

The Economics of Road User Charges : Realism and Relevance

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ABSTRACT

There are signs that the long debate among economists over how road users should pay for their use of roads is beginning to change its direction towards the problems which preoccupy policy makers in this area.

This paper examines what appear to be the main problems towards whose solution the economic arguments relating to road user charges are directed.

INTRODUCTION

There are signs that the long debate among economists over how road users should pay for their use of the road system is beginning to change its direction (Hicks 1974).

Whilst there has been substantial progress in clarifying the economic principles which should apply in this area, the change we detect is hopefully a more practical and

important one. It amounts to a growing recognition that it will never be possible to generate any enthusiasm among policy makers for schemes of road user charges based primarily upon the abstract concept of maximizing 'economic welfare'. This is not to say that policy makers in this field are unconcerned about economic welfare and efficiency. It is simply that for them (and most other people) there are other more visible and pressing issues. In other words 'road user charges' as such are not an important issue in the minds of anyone except economists.

This is not to say that economic principles are unimportant. Quite the contrary. As Thomson (1974), a leading British transport economist, has stated in a recent book, "...road transport (is) the major mode ... Because of the effects of road traffic on other modes, on the location of activities, especially in urban areas, on the environment, and on the resources of the nation, the failure to apply economic principles to the pricing of road use probably constitutes the biggest transport problem in Britain..." The same point could probably be made in relation to Australia.

Economic principles are important. So we should not abandon the attempt to apply them to the problems arising from provision and use of roads. It is likely however, that greater progress will be made in this direction if we adopt a different approach. Our discussion should begin not with the economic principles themselves, arriving finally at a scheme of road user charges based upon a rigorous application of these principles, but rather we should begin by looking carefully at the road-related problems for which policy makers are seeking solutions, and attempt to devise economically sound road user charging measures (among other things) to assist them. This means accepting the multiple objectives of government policy

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in relation to the charges they levy for roads as a fact of life, and viewing our task as trying to ensure that as piece-meal changes in charging policy are made in response to various problems, such charges all tend generally in the direction of greater real efficiency in the transport system.

It should be pointed out that it has largely been by default that the debate over road user charges has so far been conducted with economic welfare maximization as its central, though not exclusive objective. Little thought has been given by others until very recently to the objectives of policy in the transport field. However, with growing traffic congestion in our cities, growing expenditure on roads, great financial strains upon the country's railways, and pressure to decrease the protection long given to them, many policy makers have begun to think much harder about the kind of transport system they would like to see develop, and how various policy measures could assist them. Greater economic efficiency is certainly one of their objectives, but there are many others.

Of course many economists do not feel at all easy in the realm of practical policy formulation. It is too messy, and too coloured by value judgements. If he is to contribute his knowledge to the solution of real world problems however, the economist often needs to make value judgements, sometimes ones of a political nature. As De Graaff (1962) has argued, "to the taunt that he would become far too much of a *political* economist, I would reply: given the nature of the problem, that is inevitable."

It is necessary to admit, in any case, that there are probably no economic principles of charging for use of government-provided services which are generally applicable to

all government enterprises. In fact a main conclusion of welfare economics - certainly of the debate on road user charges - from which the recommendations of economists ultimately derive theoretical support, is that there are no universal truths to be gleaned from economic analysis (Millward 1971). In dealing with real world problems we shall almost always be thrown back upon second-best solutions and compelled to use rules of thumb which are far from the theoretical optimum. To know that there are no unique or satisfactory answers is better than to persist in what is almost certainly a vain search for them, especially when it is quite likely that the 'correct' answer, if ever found, will not be translatable into practice.

The aim of this paper is to help clarify the arguments on road financing and road user charges, and perhaps stimulate more progress in the new direction we have suggested above. First, we shall examine what appear to be the main problems towards whose solution some form of road user charges could possibly make a contribution. In doing this we shall look at the practical objectives which appear to be in the minds of policy makers, and how these might relate to the objectives, especially economic efficiency and equity, which have usually concerned economists. The main part of this paper summarizes the various schemes of road user charges so far proposed. Finally, we shall try to suggest how we might begin to adapt these schemes to come up with some useful rules of thumb which might guide road user charging policy.

PROBLEMS AND OBJECTIVES

There are several current problems relating to transport in Australia which charges levied upon road users might contribute towards solving.

