COST-BENEFIT ANALYSIS AND
THE WITHDRAWAL OF RAILWAY SERVICES

By P. K. Else and M. Howe

Since 1964 there has been increasing emphasis in Great Britain on the idea that proposals to withdraw railway services should not be decided purely on financial criteria, but rather on broader economic and social grounds. The main lines of the Government's thinking on the matter were first set out in the White Paper on Transport Policy, published in 1966. This stated that, whilst various railway services could be expected to be provided on a commercial basis, there were other services "which have little or no prospect of becoming directly remunerative, in a commercial sense, on the basis of revenue from users... yet their value to the community outweighs their accounting cost to the railways." Subsequent policy statements have laid further emphasis on the need to consider the broader social implications of withdrawing unremunerative railways services, and have outlined a method by which socially desirable services could be financed by the community. But they have had very little to say on how the value to the community of such services can be assessed. Under powers granted by the Transport Act 1968 the Minister of Transport has made grants to the railways for over 200 socially desirable but unremunerative services; but again there has been no indication of the methods used to assess their social value. Cost-benefit analysis is clearly relevant here as it provides a systematic framework for the evaluation of at least a substantial proportion of the social costs and benefits associated with the withdrawal of a railway service, and there have been several advocates of its use in this field. There are, however, a number of problems arising from this particular application, some of which we attempt to discuss in this paper.

To illustrate the discussion we examine and compare two recent cost-benefit studies of railway services. Both were fairly small-scale ad hoc studies, and in neither

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5 See, for example, M. Howe, "The Transport Act 1962 and the Consumers' Consultative Committees", *Public Administration*, Spring 1964, pp. 54-56.
case were there substantial resources available for extensive field work. The information used in both was to some extent rudimentary and often inadequate, but the studies do give some indication of both the potential and the limitations of cost-benefit analysis in this important field. One of the studies, in which the present writers were involved, concerns the local passenger service between Sheffield and Barnsley, passing through a fairly densely populated part of south-west Yorkshire. It originally formed part of a wider study of local passenger transport in the Sheffield area. The other relates to the service on the Central Wales line between Shrewsbury and Llanelli, providing rail transport for a sparsely populated area of mid-Wales. This was carried out as part of a study of rural transport in Wales by Clayton and Rees. Before going on to the particular studies, however, we consider briefly some general problems involved in the use of cost-benefit analysis to assess the social value of railway services.

THE USE OF COST-BENEFIT ANALYSIS

Cost-benefit analysis has most often been used in connection with proposals for public or semi-public investment projects. It has been described as:

“a practical way of assessing the desirability of projects where it is important to take a long view (in the sense of looking at repercussions in the further, as well as the nearer, future) and a wide view (in the sense of allowing for side effects of many kinds on many persons, industries, regions, etc.).”

Its use is generally advocated where a project gives rise to substantial benefits or costs which are not reflected in the prices consumers pay for the services provided by the project. This may arise either because of pricing policies or because of difficulties in charging for the benefits received if, for instance, they accrue to persons not directly using the facility. On similar grounds cost-benefit analysis may be used to appraise disinvestment projects such as the withdrawal of railway services: the benefits which existing railway passengers receive from their journeys are not always fully reflected in the fares they pay, and indirect benefits arise from the continued operation of the services.

The problems involved in estimating the social costs and benefits of withdrawing a railway passenger service are similar to those encountered by Foster and Beesley in their study of the Victoria Line in London. Since they were considering the addition of a new line, whereas we are considering the withdrawal of an existing service, what were benefits in their case become potential costs in ours, and vice versa.

On financial criteria, withdrawal of a rail service is justified if the expected loss of

6Sheffield University Working Group, Passenger Transport Integration Pilot Study: Sheffield Area (Report to the Minister of Transport, December 1966).
9Ibid., p. 683.
revenue arising from that withdrawal is less than the savings in cost likely to be achieved, and also if there is no other level of service for which the revenue produced is greater than the avoidable costs. When social cost criteria are adopted, withdrawal of the service is justified if the resulting social costs, however defined, are less than the social benefits, and if there is no other level of service at which its loss would impose greater social costs than benefits on the community. The latter point is quite important. Even if it is found that the social costs of withdrawing a service are less than the social benefits, this is not a sufficient condition for withdrawing the service: there may be some other adjustment which could be made, involving either an increase or a decrease in the level of service, which would lead to an increase in social benefits relative to costs. In practice it may be difficult to establish whether this is so, but the possibility should clearly be borne in mind.

The range of costs and benefits arising from the withdrawal of a railway service is likely to be wide, and no one could attempt to evaluate them all. Certain costs and benefits may be almost impossible to estimate; others may be ignored on the ground that from the point of view of the community as a whole they do not seem important.¹¹ Judgments of a political and social nature can enter into the selection of costs and benefits, and into the relative weight to be attached to different kinds of costs and benefits or to different classes of beneficiaries. Similar judgments are implicit in the common assumption that £1 of gain or loss is worth the same to the community however it arises, wherever it occurs and whomsoever it affects. This is a convenient assumption, but there may be cases where it is an over-simplification and should be replaced by a different assumption.¹²

The studies compared in this paper differ in the sort of costs and benefits included, as well as in other ways. We defer examination of such differences, however, until after the separate discussion of each study.

