Transport Research Foundation

# Fair and Efficient Pricing in Transport – Policy and Research

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**Fellow**

Lecture delivered
on Wednesday March 14, 2001
at the University of Leeds

**The Fellowship Chairman, Dr R M Kimber, in the chair**

First Published 2001


ISSN 1475–2298

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Professor Nash has extensive experience in transport economics. He has a first in Economics from Reading University and a PhD in Transport Economics from Leeds. He joined the Institute for Transport Studies at Leeds University in 1974 as BR Lecturer in Rail Transport, and became Senior Lecturer in 1988 and Professor of Transport Economics in 1989. He is currently Director of the Institute, which is a top (5*) rated research Institute with a staff of over 40. He is author or co-author of four books and around a hundred other published papers. He has managed many European, Research Council and industry-financed research projects, particularly in the fields of rail transport, public transport economics and project appraisal.



## Abstract

'Towards Fair and Efficient Pricing in Transport' is the title of an EC green Paper produced in 1995. Following its publication, the European Commission funded many research projects designed to clarify the principles and to explore what its implementation would mean in practice. This paper draws particularly on the results of two of these projects—Pricing European Transport Systems (PETS) and Concerted Action on Transport Pricing (CAPRI). It first outlines the conclusions on pricing principles, and considers some of the objections to them, before summarising the implications of their adoption.

This paper argues that the most efficient approach to transport prices is to base prices on short run marginal social cost, less those elements of cost (e.g. time, fuel for private vehicles) supplied directly by the user. For transport infrastructure this is the sum of the additional maintenance and operating costs imposed by an additional user on the infrastructure provider, plus those costs, principally congestion and part of accident costs, imposed on other users, plus those costs, principally environmental costs plus part of accident costs, imposed on non users. For scheduled transport services, the same three elements of marginal cost are relevant, but the costs imposed on other users are typically negative once service levels have increased to accommodate the extra traffic.

A number of arguments have been made against this basis for pricing, namely that it leads to violently fluctuating prices, that it fails to give appropriate signals for the adjustment of capacity, that it fails to recover total cost and that it assumes all other prices are appropriately set. It is accepted that all these arguments lead to a case for departures from pure marginal cost pricing, but the theory of how to take them into account is well established, and the arguments do not depart from the need to measure marginal social cost as the starting point for any sensible pricing system.

The final part of the paper considers the consequences of implementing marginal social cost pricing, based on a number of case studies undertaken or reviewed in the above projects. It is concluded that the private car is generally seriously undercharged in congested areas, but overcharged elsewhere. Long distance rail passenger services are often charged above marginal social cost, whilst for heavy goods vehicles and rail freight the position varies considerably between countries. Progress in moving towards marginal social cost pricing is also mixed. There is already a Directive in place requiring rail infrastructure charges to be set at—or above—marginal social cost, but excluding environmental costs as long as these are not charged for on road. However progress in the road sector is slow, although many cities are now examining urban road pricing, and Switzerland has implemented a kilometre based charge on heavy goods vehicles. This mixed progress raises more issues about time phasing, and second best solutions when appropriate pricing is not implemented on all modes.

The complications referred to above mean that the simplicity of the message in favour of marginal social cost pricing is lost, but the concept is still at the heart of any sensible pricing policy, and the Commission is to be congratulated for putting it there and for funding the extensive research referred to in this paper.

# Fair and Efficient Pricing in Transport – Policy and Research


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### Introduction

The phrase 'Fair and Efficient Pricing' is one that I do not think I had ever heard until the European Commission published its Green Paper on the subject in 1995 (CEC, 1995). Indeed I suppose I had always assumed that pricing could not be both fair and efficient—that there was a trade-off between the two. However, for the 5 years since then this phrase has dominated my working life. The reason is that at the time the Green Paper appeared, I was about to start work as co-ordinator of a fourth framework research project called 'PETS—Pricing European Transport Systems'. This project really fell into two halves. The first half looked in detail at what an efficient pricing system might be and the second half a series of case studies which the Commission asked to concentrate on transeuropean networks. One of the tasks the Commission asked me to do as part of this was to chair a co-ordinating committee to bring together the results of all 4th framework research on pricing, and before too long this grew into a Concerted Action (CAPRI) with a committee of experts from all member states, designed to promote concensus on transport pricing issues. I also became an expert advisor to the Commission's high level group on infrastructure pricing, as well as coordinator of two further 5th framework projects on pricing issues. More recently, DETR commissioned us to do a project applying these methods to British data, the report on which I hope will be published later this year. What follows draws heavily on the contributions of colleagues on these projects—particularly Peter Mackie, Tom Sansom and Bryan Matthews—and of our EC Project Officer, Catharina Sikow-Magny. Of course, opinions expressed are solely my own.

Hence my title this evening, Fair and Efficient Pricing—Policy and Research. What I want to do is first of all give my understanding of what is meant by fair and efficient pricing. I will then examine some of the most common objections to it. Finally I will attempt to say what I believe it would mean in practice, drawing on the many case studies I have undertaken or reviewed as part of the above projects.

### Fair and Efficient Pricing

When we started the first of these projects the Green Paper on Fair and Efficient Pricing had only just appeared. That paper argued that prices should reflect costs. It argued that some of those costs were not fully covered or not covered at all in prices, particularly thinking of the external costs of environment, accidents, congestion, but also infrastructure provision and maintenance. The costs that were excluded could be very large and for Europe as a whole the figure of 250 billion ECUs per annum was suggested. This was a radical departure for the Commission in placing so much emphasis on external costs as an issue that should be taken into account in transport pricing policy. There has been a long period of debate about infrastructure charging, but never previously with emphasis on the external costs of environment, congestion, and accidents.

However, I think it is fair to say that the Green Paper was not totally clear about what principles should be followed and how these costs should be taken into account and our first task in the PETS project was to try to clarify those principles. The key principle, which we thought would make for efficient pricing, was that the user should bear the short run marginal social costs of use of the infrastructure. Now, in case of transport infrastructure use, the users directly bear some of the costs. They always input their own time and in terms of private transport, they provide the vehicle and the fuel. So in terms of the price it is actually that part of marginal social cost that does not fall directly on the user that needs to be reflected in the charge.