Traffic Congestion

The most outstanding of these problems perhaps is growing traffic congestion in the major cities of Australia. This is no longer seen as a problem to be solved simply by adding more road space. The thought is taking hold that perhaps too many cars are using the roads, and that measures should be taken to restrain the further growth of traffic, and to encourage greater use of public transport. Traffic restraint has therefore become an objective of policy in most Australian capital cities. Policy makers are not seeking directly to achieve any abstract higher level of economic welfare or efficiency in the allocation of resources to the task of moving goods and people in urban areas. They are seeking to prevent cities from becoming choked with traffic, and becoming over-costly, dangerous and unpleasant places to live. These objectives however, are not inconsistent with greater economic efficiency of the kind sought by economists.

If analysed, the aims of policy makers are found to be complex, and often conflicting. They are seeking to protect the urban environment from excessive atmospheric pollution, noise, visual intrusion, danger to pedestrians and motor car users, and from possible degradation of neighbourhoods by construction of freeways. They want to distribute the benefits of public expenditure on transport facilities to all important sections of the political constituency, and they do not wish by any increase in charges for road use to prevent people who could not afford it from using the roads. They want to minimise the time spent in travel, and minimize the direct monetary costs of personal travel and goods movement. They want a method of doing all of this which is administratively simple and effective, and does not offend against accepted standards of personal liberty and privacy.

The main question which arises in relation to traffic restraint is whether the simple objective of reducing transport costs (by speeding up traffic flow), which in most people's minds is the real meaning of 'efficiency', will always be compatible with the economist's concept of economic efficiency. If any measures designed directly to achieve the former can be made to tend in practice towards achieving the latter, then we might be able to devise some rules of thumb useful to policy makers and, in the long run, satisfactory also to economists. This issue and the distinction between these two kinds of efficiency is discussed in a later section of this paper.

The Financing of Roads

Of course more roads will be needed, despite all attempts to restrain traffic. And they must be paid for, at increasing expense to the road authorities. Here the policy maker's concern is to obtain the required financial resources in such a way that the burden of this expense is spread among users of the road and the community as a whole in a reasonably fair manner and, where possible, in a way which does not inhibit economic efficiency.

From statements made by the Federal Treasurer in the Budget papers 1974/75, it is clear that government policy is to require public enterprises to recover an appropriate proportion of their costs through charges on users and beneficiaries.¹ The main concern underlying this policy seems to be that there should

1. The Treasurer disclosed that by 1977-78 eighty percent of expenditure connected with civil aviation was to be recovered, whilst the Postal and Telecommunications Commissions are to seek full cost recovery.

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be equity in distributing the burden of costs among users of government services, and between them and the general taxpayers. Whilst the economic reasons for cost recovery are debatable there is little doubt that there are good financial, managerial and political reasons for a policy of cost recovery for roads (or at least a 'financial target' requirement).

To what extent should this policy be applied to road costs? And which costs of roads? Public costs or congestion and community costs as well? What can economic principles contribute to this decision? To come to some practical conclusions in respect of financing roads, we shall need to determine what share of the total costs of providing and maintaining the road system should be borne by road users, and how any policy of cost recovery based upon equity considerations might affect real economic efficiency.

Economic Regulation of Road Transport

Improvements in the road system, advances in road transport technology and other factors, have led in recent years to increasing pressure to lower the barriers against road transport enacted in the 1930s to protect railway finances. This has been an important political issue in some states of Australia, and in some states the barriers have recently been substantially lowered or entirely removed. In arriving at these policy changes, the objectives which have occupied the minds of policy makers have been complex indeed. This is most evident in Victoria, where as a result of the thorough consideration given to the problem by Sir Henry Bland, a resolution between objectives is being achieved. It was less evident in South Australia and New South Wales where the changes made to road transport regulation have been much simpler. It is also less evident in Western Australia where no way has yet been found to

reconcile the complex objectives involved.

Greatly simplified, the first aim of any change in regulation would be to increase 'technical efficiency', i.e. reduce transport costs, by allowing shippers greater freedom to choose the mode which performs particular transport tasks cheapest. However, at the same time there is a desire not to risk a serious deterioration in railway finances, which could result from greatly increased competition. It is generally conceded that these two conflicting objectives could be reconciled if road transporters were made to meet all of their track costs, as the railways are compelled (in theory anyway) to do. This would make competition 'fair'. There is little doubt that an increase in the use of road transport, as an alternative to the railways, would increase road construction and maintenance costs. Making road transporters pay their full costs would, it is thought, ensure that those who benefitted from freer competition would pay the extra costs which resulted from it. This approach was supported by the Bland Inquiry in Victoria (Victoria, 1971/72).

The concern to increase transport efficiency, the first objective in giving greater freedom to road transport, relates both to 'technical efficiency' and to 'economic efficiency'.

