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Implementing rail infrastructure charging reform - barriers and possible means of overcoming them

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Summary

Setting rail infrastructure charges is difficult and controversial because of the number of different objectives decision makers have in mind. Charging short run marginal social cost provides optimal incentives for the efficient use of infrastructure, but falls far short of recovering total cost. Most ways of reconciling the two, for instance by means of efficient mark ups and two part tariffs, provide potential distortions to competition between train operators.

This paper traces the development of the Commission's policy on rail infrastructure charges through to Directive 2001/14, which stipulates that prices should be based on marginal social cost, but provides for non discriminatory mark ups to meet financial constraints and other departures from marginal cost pricing in the case of distortions in the pricing of other modes of transport. It then considers the experience of three countries with very different rail infrastructure charging regimes, Britain, with marginal social cost based variable charges, but also fixed charges for franchisees; Sweden, with something approaching pure marginal social cost pricing, and Germany, which is closer to average cost pricing.

The paper then traces through a series of barriers to marginal social cost pricing and considers ways of overcoming them. The barriers identified are:

1. Problems of measurement
2. Complexity of tariffs
3. Financial implications
4. Equity
5. Technical efficiency
6. Fair competition within the rail sector
7. Fair competition with other modes
8. Acceptability on behalf of train operators and infrastructure managers
9. Acceptability on behalf of end users and the general public.

It is considered that the principal barriers to the introduction of marginal social cost pricing for rail infrastructure are difficulties of measurement (especially for congestion and scarcity), fears that does not give the right incentive for investment, financial constraints and the desire to constitute railways as commercial bodies. No country other than Britain includes congestion costs in its tariffs, and no country includes pure scarcity costs. Scarcity costs remain a priority for further research. However, we believe that measurement problems can be gradually overcome over time, and second best reasons for subsidy will gradually reduce as prices on other modes are reformed. The crucial issues in achieving marginal social cost pricing for rail infrastructure relate to the desire for rail infrastructure managers to cover their total cost, or a greater proportion of costs than implied by marginal cost pricing, from charges, and the consequent need for two part tariffs or for tariffs differentiated according to willingness to pay.

1. Introduction

The European Commission's policy of separating railway infrastructure from operations and opening up operations to new entry has given rise to the need for explicit methods of charging for the use of rail infrastructure. The European Commission sees open access as an important way of improving the efficiency and marketing of rail transport and, hence, of increasing the role of the railways in the European 'Common Transport Policy' (CEC, 1996). They are keen to see comparable approaches to infrastructure charging being used in all member states, to avoid the distortions that exist when neighbouring countries charge for the use of

infrastructure on a totally different basis, and to base these charges on marginal social cost as the most efficient approach to transport pricing (CEC, 1998).

However, deriving an appropriate pricing system poses many difficulties and there are numerous barriers to implementation. A fundamental problem is that a number of different objectives for infrastructure charges may be identified when attempting to derive a charging system, and most possible systems score well on some objectives and badly on others. A typical list of objectives (ECMT, 1998) would be:

- promoting efficient use of the infrastructure
- promoting efficient investment in and development of the infrastructure
- recovering the costs of providing the infrastructure, including adequate funding for investment.
- promoting efficiency of operators, for instance through facilitating competition
- harmonisation of the terms of competition between modes

To achieve an objective of maximising the efficiency with which existing infrastructure is used, prices for the use of that infrastructure should be set equal to short run marginal social cost. In terms of railways, this means charging for the incremental, or marginal, cost of use of the existing, i.e. fixed in the short run, infrastructure by the train concerned, given the assumption that all other trains on the network are running. However, charges set equal to short run marginal social cost are not likely to achieve an objective of recovering the costs of providing the infrastructure, due to the decreasing cost nature of the industry which results from it being subject to economies of traffic density (Keeler, 1974; Harris, 1977; Caves et al, 1987; and Kessides and Willig, 1995). Nevertheless, it is possible to pursue a cost recovery objective whilst at the same time promoting efficient use of the infrastructure via, for example, 'two-part-tariff principles. Two-part-tariffs involve a variable component equal to short run marginal social cost and a fixed component to make up the shortfall between marginal social cost and total infrastructure costs. However, such a system is somewhat at odds with the objective of promoting competition within the rail sector, as it tends to favour large train operators over smaller entrants.

