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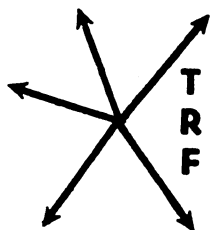
## Ninth Annual Meeting

“Transportation and Social Change”

*September 4-5-6, 1968*

*Hotel Muehlebach*

*Kansas City, Missouri*



**TRANSPORTATION RESEARCH FORUM**

# Application of Benefits/Costs Analysis To the Subsidization of Transport Operations With Special Reference To Air Carriers

by *Konrad W. Studnicki-Gizbert\**

## INTRODUCTION

The present paper is a progress report on the author's work on methodology of transport economics. It deals with analytical tools which can be applied to the assessment of transport policies, and the inherent limitations of such analytical tools. The focus of interest is on the application of benefits/costs analysis to problems of operating subsidies; air transport applications being considered as a case study in this field.

The order of discussion adopted in this paper will be as follows: Section I contains a brief summary of those aspects of benefits/costs analysis which are particularly relevant to the subsequent discussion; in Section II I shall state the general problem of the extension of benefits/costs analysis to operating subsidies, in Section III the application of the analysis to actual policy problems will be discussed.

### Section I: Benefits/Cost Analysis

Benefits/Costs analysis is a set of techniques developed to assess the expenditure of resources on projects or programs where the straightforward profitability criteria are either unavailable or inappropriate. Usually (but not necessarily) the programs in question display important indirect or "spill-over" efforts.

Benefits/costs analysis is now widely accepted as a decision-making tool relating to the expenditure policies in the public sector of the economy. There is no longer any need to "sell" benefit/costs analysis to public agencies—in fact it has now become a status symbol or a mark distinguishing "scientifically minded" and "progressive" (shall we say "intellectually swinging") offices from departments which are definitely "backward" "reactionary" or "intellectually square." Undoubtedly, the widespread adoption of benefits/costs analysis has proven to be a healthy and helpful analytical discipline; there is also little doubt that in many cases it has been oversold, and its inherent limitations not clearly realized.

Parallel with the growth of the applications of benefits/costs techniques, considerable professional literature has been developed around it, mostly during the last decade. A 1965 survey article<sup>1\*</sup> lists 90 positions in its bibliography, a vast majority of which were published in the sixties; a number of

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\*References will be found at the conclusion of this article.

new papers have been published since 1965. Also a number of serious contributions to benefits/costs analysis have not been published in a form easily accessible to the public.

It is neither possible nor appropriate to overload this paper with an extensive survey of the literature, or discussion of points which are still quite controversial. At a risk of appearing both superficial and dogmatic I shall simply list few assertions regarding the nature of benefits/costs ratios which I consider basic to the theme of this paper. These are:

(i) Benefits/costs ratios (B/C ratios) represent an ordinal index which enables us to order the items of a set of considered projects or programs from the point of view of their desirability according to the same set of criteria. A statement that B/C ratio for project *i* equals e.g., 1.37 is only meaningful if we know B/C ratio for at least one more project which is also being considered. No precise meaning can be attached to the differences between the calculated values of B/C ratios; e.g., if B/C ratio for project *i* is given as 1.37 and for project *j* as 2.74 it is not legitimate to say that *j* is "twice as good" as *i* (even if B/C ratios could be calculated with real precision implied by numbers such as 1.37, 2.74 etc., which they never are).

(ii) B/C ratios depend *inter alia* on the scope and scale of individual programs or projects as defined for the purpose of a particular analysis. Changing the scope or scale may change B/C ratio.

(iii) Where the projects or programs are inter-related B/C ratio of each is affected by the inclusion of other projects or programs. E.g., B/C ratio of project *i* can be higher than *j* if *k* also undertaken, and lower than *j* if instead of *k* project *l* is adopted.

(iv) Where the projects involve expenditures now in order to obtain a stream of benefits later (or vice versa) costs and benefits must be discounted to their present day value. This immediately introduces the problem of the selection of a "proper" discount rate. Adoption of different discount rates may result in different ordering of B/C ratios; some projects or programs are more sensitive to changes in discount rates than others. Obviously if the same stream of benefits can be obtained through heavy capital expenditure and low operating expenditures or low capital expenditure and high operating costs, the relative attractiveness of these alternative schemes will be influenced by the discount rate adopted in the analysis.

It may be noted here that in spite of considerable difficulties involved in choosing appropriate discount rates—which is particularly serious in the case of capital projects—benefits/costs analysis has mainly (but not exclusively) been applied to capital projects. This can be explained by the history of the development of benefits/costs methodology.