Removal of barriers to road transport could increase technical efficiency by permitting the use of more cost-effective technology in road transport, and it would put both road and railway managers on their toes to ensure that their respective modes were continuously kept up to date with the best equipment and methods, and that they kept their costs, both capital and operating, to a minimum. By enabling the system to respond better to the preferences of transport consumers, and (in the long run at least) probably forcing rates for particular competitive services to reflect more accurately the cost of

providing these services, broader economic efficiency would probably also be served.

The problem in reaching a satisfactory resolution to this policy problem is to determine precisely what are the road track costs which road transport operators should be made to pay. The issue is not whether all road users are or are not meeting the full costs of building and maintaining the road system. The question is whether the inter-city road transport industry, i.e. the competitor with railway goods transport, is paying its 'proper share' of these total costs. To answer this question, the policy maker must know what share of the total cost of the road system is attributable to inter-city road transport. The Bland Inquiry answered this question by resorting to the 'incremental cost allocation' method, the mechanics and rationale of which are briefly explained later in this paper. There are serious objections to this method however, (Kolsen 1973b) and we believe that its likely adverse effect upon efficiency, both 'technical efficiency' and 'economic efficiency' in the broader sense, are such that this approach cannot be supported. Some other method, which will be equitable and promote greater efficiency (in both senses) must be found.

APPROACHES TO ROAD USER CHARGING

There have been two major approaches taken to devising schemes of road user charging. One directs its attention primarily to achieving the objective of equity in meeting the cost of providing roads, while the other is designed primarily to promote economic efficiency. We shall examine these two approaches and their implications in turn.

The Equity Approach

Those who have favoured this approach to charging

for road use have been concerned mainly that the cost of constructing and maintaining the road system should be distributed fairly, both as between various groups of road users, and between road users as a whole and the community. Thus they have been seeking a solution to the second problem area discussed above, the financing of roads. There are, of course, two ways in which one can arrive at a 'fair' distribution of road costs - to distribute them among users (and non-users) either in proportion to the benefits received from roads by and within each group, or in proportion to the road costs 'attributable' to each group of vehicles. Each method has had its adherents.

Charging in Proportion to Benefits Received. There are two main questions which need to be answered in connection with this principle. First, who receives the benefits of road use and in what proportions; and second, is this principle in conflict with economic efficiency?

Identifying Road Beneficiaries. It is possible to identify three broad groups of beneficiaries, though there is some dispute as to whether they receive separate benefits, or whether the same benefits are merely passed on from one group to another. The first of these three groups is motor vehicle users (among whom one must distinguish vehicle classes and types of use); vehicle users obviously receive the direct benefits of road use. Second are property owners, who are said to receive benefits from the road system because it gives access to their properties, and hence increases their value. Third are the general public, the community at large, who are supposed to receive some extra benefit arising from the existence and use of roads. If one accepts that separate benefits are received by each of these groups, then it follows that the entire cost of constructing and maintaining all roads and streets should not be borne by road users alone. Some

of the cost should be recovered from benefitting property owners (through property taxes) and some from the community (through general taxation).

Some would argue however, that benefits to non-users should not be separated from the benefits received directly by road users, since in reality "the benefits (to non-users)... are benefits accruing through road use" (U.K. Ministry of Transport 1968). "The only purpose of any road", it is argued by another writer, "is to facilitate the movement of persons and things... Roads do not offer any services to the community which are distinct from the services offered by traffic. To attempt to separate services to the community from services to vehicles is therefore misleading when the former must necessarily follow from the latter" (Winch 1963). Dodgson (1973), in a recent study, distinguished between benefits over and above the direct benefits to the immediate passenger and commercial freight users of the road under the headings of external economies and secondary benefits. Under the first heading he concluded that if we define 'external' as meaning external to all road users there will in a developed economy be relatively few external effects which ought to be measured as benefits. For secondary benefits he argued that "where transport is an intermediate good the benefits to traffic will correctly measure the 'true' benefits to final consumers of the transported goods in a perfectly competitive world." A Canadian study also concluded that there are no significant external benefits of road use; indeed, "any externalities would be diseconomies" (Haritos 1973).

While this view is plausible in many respects, it is difficult to support the proposition that all of the benefits from all roads, however insignificant and whatever their purpose, are received directly by road users. In particular, the local

street system usually referred to as the system of 'local access roads', seems to differ markedly in function from the remainder of the road system. While the latter provides mainly a right of way for the conveyance of goods and people, the function of the former is primarily to permit easy access to property. It must be admitted however, that to draw a sharp distinction between main roads and local access roads is impossible. One cannot escape the conclusion however, that if one is to properly apply the principle of beneficiary-pays, then the cost of providing and maintaining local access roads should be borne mainly by property owners. This of course, is our current practice.