The relative emphasis given to the different possible objectives varies enormously between member states. For instance, at one extreme, Sweden has espoused the objective of efficiency regardless of cost recovery considerations, whilst at the other extreme Britain, and to a large extent Germany, has organised its rail infrastructure company as a fully commercial organisation requiring complete cost recovery.

This paper seeks to identify the key barriers to implementing short run marginal social cost pricing for the use of railway infrastructure in Europe and to offer suggestions of how these barriers might be overcome. Section two begins by setting out the development of the European Commission's approach to railway infrastructure charging, through the different policy papers and directives of the past decade. Section three considers policy developments in practice in three countries that have taken very different approaches to infrastructure charging – Britain, Sweden and Germany. Section 4 identifies what we see as being the principal barriers to implementing reform of infrastructure charges and section five then discusses these barriers, the extent to which they may pose constraints on policy-makers' opportunities to pursue reform and the ways in which they might be overcome. In these sections, reference is made to work carried out for the MC-ICAM project, a sister project to IMPRINT. Section five then seeks to draw our conclusions.

2. EC Policy development

For many decades, railways in most of Europe have been seen by the Commission as a problem. They have steadily lost market share and required high and increasing levels of subsidy. Underpinning these problems was thought to lie a number of organisational and control issues (for further details, see Nash, Matthews and Whelan, 2001). Despite initial attempts by the European Commission in the late 1960s to encourage governments to reorganise railways as autonomous commercial bodies, the Commission perceived continued major problems in the rail transport field.

In the face of these problems, the Commission produced a radical new policy statement late in 1989 (CEC(1989)). From the point of view of this paper, three of the proposals were crucial. Firstly there was a requirement for governments to ensure increased commercial and financial independence and realistic balance sheets for their railways. Secondly, and more controversially 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. Thirdly there was a requirement to replace generalised public service obligations by contracts, spelling out clearly the services to be provided and the prices and subsidies to apply. The key issue is the extent to which a more formal contractual arrangement leads to a more transparent and effective relationship between government and railway.

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.

Despite two follow-up directives relating to licensing, path allocation and charging, relatively little progress had been made in introducing more competition to the railways and virtually no open access operations had emerged by the time the Commission issued its next White Paper on Railways (CEC, 1996). 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.

In 1998 a further 'railway package' of proposals was produced, calling for clearer separation of infrastructure from operations, at least into separate divisions, for a gradual extension of access rights and for transparent and non-discriminatory infrastructure charges. However, what was eventually agreed was much more limited. Separation of infrastructure from operations was still only required in terms of accounting by Directive 2001/12, 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 throughout an extensive defined European rail freight network by 2005 and to all routes by 2008. There is an important separation of powers provided for in the form of an independent regulator, and the separation of path allocation and infrastructure charging from any organisation responsible for running rail services. We return to the Directive on

infrastructure charges below.

More recently, in January 2002 the Commission adopted a communication (known as the second package) on the further development of the European railways: 'towards an integrated European railway area'. In this, they put forward five specific proposals:

- a new directive on the regulation of safety and investigation of accidents and incidents on the community's railways;
- amendments to two previous directives on interoperability ;
- a regulation to establish a new European safety and interoperability agency;
- a recommendation for a council decision authorising the Commission to negotiate the conditions for community accession to the COTIF;
- most fundamentally an amendment to 91/440 so as to open up access to the infrastructure for national services in order to completely open up the rail freight market.

Further measures to open up rail passenger markets to competition are already under discussion, and other proposals would introduce compulsory competitive tendering for all subsidised services.

The issue of open access cannot be separated from pricing policy. To have the right of access, but at whatever price the infrastructure manager chooses, is valueless. It has long been the declared aim of the Commission that pricing policies should be developed which promote economic efficiency. This requires prices which cover marginal social cost. Originally, this was seen mainly in terms of charging for the use of infrastructure according to marginal operation and maintenance costs, but more recently the concern with environmental problems has led to an emphasis on the external costs of transport as well - congestion, accidents and environmental costs.

In 1995 the Commission published a Green Paper entitled 'Towards Fair and Efficient Pricing' (CEC, 1995). The basic argument of this paper was that many elements of cost - congestion, accidents, environmental costs and infrastructure maintenance costs - were either not reflected at all in current prices or were reflected only in part. In total these uncovered costs might be as much as 250b ecu per year for the Union as a whole. The emphasis on external cost in this paper was a radical departure in EC discussion of infrastructure policy, but - whilst the paper proposed many sensible measures, including urban road pricing, a kilometre based tax for heavy goods vehicles and more differentiated rail infrastructure charges - it did not contain clear proposals for implementation.

