THE ENVIRONMENTAL IMPACT
OF TRANSPORT AND
THE PUBLIC INTEREST

By Clifford Sharp*

In his book *Christianity and Economic Problems* [1] Denys Munby dealt with some of the philosophical issues and assumptions that are often neglected in economic analysis. In this paper an attempt is made to examine some of the more fundamental problems raised by action intended to reduce the level of environmental pollution produced by transport. In particular the nature of "the public interest" is discussed, and the adequacy of some possible measurements of welfare, such as "willingness to pay" and voting, are examined. The usefulness of the externality concept is considered, and decisions on speed limits, acceptable accident rates and permissible routes for supersonic aircraft are used as brief case studies.

THE ENVIRONMENTALISTS' CASE

Environmental pollution did not begin with the development of the heavy lorry, nor was it first discovered by the Friends of the Earth. It is very common indeed for economic activity to produce unwanted by-products. Some writings of Tudor times suggest that the feelings of our sixteenth century ancestors about sheep farming were at least as strong as the reactions of Mr. Tyme to a new motorway, or of the citizens of Queens to Concorde. But there can be little doubt that concern about environmental pollution has become much stronger and more general in recent years. The reasons for this involve political, sociological and psychological issues and cannot be explored fully here. But economists can perhaps put forward a partial explanation of the development of "environmentalism" by suggesting that it is a product of affluence. An Indian subsistence farmer who can scarcely produce enough food to keep his family alive is unlikely to worry much about the smell produced by a fertiliser that will increase his crops. As Baumol and Oates have shown, environmental quality is a normal good likely to be bought in larger quantities by people in higher income groups ([2], pp. 191–2). Other factors leading to the growth of concern about the environment may be the increased pollution hazards associated with some forms of modern industrial technology and the more universal impact of pollution. Our Victorian great-grandfathers generally assumed that the production of "muck" was justified by the creation of "money" with which it was associated. But those who

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believed in the truth of the muck-and-money aphorism were often able themselves to enjoy the money while escaping the muck.

The basic belief of modern environmentalists is that we are choosing to produce too many “economic” goods and services and not enough “environmental quality”. They believe that human welfare would be increased if some resources were directed to improvement of the environment. The arguments put forward by environmental groups do not always distinguish between the two policies which might be used to reduce environmental pollution: reducing the output of the good which causes the pollution and adopting a less polluting (but higher cost) technology. A second concern of some environmentalists is the unevenness of the incidence of environmental disbenefits. They point to the unfair degree of suffering which may be imposed on people living under a flight path of a large airport, or in a village bisected by a trunk road carrying heavy traffic.

CAN THE ECONOMIST HELP?

We must now consider what contribution, if any, the economist can make towards dealing with environmental pollution. Some environmentalists would argue strongly that the help of the economist is not required at all, and that his particular skills are quite irrelevant. This position has sometimes been put very forcibly to the author by those who have argued, for example, that road accidents and traffic noise must be reduced from their present “intolerable” levels, and that to achieve this instructions should be given to engineers to find ways of bringing about the required improvements. Even an official body, the Noise Advisory Council, argued in a recent report: “The Panel thinks, however, that . . . much can be done to ensure that Britain in 1980 is a quieter place to live in than it was in 1970. The cost of this will be high. The Panel has no doubt that the improvement which this would bring to the lives of millions of people will make the price worth paying” [3]. It is apparent that this statement leaves many questions unanswered. Measures to reduce noise could range from a slight tightening of the noise regulations for goods vehicles to the introduction of a total ban on the use of the internal combustion engine in vehicles, or the closure of all airports. Even if there is universal agreement that some reduction in the output of environmental disbenefits is required, it may be very difficult to determine how great the reduction should be or what level of costs can be justified. Any policy which will improve the quality of the environment, but which will also impose costs on the community, needs to be judged by some kind of criterion.

The obvious criterion put forward by economists for deciding whether or not to adopt a particular measure to reduce pollution is that the benefits should exceed the costs. In the theoretical world in which outputs are continuously variable, pollution would be reduced to the point at which the marginal cost of reduction was equal to the marginal value of the environmental improvement. Beckerman ([4], p. 47) has an apparently simple diagram which shows the ideal positions clearly; this is reproduced in a slightly amended form in Figure 1. Here OP represents the cost of pollution to the community and CC the costs of reducing the amount of pollution. The optimum output of pollution is therefore obviously OX, and this can be achieved by imposing a tax on the output of pollution of OT per unit, or by regulation. The
practical and philosophical difficulties start when we try to find out what OP, the community costs of pollution or "damage function", actually means in the real world.