If road users as a whole are to meet the entire cost of providing and maintaining all roads except local access roads, the question then arises, how is this burden to be distributed equitably amongst road users. Obviously the proportion of benefits received by various classes of users will vary from one type of road to another. A recent evaluation conducted by the Commonwealth Bureau of Roads (1973) shows the benefits arising from urban freeways in Sydney; see Table 1.

This shows that almost three-quarters of the total benefits are estimated to arise from cost savings to business travel (time savings and operating cost savings). On the other hand, only one-quarter of the benefits accrue to users of private vehicles. It is likely that a very large proportion of the value of benefits arising from inter-city roads also accrues to business users.

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Table 1 : Benefit Composition by Vehicle Class for Sydney
Evaluations in Australian Road Survey, 1969-1974

Item	% of Total Benefits
Operating Cost Savings	
Car - Private	11
Car - Business	3
2-3 Axle Truck	6
4-5 Axle Truck	1
Time Savings	
Car - Private	15
Car - Business	40
2-3 Axle Truck	14
4-5 Axle Truck	1
Other	9
TOTAL	100%

Source: Stanley (1974)

Beneficiary charges and efficiency. Milliman (1972) has concluded after an extensive review of the literature, that 'the issue of beneficiary charges and efficiency has not been worked out well in theory'. Nevertheless, some persuasive arguments are worth repeating. It is argued that if road user charges are set at a level to recover all road costs (excluding those for local access roads), total demand for roads may be reduced and the economy lose the potential advantages from greater

use of roads. On the other hand it has been argued that if we do not require the beneficiaries to pay the costs of the service they receive, then we will never really know whether the benefits in fact equal or exceed the cost. This argument is often made, both in an *ex ante* sense and in an *ex post* sense. The requirement of cost recovery from the beneficiaries as a precondition makes 'sure' that the beneficiaries will carefully consider the worth of the benefits in relation to the costs during the plan-formulation period. *Ex post* calculations can point out past errors and serve as a basis for future improvements in decisions for new investments. This may have an important 'discipline effect' upon road authorities, and tend to raise the 'managerial efficiency' of the road system.

Relating charges to benefits would certainly be a step consonant with the conclusion that there is a need to improve the mechanism for the transfer of income between beneficiaries of a project and the losers from it. It is difficult to say to what extent the substantial benefits from roads to business users (see Table 1) are passed on to consumers, and eventually to the community as a whole, through lower prices, or whether they are retained by business in the form of increased profits. From the viewpoint of 'economic efficiency' it matters only that the benefits generated by road improvements are greater than their cost.

As well as income redistributational implications, the incidence of benefits has broader economic efficiency implications (as recovery of benefits directly from road users would materially facilitate the conversion of potential Pareto improvements into actual improvements in welfare for all) (Dasgupta and Pearce 1971).

These arguments seem to point out strong advantages of beneficiary charges which, in practice however, may be difficult to apply because of the difficulties of identifying and evaluating benefits and their incidence. But it would seem a defensible practicable viewpoint that charges be related (at least in part) to the benefits identified by cost-benefit evaluation procedures (such as those conducted by the Commonwealth Bureau of Roads). It seems appropriate that the charging system for roads recognize and relate charges to the same benefits which justify road investment.

Charging in Proportion to Allocated Costs (The 'Incremental Cost Allocation Approach') Dissatisfaction with methods of establishing road charges based on estimates of the distribution, valuation and incidence of benefits from roads may have led to efforts, particularly in North America, to apply 'cost-allocation' methods of establishing road user charges. Such cost-based methods were popular probably because they required no evaluation, implicit or explicit, of the value of service rendered to road users and therefore were considered to have the advantage of greater objectivity. The best known of these is the so called 'incremental' method of cost responsibility, which assumes that road costs are variable with the weight and size of the vehicle and that, starting from a basic road design cost, there are successive incremental design costs to be added to meet requirements of progressively heavier vehicles. The 'basic' vehicle - a defined weight class including passenger cars - is considered responsible for 'basic' road costs which are allocated by vehicle-mile among all vehicle classes.

Since each class of vehicle heavier than the basic vehicle required additional or incremental road expenditures, the associated cost increments must be identified and collected from each vehicle class. Technical and theoretical difficulties in the application of this seemingly straightforward method arise

from the engineering problems of attributing road characteristics (and hence expenditure) to the correct vehicle classes, the insuperable theoretical problems involved in distributing the large proportion of costs that are joint and common costs, and the statistical problems of acquiring and forecasting the necessary data. It is important that the nature and deficiencies of this approach be clearly understood since the Report of the Committee of Inquiry into Land Transport in Victoria (The Bland Report) seemed to embrace a similar approach to establishing road user charges for heavy vehicles. Most importantly, it should be recognized that the method is really based on some view of 'fairness' in determining road user charges and should not be misinterpreted in a method based on the objective of promoting efficient road use.¹ The meaning of this statement will become clearer when we discuss efficiency-based road user charges.