In 1998 the Commission published its proposals for the introduction of a common transport infrastructure charging framework, which placed a further emphasis on the marginal social cost pricing approach, whilst allowing non discriminatory fixed charges to be levied where this is not adequate for full cost recovery (CEC, 1998). The proposals on railway infrastructure charging emerging from the 1998 railways package were enshrined in Directive 2001/14, on allocation of railway infrastructure capacity and levying of charges (CEC, 2001). In summary, the directive determines that charges must be based on 'costs directly incurred as a result of operating the train service' (CEC, 2001). They may include:

- scarcity, although where a section of track is defined as having a scarcity problem, the infrastructure manager must examine proposals to relieve that scarcity, and undertake them unless they are shown, on the basis of cost benefit analysis, not to be worthwhile.
- environmental costs, but only where these are levied on other modes.
- recovery of the costs of specific investments where these are worthwhile and could not otherwise be funded

- discounts but only where justified by costs; large operators may not use their market power to get discounts
- reservation charges for scarce capacity, which must be paid whether the capacity is used or not.
- compensation for unpaid costs on other modes
- non discriminatory mark ups but these must not exclude segments of traffic which could cover direct cost

In other words, this Directive reflects some quite sophisticated argument. It seems clear from the list of elements that may be included in the charges that ‘the direct cost of operating the service’ is to be interpreted as short run marginal social cost. However, the arguments that this form of pricing may lead infrastructure managers to artificially restrict capacity or to be unable to fund its activities in total or particular investments are all addressed by special provisions. Moreover, there is allowance for second best pricing in the face of distorted prices on other modes. However, the effect of these provisions, all sensible in themselves, is to considerably water down the likely effect of the Directive by giving infrastructure managers various loopholes under which they can argue for the maintenance of previous forms of infrastructure charging. In particular, the degree to which competitive charges for paths involving several countries, based on comparable pricing regimes, will be achieved will inevitably be limited.

In order to consider further the way in which the Directive might be implemented an expert group from the industry was set up. It is understood that this group will be reporting soon, and will thus be in a position to influence the guidance on calculation of marginal social cost which is to be issued along with the forthcoming Framework Directive on Transport Infrastructure Charging.

3. The diversity of approaches within the industry

National governments have, in many cases, sought to pursue their own programmes of railway industry reform over the past two decades. These reforms have generally been in an effort to try to revitalise their national rail system and, in general, have formed part of the wider European policy initiative. Understandably, national programmes of reform have progressed at different rates and have sometimes moved in different directions. Against this setting, the current situation is one in which there is a diversity of approaches in terms of charging, institutional arrangements and competitive structures. In addition, there is a diverse set of stakeholders in the industry, all of whom are inter-linked but often with differing objectives.

We will comment briefly here on the different paths taken by Britain, Sweden and Germany. In Britain the infrastructure is owned and managed by a private sector monopoly, whilst passenger operations are divided into 25 privately owned operating franchises and freight operations are privately owned with open access. An independent regulator issues licenses, and approves track access agreements including charges. Open access for passenger train operators is very limited, both by explicit decisions of the Regulator and by lack of track capacity.

Sweden also has complete separation of infrastructure and operations, but with a publicly owned infrastructure company, Bahnvehrket. There remain publicly owned passenger and freight train operating companies, but all services requiring subsidy are subject to competitive tender and there is open access for freight. The result is an increasing number of private companies sharing the track with the publicly owned companies.

In Germany, infrastructure and the majority of operations are in the public sector. DBAG, a public limited company with share capital, owned wholly by the Federal Government, forms a holding company for five other companies: two responsible for the infrastructure and three incumbent operators - one for long-distance passenger services, another for regional passenger services and a third for freight services. In addition, some regional services are contracted out by the regional governments and there is open access in both passenger and freight operations. Germany has always had a number of small private railways and these are increasingly operating over DBAG tracks.

