FARE REVENUE AND COST-BENEFIT ANALYSIS*

By R. D. Evans

This note suggests that there is an error of principle in the Cambrian Coast Line Study[1] in its treatment of fare revenue.

The object of cost–benefit analysis is to determine the difference between the pecuniary valuation of the benefits derived from a particular project, and the resource costs (and external diseconomies if any) incurred by it. Basically, the benefits will be (a) the consumers' surplus on the goods or services provided, and (b) the saving of the costs of other goods and services that would have been consumed if those in question had not been available. For example, the benefits derived from a railway passenger service will consist of shorter travelling time and possibly greater comfort, and the saving of the cost of the replacement transport (e.g. bus or automobile operating costs) for trips which would continue to be made by other modes if the rail service were withdrawn.

Some journeys would no longer be made after closure because the replacement transport, generally being an inferior substitute, would be too inconvenient or time-consuming. How, then, should the benefits pertaining to such journeys be evaluated?

Suppose that the railway service has consumers' surplus, S, and total fare revenue, F. Furthermore, assume (i) that full employment prevails in the economy (so that increased saving by one section of the community is offset by equivalent investment or consumption elsewhere), and (ii) that the prices of all other goods are equal to their marginal costs.

If the railway service is withdrawn, its users, although able to spend their fare money, F, on other goods, will suffer a net loss of benefit equal to their consumers' surplus, S. (The consumers' surplus of a good, by definition, is just the monetary value of the users' preference for the consumption pattern including that good over the next best one without it). Furthermore, by assumption (ii), the alternative goods purchased with the ex-fare money will have resource costs equal to F. Therefore, the total benefit of retention of the railway service will be $S+F$. (The *net* benefit of retention, of course, will be $S+F$ less the railway operating costs.) Possibly some of the ex-fare money will be saved, but by assumption (i) this will be offset by spending elsewhere, so the cost of the alternative output will still be F.

However, because of imperfect competition and indirect taxation, assumption (ii) is rarely realised in practice. If k represents the ratio of the true resource costs of the alternative goods to the money paid for them, F (i.e.: k is the average marginal

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*This article was first written in March 1971. The argument contained in it may have lost some of its originality from the unavoidable delay in publication.

[1] Ministry of Transport, 1969.

cost/price ratio for the goods concerned), the benefit of retention will be $S+kF$. As price/marginal cost ratios often vary considerably from commodity to commodity, it may be very difficult to estimate accurately the benefit of retention unless the alternative goods can be specified. Nevertheless, it can reasonably be assumed, unless the contrary is known, that the former users of the withdrawn service will, in aggregate, spread their spending over a wide range of goods. Thus k can generally be taken as at least $1-t$, where t represents the average proportion of indirect taxation in market prices. Therefore, in the British economy, it would be sensible to deflate values of F by about 20 per cent in order to estimate real resource costs.[2] (This makes no allowance for imperfect competition.)

Therefore, the total benefit of retention of a railway service must include the following items:

(i) The consumers' surplus on trips that would continue to be made by other modes if the railway were closed. This amounts to the monetary value of the time savings and any additional comfort or convenience afforded by the railway service compared with the replacement transport;

(ii) The saving of the cost of the alternative consumption on trips that would be continued (i.e. the cost of the substitute transport);

(iii) The consumers' surplus on trips that would be foregone in the event of closure;

(iv) The saving of the cost of the alternative consumption in respect of trips foregone (i.e. the cost of the goods purchased with the ex-fare money).

Estimates of (i), (ii) and (iii) were made in the Cambrian Coast Line Study, but (iv) was overlooked. It was argued that fares were of little importance in cost–benefit analysis[3] (presumably because they are transfer payments); but this is true only if the change in resource costs occasioned by the use of fare revenues has been taken into account elsewhere.

Consider a hypothetical railway service with consumers' surplus of £2, revenue of £6, and costs of £5, and suppose that none of its users would continue to travel if the railway were closed, even if alternative transport were available. Then, by the Cambrian Coast argument that the only important benefit in respect of foregone journeys is the consumers' surplus from them, the railway should be closed, although profitable! This follows, since the consumers' surplus is £2 compared with costs of £5, making the net benefit of retention equal to −£3. The railway could be "saved" by the simple expedient of abolishing all fares, thereby increasing consumers' surplus to £8 and giving a net benefit of +£3. If this principle were true, its implications for transport policy would be interesting, to say the least.

The Cambrian Coast principle would be true only if the alternative goods were of zero marginal cost. There is little likelihood of this, even if the prices of most goods (net of tax) are somewhat above their marginal costs. However, there is one instance applicable to railway services to holiday areas. If the service to one resort were withdrawn, its users might travel to another rail-served resort. If there were spare capacity on the alternative line, very low marginal costs would be incurred.

Obviously this error would lead to the benefits of a service being underestimated;

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[2]For this point I am grateful to D. N. M. Starkie, of the University of Reading.

[3]Cambrian Coast Line Study, paragraph 2.1.

this could make all the difference between a positive and negative net benefit of retention. Obviously, then, the results of the Cambrian Coast study should be revised to allow for this.

According to the Study[4] 45 per cent of summer and 20 per cent of winter journeys on the Cambrian Coast Line would not be made on a replacement bus service. Thus for the Machynlleth–Barmouth section, where such journeys totalled 34,300 per annum (based on 1968 survey data), the fares of those who would not transfer would be up to £10,000 per annum. Taking this into account, the table shows the costs and benefits of retaining the Barmouth section for ten years (the "cheapest" of the three options examined in the study).

Retention of the Line between Machynlleth and Barmouth for Ten Years

Benefits	*Discounted Value of next ten years (at 8%)*
	£000 (1969 *prices*)
(1) Cost of additional travelling time by bus if railway were closed	14*
(2) Net benefit of journeys by passengers who would not transfer	23*
(3) Additional road and bus costs avoided	196*
(4) Additional costs of alternative goods bought by passengers who would not transfer	54**
Total benefit	287
Net opportunity costs	344*
Net cost of retention	57
Benefit/cost ratio	0·84

*From Cambrian Coast Line Study, Table 16, p. 32.
**This allows for indirect taxation levels of 20 per cent on the alternative goods.

Although the costs of the line still outweigh its benefits, the gap is much smaller than indicated by the study. (Net cost of retention was given in Table 16 as £111,000, implying a benefit/cost ratio of only 0·68.) Thus, in the terms of the report, benefits would have to increase by only 19 per cent to justify retention.

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[4]*Ibid.*, para. 2.10.