The Economic Efficiency Approach to Road User Charges

Here we examine a different approach to road user charges, the basic rationale of which is to promote the efficient use of the road system and of the transport system as a whole. It is this efficiency objective which contrasts this approach from the approaches previously discussed. Their primary objective was to recover the financial costs of roads equitably, rather than to induce the most efficient use of road capacity. While the economic principles which should underlie efficient road user charges are now well established, this was not always so. As we shall explain, much of the disagreement really stemmed from the dilemma of all charging policies where there are durable fixed assets, namely that the optimal use of

1. For a more detailed critique of the incremental cost allocation see: Kolsen (1973b); U.K. Ministry of Transport (1968) chapters 5, 7, 8, especially para. 95; and Ker (1974).

existing capacity requires prices equal to short-run marginal cost, whereas optimal investment implies prices equal to long-run marginal costs. In practice however, there can be no doctrinaire definition of the marginal cost to be adopted. Some compromise is likely to be needed between the desire to use a given road capacity as efficiently as possible and the desire to meet other pressing objectives, including that of assisting efficient development over time of the activities dependent on road services.

Road Costs. We shall begin with the costs of road use. Table 2 sets these out in summary form.

- (1) User Costs - By their nature user costs are met by road users in the same way as consumers of other services pay directly for what they get. Thus the question of who should pay for these costs and how does not arise.
- (2) Non-user Costs
 - (i) Public Costs - These are the costs incurred by road authorities for construction, maintenance and policing of the road system, i.e. 'road track costs'. This category of costs raises two main questions. First, it is not immediately obvious what public costs should be placed in the category of 'road track costs'. Secondly, how should the cost of capital expenditure on roads, clearly a road track cost, be attributed to vehicle users in any given year?
 - (ii) Community Costs - These are the costs to society at large, of the external effects of vehicles use i.e. 'social costs'. It is these we are concerned about in attempting to reduce traffic congestion.

Table 2: Road Cost Categories

<u>User Costs</u>	<u>Non-User Costs</u>	
	<u>Public Costs</u>	<u>Community Costs</u>
Purchase of Vehicles	Capital: new roads and major improvements	Amenity loss through
Running costs of Vehicles	Maintenance and minor improvements	(a) noise
(a) expenditure on fuel, wages, repairs, etc.	Cleansing	(b) fumes
(b) value of time spent travelling	Lighting	(c) other factors
Vehicle excise duties	Policing	Accidents
Accidents	(a) regulation and policy	(a) lost output
(a) insurance payment	(b) research	(b) subjective costs (grief, pain)
(b) subjective costs (grief, pain)	(c) administration of expenditure	
	Accidents (costs not covered by insurance payments)	

Source: U.K. Ministry of Transport (1968) p4.

Congestion Costs. By well-established economic usage, a cost which is imposed on another party, and is not recouped from the person who imposes it, is a 'social cost'. Thus, some of the costs which arise from traffic congestion are 'social costs' - accidents, pollution, noise, and visual intrusion, many of the things which are of current concern as a result of rising volumes of motor car traffic in inner urban areas. However, congestion also gives rise to costs which fall upon road users themselves. When an additional road user enters a crowded street, his arrival has the effect of slowing down other vehicles. He thus imposes additional costs upon other vehicles (as well as those which he incurs himself).

The Nature of Economic Efficiency. Economic efficiency is a many-sided concept used by different people to mean different things. Accordingly it is important to be clear about what kind of efficiency we are speaking of if unnecessary disagreement and confusion is to be avoided. Technical efficiency, which we have already referred to several times, is the sense in which 'efficiency' is most commonly used. It means producing at least cost - an important objective which will be familiar to all. This technical efficiency (including 'managerial'¹ and 'technological' efficiency) is a necessary condition of broader economic efficiency. For an individual firm the fulfilment of this condition will facilitate increased profits by increasing the margin between the price of output and the cost of inputs. Economic efficiency however is usually explained as an economy-wide concept relating to the use of the economy's resources in a way which maximizes the economic welfare of the community as a whole. It requires, in addition to technical efficiency, the conditions that:

- the goods and services produced at least cost must be the ones most preferred by consumers, and that
- these goods and services end up with the people who exhibit the strongest preferences for them.