THE SHEFFIELD-BARNSLEY SERVICE

The local passenger service between Sheffield and Barnsley is provided by stopping trains between Sheffield and Leeds, approximately every hour in each direction. The cost-benefit study was concerned only with the 15-mile section between Sheffield and Barnsley. The places served by that part of the route are fairly well supplied with alternative public transport facilities, and one of the more interesting facts which emerged from the wider study was the small part played by the railways in providing local transport in the area.¹³ Nevertheless the Sheffield-Barnsley service carries an appreciable volume of passengers, including commuters into Sheffield, and it appears to be the busiest local service in the area. No formal proposals to withdraw the service have been made,¹⁴ and the cost-benefit analysis was not intended to

¹¹For a more detailed discussion of this point see C. D. Foster, The Transport Problem (Blackie and Son, London and Glasgow, 1963), pp. 64–67.
¹³It was found that, of commuters from outside Sheffield arriving in the city before 9 a.m., approximately 3 per cent travelled by train, 45 per cent by bus and 52 per cent by car.
¹⁴It is one of the services now supported by a grant from the Minister of Transport.
influence any policy decision, but rather to illustrate the use of the technique. Indeed, if the analysis were to be used for such a decision, it would be hoped that it could be based on rather more detailed information.

The main social costs arising from the withdrawal of the local passenger service between Sheffield and Barnsley were divided into three main groups:

(a) those arising from journeys diverted to other forms of transport, namely, bus and private car;
(b) those arising from journeys no longer made; and
(c) those affecting the rest of the community.

The starting point was to estimate the proportion of rail journeys that would continue to be made by other forms of transport, and how these would be divided between bus and private car. The only data concerning the rail traffic were the numbers of tickets issued at various stations on the line in May 1966 and the results of a railway passenger count. The raw data were thus confined largely to the numbers of passengers travelling between particular stations in a given month, supplemented by some indication of the distribution of traffic over times of the day. Nothing was known about who bought the tickets or for what purpose journeys were made, although the information about the distribution of traffic over time of day gave some rough indication of the extent to which the service was used for journeys to work.

As the data were so limited, an alternative approach would have been to base the forecast on what has happened after previous withdrawals of comparable services. Again, however, the evidence readily available is somewhat scanty. Thomas, in his study of rural transport, quotes the results of surveys into the effects of the withdrawal of local railway services on former passengers; but the area with which he was concerned is very different in character from the semi-urban area served by the Sheffield-Barnsley line.

In the absence of suitable information assumptions had to be made about the proportion of traffic continuing to travel and its modal split. To show the effects of varying the assumptions, three alternative sets of assumptions were used. These are referred to as assumptions A, B and C and summarised in Table I.

<table>
<thead>
<tr>
<th>Assumptions made about the distribution of displaced rail traffic</th>
<th>Proportion of journeys (%)</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(i) Diverted to bus</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33·3</td>
</tr>
<tr>
<td></td>
<td>(ii) Diverted to private car</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33·3</td>
</tr>
<tr>
<td></td>
<td>(iii) No longer made</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33·3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

For some longer journeys, such as those between Sheffield and Leeds, an alternative rail service is available. Since this is almost as frequent as the service through Barnsley and also faster, it was assumed that the social costs imposed on traffic diverted to it would be negligible.

Assumption A is a simple one taken as a rough starting point. It possibly over-estimates the proportion of journeys no longer made. Thomas's evidence\textsuperscript{17} suggests that on average about 20 to 30 per cent of the journeys in his areas would no longer be made. But in the rural areas with which he was concerned the cost difference (in terms of journey times, convenience, etc.) between the rail service and the next best alternative may be larger than in south-west Yorkshire, where bus services are quite frequent and convenient. It is possible therefore that an even smaller proportion of journeys might be lost between Sheffield and Barnsley if the rail service were withdrawn, but there is no conclusive evidence on this point. Secondly, assumption A probably over-estimates the proportion of journeys transferred to private car. In the East and West Ridings the ratio of private cars to total population was of the order of 16 per cent in 1966. The proportion of journeys diverted to private car would thus approach one-third if four conditions were satisfied:

1. if car ownership among existing rail passengers was at the same average level as in the population generally;
2. if the frequency with which car owners use the existing service is on average no less than that of other passengers;
3. if all their present rail journeys were to be made by car after the withdrawal of the train service;
4. if on average two displaced rail passengers were to travel on each car journey.

Again we have no conclusive evidence, but it seems likely that none of these conditions would be fully satisfied.

Assumption B is a modification of assumption A taking account of evidence which seems relevant to condition (4). Average car occupancy observed in Sheffield during the course of the study was 1.36 persons per car. If this figure is applied to a car ownership estimate of 16 per cent and if the other conditions are satisfied, the proportion of rail journeys diverted to private car falls to 22 per cent. Roughly the same proportion of journeys lost is assumed as in assumption A; this implies an increase in the proportion of journeys diverted to bus services to 45 per cent. But still the proportion assumed to transfer to private car may be too high.