Attention has generally been concentrated on the problems involved in finding money values for the social costs of pollution. Since improved environmental quality cannot normally be sold on the market, and since no reliable method of persuading people to reveal their preferences has been discovered, this presents extreme difficulties. It is not surprising that, as the problems at this stage are so great, most writers have not spent much time on questioning the underlying assumptions beneath the concept of social costs or a damage function. But, it may be argued, these are of considerable importance, and the difficulties of finding money values for the costs of noise, visual intrusion, accidents, and other social costs associated with transport do not mean that we can ignore the further problem of considering what it is that we are trying to measure. Even if we knew that the global sum that the community was prepared to pay to bring about an environmental improvement was greater than the cost of the improvement, it would not necessarily follow that the improvement should be made. The sum that people are willing to pay for a change may be no more than one important clue to its desirability. Most reductions in the environmental costs of transport have the nature of public goods, if only because they can usually be brought about only through collective action by the state. Road hauliers will not use quieter but more costly lorries unless they are all compelled to do so. Even if some hauliers would like to employ less noisy vehicles, they will be dissuaded when their competitors choose to operate cheaper but noisier ones. A car
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manufacturer will not install expensive low-pollution exhaust systems in his products unless the state forces all his competitors to do the same. The market mechanism is unlikely to lead to the production of low-pollution cars, or quiet lorries or aeroplanes, without state interference. The case for classifying environmental "goods" such as quietness and unpolluted air as public goods is reinforced by the difficulty of excluding any one from enjoying them.

If decisions about measures designed to produce environmental benefits are taken by the state, this may influence the choice of criteria by which the measures will be evaluated. When goods are sold on the market it is not necessary to worry about what people's willingness to pay measures. It seems reasonable to assume that people are the best judges of their own interests and that they will spend their income so that it gives them the maximum amount of satisfaction. If the community is concerned that some people are able to buy a Rolls Royce while others can only find the money for a bicycle, then the machinery of the state can be used to make the distribution of income more even.

THE PUBLIC INTEREST

But when the state makes a decision about the supply of a public good the situation is very different. When examining a policy that will result in the production of environmental benefits, the criterion for the state must presumably be that the result will be "in the public interest". As Steiner has written in a paper on the allocation of public goods, "The question 'What is the public interest?' has no simple answer. Indeed, asking the question invites the sort of smile reserved for small children and benign idiots" ([9], p. 54). Despite the risk of being consigned to the latter category, we will nevertheless pursue the idea of the public interest. If it could be shown that human happiness would be increased by some state action, that action would be justified. Since happiness cannot be measured, all that can be done is to use some other indicators as proxies and hope that these will give reasonable clues to happiness. Before we examine some of these proxies it is perhaps worth while to make a short digression to stress that our assumption that decisions about the supply of environmental benefits should be made "in the public interest" does not reflect any particular economic philosophy. Even if we have a fervent faith in the price mechanism, wish to minimise state activity, and believe that the existing distribution of income reflects a fair reward for people's contribution to society, the situation remains the same. When a decision must be made about the supply of a public good, then, at least in a democratic state, the good of all citizens must be the ultimate objective.

The statement that a policy to reduce pollution would be desirable if it was known that the benefits exceeded the costs would probably meet with general acceptance. But there is a semantic trap which must be avoided. "Benefit" can be interpreted in its standard English meaning of "advantage" or "good produced for people", so that increased benefit might be assumed to be synonymous with increased happiness. But in economic analysis "benefit" is often used to describe one particular clue to creation of happiness, the money measurement of willingness to pay. It is clearly important not to confuse the indicator or proxy with the reality. The term "welfare",

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which it is assumed is equivalent to “an increase in happiness”, will be used in this discussion. The discussion will concentrate on welfare changes, since it can be assumed that there are no insuperable difficulties involved in measuring the money costs of pollution-reducing policies.