Economic efficiency is usually defined in a limiting sense. Pareto defined it as being a situation a move from which could make one person better off only if others were rendered worse off, i.e. a situation where the last drop of satisfaction

1. What Leibenstein (1966) has called 'X-efficiency' is, according to Nath (1969), in fact, none other than an aspect of this technical or managerial efficiency. As Leibenstein and others concluded, the available empirical evidence suggests that 'X-efficiency' is probably a more significant area in which to seek improvement than allocative or economic efficiency.

had already been squeezed from the economy's economic resources. Whilst this definition establishes a point of reference it is not operationally useful. In reality we are not likely ever to reach this 'utopia', but we should be seeking policies which will take us a step in this direction. However, such policies, while making some people better off, will undoubtedly make others worse off. A way out of this problem was suggested by the criterion that a measure could be considered an improvement in economic efficiency if the gainers could compensate the losers and still have some gains left over. (Some would argue on income redistributational grounds that only when the gainers do compensate the losers is this criterion acceptable.) In practice this means that the objective of economic efficiency can be interpreted (at least for the public sector) to be that of maximizing net social benefit (where the term 'social' includes external costs to the community, such as noise, air pollution etc.). This objective is clearly different from the one which presumably concerns the private firm - that of maximizing net private returns (profits).

In the following sections we shall examine the approach to charging for road use which has as its main objective the encouragement of economic efficiency:

- . in the use of a given road capacity, and
- . in obtaining efficiency in the longer term, relating not only to existing road capacity but also to efficiency in expansion of capacity.

The Short-Run Marginal Cost Approach (SRMC). This approach is based upon cost but it is completely different from the cost-based scheme previously discussed. The SRMC charging rule suggests that the capital costs of roads need not be reflected in the charges made to road users since the allocation of these resources cannot be altered. Only those costs which are immediately

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responsive to changes in the current level of road use should appear in the charge. If road user charges reflect the marginal (extra) costs of road use in this way, then, as Professor Alan Walters (one of the major proponents of this approach) argues,

"the road user can decide whether his interests are best served by 'buying' the road journey or by purchasing some other commodity; and the resources will be devoted to the use that most satisfies him.

when prices reflect costs, resources will be efficiently distributed between one sort of road and another, and between one agency and another. This stripped of qualifications is the essence of the case for economic user charges". (Walters 1968)

If charges do not so reflect costs (if for instance, they are made to reflect the fact that on a particular road a large amount of capital expenditure has been made in the past), then, it is argued, users may be led to choose a service or product which is more expensive in terms of current resources used; or in the extreme case, if the charge is too high, they may not consume it at all, even though they may be prepared to pay for the actual resources used up. This is the logic of a much better known business and economic proposition: that if a mistake has been made and over-investment in capital equipment has occurred, there is no point in trying to set a price to cover all costs including capital costs. That policy will drive away custom and reduce profits by more than a policy which attempts to maximize net revenue as long as revenue exceeds the marginal or variable costs of production.

The arguments that sunk Public costs are irrelevant may be convincing to economists. But how would it shape up in the real world of public finance and expenditure? Are there not serious behavioural implications stemming from the proposition that financial costs should be ignored the day after a project is constructed? Can you tell users and public agencies that costs are important before a project is built and then not require

cost-recovery the day after?

If the historical (financial) costs of roads are not recovered from the road users, who will bear this cost? If road users, then according to some theorists there may be adverse effects upon the efficient use of existing road space. If tax-payers, on the other hand, then we should be concerned about the adverse effects of extra taxes upon efficient resource allocation in the remainder of the economy. A number of economists (e.g. Coase 1946, Haritos 1973) have argued that road user charges should in the interests of efficiency be based upon long-run marginal costs, i.e. the entire costs, including capital costs, of providing and maintaining the road system. If one accepts their arguments, there is no conflict between full cost recovery and economic efficiency.

Nor would cost recovery conflict with 'managerial efficiency'. The requirement of full cost recovery (or some other financial target) would clearly put pressure upon road authorities to keep their costs down - a pressure which might be absent if 'deficits' or 'losses' did not matter. This form of 'managerial efficiency' is important and as we have already stated, is a necessary condition of economic efficiency. Thus it may be argued that the benefits from a cost recovery policy arising from managerial efficiency could well more than compensate for any inefficiency which may result due to a departure from a theoretically optimal level of road user charges.

The SRMC rule promises much more important consequences if instead of being applied merely to reflect differences in marginal public costs, variations in congestion costs were also included. The economic case for doing this has been argued many times (e.g. Walters 1968, U.K. Ministry of Transport 1964, Vickery 1968, Roth 1967, Buchanan 1952) though usually by economists rather than road administrators. There is,

however, the practical problem of measuring congestion costs and levying charges which precisely reflect them. In practice, charges cannot be expected to be more than very approximate reflections of congestion, but this does not greatly matter since marginal cost pricing is not in itself an objective, but merely a means to an end.