Assumption C is a modification of assumption B taking account of the possibility that the number of journeys assumed to be no longer made may be too high. Basically it distinguishes between peak period journeys, which to a large extent are likely to be journeys to and from work, and journeys at other times. In fact, it makes the extreme assumption that all peak period journeys continue to be made after the withdrawal of the rail service, but that, as before, a third of other journeys are lost. If the same number of journeys are assumed to be diverted to private car as in assumption B, the effect of this modification is again to raise the proportion of journeys diverted to bus services, but an important point is that the extra bus passengers are all peak-hour travellers.

These then were the assumptions on which the estimates of social costs were based. Other equally plausible assumptions could have been made, but the three actually chosen seemed sufficient to indicate the range within which the social costs of withdrawing the passenger service between Sheffield and Barnsley might lie.

\textsuperscript{17}Ibid., pp. 111–116.
The social costs for which estimates were made are shown in Table II. A few brief comments should perhaps be made on the estimates. Fairly frequent bus services operating on largely parallel routes to the railway already exist. It was estimated that outside peak periods these would be able to provide without additional capacity for nearly all the additional traffic which it was assumed would arise from the withdrawal of the rail services. During peak periods, however, additional capacity would have to be provided, since at such times existing bus fleets are already fully utilised. The cost of additional buses therefore includes an estimate of the annual capital cost of the additional vehicles that would be needed, as well as of their operating costs.

The extra time which would have to be spent on journeys diverted to bus services was estimated from the official bus and train time-tables, but allowance was made for additional delays due to congestion during peak periods. Nothing was known about the purposes for which journeys on the existing rail service are made, but it would appear from the daily pattern of journeys that about 25 per cent could be journeys to and from work. Following Beesley, the extra time on such journeys was valued at 40 per cent of an estimated average earning rate for the persons concerned. Valuing the extra time spent on other journeys in principle presents more difficulty.

### Table II

*Estimated Annual Social Costs arising from the Withdrawal of the Local Rail Passenger Service between Sheffield and Barnsley*  
(based on the 1966 volume of traffic)

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Assumption</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>(i) Traffic diverted to buses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Cost of additional bus journeys</td>
<td>£6,540</td>
<td>£9,810</td>
</tr>
<tr>
<td>(b) Value of additional journey time</td>
<td>£15,760</td>
<td>£21,330</td>
</tr>
<tr>
<td>TOTAL</td>
<td>£22,300</td>
<td>£31,140</td>
</tr>
<tr>
<td>(ii) Traffic diverted to private car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Running cost of vehicles</td>
<td>£25,040</td>
<td>£25,040</td>
</tr>
<tr>
<td>(b) Value of additional journey time</td>
<td>£1,590</td>
<td>£1,050</td>
</tr>
<tr>
<td>TOTAL</td>
<td>£26,630</td>
<td>£26,090</td>
</tr>
<tr>
<td>(iii) Traffic lost Value of benefits foregone</td>
<td>£11,150</td>
<td>£11,140</td>
</tr>
<tr>
<td>Total of Estimated social costs (i + ii+ iii + iv)</td>
<td>£68,150</td>
<td>£77,290</td>
</tr>
</tbody>
</table>


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A small proportion of them would be journeys undertaken in working hours, which conventionally are valued at the full earnings rate. Most of them, however, would be leisure-time journeys. For wage earners there is a case for valuing time spent on such journeys at the same sort of rate as journeys to work, as they are both uses of scarce leisure time. Non-earners, however, are less easily dealt with; it is possible that for some, such as the unemployed, the retired and the idle rich, time has little value. These difficulties were side-stepped by valuing all extra time spent on journeys at 40 per cent of the average earnings rate, which can perhaps be justified as a rough average for all journeys taken together.

For the traffic diverted to private cars it was assumed that the cars used would already be owned by the rail passengers concerned. Hence the only additional costs arising would be the cost of any additional car mileage arising from the withdrawal of the rail service. Here again an average, based on Automobile Association data for 1966, was used. The only additional time spent on journeys diverted to car was assumed to be that arising from road congestion on peak period journeys. In off-peak periods it was assumed that car journeys would take no longer than the corresponding train journeys.

The journeys no longer made after the withdrawal of the rail service are those for which the benefits obtained from the journey are not worth the higher cost. If bus is the alternative mode of transport and if bus and train fares are reasonably comparable, this extra cost is largely the extra time required for bus travel. The estimates in Table II of social costs arising from journeys no longer made were derived from the conventional assumption that the average loss per journey no longer made would be half the additional cost (i.e., half the value of additional journey time) of bus travel for each journey. This amounts to no more than assuming that the demand curve over the relevant range is a straight line; it exactly corresponds to the conventional procedure adopted by Foster and Beesley in estimating the benefits to traffic generated by the opening of the Victoria Line.

The extra road traffic caused by the withdrawal of the rail service would have to travel on roads already congested at certain times of the day, particularly in Sheffield itself. Outside peak periods the effect of the additional traffic may not be very great,

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19Doubts have been expressed about this. See D. W. Glassborow, The Road Research Laboratory Criterion Examined. Bulletin of the Oxford University Institute of Statistics, Vo. 22 (1960), pp. 327–335.