Why this is the most efficient basis for charging is something that economists have been very bad at explaining to the outside world. The principle is that all costs are valued at the compensation needed for those incurring them willingly to do so. Those users, who value their use above the costs they impose by adding to traffic flows, will travel. Those who value their use below that cost will not travel or will use some alternative means. Consequently, when expanding traffic to the level implied by short run marginal cost pricing, it would be possible to make everyone better off by the move; users could fully compensate all those bearing costs by the move and still be better off themselves. Similarly if traffic were currently at a higher level than that implied by this principle, those suffering the costs of the higher level of traffic would be able to fully compensate marginal users for giving up their journeys and still be better off themselves (Figure 1). Of course, the fact that the losers could be compensated does not mean they will be, but this potential for benefiting everyone is something one would expect to be of interest, not least to politicians.

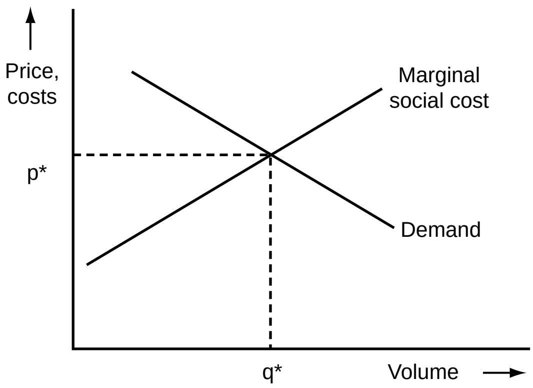


*Figure 1*

What the principle of short run marginal cost pricing translates into, in terms of infrastructure charging, is that we need to measure three components of cost for the addition of extra traffic to the existing infrastructure. Firstly the cost imposed by additional use on the infrastructure provider. This comprises additional maintenance and renewals costs plus maybe some additional operating costs. The second component is the marginal cost imposed on other infrastructure users, in terms of delays, congestion, accidents and opportunity costs (perhaps more commonly referred to as scarcity costs), on those modes where there is a physical limit and once all the slots are taken no-one else can get one. Then there is a cost imposed on those people who are simply excluded from access when they want it. And the third element is the cost imposed outside the transport system and that is mainly environmental cost. Also some elements of other costs such as accidents, for instance where these are borne in part by the police or health service and not recovered from users, may enter there.

You can translate the same sort of approach to scheduled transport services. In the case of private transport, if you get the infrastructure prices right, essentially, you have solved the problem of efficient use of the system. But with scheduled transport services that is not so. Or at least it is not so unless you have a fully competitive environment and you can just leave it up to market as to what is produced. In practice, we do not have that, I do not believe we will have that and there are various costs characteristics of scheduled transport which make that difficult and unlikely. For instance when you add traffic to public transport systems, either you raise load factors, operate larger vehicles, longer trains and in that case the marginal cost to the operators is very low. Or you increase services, and in that case there is a benefit to existing users from a better service as traffic rises. In other words, for the marginal social cost of operating scheduled transport services, there is a similar mix of costs to the supplier, to the users and to society at large. But the cost to other users is typically negative because extra traffic leads to an improvement in the service. (I suspect this effect was known to transport managers long before the seminal article by Mohring, 1972). And what this means is that there is an a priori case very often for subsidising scheduled transport services in order to implement pricing policies which don't cover full cost. If you don't get efficient provision of the scheduled transport services themselves there is no guarantee that simply getting the infrastructure charging right will even improve resource allocation let alone solve the problem. The Commission has been concerned mainly with infrastructure charging because of its concern with the terms of competition between different users of the infrastructure as it promotes open access and competitive markets for all modes of transport, but in doing so it has neglected a very important aspect of transport pricing, which is that for scheduled transport services it is the final price to the consumer that determines its competitive position with respect to other modes.

Now if it was slightly vague on what it meant by efficient pricing, the Green Paper was a lot less clear on what it meant by 'fair' pricing. Fairness seemed to be based on some version of the polluter pays principle, whereby the user paid the costs they imposed. But this principle might be applied at the margin, that the individual consumer should pay at least the additional costs they impose, or it might be applied at a more aggregate level—e.g. that all users of a particular mode of transport should collectively bear the total costs this mode of transport imposes. Rather remarkably, by the time the Commission issued a White Paper on Infrastructure Charges (CEC, 1998), which firmly espoused the marginal cost pricing principle, it was entitled Fair Payment for Infrastructure Use, the word 'efficient' having been dropped rather than the word 'fair'.

My own inclination, like that of many economists, is to approach the problem of equity a totally different way. I see equity as concerning the overall package of costs and benefits experienced by each individual or group of individuals in society. Thus if someone is poor, or disadvantaged in some other way—for instance through lack of affordable transport—then policy needs to seek to offset this disadvantage; if someone is clearly well favoured, then they represent a prime target for the levying of additional charges. Of course in an ideal world this could all be done through the taxation and income supplementation system, and pricing of transport services could then ignore equity as an issue. But given that it is not politically or practically possible to deal with all these issues in this way, they do need to be taken into account in pricing decisions. It is necessary therefore to know who will gain and who will lose by these decisions. Thus, for instance, I would be more likely to favour expanding subsidies to bus services than to air services or high speed trains, even though on pure efficiency grounds the argument may go the other way. That is why I said at the beginning that there is a trade-off between efficiency and fairness.

When we presented these principles to our committee of national experts at the first meeting of CAPRI, their reactions were extremely interesting, because they fell into three clear geographical areas (Figure 2). There was a band of North West Europe were they were instantly accepted as the simple and obvious answer to the problem of fair and efficient transport pricing (I have often thought it must be wonderful to be a transport economist in Scandinavia, where politicians not only act on the principles of transport economics, but even talk about marginal social cost pricing when doing so). Then there were countries including Britain and France, who broadly accepted the principles but thought they might need modifying in practice, in particular to take account of the marginal capital costs of expanding the network. Then there was a strong band of countries, led by Germany but including much of Southern and Central Europe, who largely repudiated the policies, in favour of an insistence on full cost recovery.

In the next section I will discuss the long run marginal cost pricing alternative to the Commission's approach. I will then turn to the 'German' repudiation of marginal cost pricing.