The SRMC principle has begun to see some application in practice,¹ indeed to a far greater degree than most policy makers in this country probably are aware. In practice there are several methods by which congestion pricing can be implemented. The most novel, and least tried, depend upon accurately monitoring the position, and speed, of individual vehicles, either by recording devices mounted on the vehicle which are activated by devices in the roadway, or roadside recording devices which record the passage of individual vehicles. Practical systems of this kind have been developed in the U.K., Europe and the U.S.A. In the U.S.A. several local authorities have set up pilot schemes of this type. A simple device, commonly known as 'travel actuated metering' (TAM) involves a sealed meter mounted on every vehicle which monitors such parameters as speed, travel time, frequency of stops, and so forth. The Swedish government has begun to implement a TAM system, and plans to give it very extensive application in the near future. A third type of charging mechanism involves requiring that all vehicles entering a specified area between certain times should carry a supplementary licence. The Singapore government has announced its intention to implement such a system in the near future, and a plan has also been drawn up for its application to London. Finally there is the much simpler device of imposing high parking charges upon cars parked all day, i.e. those which use the road system to come and go from the city

1. Hicks (1973) gives an interesting brief account of the present state of the art in this field, pp. 14-19.

during times when the road system is congested. This is widely applied in many places, though not often as a conscious attempt to impose a price on congestion.

The Public Utility Approach (The Long-Run Marginal Cost Approach)

This approach stems from the view that the "supply of road space is not sufficiently different from the supply of other outputs, particularly those of other public utilities, to justify the neglect of the pricing and investment criteria used there" (Kolsen 1973b). Contrary to what is sometimes argued, it is not so much in disagreement with the SRMC approach as in requiring further conditions of a charging system for roads than that required by the SRMC approach.

A clear exposition of the principles relating to the pricing policies of public utilities was provided by the 1967 U.K. White Paper on Nationalized Industries (U.K. 1967). The White Paper started from the position that public utilities should be operated basically as commercial concerns and have as well the objective of promoting an efficient allocation and use of resources. It declared firstly that financial costs should normally be covered in full and, secondly, that the consumer should usually pay at least the 'true' costs of the goods and services he consumes in every case where these can be sensibly identified.

The pricing policy generally recommended was that of long-run marginal cost, where this includes provision for the replacement of fixed assets needed for the continued provision of services. Circumstances in which this pricing rate would need to be departed from were recognised. Thus if there existed either spare capacity or excess demand, prices should either, respectively be lowered to short-run marginal costs or increased as a rationing device.

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The rationale of this charging principle is that if existing users pay the costs that actually will have to be incurred to replace the facilities they are using and additional users pay what it costs to provide for them, the appropriate level of investment will be indicated by comparison of revenue and LRMC. Where indivisibilities (industry joint costs) make it difficult to allocate costs to specific services, the White Paper suggest that the twin requirement of making prices reflect costs while covering financial costs might be satisfied by using either two-part tariffs or setting prices proportional to marginal costs. A two-part tariff would consist of one part designed to recover directly attributable, i.e. escapable costs, and a second part designed to recover as much of joint costs as demand elasticity permits (Baumol and Bradford 1970). Pricing of railway services has generally been based upon these public utility criteria.

For the preceding pricing recommendations to be applicable to road services, it must be accepted that the 'supply of road services is not sufficiently different from the supply of other outputs'. Under perfectly competitive circumstances, prices usually perform two functions: first in adjusting demand to existing supply, and second in signalling whether production or capacity should be expanded or contracted. However, where goods and services are not sold under competitive conditions and where there are significant social (community) costs, as in the case of congested urban roads and in the real world conditions of uncertainty (especially in urban areas where, owing to complex system effects, prediction is much more difficult than on the relatively simple rural road system) the revenue signals are of limited usefulness for roadway investment decisions. In practice, investment decisions are based upon the expected benefits over and above the expected costs as established by benefit cost analysis. While it may be argued that so long as consumers are deemed willing to pay, whether or not the public

authorities actually recapture some of these benefits through road user charges could be held irrelevant in decisions concerning investment but, as we have argued earlier, making beneficiaries pay could have favourable efficiency (as well as equity) implications.

CONCLUSION

This paper has been more concerned with practical policy problems than with theoretical elegance and rigour. That will have been obvious. We are not proposing to devise an ideal system of road user charges, but only to suggest some combination of approaches to charging which will take us in the right direction. To do this we have sought to establish the economic principles which are relevant in providing guidelines for a rational and realistic system of road user charges.