20This is a rather lower estimate of the value of time than has been used in some other studies. For a more detailed discussion of the general problem, see A. R. Prest and R. Turvey, op. cit., pp. 711–714 and references cited.

21Most of the rail journeys between Sheffield and Barnsley are made on special cheap fares, fixed by the district railway management at levels competitive with local bus fares.

22For some of the lost journeys the benefits foregone will be worth only just less than the increased cost. The journey is only just not made, and would be made if the cost were marginally less. This implies that when the journey was made by train a surplus of benefit over cost was received by the passenger almost equal to the difference between the cost of travel by bus and train. For other journeys originally made by train the surplus benefits would be less, and at the limit might be zero where the benefits from certain marginal train journeys were only just equal to their costs. The benefits lost on journeys no longer made therefore consists of the sum of a whole series of losses, ranging from zero to the difference between the cost of travelling by rail and the next best alternative.

23C. D. Foster and M. E. Beesley, op. cit., p. 77.
but during peak periods even a small increase in the volume of traffic could add significantly to the congestion. The costs arising from additional congestion are difficult to estimate; but, since they could constitute a substantial proportion of the overall costs, it seemed desirable to make some estimate of them. The estimates in Table II are based on the Road Research Laboratory’s estimates of the congestion costs imposed by a typical car on other vehicles at various speeds on a network with the speed-flow characteristics of central London in 1961. It was assumed that additional congestion costs would be negligible outside peak periods and outside Sheffield, so the figures are based entirely on the estimated addition to peak period traffic within the city boundary. It was recognised that these estimates would be extremely crude, particularly since the Road Research Laboratory’s calculations are based on 1962 prices and do not specifically relate to Sheffield, but it was thought they gave some indication of the orders of magnitude likely to be involved.

The social costs as estimated add up to just over £68,000 per annum under assumption A, to over £77,000 for assumption B and nearly £92,000 for assumption C. The costs are higher under assumption B than under assumption A because of the greater capacity needed to accommodate the displaced traffic. They are higher still under assumption C because the extra capacity requirements would be still larger, and would occur largely during peak periods when costs are high.

It was suggested earlier that assumptions A and B probably placed too high the proportion of the traffic assumed to transfer to private car, and also the proportion of journeys assumed to be lost. Reducing the first would reduce costs a little, as buses impose less social costs than cars; reducing the second would increase them. Reduction of the proportion of journeys assumed to be lost is allowed for under assumption C, but perhaps to an excessive degree. On the whole it seems likely that the social costs would lie somewhere between the estimates for assumptions B and C: that is, within the range of £77,000 to £92,000 per annum.

On top of this some allowance must be made for the more intangible social costs not included in the estimates. These would include the reduction in convenience and comfort arising from the absence of a rail service, the costs of things like accidents arising from the greater volume of road traffic, and the cost of any additional car parking facilities provided. Further, account should be taken of the possible adverse effects of the withdrawal on the longer-term development of the area. Here one of the main problems which the area is likely to face in the near future is the need to attract new industries to offset the planned contraction of the coal industry and labour saving in steel and engineering. It can be doubted whether the presence or absence of this one local passenger service would have much effect on the attractions of the area to potential new industries. Sheffield, which has good rail connections with many parts of the country, would still be a reasonably accessible “railhead” for the area even if the journey into the town had to be made by road. Furthermore, the extension of the M1 motorway from Sheffield to Leeds since the study was

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24In the Victoria line study the benefits to travellers indirectly affected were estimated to amount to just over half the total benefits. Ibid., p. 49.
26It was assumed that the line would be retained for freight traffic.
carried out has improved communications both within the area served by the Sheffield-Barnsley service and with the rest of the country.

Against the social costs arising from the withdrawal of the Sheffield-Barnsley service must be set the "benefits". These were considered to be mainly the value of the resources at present used in operating the service, which would be saved if it were withdrawn. No direct estimates of these costs were available, but from other information about the cost of operating such services it was estimated that it would lie in the region of £80,000 per annum. This excludes any small savings in track and signalling costs: it was assumed that the track would still be required for freight traffic, which is considerable in the area. The figure is just inside the range within which it is thought that the total estimated social costs lie, but if allowance is made for the intangible elements of social cost it would appear very probable that the social costs of withdrawing the Sheffield-Barnsley service would exceed the benefits. Even if, therefore, the service is unremernerative to the railways, retention of it may be justified.

But this does not necessarily imply that the service should be retained in precisely its present form. There may be a case for closing some of the stations served and making other modifications. Further, the calculations relate to the social costs in a single year from the displacement of the 1966 level of traffic. Modifications to the service are likely to alter the level of traffic; it may also be affected by such external factors as the continued rise in car ownership and the completion of the M1. In the longer run, therefore, the social costs, which at present could tilt the balance in favour of retaining the service, may become less important, and its retention may no longer be justified.