## Section II: Benefits/Costs Analysis of Operating Subsidies

In view of the wide range of operating subsidies and the alleged reasons for their existence some preliminary classification of the subsidies is necessary to make further discussion meaningful. For the purpose of our analysis the following four classes of operating subsidies are distinguished:

(a) **Developmental subsidies.** These are the subsidies paid in order to enable a new service to develop up to a point where it could become financially self-sustained. Subsidies are required either because the available technology is not capable of producing a service at a cost which could be recouped through direct sales to the users, or the "market" is not large enough to buy the minimum quantity of service which can reasonably be provided. It is expected that either the technological improvements will result in serious cost reductions or that the "market" for a given service will grow, or any combination of these factors. U.S. subsidies to helicopter services in metropolitan areas are an example of this type of subsidy.

(b) **Phasing-out of service subsidy.** The reason for this type of subsidy is that a withdrawal of a "basic" service produces considerable upheaval which can be minimized and orderly re-adjustments affected if such a basic service is phased out over a longer period of time. However, if such a "basic" service is produced at a loss, its gradual withdrawal involves costs over and above those which would be incurred if it were abandoned immediately—this implies subsidy payment.

An example of this type of subsidy is the branch railway lines abandonment scheme as recommended by the McPherson Royal Commission and accepted by the drafters of the National Transportation Act.

(c) **Subsidized service as a means of achieving a stated objective.** In this case the objective is given and a service subsidy is considered only as a means of achieving it. Such objectives may be stated in a great number of ways, for example:

(i) "Every inhabitant of this province must be within  $x$  hours of an emergency hospital facilities"; in order to satisfy this objective additional hospitals may be built, or an air ambulance service established, or a mixture of both. The operating subsidy of an air ambulance service thus becomes a cost of one alternative of reaching the given objective.

(ii) "Inhabitants of Y-town must have a direct access to mainline air transport service"; this objective may be achieved by construction of an airport at Y-town or a subsidization of a helicopter service connecting Y-town with the nearest mainline terminal. Incidentally, construction of an airport may not in itself be sufficient and some operating subsidy may be needed to induce a carrier to provide such a service.

(iii) On a larger scale: "in order to encourage the development of industries in the Atlantic Provinces costs of transport must be lowered"; here the Maritime Freight Rates Act is the selected subsidy instrument ("selected" is not a happy description of the tortuous and haphazard way this subsidy actually developed in practice!)

(d) **Subsidy to a service producing important external economies:** This is a classical case where the economist tends to recommend a subsidy. A service provides important net benefits over and above those whose beneficiaries can be identified and made to pay for.

It would be presumptuous to attempt an exhaustive discussion of the problems of the application of benefits/costs analysis to cases in each of the

above noted groups. What follows is a rough indication of the general approach.

(a) **Developmental Subsidy.** Although no visible "capital" good is created through this type of expenditure, if the service or program selected proves to be successful the productive resources of the society are increased. The accumulated experience, the inter-action of the development of operating techniques and the solution of technological problems which leads to the lowering of production costs are of the same economic significance as the acquisition of a "visible" physical capital asset. In fact, modern capital theory does consider "learning by doing" as a *sui generis* investment affecting the growth of an economy or of its sectors.<sup>2</sup> The actual evaluation of long run productivity gains thus achieved produces some special difficulties related to the selection of the appropriate "progress rates" and/or "learning rates" and to the diffusion of progress to other sectors of the industry. Considerable work is required to refine and develop the needed analytical framework and to make such an analytical framework serve as a base, for applied work in benefits/costs analysis. However, this effort appears to be particularly worth while. Essentially, the assistance or subsidization of developmental services is equivalent to the efforts of private enterprise to develop new projects or new losses, often at a considerable initial loss which it is hoped will later be recouped. Public action in this field appears to be justifiable only if either the period (and costs and/or risks involved) necessary for the development of self-sustained service is too long to be accepted by the private enterprises with more limited "planning horizons," or if the developmental benefits will be so widely diffused that no practical way of their financial recouping exists or would not exist without state action.

(b) **Phasing-out of service subsidy.** Little actual work has been done on the costs of economic and social disturbance if a basic service is terminated abruptly rather than phased out over a longer period of time. In some cases the losses of sudden service termination are obvious: existing capital equipment geared to the availability of the service must be adjusted, in many instances the plants or warehouses re-located. Obviously, those who have to bear these costs have considerable interest in stressing and over-stressing their existence, as well as claim the existence of "invisible" re-adjustment problems.

The problem of re-adjustment costs is one of neglected fields in economics which one hopes that someone sometime will do something about. With the growing literature in the fields of economic dynamics where adjustment paths through time are treated explicitly considerable theoretical progress can be expected with a possible fall-out into these rather mundane fields of application.