WILLINGNESS TO PAY

There are two main clues to welfare changes which can be used to guide state decision making. These are “willingness to pay” measurements and votes. The most convenient way of putting a money value on environmental benefits is to observe what people will pay to enjoy them, or to try to find out how much money compensation they will need to be given to be persuaded to endure the disbenefits. Thus we can deduce something about the value of noise reduction by finding out how much people will pay to install noise-insulating double glazing [6] or how much less they will pay for a house situated under the flight path of a major airport than for a similar house in a quieter location [7]. But, as has already been suggested, “willingness to pay” measurements can be used as a guide to welfare changes, but no more. The welfare obtained from the money payment may not result only from the environmental improvement in which we are interested. People’s willingness to pay for double glazing, for example, may reflect the hope that their fuel bills will be reduced as well as their desire for more quiet. A more important problem results from the uneven distribution of income. It has already been argued that in a democratic state it can be assumed that decisions are based on the value judgement that the welfare of all citizens is of equal importance, even though the community may agree that some people deserve higher incomes than others. This assumption means that the willingness of a rich man to pay more than a poorer man for an environmental improvement does not mean that he will gain more welfare from it.

Suppose that two housewives, Mrs. Smith and Mrs. Robinson, were asked how much more they were prepared to pay for their groceries in order to enjoy a 5 dB(A) fall in the level of traffic noise at their local shopping centre (we must also assume that a demonstration of the quieter level has been given, so that the ladies can make an informed choice) ([8], pp. 5–11). If Mrs. Smith was prepared to pay only an extra 0.5p in the £ for her groceries, while Mrs. Robinson would pay an extra 3p in the £, it would not necessarily follow that Mrs. Robinson was more sensitive to noise. The respective budget constraints of the two ladies might be such that the opportunity cost of quieter shopping (supposing that this could be bought for 2p extra per £ of groceries) for Mrs. Robinson was a seventh weekly glass of sherry, while for Mrs. Smith it was two hours’ less warmth from her gas fire each week. If benefits could be measured directly in “utils”, Mrs. Smith might be found to enjoy the reduction in traffic noise more than Mrs. Robinson. In the theoretical world of welfare economics Mrs. Robinson might be able to compensate Mrs. Smith for her loss of welfare if she was forced to consume the extra quiet at the cost of 2p per £ worth of groceries, but in the real world this is clearly impracticable.

In a recent study of some methods of restraining road traffic, although an attempt was made to measure the effect of different measures on income distribution, willingness to pay was equated with benefit. The report contained the statement, for ex-
ample, that “if a car user is deterred this implies that his ‘surplus benefit’ from using his car is low compared to those prepared to pay restraint charges” ([9], p. 92). But a deterred car user who is poor might gain more welfare from a car trip on the congested road than an undeterred car user who is rich. Voting has the well-known disadvantage that it does not reflect the intensity of consumers’ preferences.

AVERAGE COST AND VOTING

A full measurement of willingness to pay would involve the almost impossible task of measuring consumers’ surplus. In the real world all that we are likely to be able to discover is how many people would be prepared to pay some fixed sum to be able to enjoy an environmental improvement. In this case those who would be willing to pay the tax would also presumably vote in favour of the environmental improvement (given the same cost implications). If the total cost of the environmental improvement were shared equally among all consumers, it is clear that the “voluntary” revenue from the charge made would fall short of the total costs of the improvement. If even one single consumer believed that enjoying the environmental improvement but paying the charge would reduce his welfare, the total charges that consumers would be willing to pay would be lower than the total costs. This, of course, reflects the inability of an “average charge and voting” criterion to allow for the value of the consumers’ surplus accruing to those who would be willing to pay the average improvement charge. If the total annual cost of an environmental improvement affecting \( n \) people was \( £x \) and the consumers were asked whether they would pay a yearly charge of \( £x/n \) in order to enjoy the improvement, it is likely that at least some of them would vote “No”. If \( \Delta n \) consumers voted for the improvement, and they were then asked whether they would pay \( £x/\Delta n \) for the environmental “good”, it is likely that some would change their “Yes” vote to a “No”. This leads to the question whether any useful information about the desirability of providing a “public good” environmental improvement could be gained from finding out how many people would be prepared to pay its average cost. If we deny the validity of any interpersonal comparisons of welfare, and believe that the loss of welfare of one man could outweigh the total gains of a million others, then the “charges and voting” criterion may be regarded as being of little value. But, following the previous value judgement that every citizen’s welfare is of equal value, an (unprovable) working hypothesis which stated that everyone’s “budget” of welfare is limited might be acceptable. It could be argued that the gains and losses in welfare of individuals from the adoption of a policy of environmental improvement are not likely to be either infinitely large or infinitely small. It would then follow that there must be some majority on the “charges and voting” criterion in favour of an improvement policy which would justify its adoption. Suppose we assumed that the ratio between net welfare gains and net welfare losses from an environmental improvement could not be greater than \( 1:a \). Using the same symbols as above, we could then say that when