THE CENTRAL WALES LINE

The service on the Central Wales line operates under very different conditions from those on the Sheffield-Barnsley line. The route, between Shrewsbury and Llanelli, is 80 miles long and passes through a sparsely populated area which is generally deficient in public transport facilities. Currently the service is provided by four trains a day in each direction (except Sundays). It carries few passengers and is highly unremernerative; yet it appears to be one of the most important public transport facilities in the area it serves. Its withdrawal had been proposed even before the Beeching plan, but it has since been reprieved. The service was reorganised, however, in an attempt to reduce operating costs whilst still providing a reasonable level of service. As a further economy measure, all but the busiest stations on the line were made unstaffed halts, tickets being issued by conductor guards on the trains; but it is still unremernerative and fresh proposals to withdraw it are now being considered by the Minister of Transport.

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27Some stations have in fact recently (December 1967) been closed, but only one between Sheffield and Barnsley.

28For a detailed account, see G. Clayton and J. H. Rees, op. cit., chs. III–IV. We are mainly concerned here with bringing out the main points for comparison with the Sheffield-Barnsley study.

29March 1969.
The main results of the cost-benefit study of the line are shown in Table III.

**Table III**

*Estimated Social Costs and Benefits per annum arising from the operation of the Passenger Service on the Central Wales Line*  
(based on the 1964 Volume of traffic)

<table>
<thead>
<tr>
<th>Benefits</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of time savings:</td>
<td></td>
</tr>
<tr>
<td>Working time</td>
<td>4,319</td>
</tr>
<tr>
<td>Leisure time</td>
<td>12,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>£16,319</strong></td>
</tr>
</tbody>
</table>

*plus* Intangible factors not estimated.

<table>
<thead>
<tr>
<th>Costs</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating costs</td>
<td></td>
</tr>
<tr>
<td>Less Net loss of revenue to B.R.B.</td>
<td>100,000</td>
</tr>
<tr>
<td>Less Net loss on operation of replacement bus service</td>
<td>30,000</td>
</tr>
<tr>
<td>Net cost of retaining service</td>
<td>40,000</td>
</tr>
<tr>
<td>Surplus of annual cost of retaining the service over estimated annual social benefits</td>
<td>23,681</td>
</tr>
</tbody>
</table>

*Source:* Clayton and Rees, *op. cit.*, Table XVIII, p. 27.

The general approach was to compare the cost and benefits of retaining the service rather than the costs and benefits of withdrawing it. An advantage of this approach is that it leads more naturally to a consideration of whether the cost of retaining the service need be as high as the current operating costs.

Clayton and Rees suggested that operating economies could be achieved by closing some stations, reducing the number of calls made by trains at others and reducing the number of journeys per day in each direction from four to three. The costs of retaining the service were therefore considered to be the estimated costs of operating their revised service rather than the service currently provided. A difficulty here is that the reduction in the level of service suggested would lead to some reduction in the level of traffic. Hence the benefits to be obtained from the retention of the revised service may be somewhat less than the benefits obtained from the current service, but it can of course be argued that the effect would not be very great.

The main social benefits which would be lost by the complete withdrawal of the service were considered to be:

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30 In the course of the study it emerged that 7 stations on the line were used by fewer than 5 passengers per week (G. Clayton and J. H. Rees, *op. cit.*, Table IA, p. 10).

31 The estimates include a contribution to track and signalling costs, as it was assumed that the line would not be retained in the absence of the passenger service. This and the length of the route account for operating costs being higher than for the more frequent Sheffield-Barnsley service.
(a) the savings in journey time made possible by the existence of the rail service;
(b) the availability of ample spare transport capacity, especially for industry, in an area where it is government policy to attract new industries;
(c) the maintenance of employment in an area where employment prospects are poor;
(d) the amenity value of the area to tourists, arising from the availability of good long-distance public transport facilities.

Some of these benefits are inevitably rather intangible, and in fact only the first was estimated. The estimates of social benefit were then compared with the financial cost to the railway of retaining the service. This was a different approach from that used in the Sheffield-Barnsley study—but, since it implies a different criterion for the retention of the service, we will postpone discussion of this point until the next section.

The estimates of the social benefits of the Central Wales service were based on a survey of passengers using the line during one week in the early summer of 1964. It was considered to be a fairly representative week, since, although there were some holiday-makers using the line, the main holiday rush had not begun. The number of passengers was sufficiently low (about 2,500) to allow a reasonably comprehensive questionnaire to be designed which could be answered by every passenger. Information was collected about the sex, age groups and occupations of those using the line, the purposes for which they were travelling and the origins and destinations of their journeys. It was found that in the event of withdrawal some passengers, mainly those travelling the whole length of the route, would be able to use alternative railway services. These would be less direct and would take more time, but the extra time involved could easily be calculated from published timetables. Other passengers would have to rely on whatever replacement bus service could be provided, since there is no existing bus service covering the whole route. It was thus necessary to construct a hypothetical timetable for a suitable replacement service and to estimate the extra time spent on bus journeys on the basis of that. The actual value imputed to the extra time depended primarily on the nature of the journeys involved. For work journeys, travellers were classified into broad occupational categories\(^{32}\) and time was valued at the appropriate average earnings rate per hour for each class, as estimated by the Ministry of Labour.\(^{33}\) Other journeys—mainly leisure-time journeys—were valued at 50 per cent of the estimated average earnings rate of all the passengers taken together.