## Long run marginal cost pricing

One factor that many people find unacceptable about short run marginal cost pricing is that it totally ignores the capital costs of expanding the system. There is an alternative in the textbooks, known as long run marginal cost pricing, which charges not the costs of adding extra traffic to the existing infrastructure, but the costs imposed by the extra traffic when the infrastructure is optimally adjusted to the new traffic level. This will therefore include some marginal capital costs, but compared with short run marginal cost the congestion cost, and possibly some of the other external costs, will be reduced. It is easy to show that if capacity is optimally adjusted, then it is expanded

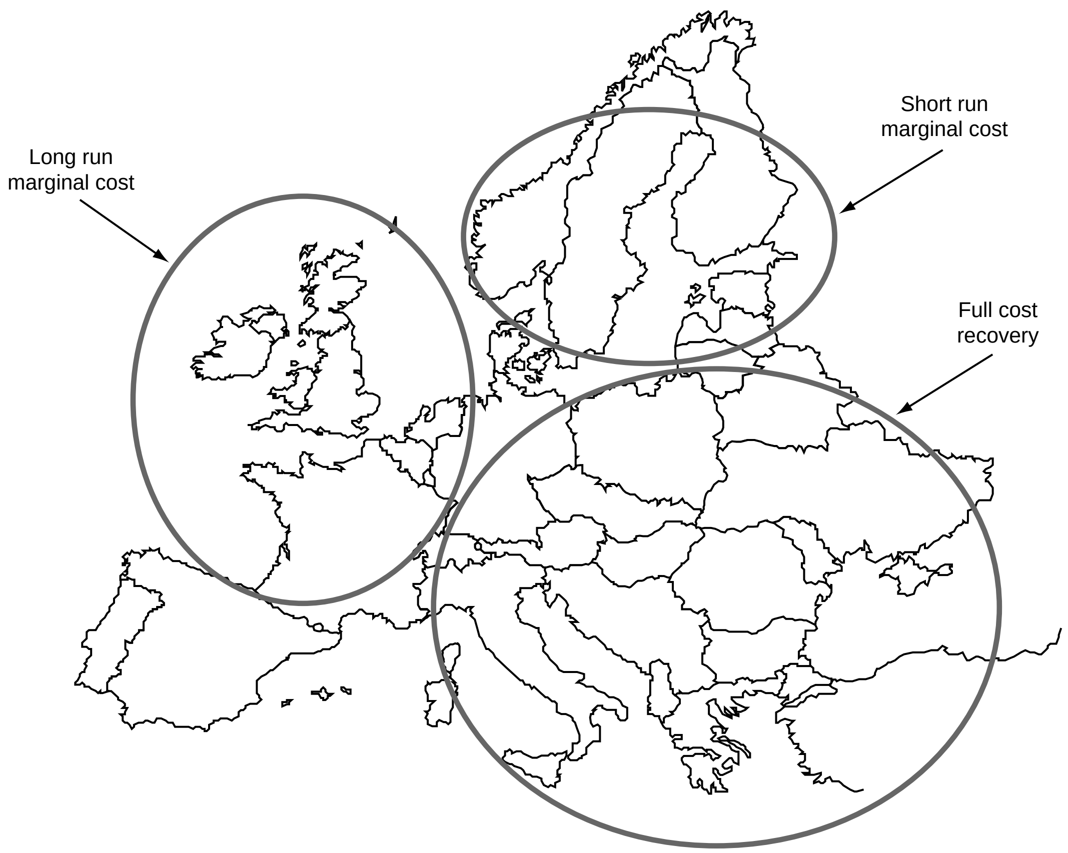


*Figure 2 Alternative approaches to transport pricing*

up to the point where the extra capital costs of expanding capacity just equal the reduced other costs so that at the margin short run marginal cost and long run marginal cost are equal. There is therefore only an issue between the two as a basis for charging when capacity is not always optimally adjusted to demand.

Our conclusion was that the provision of extra infrastructure is so subject to indivisibilities, so subject to time lags and so subject to political considerations about what capacity is provided that it is more efficient to charge to get efficient use of whatever infrastructure is there and then to look at adapting infrastructure using the principle of cost benefit analysis. Having said that I would certainly accept that existing prices give signals to users which cause them to get locked into a particular situation—thinking particularly of commuting journeys, where home and work location are influenced by the current price. Then, there is a case for taking account of plans for new capacity to charge what the short run marginal cost will be in the longer term, rather than incur violent fluctuations in these prices. If in the long run, capacity will be optimal, this amounts to long run marginal cost pricing.

If we moved entirely to long run marginal cost as the basis for charging then congestion pricing would essentially be an irrelevance; the case for charging higher prices in urban areas would be based on the high cost of expanding capacity in such locations. But in practice most advocates of long run marginal cost pricing would accept that in some locations, particularly in urban areas, the costs of expanding capacity are so high and the political problems so great that it is inappropriate to price on this basis—it is more important to get efficient use of existing capacity by pricing at short run marginal cost. It is only in locations, perhaps on the inter-urban road network, where capacity expansion is actually likely to take place, that there is a case for long run marginal cost pricing.

My answer to this would be to say that the role of indivisibilities and of political constraints still means that most of the time in most locations capacity is and will remain non-optimal. Thus I would still advocate the form of 'smoothed' short run marginal cost pricing advocated above. Nevertheless I would concede that in these circumstances those responsible for pricing decisions would do well to look at long run marginal cost as well, and to consider the implications for their plans and assumptions about future capacity if short run and long run marginal cost differ.

Finally in this section it is worth commenting on some commonly given reasons for adopting the long run marginal cost approach which are certainly not valid. One is that this will achieve higher revenue and cost coverage than short run marginal cost pricing. This is basically only true where there is excess capacity, and it is commonly argued that the big problem of transport infrastructure is inadequate capacity. The argument is probably based on a common misunderstanding of short run marginal cost pricing which sees it as covering only wear and tear costs, and not the costs of congestion and other externalities. A second is that short run marginal cost pricing cannot be implemented because the pricing instruments for such a differentiated pricing scheme are not available or are too expensive. Both short run and long run marginal cost pricing require highly differentiated prices; if these are not possible then in both cases a high degree of averaging is required but both approaches remain feasible.

## Full cost recovery

Whilst in Britain and France the argument between long run and short run marginal cost pricing proceeds, in Germany the whole approach of marginal cost pricing is subject to major criticism. The most dramatic illustration of this is a report of the German Scientific Advisory Council on Transport entitled Fair Payment for Infrastructure Use: Outline of an Alternative Approach to the European Commission's White Paper. This council consists of 15 professors including most of the leading names from German transport economics.

The key criticisms of the approach put forward in this paper are as follows:

a It will lead to violently fluctuating prices, given that there are indivisibilities and time lags in adjusting capacity to demand.

b It will fail to recover total cost, and result in a combination of cross subsidy and direct subsidy from taxpayers.

c It fails to give appropriate signals for the efficient provision of infrastructure.

d It assumes that all other markets are priced at marginal social cost and ignores indirect effects such as effects on land use.

The first point has already been discussed in the previous section and the case for some deviations from marginal social cost pricing in order to smooth fluctuations accepted. We will now discuss the other three points.