As outlined near the beginning of this paper, the main problems currently occupying the minds of transport policy makers to which the economic principles of road user charges may be relevant are:

- . how to finance the increasing cost of providing and maintaining the road system in a way which is both equitable and efficient;
- . how to enable road transport to compete more freely with railway transport, in a way which will not unduly affect railway finances, and which will increase the economic efficiency of the transport system; and
- . how to alleviate the problems which arise from traffic and traffic congestion in major urban areas?

Our analysis indicates that economic principles can contribute to answering these questions. However, we should be pragmatic in applying them, since it is not the rigorous application of economic principles which is the objective, but the practical effect which can be achieved through use of economic reasoning. Thus we have concluded that in order to answer each of these questions we shall need to employ various elements from among the economic principles relating to road user charges.

The entire public (financial) cost of providing and maintaining the road system (excluding local access roads) should be borne by road users, since our survey has indicated that there seem to be no significant external benefits from road use. Any loss in efficiency which some would argue will result from attempting to recover the total cost of the road system could well be out-weighed by the managerial efficiency effects of imposing such a financial target upon road authorities. However, it is difficult to establish the total cost of the road system in a given year, owing to the problems involved in distributing capital costs between current and future road users. Since the life of any road is rather indeterminate, any amortisation period will be arbitrary. Inevitably the total costs to be recovered in any one year will depend partly upon judgments by policy makers.

The establishment of charges to recover road track costs from amongst various classes of road users should be in accord with the principles underlying the public utility approach. The application of this approach to charging for road track (it is already commonly used as a basis for recovering railway track costs) will facilitate efficient competition between road and railway transport. This is consistent with the conclusion arrived at by the Bland Inquiry (Victoria 1971-2), that "the

long-term interests of Victoria would be best served if there were a progressive extension of the scope for real competition ... with ultimate distribution of traffic between modes being based on market determined charges related to real costs". (9.35). The public utility approach would enable market-determined charges to be established for the road track as well as for rail. The difficulty, of course, lies in determining the share of total road construction and maintenance costs that should be recovered from goods-carrying vehicles, and the same applies to the sharing of the costs of the rail track.

Unfortunately the Bland Inquiry chose to use the arbitrary 'Incremental Cost Allocation Approach' to overcome this difficulty for roads. The public utility approach, by enabling road authorities to adopt similar economic principles in solving this difficulty as those generally used by railways, would have resulted in more consistently 'market-determined charges'. The public utility approach is appropriate for recovering road track costs from road users. Moreover, since it advocates that when excess demand exists an SRMC pricing rule be used for rationing purposes, it is consistent with a congestion pricing scheme for roads. Where the revenue raised from congestion charges exceeds the financial target so that a 'surplus' results such funds could be applied to public transport improvements so that those who are 'priced out of their cars' may be compensated. Certainly, to the extent that congestion pricing results in improved traffic flow bus speeds will also improve. Pricing methods of traffic restraint should be used, at any rate, in conjunction with non-price traffic management techniques. The latter may well be more effective than pricing but there is little doubt that they would be more effective if used in conjunction with pricing schemes rather than in place of them. And if congestion pricing does not effect a reduced demand for urban roads due to low price elasticities of demand, it may still not be inappropriate to levy

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a congestion charge the proceeds of which could be used to compensate those who suffer from urban congestion, or used in ways which would reduce the costs imposed on the community from noise and air pollution etc. The inclusion of such community costs of air and noise pollution, accidents, visual intrusion etc., in a system of road user charges, while warranted in principle, is ultimately a matter for the judgment of policy makers. Obviously it would be practicably impossible to establish precise costs which should be imposed on road users, but if considered appropriate, any charge would be a step in the right direction.

As regards the political impracticality of the sort of charges outlined above, could it be that too much is made of this? It would seem that people are accustomed to paying higher rates for electricity and parking at certain times, for long-distance telephone calls during working hours, and for air travel and hotel accommodation during holidays. Would it be impossible to persuade the public if:

- (a) the logic of the proposal were clearly presented;
- (b) the benefits were explained (e.g. faster travel time during peak hours, lower levels of air pollution, a source of revenue perhaps for investment in public transport, reduced needs or requirement for additional freeway capacity, and better information for planners concerning the demand for travel on all modes of transport);
- (c) the methods of levying charges were simple and clearly understood, this suggests parking charges and special entry fees rather than 'black box' methods;
- (d) transport alternatives were increased and improved to permit people a wider range of choice, particularly to avoid severely penalizing those

- who were 'priced off'; and
- (e) perhaps if the scheme were accompanied by a reduction of some forms of road user charges (such as annual licence fees)?

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