The treatment here is different in certain details from that of the Sheffield-Barnsley study. Firstly, more information was available about the travelling public. Secondly, journeys to and from work were counted as “work journeys” and valued at the earnings rate rather than at a lower leisure-time rate. Beesley's work\(^ {34}\) suggests the valuation of time on journeys to and from work at some fraction of the average earnings rate, and from that point of view it can be argued that the estimate of the value of extra time in Table III may be too high. Thirdly, leisure time was

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\(^{32}\)Manual workers; administrative, technical and clerical workers; and self-employed.

\(^{33}\)Separate estimates were available for males and females in each class.

\(^{34}\)M. E. Beesley, op. cit.
valued at 50 per cent of the average earnings rate rather than the 40 per cent used in the Barnsley study, but the case for preferring one to the other is perhaps rather less well established.

Further, in aggregating the losses which would be suffered by individual passengers if the Central Wales service were withdrawn, it was assumed that there would be a complete transfer of passengers to the bus services (or alternative rail service if more appropriate). 35 The implication of this assumption seems to be, not that all passengers would in fact transfer, but that those who did not would suffer the same loss as those who did. 36 Again the approach is rather different from that used in the Sheffield-Barnsley study, in which it is implied that some journeys will not be taken after the withdrawal of the rail service because the value of the journey to the prospective passenger is less than the cost (in time and money) that now has to be paid, and the loss suffered by not taking the journey is considered to be less than the additional costs of the journey. The procedure in the Central Wales study eliminates the difficulties of estimating the proportion of passengers continuing to travel — although some estimate could possibly be made from the results of the passenger survey — but it could have over-estimated the social losses arising from the withdrawal of the service.

In addition, the complete transfer assumption does not take account of the possibility that some displaced journeys would be made by private car rather than by replacement bus services. It is unlikely that any extra time would need to be spent on these journeys. In fact they would probably be quicker than the train journeys they replaced; and it could perhaps be argued that in an area like Central Wales, where the existing rail service is infrequent and not particularly fast and convenient, anyone able to travel by car would already be doing so. On that basis the people using the train service would largely be those without access to private transport, who, if they travelled at all when the rail service was withdrawn, would have to travel by the replacement bus services. The proportion transferring to private car would thus be negligible. But again some lead on this could possibly have been obtained from the passenger survey.

It will also be observed that the costs of providing additional transport facilities for displaced rail passengers, which were considered quite an important social cost, are not specifically included in Table III. 37 This is not because of the existence of adequate spare capacity on alternative services, because there is no alternative bus service covering the whole route and one would have to be provided if the rail service were withdrawn. Such costs, however, are not entirely ignored, as the social losses passengers would suffer from the withdrawal are compared with the financial savings to the railways. These savings depend to some extent on the costs of providing an alternative bus service, since it was assumed that consent to withdraw the rail service would be conditional on the provision of a suitable alternative, which would

36 Of the passengers surveyed, 25 per cent said they would not travel if the rail service was withdrawn. Ibid., p. 12.
37 These are costs which would be avoided by the retention of the service, and could hence be considered as part of the total value of the benefits from retaining it.
only be provided – given the number of passengers expected to use it – if it was subsidised by the railways.38

Also affecting the financial savings to the railways is the loss in revenue they would suffer by withdrawing the service. Hence the overall financial savings from the withdrawal consist of the cost of operating the (revised) service, less the net loss in the operation of the replacement bus service, less the loss in revenue. These savings were estimated to exceed the quantified benefits from retaining the service by nearly £24,000 per annum. But against this sum must be set the more intangible benefits arising from the retention of the line, particularly the benefits to the tourist trade and to employment and development in the area. In other words, whether the line is worth retaining or not depends on the view taken about these intangible factors; but, as the authors imply, it is not possible to come to any conclusions on these factors until the government has made firm decisions about the future economic development of Mid and West Wales.39

COMPARISON OF COST-BENEFIT CRITERIA

The comparison of the social losses to passengers with the financial gain to the railways in the Central Wales study (which we will refer to as the CW approach) can be contrasted with the comparison of the value of resources needed to provide alternative transport facilities, and other social losses, with the value of the resources saved by the withdrawal of the rail service, aimed at in the Sheffield-Barnsley study (the SB approach). The two approaches imply different criteria for the retention of rail services, and, as already suggested, the choice of approach must to some extent be based on political and social judgment; but we prefer the SB approach for reasons given below.

Some indication of the practical implications of the difference between the two approaches can be obtained from Table IV, where the data in Tables II and III are rearranged to allow a more direct comparison. The main modification to the Central Wales data is the breakdown of the estimated net loss on the replacement bus service into its main components – the cost of providing the service, estimated at £40,000 per annum, and the revenue to be obtained from it, estimated at £10,000.40

The estimates from the Sheffield-Barnsley study are shown in a rather more aggregated form than in Table II, but only the relevant figures for assumption B are included – these being sufficient to illustrate the difference between the two approaches.