Point (b) reflects the most common objection to marginal cost pricing—that it does not recover total cost. It is clear that there is a big conflict between marginal cost pricing and recovering the total costs of providing the system. At the aggregate level, pricing to recover total cost typically implies big increase in rail and other public transport charges, and reductions in road taxation, whereas marginal cost pricing often implies the reverse. Most transport infrastructure is subject to increasing returns to scale, which means if capacity is anything like optimal, then marginal cost pricing will not recover the total cost of the system. On the other hand cost of land and property acquisition limit expansion, particularly in urban areas, so efficient supply of capacity in urban areas will typically still involve significant congestion and still involve substantial marginal cost and therefore substantial charges. So the likelihood it is that if you move to marginal cost pricing what you will find is that you get substantial surpluses on urban roads; they would far more than cover their costs. Whereas on rural roads and much public transport, you will get deficits. And that leaves two big questions. One is whether the whole package of effects satisfies government budget constraints. Does it provide enough finance, or are there other means of supplementing it if necessary? There is some evidence from a number of studies that actually the surpluses in urban areas are so big that maybe the budget constraints problem is not such a big issue (Roy, 2000). But then we have a second issue, and that is—is this system equitable? Is a system whereby urban road users greatly cross-subsidise rural road users and public transport users, perceived as fair?

If the answer to either of those questions is 'no', then of course we have to depart from marginal cost pricing, but that does not mean we throw the principles away. There are well-established rules for supplementing the revenue raised in the way which is least damaging to the efficiency of the system. We will then be thrown into debate about two part tariffs and about differentiating pricing structures but with marginal social cost as a starting point, and then looking for the optimal departures from that base.

The German report in a sense takes the 'dual' approach to this. It takes as its starting point the need to achieve total cost recovery on each mode, and then explores Ramsey pricing and multi-part tariffs as ways to do this with the least damage to efficiency possible.

The logic behind the German position is the argument that transport infrastructure is what is known to economists as a 'club' good. A club good is a good where the marginal costs of use may be small but it is possible to confine use to those who funded provision of the good. The argument is that it is both fair and efficient to require users to fund provision of the good through a membership fee (vehicles excise duty, or the fixed element of a two-part tariff would be such a membership fee). It is fair because the consumers of the good are paying for it, and it is efficient because it prevents excessive lobbying for better provision at the taxpayers expense.

My own view is that 'club good' theory may have some relevance to the provision of tennis courts or bowling greens. But transport infrastructure is such an integral part of the economy that everyone is a user or beneficiary in some sense. It would only be if it were possible to have a pricing system where people paid separately for access to each individual piece of infrastructure that the argument would have any relevance. And even then I would dispute both the efficiency and equity arguments for pricing for total cost recovery. However, these arguments certainly appeal to those in the road lobby who expect to profit by them.

Those supporting this argument generally also reject the notion of congestion as a cost that needs to be recovered through pricing. The reason is that congestion is largely a cost imposed by some users of the transport system in question on other users. Thus it is a cost that is, in total, already borne by users of the system in question without further pricing action.

Obviously whatever the structure and ownership of the transport industry, there is a sense in which total cost coverage is essential, at least in terms of the cost of providing and maintaining the infrastructure. If infrastructure managers do not receive sufficient income to pay the efficient costs of providing and maintaining the system then rundown and inadequate infrastructure is the inevitable result. The argument therefore becomes one of whether the government might provide part of that income, perhaps out of surpluses on other infrastructure, and require appropriate expansion of capacity in return for doing so.

Point (c) reflects the problem that under short run marginal social cost pricing, prices will be high where capacity is inadequate, giving the infrastructure manager an incentive to withhold necessary investments. Of course, if it could be assumed that infrastructure decisions were taken by governments, solely on the basis of social cost-benefit analysis, then this would not be a problem. But most economists recognise that governments are not so entirely benevolent in their motives. Moreover, part of the German argument is that efficiency requires infrastructure managers to be constituted as commercial organisations exploiting private capital to fund their investment.

The final argument of the report is that the case for marginal cost pricing assumes marginal social cost pricing elsewhere in the economy. Again few advocates of marginal social cost pricing would deny this. For instance, if one good is charged a price below marginal social cost, there is a case for charging substitute goods below marginal social cost as well to avoid distorting choices between them. The practical implication is that, where there are divergences between price and marginal social cost in related markets, these lead to cases for divergences in the market in question. The most common application of this argument is in terms of competition between modes. But the German report raises another important issue. If the costs of urban sprawl are inadequately reflected in market prices, then transport prices should be configured in part to offset this distortion and discourage sprawl. The implication is that charges for entering town centres should be below marginal social cost. Similarly if labour taxes discourage labour supply that may lead to a case for subsidising the cost of commuting.

In essence, up to a point most advocates of marginal social cost pricing would accept these criticisms. What they would say is that 'pure' marginal social cost pricing has to be modified to take all these issues into account. Perhaps then we should talk, following Baumol and Bradford (1970) of optimal departures from marginal cost pricing rather than of marginal cost pricing itself. That of course does pose difficulties for European legislation on the subject of pricing. It is a common problem of EU Directives that, because they represent the results of political compromises, they are typically relatively unspecific and general. Directives based on the principle of optimal departures from marginal cost pricing would be even more vague than most already are and leave the way open for neighbouring countries to take incompatible and distorting decisions on pricing policy.

But at the end of the day there is a crucial difference between the philosophy behind the German report and the Commission approach, and it reflects a deep philosophical difference between the member states of the European Union. The Commission's approach assumes that governments will take decisions about pricing and investment in transport infrastructure. The private sector may be involved but very much as the agent of the government, for instance, under concessioning or other contractual arrangements which maintain government control of decision-taking. The German approach seeks to get away from this. Thus it sees the prime need as being to establish infrastructure managers as commercial organisations, reacting to market incentives. Yet even then the difference in philosophy is not complete. The German report does not see 100% cost coverage from users as an automatic rule; contributions from governments are possible where they are justified. A fully commercial infrastructure manager may still have the government as one of its customers, as will be the case when Railtrack receives grants from the Strategic Rail Authority. Again the two approaches are not so totally incompatible as they may seem.

## Implications of marginal cost pricing

Having discussed the principles of fair and efficient pricing, we now go on to discuss the practice relying on the case studies undertaken in PETS, and other relevant projects.

