1}:

$$X_t = c_0 + c_1 A_t + c_3 R_{t-1} + f_t, \tag{5}$$

where f_t is a residual. We then have the three identities between the parameters of Equations 3 and 4:

$$B_0 = b_0 - c_0 B_2, \tag{6-a}$$

$$B_1 = b_1 - c_1 B_2, \tag{6-b}$$

$$B_3 = b_3 - c_3 B_2. \tag{6-c}$$

Suppose that X_t is real income and affects revenues, R_t, in a direct way, thus implying that B_2 is positive and large. The comovement of X_t with current advertising outlays, A_t, and lagged revenues, R_{t-1}, is

described by the auxiliary regression Equation 4. Since all three variables have grown over time, it is likely that both c_1 and c_3 will be positive. To the extent that the estimated model. Equation 4, omits a pertinent variable such as X_t, the estimated parameters do not give unbiased estimates of the effects of changes in the explanatory variables. In the example I have cited b_1 will be an over-estimate of the corresponding parameter, B_1, in the correctly specified model (Equation 3). Similarly, b_3 will be larger than B_3. Indeed, his parameter estimates would be unbiased if and only if one of the following two conditions prevailed: (1) any pertinent excluded variables are statistically independent of both advertising expenditures and lagged revenues, or (2) excluded variables have no effect on current revenues. The possibility that either condition truly prevails contradicts intuition about the market for air transportation. Kraft's defense for omitting these "other variables" is that they produce too formidable a problem of collinearity. If collinearity is present the exclusion of the collinear variables will lead to false conclusions.

One method for handling the problem of collinearity has been suggested by Richard Stone. First differences or other statistical tricks have also been used. Until Kraft gives explicit consideration to other variables affecting an airline's revenues the empirical work will leave much to be desired.

Finally, the theoretical justification for the model strongly supports cross-sectional analysis. If relative advertising expenditures do not vary across firms then an empirical analysis cannot hope to succeed.