The figures for social benefits lost by the withdrawal include all the items of social costs in Table II apart from the cost of augmenting alternative bus services, which is shown separately. They are perhaps not exactly comparable with the estimate of social losses in the Central Wales study, but for present purposes can be regarded as

38 Under the Transport Act 1968, where alternative bus services are provided by subsidiaries of the National Bus Company (or Scottish Transport Group), the cost is to be borne by that company (or group); but provision is also made for the payment of subsidies for essential rural bus services (Sections 54 and 34).
39 G. Clayton and J. H. Rees., op. cit., p. 27.
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Table IV
Comparison of Criteria

<table>
<thead>
<tr>
<th></th>
<th>Central Wales</th>
<th>Sheffield-Barnsley (Assumption B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£ per annum</td>
<td></td>
</tr>
<tr>
<td>(i) Social benefits lost by withdrawal</td>
<td>16,319</td>
<td>67,480</td>
</tr>
<tr>
<td>(ii) Cost of retaining rail service</td>
<td>100,000</td>
<td>80,000</td>
</tr>
<tr>
<td>(iii) Loss of railway revenue from withdrawal</td>
<td>30,000</td>
<td>50,000</td>
</tr>
<tr>
<td>(iv) Cost of additional bus facilities</td>
<td>40,000</td>
<td>9,810</td>
</tr>
<tr>
<td>(v) Additional revenue to bus operators</td>
<td>10,000</td>
<td>22,500</td>
</tr>
<tr>
<td><strong>Excess of social benefit over cost of retaining rail service</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(vi) Using SB approach (i + iv - ii)</td>
<td>-43,681</td>
<td>-2,710</td>
</tr>
<tr>
<td>(vii) Using CW approach i - [ii - iii - (iv - v)] = vi + (iii - v)</td>
<td>-23,681</td>
<td>+24,790</td>
</tr>
</tbody>
</table>

equivalent to it. The estimates of changes in revenue for the railways and bus operators are no more than informed guesses, but they are sufficient to illustrate the difference between the two approaches. The surplus of benefit over the cost of retaining the rail service has then been calculated for each set of figures, using both the SB and CW approaches. The arithmetical difference between the two approaches is simply the net loss in revenue to public transport undertakings arising from the withdrawal of the rail service (i.e., the loss in revenue to the railways less the gain to bus operators). This is subtracted from the cost of retaining the rail service in the CW approach but is not included in the calculations under the SB approach. Hence, the surplus of benefit over cost under the CW approach is greater (or the deficit less) than under the SB approach. Consequently, the latter provides a rather more stringent criterion for the retention of rail services – a point well illustrated in Table IV by the figures shown for the Sheffield-Barnsley service. If these could be interpreted as a reasonably accurate statement of the relevant social costs and benefits,41 retention of the service would be justified under the CW approach, but not under the SB approach.

From the way the figures are set out in Table IV the CW approach can be regarded conceptually as comparing the social benefits of the rail service to the community with the net financial cost to the railways of retaining it. The SB approach, however, compares the benefits with the difference between the cost of providing the rail service and the cost of providing alternative bus facilities, i.e. the net reduction in the cost of providing transport facilities. In so far as a reduction in the cost of providing transport facilities implies a reduction in resources used, it can be regarded as a gain to the community, as it represents a net increase in the value of resources available for other uses. Alternatively it can be regarded as a social (opportunity) cost of retaining the rail service. The SB approach therefore conceptually compares the social benefits from retaining a rail service with social costs rather than with the narrower net financial costs to the railways, and from that point of view alone would seem a preferable approach.

41It will be recalled that it was thought that actual social costs would be higher than the social costs estimated for assumption B.
The SB approach in fact appears to be in line with that used by Foster and Beesley in their Victoria Line study, but the recent White Paper seems to be more along the lines of the CW approach. The White Paper states that in deciding whether to provide financial assistance to socially desirable but unremunerative services

"the Minister will weigh the cost of retaining the service—in terms of the amount of grant which will have to be paid—against the social and economic benefits it will bring." 

It is intended that the amount of grant will be determined by the expected financial loss on the service in question, subject to an assurance that the service is being operated economically. The CW approach has obvious attractions here, as it seems that comparing the benefits to the community with the cost to the government is equivalent to comparing them with the cost to the community. But in fact the government grant will cover only part of the cost of retaining the service; the remainder will be covered by the fares paid by passengers continuing to use it. In other words, the cost to the government represents only part of the cost to the community—ultimately the part paid by individual members of the community in their capacity as taxpayers; the other part is paid by certain individual members of the community in their capacity as users of the service. The CW approach thus appears to suggest that a service should be retained if the value of its social benefits exceeds that part of the cost of retaining it not covered by its revenue. The SB approach, however, suggests that a service should be retained only if the value of its social benefits exceeds the overall costs of retaining it; this seems a more obvious criterion and a more satisfactory one. It would, no doubt, lead to the retention of fewer unremunerative services, but the total cost to the government would be correspondingly smaller.