In the PETS project the key externalities we looked at were:

- congestion; there is a long tradition of measuring and valuing congestion, so it is not so controversial (although the German critique included the argument that there was no agreement even about measuring congestion costs);
- accidents, where there is also a long tradition, but there is more uncertainty about issues like the degree to which extra traffic imposes risk on other users;
- air pollution, where there are more uncertainties still but we had the results of a very major project called 'EXTERNE' which had as its aim to value air pollution (Friedrich, Bickel and Krewett, 1998);
- noise where there are actually some particular problems, but again a lot of research;
- global warming, where of course the uncertainties are greatest of all; again, this was examined by ExternE but their valuation changes drastically from one report to another.

We were able to estimate all of these items though subject to uncertainties. Looking at some of the results for case studies, the uncertainties are reflected in the fact that we estimated low and high values. Table 1 shows the changes to passenger transport charges that would be needed to have marginal social cost pricing in the year 2010. The year is important because we

**Table 1 Changes in passenger prices (ECU/100 passenger km) (change compared to 2010 base situation)**

| *Case study* | *Cost est.* | *Car* | *Bus* | *Train* | *Air* |
|---|---|---|---|---|---|
| Cross channel | Low | -2.75 | – | -3.00 | -2.27 |
| | High | -1.35 | – | -2.82 | -1.16 |
| Finish | Low | -2.24 | -2.96 | -4.06 | – |
| | High | -0.49 | -2.56 | -4.04 | – |
| Oslo–Goth | Low | -2.57 | -1.18 | -1.26 | -5.71 |
| | High | -0.80 | 0.51 | -1.22 | -4.54 |
| Lisbon | Low | +1.19 | -1.72 | -0.90 | – |
| | High | +3.37 | -1.65 | -0.87 | – |

*Source: PETS Project*

were assuming continued improvement in emission standards of the vehicles and we were assuming that quite substantial increases in capacity would be in place by 2010. What we found on that basis is that in interurban transport, the current level of taxation on cars would more than cover marginal social cost by 2010. It would be efficient actually to charge cars less on long distance transport. But in our one more urban case study, the Lisbon one, and in a number of case studies done by other projects we looked at, as you would expect, it is always the case that in big congested cities current taxes on cars are far below marginal social cost. For bus and rail passenger services commercial considerations tend to leave the prices above marginal social cost and in fact for our two air examples, that was also the case (a factor here is that the air case studies were in countries where there are significant departure taxes). Looking at the sort of changes in passenger demand that we forecast resulting from these price changes (Table 2) we find that rail gains in most of the corridors but the only place really where car has a significant reduction is the urban case of Lisbon.

**Table 2 Changes in passenger demand (% change compared to 2010 base situation)**

| *Case study* | *Cost est.* | *Car* | *Bus* | *Train* | *Air* | *Total* |
|---|---|---|---|---|---|---|
| Cross channel | Low | -0.2 | – | +7.1 | -1.7 | – |
| | High | -0.7 | – | +10.3 | -2.2 | – |
| Finish | Low | -1.4 | +3.7 | +12.1 | – | – |
| | High | -3.2 | +11.4 | +20.7 | – | – |
| Oslo–Goth | Low | +21.5 | -10.5 | -8.4 | +6.8 | +14.6 |
| | High | +6.2 | -4.4 | +0.2 | +8.9 | +4.7 |
| Lisbon | Low | -29.0 | +22.2 | +29.6 | – | – |
| | High | -36.3 | +25.0 | +32.0 | – | – |

*Source: PETS Project*

On the freight side the picture is a bit more mixed (Table 3). For heavy goods vehicles efficient prices would involve raising taxes in two of the case studies, but in the transalpine one, where there are already substantial charges actually the taxes would be lowered, and for rail in some cases the subsidies already reduce charges below marginal social cost. So rail prices could go in either direction. The changes in demand in the freight sector (Table 4) as a result of moving to efficient pricing are not very large and certainly the Swiss results suggested that, particularly efficient pricing with the low valuation of externalities on the transalpine corridor would actually divert from rail to road which is not a popular conclusion.

To sum up, then, it is possible to measure marginal social cost although uncertainties remain. For most estimates it is not simply the case that efficient pricing would favour environmentally friendly modes, for instance by uniformly diverting traffic from road to rail. The picture is more complex. For road, the position for passenger cars tends to be that charges are far too low in congested areas but too high elsewhere. For heavy goods vehicles the position varies enormously between countries. For rail, passenger is often priced above marginal social cost, but freight again varies.

**Table 3 Changes in freight prices (ECU/100 tonne km) (change compared to 2010 base situation)**

| *Case study* | *Cost est.* | *HGV* | *Train* |
|---|---|---|---|
| Cross channel | Low | +1.21 | +1.50 |
| | High | +2.04 | +1.61 |
| Finish | Low | +1.13 | -0.27 |
| | High | +1.58 | -0.26 |
| Transalpine | Low | -4.80 | +0.28 |
| | High | -1.19 | +2.02 |

*Source: PETS Project*

**Table 4 Changes in freight demand (% change compared to 2010 base situation)**

| *Case study* | *Cost est.* | *HGV* | *Train* |
|---|---|---|---|
| Cross channel | Low | +1.2 | -3.0 |
| | High | -1.5 | +4.0 |
| Finish | Low | -5.9 | +7.4 |
| | High | -7.9 | +9.7 |
| Transalpine | Low | +3.1 | -12.5 |
| | High | +0.1 | -1.7 |

*Source: PETS Project*

## Implementation issues

Sometimes marginal social cost pricing appears to be seen as an end in itself. Given that the technology exists it is argued that we should implement electronic road pricing everywhere with tariffs that vary by the minute in terms of the price paid by the user. For rail and public transport the scope for highly differentiated prices is even greater.

However, implementation of sophisticated pricing systems remains far from costless, whilst the ability of users to respond to the prices may be limited by their ability to understand and predict what they will have to pay. Thus there is an optimal degree of complexity of any price structure arrived at by comparing the benefits of greater differentiation in terms of their influence on the volume and location of traffic with the costs. There are also issues concerning the speed of implementation, which may differ between the modes both because the technical requirements differ and for political reasons. In turn, these factors lead to second best considerations; differing degrees and speed of implementation between the modes could itself be distorting and needs to be taken into account in policy determination. Thus implementation of marginal social cost pricing is far from straightforward.

For road, it appears that there should be two priorities. The first, and obvious, one is to implement some form of road pricing in congested areas. These are likely to be mainly, but not necessarily solely, urban areas. How sophisticated a system this should be depends on the trade-off referred to above. The second is to reform charges for commercial vehicles, and particularly heavy goods vehicles. The first step here would be a kilometre-based charge varying with axle weight and gross weight, to reflect the importance of wear and tear costs for such vehicles. Ideally this would vary with the type of road—these costs are much greater off the motorway and trunk road network where pavements are thinner. To this needs to be added external costs—accidents, environment and congestion. Clearly these vary with location and time of day, so the ideal would be universal electronic road pricing for heavy goods vehicles. But it may be that a significant step forward in terms of efficiency may be made by charging a fixed rate per kilometre, plus supplementary charges where urban road pricing is implemented.