The three countries have also taken very different approaches to rail infrastructure charges. For the main franchised operators, Britain has adopted a system of two part tariffs, with the variable element of the tariff based on an estimate of short run marginal cost. We will say more in a later section on its calculation. The fixed element was originally set to meet the full financial needs of Railtrack, but Railtrack now receives funding direct from the Strategic Rail Authority (a government body) as well. Open access passenger (where permitted) and freight operators now only pay the variable element, although previously they paid a negotiated charge on the basis of willingness to pay. By contrast Sweden has a simple charge per train kilometre, which is intended to reflect short run marginal social cost; the degree to which it does is examined in a companion paper by Jan Eric Nilsson at this seminar (Nilsson, 2002).

The situation in Germany is the most complicated. Originally Germany had a system of charges per train kilometre differentiated by type of train and location and designed to recover total cost, except for those capital costs borne by government. In other words it is essentially an average cost pricing system. Modifications led to the introduction of a two part tariff, in order to meet complaints from regions about the high marginal costs of high frequency services. However, following complaints that the two part tariff favoured large operators, and especially DBAG itself, it has reverted to a single part tariff with a differentiated charge per kilometre.

Thus it may be seen that there are large differences in charging systems between countries. Partly these are philosophical; Sweden for instance subscribes to marginal cost pricing principles, whilst Germany appears to believe that average cost pricing is the basis of efficient allocation. Britain lies between the two, in that – at least at privatisation – it was believed important for efficiency that Railtrack covered its total costs from charges, whilst offering a variable charge related to marginal cost. But there are other reasons for the differences; for instance, the emphasis on open access in Germany makes non discrimination a key issue, whilst the constraints on open access in Britain mean that two part tariffs are more acceptable.

4. Barriers to implementation

We noted earlier that not only are there difficulties in deriving and developing railway infrastructure charging policy, there are also barriers to implementing policy once it has been agreed. We have seen in section 2 above that the European Commission has been very active in the area of railway policy development, particularly throughout the last decade. However, section 3 illustrates that progress with and approaches to implementing reforms has been rather varied across the different member states. A number of reasons for this can be identified and are typically thought to arise out of particular ‘barriers to implementation’.

Barriers to implementation may come in a number of different forms. Some barriers may relate to the industry in general, irrespective of the member state or region involved, whereas others will be more country-specific, being linked to the institutions, finances or philosophy of that member state or region (see, for example, Quinet, 2001). Whilst industry-related barriers are likely to apply more or less evenly across the different member states, country-

specific barriers may be very relevant for some member states but much less relevant for others. In addition, barriers may be perceived or actual. Perceived barriers may exist where research is not effectively feeding through to the policy-making community. A failure to disseminate state of the art research on issues affecting the implementation of marginal cost pricing may result in policy-makers perceiving there is a barrier to implementation where there is not. It is important to expose these perceived barriers through effective dialogue between the research and policy-making communities. In the end, the important task is to identify the actual barriers and, subsequently, possible means of overcoming them.

The MC-ICAM project is, in part, seeking to identify the key barriers to implementing transport pricing reform. As part of this project, the authors have led the work relating to rail, which has involved reviews of experience with implementing reform in Britain, Sweden and Germany (as well as Hungary), including interviews with some of the key actors in the reform processes; the discussion which follows rests heavily on the British experience, being that with which we are most familiar. From this work, the relevant barriers to marginal social cost pricing in the rail sector appear to be:

1. Problems of measurement
2. Complexity of tariffs
3. Financial implications
4. Equity
5. Technical efficiency
6. Fair competition within the rail sector
7. Fair competition with other modes
8. Acceptability on behalf of train operators and infrastructure managers
9. Acceptability on behalf of end users and the general public.

Problems of measuring the additional costs imposed by a particular train service, given that all other services are operating and are paying for the additional costs which they each impose, have often been cited as a barrier to implementing marginal cost pricing. The costs generated when an additional train uses the infrastructure are comprised of five main elements:

- use-related wear and tear costs;
- congestion costs;
- scarcity costs;
- external accident costs; and
- environmental costs.

In order to implement effective marginal social cost-based pricing, it is, therefore, necessary to be able to derive accurate, disaggregated estimates of these various cost components. Whilst there are difficulties associated with the measurement of each component, problems are especially acute for congestion and scarcity. Other papers for this seminar provide a review of the state of the art on research into the measurement of these costs (Lindberg, 2002) and particular approaches to measurement of scarcity (Nilsson, 2002). Below, we give a brief summary of approaches to overcoming this barrier in Britain.