(c) **Subsidized service as a means of achieving a stated objective.** Conceptually this type of analysis appears to be the simplest, in practice some almost unsurmountable problems tend to appear. Let us list the main ones—

(i) "Stated objectives"—how well are they defined? Does the true objective (as opposed to alleged objectives) permit the choice of methods of achieving it? To what extent the existing institutional decisions predetermine the solutions by changing the nature of the systems analyzed? Of all the simpli-

fixed assumptions in economics and myths in administrative studies one can rarely find a less realistic one than that of an existence of a "decision-maker" with a well defined set of objectives which can be handed over to "an analyst."

(ii) Often a comparison is involved between a capital expenditure with a long economic life and low running costs and a service with high operating costs and low capital costs. The results of the analysis may, under those conditions, depend on the assumed discount rate. Even if the problem of a discount rate is solved (by definition, of course), the choice between the low and high capital alternatives may be affected by attitudes to long term commitments. Some may argue (presumably those who tend to be sceptical about the objective and the programs designed to meet it) that a method which allows lower initial commitments and provides the possibility of an easier and less costly over (or abandonment) in future is, because of these features, preferable. On the other hand, others (especially those who want this particular commitment) may argue that large, "one-shot" commitment is preferable because it cuts future administrative and political problems of renegotiations, cost changes, quality of service changes and the associated uncertainties.

The present author is in favour of selecting alternatives which minimize the irrevocability of long range commitments. He believes that once future cost increases etc. have been estimated, and 'capital-intensive' and 'high operating costs' solutions compared and found broadly equivalent, considerable premium should be attached to the ability of subsequent changes in the concept of service.

(iii) Further complication is introduced by the fact that the scope and the scale of alternative services designed to meet a particular objective may considerably differ. For example, alternative I may in addition to meeting the given common objective also produce one set of related benefits,  $B_1$  while alternative II would produce another set  $B_2$ . Neither  $B_1$  nor  $B_2$  may be of direct interest to the decision-maker interested in reaching a given objective—shall he try to evaluate them (we assume that he cannot induce people who benefit from  $B_1$  or  $B_2$  to contribute), and if so to what extent. If the alternative solutions are fundamentally different, the "incidental" differences in scope and scale may be particularly important.

Having noted these difficulties let me add that I consider that some of the most important, useful and fascinating transport problems fall into this class. To name a few examples: S.T.O.L. and/or helicopters vs airport construction; rapid transit vs subsidization of buses; "developmental" highways or railways vs air transport etc.

(d) **Subsidy to a service producing broad external economies.** The two major practical difficulties in this area are:

(i) Identification and quantification of such "widely diffused" external economies. If they are so "widely diffused" and if the gainers are difficult to identify and made to pay, it is only natural to expect that the benefits are also difficult to define and quantify.

(ii) Some of the indirect benefits are also related to the size, scope and extent of the service network and the competitive element present over dif-

ferent parts of such a system. For example, the benefits from the existence of the extensive service networks of U.S. local air service carriers are really the benefits of an easy access and thus increased availability of a very extensive, world-wide trunk airlines network. The better the trunk carriers network, the more valuable was the local service carriers service.

### Section III: Subsidization of Air Carriers

Subsidization of air carriers provides a useful case study or an example of the actual problems involved in developing adequate benefits/costs analysis for service subsidy.

In order to set the practical aspect of the problem in its proper context let us review briefly the stated subsidy philosophy of the government. The criteria against which the subsidy requests are supposed to be judged are stated in Air Transport Board Circulars Nos. 61/66 and 62/66.<sup>3</sup> The conditions which have to be met in order to qualify for the subsidy are:

- (1) Where air service is needed to a remote area which requires the maintenance of regular air service for its existence; and where other means of transport are inadequate or non-existent.
- (2) Where a developmental activity is involved and air service is essential to the support of that activity.
- (3) Where a regular route operation appears to have a good chance of success but requires support during the initial period of growth.
- (4) Where an established route needs to be withdrawn but gradual withdrawal is needed rather than immediate cessation.
- (5) Where by payment of subsidies higher cost to the federal government, for example in the development of facilities or alternate transport, may be avoided.

#### A.T.B., Circular 61/66

In addition, the service in order to qualify for the continuation of the subsidy must meet "Use-it-or-lose-it" policy criteria.

The National Transportation Act also deals with the problem of subsidies; even more important is the fact that according to the Act all forms of transport which come under the jurisdiction of the Parliament of Canada are to be regulated by the same agency, this agency—Canadian Transport Commission—is to assure the broad equality of treatment of all the industries and co-ordinated approach to their problems.

The only specific subsidy provisions mentioned in the Act relate to the gradual withdrawal of certain loss services of the railways. The basis for the subsidy payment in some cases—"variable costs"—are not quite applicable to air transport industry. No attempt has been made to state a "use-it-or-lose-it" policy for the railways.