Although road freight traffic is not very price sensitive, such a charging system would reduce distortions between vehicle types and countries of origin as well as between modes. If these changes were implemented, then efficient pricing would dictate a reduction in fuel tax in many countries including Britain. It would also be possible to reduce or eliminate vehicle excise duty on vehicles subject to the kilometre charge, so that vehicles would pay the same no matter where they were registered. The continuation of vehicle excise duty on cars would be a matter for consideration in terms largely of revenue requirements and equity; it is likely to be a relatively undistorting form of two part tariff with little effect either on car ownership or car use, but may be a useful way of encouraging less polluting vehicles if it is appropriately differentiated.

For rail, whilst in some senses implementation is easier, in other senses there are greater complications in implementation.

Firstly there is a big difference in the nature of congestion between road and rail. On roads, congestion usually manifests itself as volumes of traffic such that speeds are reduced below free-flow speed and/or queuing occurs at junctions. Since rail infrastructure managers control access to the network on a planned basis, rail congestion manifests itself in a different form. Indeed, it is useful to distinguish between two effects of shortages of capacity—congestion and scarcity.

Congestion represents the expected delays resulting from the transmission of delays from one train to another. These become worse at high levels of capacity utilisation, since there is a lack of spare capacity to recover from any delays, (Gibson, 2000). Congestion costs are the costs associated with these expected delays. Scarcity represents the inability of an operator to obtain the path they want, in terms of departure time, stopping pattern or speed. Therefore, in the presence of a capacity constraint, the value of any train which could not be run as a result of lack of capacity would be added to the costs of track damage and of expected delays. The High Level Group on Transport Infrastructure Pricing identified scarcity, rather than congestion, as the dominant consequence of existing capacity constraints on the existing rail network (CEC, 1999).

Both in the case of congestion and scarcity, it may be argued that there is only a genuine external cost imposed when the effect is on the train of another operator. However, the issue arises of whether the cost perceived by the operator fully reflects the cost imposed on the final users. Only in the event of perfect price discrimination is this likely to be true.

Secondly, there is a particular issue involved in the setting of rail infrastructure charges, and that is the desire to encourage open access. As a result of dissatisfaction with the rail industry performance, the Commission produced a radical new policy statement late in 1989 (CEC,1989). From the point of view of this paper, the key proposal was the requirement for rail operators to establish separate divisions for infrastructure and operations, to require the infrastructure to be accessible to other operators, on fair and equal terms and to implement a system of charging for the use of infrastructure (based on train kilometres, speed, time, axle weight, etc) which facilitates this in the context of fair competition between modes. In other words, for the first time a policy based on separating infrastructure from operations and seeking to attract new entrants to compete in the rail industry was being put forward.

After much negotiation, a limited version of these proposals was implemented in Directive 91/440.

Separation of infrastructure from operations was only required in the form of separate accounts with transport infrastructure charges. Legal rights of access to railway infrastructure in EC countries were established for two types of undertaking: international groupings of railway undertakings—defined as two or more operations from different countries wishing to run international services between the Member States where the undertakings are based, and any railway undertaking wishing to run international combined transport goods services between any Member States.

By the time the Commission issued its next White Paper on Railways (CEC, 1996) relatively little progress had been made in introducing more competition to the railways and virtually no open access operations had emerged. Many argued that this was because the existing legislation only provided for minimal rights of access for international rail freight operators, and left the administration of those rights, and the charges to be levied, in the hands of the existing rail operators, who had a vested interest in preventing them from being exercised. Accordingly the Commission argued for stronger actions to open up the railways to market forces, including:

- separation of infrastructure management and transport operations into distinct business units, rather than merely accounting separation;
- open access for all freight and international passenger services.

However, what was eventually agreed was much more limited. Separation of infrastructure from operations was still only required in terms of accounting, although separate balance sheets as well as profit and loss accounts, and separate accounts for passenger and freight, would now be required. Access for international freight services was to be extended, ultimately to the entire network, and prices based on marginal social costs, but with non-discriminatory mark-ups permitted where required for budgetary purposes.

From the point of view of economic efficiency the best way to implement these mark-ups would be via two part tariffs, as with roads. The fixed element could then be recovered by the train operator from their customers in the most efficient way possible. But there is a big concern that such fixed charges could not be levied on existing operators and new entrants in a non discriminatory way. For instance, if both have to pay the same fixed charge, then the new entrant, who is almost certainly smaller than the incumbent, is penalised. If the fixed charges differ, how is the charge for the entrant to be set? Baumol (1983) produced an ideal solution, that it should be set in accordance with the loss of contribution to the fixed costs that the entrant imposes on the incumbent, but that is very difficult for a regulator to estimate.

What is often favoured therefore is some sort of differentiated charges according to the market position of the commodity or type of traffic to be transported (Ramsey pricing, to the economist). In other words the charges per train kilometre are raised above marginal social cost.

Whilst a lot of attention has been paid to rail infrastructure charges, because of the open access proposals, relatively little attention has been paid to the charges faced by the final customers. For reasons explained above these often exceed marginal social cost, quite apart from any overcharging for infrastructure.

There is thus now a Directive coming into force which will implement marginal social cost pricing, or something above that, for rail infrastructure, with almost certainly a greater disparity between marginal social cost and price for the final consumer. At the same time very slow progress is being made in terms of charging for the use of roads. This raises serious second best considerations. As long as heavy goods vehicles in long distance freight traffic are undercharged, charging at or above marginal cost for rail may actually worsen efficiency rather than improve it. For passenger traffic the position is less clear, but the regime may actually favour rail relative to road in long distance markets, whilst leading to too little rail traffic in congested areas.

In part, these problems are reduced by a provision in the Directive that rail should not be charged for its environmental costs until road is. But that only partly solves the problem. As we have seen in some contexts road is already being charged for its full external costs, but in others it is grossly undercharged. The failure to charge rail for its, in any case low, external costs will only correct this price distortion to a very limited degree.

In other words there are potentially very serious issues of second-best and of time phasing to be borne in mind in planning the implementation of marginal social cost pricing. In my judgement these are particularly serious in the case of freight, where almost all rail freight is carried in direct competition with road, whereas in passenger, the interdependence is less strong and the cross elasticities lower.