Tariff complexity arises as a result of marginal social cost varying widely across space and time, as it does in the railways sector. The marginal cost associated with a commuter train, operating during the peak and serving a busy metropolitan area, using the infrastructure is likely to be very different from the marginal cost associated with a rural train service in the middle of the afternoon. The danger is that the tariffs become so complex that they are then difficult to understand and interpret, resulting in the incentive underpinning them being masked. However, despite there being scope for such complexity within rail infrastructure

charges, we view this as probably not being a particularly serious problem, either in terms of infrastructure charges or of tariffs to final users. Infrastructure charges are levied on train operating companies who should have the sophistication and software to handle complex charging structures. For final users the railway industry has employed complex tariff structures already for some time, and can do so because tickets are generally purchased in advance via systems that can handle the complexities involved. There is, however, some evidence that freight operators are having some difficulties with interpreting the new regime of infrastructure charges in Britain, particularly the congestion component of the charges, and there is a long history of complaints that passengers, and even railway staff themselves, do not understand the full complexities of the fares system. So tariff complexity is an issue of some importance.

The financial implications of marginal social cost pricing of railway infrastructure arise as a result of the economies of traffic density which are generally recognised to exist in the rail industry. These economies of traffic density mean that the short run marginal cost of infrastructure use is below average cost and, hence, that marginal cost pricing will result in a financial deficit. Evidence from Sweden and Finland suggests that revenues from charges based on the marginal wear and tear costs recover less than 20% of total maintenance and renewals costs (Johansson and Nilsson, 2001). Whilst the picture is less clear once charges for congestion, scarcity, accidents and the environment are added into the equation, it is likely that pure marginal social cost pricing will still fail substantially to recover total costs. The key question determining whether and to what extent this is a barrier to the implementation of marginal social cost pricing is whether governments are willing and able to provide the necessary subsidies to cover the financial deficits.

One of the factors influencing whether or not governments are willing to provide the necessary subsidies to cover financial deficits in the rail industry is the issue of equity. The argument is that it is unfair to provide subsidies to the rail industry because rail users tend to come from higher income groups. Hence, it is argued that subsidy to the rail industry disproportionately benefits those higher income groups through, for example, lower rail fares than would otherwise be the case and is, in effect, a subsidy to 'the rich'. This is often seen as a major issue, especially where rail users do tend to come from higher income groups (DOE, 1976). This leads to various forms of mark up over marginal cost so as to minimise subsidy levels in many countries.

Concern regarding technical efficiency is a further reason why governments might be unwilling to use subsidy to cover financial deficits in the rail industry. That is, there is a fear that subsidies lead to technical inefficiency by relieving railway managers of hard budget constraints. This is a long-standing argument in economics against subsidy and some evidence for this in the specific context of railways is found by Oum and Yu (Oum and Yu, 1994). The growing requirements for subsidy within the railway industry in many countries during the 1970s and 1980s may also be seen as more general evidence of this.

Fair competition within the rail sector is a further potential barrier to marginal social cost-based pricing of railway infrastructure use, in a situation in which mark ups are needed for financial reasons. Second best policy involves two part tariffs and/or Ramsey pricing, but can this be done in a way that preserves terms of competition between operators?

Fair competition with respect to other modes is also a potential barrier to implementing infrastructure charges based on marginal social cost. We have already seen that the EC Directive permits rail charges to be below marginal social cost if this is the case on competing modes. It is necessary to consider the phasing of reform across all modes of transport where they compete with each other, rather than dealing with any one mode in isolation.

We have already seen that acceptability to local authorities was an issue in the German experience. Acceptability to final users is also an issue, especially where commuter fares are involved, as commuters are regular travellers who seem to be better organised to exert political influence than most groups of rail users.

5. Possible means of overcoming the barriers

The first barrier raised above was that of measurement. As noted above, this has been the subject of considerable research in recent years, both at national and European levels (e.g. Sansom et al, 2001; Johansson and Nilsson, 2001).