The difference between the two approaches can also be expressed in terms of the distinction made by McKean between technological and pecuniary spillovers. Following his definitions, the technological spillovers from the withdrawal of a rail service include any change in the production possibilities in the rest of the economy (reflected in the net change in the resources required for the provision of transport facilities) together with the net change in the level of consumers' satisfaction arising from the withdrawal. Pecuniary spillovers include the effect on the profitability of organisations affected by the change. Hence, whilst the SB criterion is concerned with the cost of retaining a rail service in terms of technological spillovers, the CW criterion is concerned with a pecuniary spillover—the effect of the change on the railway's profits. McKean argues, and he appears to be supported in this by other

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42 C. D. Foster and M. E. Beesley, *op. cit.*
43 *Railway Policy*, Cmd. 3439.
44 Cmd. 3439, paragraph 8.
46 Other pecuniary spillovers include the effects on the profits of firms whose goods consumers buy in place of rail travel.

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authorities, that cost-benefit analysis should be concerned with technological spill-overs rather than with pecuniary spillovers.

This view does, however, imply a particular type of policy objective – one defined in terms of an efficient use of productive resources. Cost-benefit analysis is conceived as being used to help to achieve a better allocation of resources than would be achieved by the ordinary workings of market forces, because of the presence of externalities and other factors. But a more efficient use of resources in the provision of transport facilities is presumably one of the more desirable objectives of transport policy, so from this point of view it seems desirable to use the SB approach to the cost-benefit analysis of unremunerative railway services. The CW approach could possibly be defended from the point of view of a different policy objective, but it is not obvious what that might be.

GENERAL CONCLUSIONS

Cost-benefit analysis is a useful, if as yet imperfect, tool, providing a means for some systematic assessment of the social benefits of particular railway services. Some of its imperfections will no doubt be reduced by further development of the techniques. In addition, its use ideally requires more information than is usually collected about the passengers using the services, the nature and purpose of their journeys, and so on; indeed with more information the two studies examined here – but particularly the Sheffield-Barnsley one – would have been more conclusive. But apart from this there are some general problems raised by the studies.

First, since certain social costs, which may be quite important, cannot easily be quantified, the study of particular services will be incomplete. With further development in the techniques for estimating social costs some of the omissions will no doubt be rectified, but some costs by their nature will probably remain intangible. An obvious example is the effect of the closure of the Central Wales line on the future industrial development of the area. But the case for retaining the line depends to a large extent upon the value of that item. The same will probably be true of the Cambrian Coast line (the subject of a pilot cost-benefit study within the Ministry of Transport), as the area served is similar in many respects to that served by the Central Wales line. In its present state of development cost-benefit analysis would thus appear to provide in these areas a less definite criterion for the retention of services, and to be rather less helpful, than in cases where the more tangible social costs are sufficient by themselves to justify retention, as appears to be the case for the Sheffield-Barnsley service – although it does, of course, help to place narrower limits on the level of intangible costs which would justify retention of the service.

Secondly, it can be seen from the two studies that the more tangible social costs depend to quite a large extent on the volume of traffic using the rail service, the degree of spare capacity in alternative forms of transport, and the extent to which the roads in the area are already overloaded. These costs are likely to be highest, in relation to the cost of providing the railway service, in congested areas where the

\[E.g.,\ A. R. Prest and R. Turvey, \textit{op. cit.}, p. 688.\]
rail service carries an appreciable volume of traffic. With heavy traffic, however, the revenue of the service may also be relatively high, so the service may be profitable anyway. If it is not, the reason is probably that the flow of traffic is uneven, a large proportion of the passengers travelling at peak periods. Consequently, the kind of unremunerative service the retention of which could be expected to be most easily justified by cost-benefit analysis would seem to be commuter services operating in relatively urban areas. Similarly, of course, cost-benefit analysis would potentially give a clearer indication when such services should not be retained, as the more intangible factors would probably not be of great importance.

All this, however, raises a third problem – the nature of social costs included in the calculations. One of the most important costs appears to be the cost arising from extra time spent on journeys.\textsuperscript{48} These costs are imposed on those who have to change their mode of transport as a result of the withdrawal, and on existing road users who are delayed by additional congestion. In most cases, however, the extra time spent on journeys is at the expense of other leisure-time activities. Clearly this is a cost to the persons concerned; but governments may feel that it is not very important since it is unlikely to have serious repercussions on the productive capacity of the economy, or more simply that the desire for less restricted leisure time is not the sort of social need regarded by the government as meriting a subsidised railway service. This is part of the more general problem exemplified, to some extent, by the differences between the two studies discussed in this paper. Cost-benefit analysis is only

\begin{quote}
\textbf{"a technique for taking decisions within a framework which has to be decided upon in advance and which involves a wide range of considerations, many of them of a political or social character".}\textsuperscript{49}
\end{quote}

If the technique is to be used by the Ministry of Transport in deciding which unremunerative services to retain and subsidise, some thought needs to be given to the relevant framework of analysis, to the costs and benefits to be taken into account and to how they should be valued and compared.

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\textsuperscript{48}Similarly the value of time saved is considered to be an important benefit in the Victoria Line study (C. D. Foster and M. E. Beasley, \textit{op. cit.}) and in other cost-benefit studies involving transport facilities.

\textsuperscript{49}A. R. Prest and R. Turvey, \textit{op. cit.}, p. 685 \textit{(our emphasis.)}