## Conclusion

The adoption by the Commission of the simple rule of marginal cost pricing is a really quite remarkable and all too rare example of policy makers following the prescriptions of transport economics. It is a simple message, and perhaps it has to be simple for there to be any hope of progress being made.

In reality, complexities inevitably crowd in. We have to find ways of dealing with institutional issues and the presence of commercial infrastructure managers, with budgetary issues and the problems of equity, with the trade off between accuracy and complexity and with the problem that progress will not be equally fast for all modes and locations. In dealing with these problems the simplicity of the message is inevitably lost.

But I remain convinced that a knowledge of marginal social cost is the essential starting point to any sensible discussion of pricing policy. Whatever the complexities, I am convinced that the argument for much higher prices on congested urban roads, and for long distance road freight would survive, and the unprecedented interest in policies to tackle these issues (eg the number of cities studying road pricing, and the Swiss kilometre based charges for heavy goods vehicles) give encouragement that progress is being made. The Commission is therefore to be thoroughly applauded for its espousing of the principle as the basis for its policy and for the funding of extensive research to examine how to turn that principle into practice. Long may both, and especially the funding of research, continue.

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## DISCUSSION

### Rod Kimber (Chair)

Many thanks for an excellent exposition on a subject that challenges many established views. Let's be as wide ranging as we can in discussion, to bring out the key issues.

To start the discussion, let me first say that what I thought particularly challenging were the regional differences in argumentation that you set out. This is the sort of thing that the Commission usually faces, but—given the political difficulties of entry into any programme of change in this area—I thought these were a particularly marked set of barriers. How do you see that evolving? Do you see any sort of convergence happening?

### Chris Nash

Very little I am afraid. That is exactly why all of the Directives in this area end up allowing people to do whatever they like. For instance the current Directive on rail infrastructure charges started off by saying that rail access must be charged at marginal social cost. But it ended up saying rail access must be charged at marginal social cost plus anything you feel you want to add on to that; and of course that covers all of the different points of view! I've tried to understand why there are these regional differences but don't claim to know fully.

I do have a hypothesis and I'd be interested if anyone else has other hypotheses. The differences are related to what people see as the big issue. So for instance in the Nordic countries congestion and capacity aren't really the big issues – rather the big issue is in providing infrastructure to a far flung region and then pricing it appropriately. In contrast, the more congested countries do see the costs of capacity expansion as a big issue. Germany and central Italy see financial problems, particularly in the railways, as top priority and that I think, is reflected in their views. This was brought home to me when I went to a talk given by the Head of Italian Railways who said that clearly railways should be completely commercial – they should have no government subsidies. This was the head of a railway where 84% of his costs were at the time covered by subsidy. This is the biggest proportion in Europe, and probably in the world, and I thought that was remarkable; it made me reflect how big a concern it is in Italy.

### Question/Comment

How great is the consensus on the accuracy of costings?

### Chris Nash

The simple answer is that there is not a consensus: there are arguments—even about the congestion element. Except for the case of global warming the tendency has been for estimates to go up over the years: to discover new costs which nobody had previously dreamt of. I can remember when diesel fuel was seen as clean and everyone wanted to encourage its use and nobody had any concern about PM10s, yet now they have become a dominant issue in the air pollution costs.

Clearly the global warming costs are subject to enormous uncertainties and personally I just don't believe that the figures have any value at all. I would go for a totally different approach which is to say: governments have agreed some targets so let's assume politicians mean what they say, and let's therefore at least look at the costs of achieving those targets.

So there is a lot of uncertainty about some of the elements. However, they would in fact have to change an enormous amount for the implications to be all that different from what I have said. Therefore the messages that this work brings out would apply with any reasonable set of values.

### Question/Comment

These discussions really go back to the importance of urban road pricing, which we have, of course, been working on for 25 years. Perhaps I can put to you a couple of arguments on the practice of road pricing that have been made. The first is that the simple way of invoking road pricing—through cordon-based charges—introduces distortions into the system, including rerouting, which rapidly undermine the benefits, whereas the more complex and precise ways of charging marginal costs are too expensive to justify. How far can that be addressed within the principles you've given? The second argument is that what we really want to do when we get the revenue from road pricing is to hypothecate it for the greater good of the community that's being served. Again how does that fit in with the principles?

## Chris Nash

The first part of the question then is: would cordon based charges introduce so many distortions that they would create as many problems as they solve? And at the same time would more complex methods be too expensive? I had hoped that when in CAPRI we were synthesising the results of all the research and we would find a nice pattern emerging in which in large and very congested cities one could justify going for a complex method of pricing. In smaller cities one might identify ways of siting cordons that didn't have serious effects. This might have established a pattern: of which method was suitable for which location. But when we looked at the research we couldn't really see that coming through. In some studies we found tiny cities where complex methods seemed to be justified and big cities where nothing seemed to be justified. There wasn't really any pattern; and there were a lot of arguments as to why that might be.

It might be a consequence of using different models in different locations. If that's true it would be a bit worrying because it would suggest that different models give different answers. I know more work is proposed which I hope will settle that issue. There did seem to be evidence that actually the more complex methods are in fact justified in the biggest and most congested cities; but whether anyone would dare to actually launch a scheme with one of the more complex methods I don't know. While the simpler methods have their problems the question is whether problems are so bad that they would make such methods not worthwhile at all. A cost benefit analysis is obviously needed; but I have been pretty convinced that with one or two exceptions there is not much evidence of people significantly managing to reduce use of the private car in cities without pricing measures. There is plenty more research to do!

## Rod Kimber

I agree: networks are so rich conceptually and differ in such subtle ways that there is much need for further investigation!

## Chris Nash

The second half of the question was on hypothecation. In terms of moving to the most efficient pricing system hypothecation is bad. One of my colleagues frequently says that hypothecation is an appalling system which nobody should ever sign up to, because one would be committed to using the revenue in what might be an inefficient way, and the whole point of road pricing is that it is only worthwhile if you use the revenue sensibly. On the other hand it is quite clear to me that without hypothecation we won't make any progress. So again one has to do a cost benefit analysis, and as long as hypothecation is to uses where there are sensible investments to be made, I am willing to accept hypothecation as the way of making some progress.

## Question/Comment

What do you think might happen if there were full cost recovery for some UK roads? It seems that the Germans happily say there should be total cost recovery and quite often people involved in the sustainability analysis say that as well. About ten years ago the Canadians looked at this.