\[
\Delta n > \left( \frac{a}{a + 1} \right)^n
\]
the adoption of the policy would be justified. If there were 8,000 housewives in the Smith and Robinson example and if a was assumed to be 3, the policy would be justified if more than 6,000 housewives voted to accept the policy (at the charge of 2p per £ of groceries). Even if all the “Yes” voters were minimum gainers and the “No” voters were all maximum losers, there would be total net gains.

DANGER OF WRONG DECISIONS

There are two possible errors which the state can make in deciding whether to adopt a policy to improve the environment. There is an analogy with statistical decision theory, and its terms and analysis may be adopted in this discussion. We could call the situation where an environmental improvement policy would increase welfare but is rejected a Type X error. The other possibility, that an improvement policy that would reduce welfare is adopted, might be called a Type Y error. The likely errors associated with different criteria can now be reviewed briefly. It is assumed that there are no measurement errors and, as before, that the costs of the improvement policies are known. The use of a full willingness-to-pay criterion, with actual payment made in proportion to willingness to pay, avoids the risk of a Type Y error. However, if the willingness-to-pay criterion is used but all beneficiaries are made to pay an equal contribution to the cost of the collectively provided environmental improvement, then, if the policy is adopted, there is a risk of a Type Y error. If the willingness-to-pay measurement shows that the total willingness-to-pay value is less than the cost of the measure, there is no risk of a Type X error. Suppose that an environmental improvement will affect only two people, A and B, that the gross welfare gained from the improvement for each beneficiary is $G$, and that the foregone welfare represented by spending one money unit on buying the environmental benefit is $W_a$ for A and $W_b$ for B. Then their respective “willingness to pay” for the improvement will be

$$\frac{G}{W_a} \quad \text{and} \quad \frac{G}{W_b}.$$  

If total willingness to pay is greater than the cost of the improvement $C$, then:

$$\frac{G}{W_a} + \frac{G}{W_b} > C$$

The required payments are therefore

$$\Delta \frac{G}{W_a} \times W_a \quad \text{and} \quad \Delta \frac{G}{W_b} \times W_b$$

which are less than

$$\frac{G}{W_a} \times W_a \quad \text{and} \quad \frac{G}{W_b} \times W_b$$

respectively. Since
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\[
\frac{G}{W_a} \times W_a + \frac{G}{W_b} \times W_b = 2G
\]

while

\[
\left( \frac{\Delta G}{W_a} \right) \times W_a + \left( \frac{\Delta G}{W_b} \right) \times W_b < 2G
\]

the welfare gains must be greater than the losses. But if the costs are equally divided there is no way of knowing whether

\[0.5C \times W_a + 0.5C \times W_b\]

is greater or less than \(2G\). If

\[
\frac{G}{W_a} + \frac{G}{W_b} < C
\]

and the improvement policy is rejected, this cannot result in a welfare loss. If A’s foregone welfare per unit of money was 10 and B’s was 20, and if the gross welfare gain from the improvement was 100 welfare units for each of the beneficiaries, then A’s “willingness to pay” would be 10 money units and B’s would be 5 money units. If the cost of the improvement was 14 money units and charges were made in proportion to willingness to pay, then there would be a net gain of approximately 15 welfare units. But if each beneficiary was charged 7 money units there would be a net welfare loss of 10 units.

The “average charge and voting” criterion could result in a Type Y error, though the probability of this would fall as the majority in favour of the charge increased. There would be a greater likelihood of a Type X error with this criterion, since the intensity of demand of a minority favouring the adoption of the improvement policy would not be measured. A “real world” decision based on the political impact made by rival pressure groups clearly involves a high risk of either a Type X or a Type Y error being committed.