In the decision in its first subsidy case, the Air Transport Board stated *inter alia*: "In adopting the subsidy policy it was the intention that subsidy would only be authorized when the service being subsidized stood some chance of becoming economically self-sufficient in the foreseeable future"<sup>4</sup>, it also noted that "the passenger would contribute, in the case of service between Winnipeg and Brandon, the sum of \$9.00 and on the basis of an



unweighted average the taxpayer would contribute \$25.00 . . .”<sup>5</sup> which is apparently too much. This philosophy is not dissimilar to that of the McPherson Commission and of the National Transportation Act—in the case the majority or railway subsidies, they are to be phased out after a certain period of time (a service which after abandonment produces zero-loss can be considered for some purposes equivalent to a service which becomes self-sufficient). No attempt has been made to establish at which level of subsidy/transport charge ratio ceases to be acceptable—25/9 is obviously not; would 25/10 be acceptable or should the subsidy/user charge ratio be always lower than 1? Interestingly enough, Decision Serial No. 2550 contains no analysis of the subsidy condition<sup>4</sup> (where an established route needs to be withdrawn but gradual withdrawal is needed).

It appears that in developing operating subsidies in transport we have reached the stage where general, non-quantifiable and non-quantified criteria have evolved. These criteria should lead to a more consistent approach in the subsidy case, but the increased consistency of approach must be confused with consistency of results. “Consistency of approach” implies that when the subsidy problem is to be discussed, it will be discussed in a reasonably consistent and coherent fashion; it means that the same criteria of what is and what is not relevant will be used; it does not mean, however, that using the same general criterion the actual decisions will necessarily be consistent, in fact there is no yardstick to measure the consistency of such decisions. In order to develop this yardstick a degree of quantification is necessary, and this implies the use of benefits/costs analysis.

This scheme is admittedly crude and is presented here as a first approximation. Some of the problems of introduction of benefits/costs analysis were discussed in Section II of this paper; the approach in Section II can equally well serve to produce the basic framework for the analysis.

The adoption of benefits/costs analysis to the subsidy problems would logically lead to the elimination of the two presently used semi-quantitative yardsticks, namely “use-it-or-lose-it” criteria and “eventual self-sufficiency” condition.

Obviously, the results of the analysis would differ depending on the definition of the scope of the transport system—i.e., whether we are talking about air transport system, transport system as a whole or a general (regional or national) development program.

#### REFERENCES

1. A. R. Prest and R. Turvey, “Cost-Benefit Analysis: A Survey,” *The Economic Journal*, December 1965.
2. Particularly useful in this context are: K. J. Arrow, “The Economic Implications of Learning by Doing,” *Review of Economic Studies*, June 1962; P. K. Bardham, “External Economies, Economic Development and the Theory of Protection,” *Oxford Economic Papers*, March 1964.
3. Canada. Air Transport Board. *Circulars* 61/66 and 62/66. Also see the *Decision Serial No. 2550* relating to the first application of such rules in practice. For general considerations relating to these subsidies, see K. W. Studnicki-Gizbert, *The Regional Air Carriers Problem*, Ottawa: The Queen’s Printer, 1966.
4. Canada. Air Transport Board, *Decision Serial No. 2550*, p. 15.
5. *Ibid.*, p. 14.

**As a first and very rough approximation to a possible scheme of benefits/costs analysis as applied to subsidy problems let us use criteria stated in A.T.B. Circular 61/66:—**

**CONDITIONS**

“(1) Where air service is needed to a remote area which requires the maintenance of regular air service for its existence; and where other means of transport are inadequate or non-existent”

- (a) How does one establish the need for a regular air service?
- (b) Should an activity at this location exist?
- (c) Adequacy of alternatives

**PROBLEMS**

- (a) Increased costs if no regular service appeared
- (b) Loss if point in remote area disappeared
- (c) Alternative means of satisfying obligations inherent in welfare etc., policies; cost of alternatives
- (d) Costs and benefits of alternatives (benefits as calculated under [a])

**POSSIBLE APPROACH**

“(2) Where a developmental activity is involved and air service is essential to the support of that activity”

- (a) Why to support a developmental activity?
- (b) Why service is essential?

“(3) Where a regular route operation appears to have a good chance of success but requires support during the initial period of growth”

The main problem is the establishment of a possible logical growth path and the evaluation of long term benefits stemming from the adoption of a particular growth path.

“(4) Where an established route needs to be withdrawn but gradual withdrawal is needed rather than immediate cessation”

Costs of different withdrawal patterns.

“(5) Where by payment of subsidies higher costs to the federal government . . . may be avoided”

- (a) Definition of the objective: “why to incur any costs at all.” Budgetary constraints.
- (b) Comparison of alternative programs.
- (c) Operating subsidy vs capital expenditures.