## Chris Nash

Certainly there are big subsidies. Typically in Europe I suppose if you went for total cost recovery on rail you would double the charges. If you doubled the charges you would get rid of a lot of the traffic and close a lot of the services. On the roads side the German argument is that if you are going for total cost recovery the road user should bear the total costs of the road system. Since the road users already bear the cost of the congestion one wouldn't include that in the costs charged for. So one would probably find that the charges would go down in most places. The implications of total cost recovery therefore would push to an extreme extent in entirely the opposite direction to what I would regard as an efficient pricing system.

Having said that there is still a lot of confusion about exactly what people mean by total cost recovery. For example, when the head of German Railways says we must have total cost recovery I think what he means is that someone must pay all of the costs. If the revenue cannot be raised to cover all costs then there can be no investment—the system cannot be maintained and will collapse. Much of the concern from parts of the industry is that if there is marginal cost pricing when no-one will pay the rest then the system will collapse. That's obvious: one could only have marginal cost pricing if someone somewhere can meet the rest of the costs. And even the most hard line of the German advocates of total cost recovery still tend to say that if there is a good case for putting Government money in then that is permissible. So I am not sure if anyone except part of the roads lobby is really arguing for total cost recovery. I do think some of the environmental lobby who argue for it are misguided because they don't actually understand what it would do.

## Question/Comment

You spoke about charging for infrastructure use but you also mentioned the importance of getting prices right on public transport services, the prices to users. To what extent does European policy impact on public transport prices in an environment of deregulation?

## Chris Nash

The general approach of the Commission to public transport remains one of saying that some sort of franchising is likely to be the best way forward (rather than the approach we have taken to our bus system) so that does leave governments in a position to influence prices to quite an extent. On the other hand as I implied earlier I think there are big issues about trying to go for marginal social cost pricing throughout the public transport system. Certainly in the longer distance case one can have quite a lot of price differentiation; a good deal more can be recovered than marginal cost in that way. So whilst I wouldn't advocate going all the way to marginal cost pricing, I would certainly advocate looking seriously at the degree to which existing prices are distorted. This answer is in one sense consistent with Commission policy for buses and rail, but certainly not air which is another matter.

There is another issue in all of this and that is subsidiarity. The European Commission sees the issue for them as international competitiveness: it is road haulage and international rail, that are the big issues for them. Even with road pricing they say essentially that urban road pricing is a matter for the individual state. They will advise, they will sponsor research, they will promote best practice but at the end of the day it is for the individual member states to take the decisions. I suspect that would also be the attitude for short distance public transport as well.

## Question/Comment

A comment and a question. The comment is that you said it would be worrying when different models gave different results. Modellers will say that it is obvious that different models will give different results. The concern is that we tend to spend too much time turning handles on particular models to get results out and not enough time actually investigating the whole spectrum in modelling . The question comes from a geographical perspective. A key problem is that we live in an era when so much has been and is being agglomerated. We've got increasingly big shopping centres outside of towns; we've got big facilities in hospitals; we are hearing all the time about sheep being transported all over the country; and when ministers say they are going to specialise schools I can see that means one is not going to be able to go to the local school to get what one wants but instead will have to drive to the other side of the city. Is there a potential problem with putting all cost of travel on the individual—who doesn't necessarily have the choice of where to travel. And somewhere along the line the other people both commercial and political decision-makers that affect land use and spacial organisation need to be persuaded since they have to modify their practices as well.

### Chris Nash

I agree with both of your points. On the modelling issue, while (obviously) different models give different answers, this is not a big problem either if they are not *too* different and the message is substantially the same, or if we know which model to believe. But if it really is true that we are getting radically different answers from different models and we don't know which to believe then obviously we are in difficulties.

On the land use issue, the biggest problem area is what the effects of changing transport pricing systems would be on spacial decisions. I totally agree also that transport pricing will only really be effective in influencing locations if it feeds through to the ultimate decision-taker. With *joined-up* government one might hope that education departments or health authorities would look at the transport implications of their decisions rather more than they appear to have done in the past. But certainly transport pricing is only one of a whole package of measures that are needed in order to pursue a sensible transport policy. Another essential part of that package is for land use planning and location decisions to be taken sensibly.

### Question/Comment

I was interested in the results of your study in respect of the total cost of different externalities, but I wonder how these compare with the Adam Smith Institute's traffic flow project where they did a meta analysis putting together all of the various sources, and found a global total of something like £30bn for the UK as a whole. Of this two thirds was due to congestion and lesser amounts to the other sources, including an absolutely infinitesimal amount attributable to global warming, of course. What was interesting was that £30bn isn't too far away from the total tax duty revenues from all forms of vehicle taxation in the UK.

Are you therefore of the view that these two global figures might actually be rather similar? The political argument that vehicle users are already paying for this might not therefore be too far from the truth, whilst the argument that they are clearly not paying the marginal social costs in congested urban areas is equally true. And so what we should perhaps be looking for is an effective form of redistribution that is fiscally neutral, much more in terms of the distribution than in simply raising the total costs. Is there some way in which that can be presented politically if it's broadly true?

### Chris Nash

Is it true that road users in total are paying the total costs of the road system whilst clearly failing in a lot of locations to pay the marginal costs? I mentioned we are doing some work for DETR and hope that we will be publishing our answer to that question before too long. But let me do the best I can in advance of completing that work. I think it is true that in total the tax taken from the road users probably exceeds the total costs of the road system—if you leave congestion out of the picture on the basis that road users are already bearing that in total themselves. If congestion is to be put in there are arguments about how you should measure it, and it is not clear that the analysis would still hold. Maybe on average the marginal cost would be higher than effectively the marginal charge. If you add the aim of moving to a more efficient pricing system without increasing the total burden on road users then you would be pushed into the direction of introducing congestion pricing in the most congested areas and so on, but matching that by reducing VED and maybe a bit of a reduction in other tax. Now whether that package is sellable I don't know, because it does run entirely counter to the idea of giving the money from congestion pricing to the congested areas. Really one ought to use this money to reduce the burden on motorists *in general*. So as I said earlier I don't particularly believe in the argument that you should add up all of the costs and compare them with all of the revenues and get a balance. But if one did take that view I think there are still a lot of changes that could be made to the pricing system which would become much more efficient whilst still maintaining that type of position.

### Rod Kimber

Thank you very much Chris. Time is advancing and I think we really ought to wind up at this point. It remains for me to thank Chris for all of the work he has put into this. It has been a splendidly lucid exposition and we are all very grateful to him for it. It has for me drawn together a whole raft of ideas in a way that one rarely finds—bringing a clear and fundamental analysis to issues that are very much of topical importance, and that are exercising governments, operators, and lobbies considerably. These ideas will I am sure grow even further in importance over coming years.