CHARGING BY PRICE OR TAXATION

For the sake of efficiency it is usually suggested, quite correctly, that the social costs of producing any product should be reflected in its price. For example, “The cost of these measures (to ensure that the environment is in an acceptable state) should be reflected in the cost of goods and services which cause pollution in production and/or consumption” ([4], p. 13). The arguments of this paper suggest that there may be some circumstances in which charging for an environmental improvement through progressive taxation will be more equitable than charging in the price of the product, and will not involve any loss in economic efficiency. Suppose that the government enforces the adoption of a less polluting but higher-cost technology, and that both the environmental benefits and the product of the process which causes the pollution are consumed by almost everyone. Then economic efficiency will not be increased by making consumers pay for the cost of the low-pollution technology by increasing the price of the product rather than by taxation. On the other hand, it might be more equitable to relate charges for an environmental public good to income levels.
As has been shown, an environmental improvement may be provided as the result of a collective decision based on the belief that average willingness to pay exceeds average costs. But if the standard deviation of individual willingness-to-pay sums is large, so that a significant number of people would not be prepared to pay the average cost charge, and if willingness to pay is associated with income levels, then collecting the payment through progressive taxation would increase welfare. This conclusion does not depend on whether or not it is thought desirable to redistribute income. Analysis of the pure theory of public expenditure has shown that, when aggregate willingness to pay exceeds the cost of supplying a public good, a theoretical optimum position could be achieved by charging for the good through a variable tax related to the benefits received (as measured by individual willingness to pay). Thus Bowen wrote of optimum prices which would vary according to individual marginal rates of substitution for the public good ([10], p. 44). But most of the discussion has concentrated on the impossibility of determining these prices, since people cannot be persuaded to reveal their true preferences ([11], pp. 387-9). Determining optimum prices for an environmental public good is equally impossible, but it can be argued that charging for an environmental improvement through progressive taxation might be acceptable as a crude approximation to benefit taxation. As already suggested, this analogy with public expenditure theory only holds when both the consumption of the pollution-producing commodity and the incidence of the disbenefit are very widespread.

It is likely that some pollution will still remain after the improvement policy has been carried out, and there are good efficiency and equity arguments for believing that the price of the product should reflect the cost of the pollution caused by its manufacture. (The problem here, of course, is that it may not be efficient to charge for some social costs and not for others. It may be neither equitable nor efficient to charge consumers of transported goods for the noise caused by heavy lorries but not to charge the users of bricks for the smell and pollution caused by brickworks.)

**EXTERNALLITY**

Environmental pollution is dealt with by many writers as an external disbenefit, and it is often implied that if an externality can be internalised the problem is removed. But, with the “public good” environmental benefits that have been discussed in this paper, “internalising” a disbenefit may give us little help in deciding whether to accept or reject an improvement policy. This may be true even when only small numbers of people are involved. Suppose that Mr. Smith and his family lived in a house next to a field growing potatoes, which had been treated with an evil-smelling fertiliser. If Mr. Smith bought the field as a source of supply of potatoes for his family, the external disbenefit of the smell would be internalised. But the choice between the bad smell and a smaller potato crop (assuming that no other fertiliser was effective) would remain. If Mr. Smith’s daughter disliked potatoes while his potato-eating mother-in-law had lost her sense of smell, the choice might not be easy. The nationalisation of the road haulage industry would not do very much to solve the problem of the environmental costs of goods vehicles. The decision on whether to mine coal in the Vale of Belvoir in Leicestershire is not made much easier
because the coal industry belongs to the nation. All that internalisation ensures in these examples is that some attempt will be made to consider the interests of all those who enjoy the benefits and suffer the costs associated with the economic activity. In democratic countries today, the polluted are learning how to use the machinery of the state to influence the actions of polluters, so that there is a sense in which even the social costs produced by private sector industry can no longer be described as externalities. Where the market mechanism is clearly inoperative and environmental improvement can only be brought about by collective action, the “internalisation” of social costs would be largely irrelevant.

The theoretical and philosophical arguments of this discussion can now be related briefly to two “real world” problems where decisions must be made about policies which will affect the level of environmental disbenefits produced by transport. These concern speed limits and the use of supersonic aircraft.

SPEED LIMITS AND ACCIDENTS

It is apparent that speed limits can only be fixed by collective action. It is not practicable to allow every motorist to buy the right to drive at his own optimum speed. Fixing a speed limit is particularly difficult because neither money costs nor money benefits can be measured directly. In normal circumstances the main gain from a reduction in speed limits will be a reduction in accident rates, while the chief cost will be a lengthening of journey times. As a result of the “oil crisis” in 1973/4 and the dramatic increase in the price of petroleum, many countries, including Britain and the U.S.A., reduced speed limits. There can be very little doubt that the reduction in speed limits led to a fall in accident rates. In Britain a speed limit of 50 miles per hour was imposed, for the period 8 December 1973 to 29 March 1974, on all roads not subject to a lower limit. In the same period the accident rate on motorways (per million vehicle kilometres) fell from a predicted level of 0.127 to an observed figure of 0.073. The difference was significant at the 0.001 level ([12], p. 13). Reported accidents in the period November 1973 to October 1974 fell (compared with the previous year) by 16 per cent on motorways, by 15 per cent on all-purpose roads with a former speed limit of 50–70 m.p.h., and by only 6 per cent on all-purpose roads not affected by the new speed limit. In the U.S. fatal accidents fell by 27 per cent and injury accidents by 24 per cent on controlled access roads on which the speed limit was reduced from 65 to 55 m.p.h. ([13], p. 36). A study of accidents in California suggested that about 40 per cent of the fall in the accident rate could be attributed to the more stringent speed restrictions ([13], p. 37). The pre-fuel-crisis speed limit of 70 m.p.h. was restored for motorways in Britain on 29 March 1974, and for all-purpose roads on 8 May 1974. A new restriction for all-purpose roads of 50 m.p.h. on single carriageways and 60 m.p.h. on dual carriageways was introduced on 14 December 1974, but this was replaced by a limit of 60 m.p.h. on single carriageways and 70 m.p.h. on dual carriageways on 1 June 1977. This raising of the speed limit was welcomed by the R.A.C. when it was announced as a “splendid Easter gift for motorists”.

Other countries have speed limits that differ markedly from those in Britain. The limit on motorways in France is 130 k.p.h. (or 80.79 m.p.h.) and in West Germany
Table 1
Deaths in Road Accidents

<table>
<thead>
<tr>
<th>Country</th>
<th>Deaths per 100,000 population</th>
<th>Deaths per 10,000 vehicles</th>
<th>Deaths of car users per 100 million cars: miles</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>32</td>
<td>21</td>
<td>7</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Spain</td>
<td>18</td>
<td>—</td>
<td>10</td>
<td>—</td>
<td>14</td>
</tr>
<tr>
<td>West Germany</td>
<td>26</td>
<td>23</td>
<td>9</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Great Britain</td>
<td>14</td>
<td>13</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>


There is only an advisory limit (of 130 k.p.h.) on some motorways outside built-up areas. The accident rates (which of course are influenced by many other factors besides speed limits) also vary, even between such similar countries as France, Germany and Britain.

Table 1 shows some comparable fatal accident rates for four European countries. The speed limit changes in Britain, and the persistent differences between European countries in road accident levels, suggest some interesting questions. Although the relationship between speed limits and accidents is complicated, and some important issues such as the level of observance have not been mentioned in this brief survey, it is nevertheless quite clear that the speed limit reductions in 1973–4 did reduce accident rates. Some people who are now alive would have been killed if speed limits had not been reduced. Many more would have suffered injuries in accidents. But this reduction in what many people would regard as the most serious disbenefit produced by road transport was obtained only as a by-product of a decision that was made in order to use petroleum fuels more sparingly and to protect Britain’s balance of payments. Is it really true that the reduced speed limit was justified by regard for the balance of payments but would not have been justified by the accident reductions alone? Or is it perhaps that the state can react to a danger to the balance of payments in a way that it cannot react to a threat to the safety of its citizens? Is the return to pre-fuel-crisis speed limits, now that we have more of our own oil available, in the public interest? If the trade-off between reduced journey times and the probability of being involved in a road accident could be presented clearly for public discussion and decision, would there be a majority in favour of the higher speed limits? Is this perhaps an area where the benefits (of shorter journey times) can easily be perceived, while the costs may not be appreciated by all those people who have not studied accident statistics? The decision may also be influenced because motorists know that they will enjoy their “splendid Easter gift”, whereas no one knows who will be the sufferers if there are more accidents.
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Given the costs of fuel, the estimated money costs of road casualties and the estimated values of time savings, it is possible to estimate "optimum" speed limits. Thus Ghosh, Lees and Seal calculated that if the TRRL estimates of the cost of accidents were used with time valued at £1.00 an hour and a "unit of casualty" at £2,445.34, the optimum speed on motorways would be 67.45 m.p.h. ([14], p. 140). Reducing time values to £0.50 per hour would reduce the optimum speed to 47.69 m.p.h., but doubling the cost of a casualty would only reduce the optimum speed (with time valued at £1.00 an hour) to 62.30 m.p.h. This raises the question whether estimates of the cost of road accidents are of the right order of magnitude when "optimum" speeds are shown to be more sensitive to changes in time values than in accident costs. Estimated accident costs in Britain are increased to allow for "observed rates of inflation (indicated by changes in the Retail Price Index) and real growth" [15]. Values of time saved are related to earnings. This would suggest that when earnings rise faster than the rate of inflation, values of time savings increase more than accident costs, and therefore speed limits should be raised, but that when the reverse is true they should be lowered. This appears to be an area in which any mechanical projection of figures may lead to unpredictable and possibly perverse results.

If the relatively high accident rates in some European countries reflect planned collective decisions, this would suggest that relationships between accident costs and the costs of accident prevention (including the time costs resulting from lower speed limits) differ from those in Britain. But it may be that the acceptance of higher accident rates in France and Germany is merely a chance result of the system of decision-making in those countries. The different accident rates and speed limits do not encourage much confidence in the ability of the state to determine what is an "acceptable" level of environmental disbenefit. It seems likely (though no proof is possible) that the chief danger in decisions about collective measures designed to reduce accident rates is that a Type X error will be committed and improvements that would increase welfare may be rejected.

SUPersonic aircraft

Our second and much briefer "case study" is the routing of supersonic aircraft, and particularly the right of Concorde to land at Kennedy airport. If this were to be determined by a willingness-to-pay measurement with actual compensation, it seems probable (though not certain) that the British and French aircraft industries and governments, and transatlantic passengers, might be able to compensate the citizens of Queens for any marginal increase in the noise from which they suffer. (This assumes that the decision related only to a limited number of Concordes and not to a widespread use of supersonic aircraft.) The "average cost and voting" criterion would not be applicable, since the losers and gainers are largely separate groups of people. Direct voting on the issue in the U.S.A. would not allow a vote to some of the gainers. The Kennedy landing rights issue, depending on political pressures and the chances of legal proceedings, is one in which either a Type X or a Type Y error could be made; a Type Y error is slightly more probable.

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CONCLUSIONS

The conclusions of this paper may now be summarised.

(i) Policies that will lead to an environmental improvement are not automatically justified. Two possible errors may be made. An environmental improvement that would increase welfare might be rejected (Type X error) or one that would reduce welfare might be accepted (Type Y error).

(ii) Environmental improvements resulting from a reduction of disbenefits produced by transport usually have the characteristic of public goods. Ideally the criterion for the acceptance or rejection of a policy for environmental improvement should be whether it is in the public interest, which has been assumed in this discussion to be synonymous with an increase in welfare.

(iii) Some clues to the public interest can be found in measurements of willingness to pay, through voting on the acceptability of the average cost of the improvement (called here the "average charge and voting criterion"), and through the activities of pressure groups.

(iv) Even if the total "willingness to pay" for an environmental improvement which is a public good is greater than the cost involved, this does not necessarily mean that its adoption would lead to a net increase in welfare. This conclusion does not depend on any particular value judgement about income distribution.

(v) In some circumstances there could be a gain in equity and no loss in economic efficiency if the cost of the environmental improvement were met by progressive taxation rather than through an increase in the price of the good produced by the process which causes the disbenefit.

(vi) The internalisation of an environmental external disbenefit does not solve the problem of how to determine the desirability of collective action to bring about a reduction in the level of disbenefits. The most that it may ensure is that the interests of all those affected by the decision will be taken into consideration.

(vii) Some actual decisions, such as those on the impositions of speed limits and on the permitted routes for supersonic aircraft, appear to be based on very inadequate criteria. The risks of enforcing environmental standards that would reduce welfare, and of refusing to introduce environmental improvements that would increase welfare, both appear to be high. Possibly economists would do better to devote more energy to finding ways of reducing these risks, rather than to continue to explore methods of reaching optimum positions in an imaginary world.

REFERENCES

THE ENVIRONMENTAL IMPACT OF TRANSPORT

Clifford Sharp