In Britain, research into the causation and variability of maintenance and renewal costs was undertaken both by the infrastructure manager (Railtrack) and the regulator as part of the periodic review of Railtrack's access charges. The proposals they arrived at for measuring costs and levying charges were, however, somewhat different from one another. The approach to cost estimation put forward by Railtrack was a bottom up approach based on an understanding of detailed engineering relationships and the summation of individual elements of cost caused by additional trains. Somewhat by way of contrast, the Regulator put forward a top down approach which starts by identifying the total planned maintenance and renewal expenditure on different types of asset, then applies the percentage of these costs which vary according to number of trains run so as to derive a total variable cost for each asset type. It then uses detailed engineering relationships to allocate these total variable costs to particular vehicle types. An advantage of the Railtrack approach is that it produces estimates at a level of fine detail for different types of vehicle and infrastructure category. However, the regulator was not happy that all the elements of the Railtrack model were based on adequate evidence, and he was concerned that the charges produced by the model had no direct link with Railtrack's actual expenditure. The charges finally agreed upon were derived using the Regulator's 'top down' approach, though this incorporated Railtrack's findings on the detailed engineering cost causation relationships. Some examples of the resulting figures are given in Table 1.

Table 1

Typical examples of usage charges (p/vehicle km 1999/2000)

Diesel shunter (class 08)	2.6
Diesel loco (class 47)	63.9
Electric loco (class 90)	59.7
Passenger car (mk 3)	10.4
Diesel multiple unit (class 158)	10.4
Electric multiple unit (class 333)	
Powered car	15.4
Trailer car	11.9
Freight wagon	2.7 - 3.3 *

* p per gross tonne km

Source ORR (2000a, 2000b)

We commented above that one of the most difficult issues to deal with in rail infrastructure charging is that of scarce capacity. Charges need to reflect two different costs; the cost of expected additional delays to other services as a result of running an additional train, and the

costs of not being able to obtain a path at the desired time.

The costs of additional delays may be estimated by means of modelling (Gibson, 2000). For instance, the approach taken by Railtrack in Britain was to use historical data on delays and capacity utilisation to specify a function which could replicate the observed delays. This involved identifying appropriate measures of delay and of capacity utilisation, identifying appropriate functional forms and then testing the strength of the relationship between incremental delay and capacity utilisation. The result was a proposed tariff broken down into several thousand track sections and by time of day. However, the Regulator both simplified the structure and halved the level of charges before incorporating this element of costs into the tariff. It seems that he was concerned at the degree to which levying the full congestion charge might reduce demand (and it must be said that the proposed charge was based on existing, rather than equilibrium, levels of congestion. On the other hand, given the expected underlying growth in demand, it may reasonably be expected that congestion will get worse rather than better.).

In addition to the expected delays there is the issue of inability to obtain the desired slot. The most attractive solution to this problem in theory is to 'auction' scarce slots. There are many practical difficulties however, including the complicated ways in which slots can be put together to produce a variety of types of service, and the possibility of lack of adequate competition to ensure a competitive price. In practice it is therefore usually accepted that any degree of price rationing of scarce slots will have to be on the basis of administered prices rather than bid prices, although some countries, including Britain allow for a degree of 'secondary trading' in which slots change hands between operators at enhanced prices (strictly, this must take place through Railtrack, so it is not secondary trading in the sense forbidden by the EC Directive). The issue of auctioning is considered in more detail by Nilsson (2002).

A second possibility is to simply impose a price and see what happens to demand, and then iterate until demand equals capacity. The risk is, however, that serious distortions may occur whilst the price is adjusting, and that strategic game playing may occur to force the price down by withholding demand, where competition is not strong.

A third approach, recommended by NERA (1998), is to identify sections of infrastructure where capacity is constrained and to charge the long run average incremental cost of expanding capacity. However, this is a very difficult concept to measure (the cost of expanding capacity varies enormously according to the exact proposal considered, and it is not easy to relate this to the number of paths created, since they depend on the precise number and order of trains run). It may be argued, however, that more appropriate incentives are given to infrastructure managers if they are allowed to charge the costs of investment they actually undertake, rather than for the scarcity resulting from a lack of investment. Directive 2001/14 seeks to get round this by requiring infrastructure managers to undertake studies to determine the cost of expanding capacity, and to test whether this is justified on cost-benefit grounds, where scarcity charges are levied.

Given the difficulties with all these approaches, it may be thought that the best way of handling the issue is to permit direct negotiation between operators and the infrastructure manager over the price and allocation of slots, including investment in new or upgraded capacity. However, British experience of this approach is that it is complex and time consuming given the number of parties involved and the scope for free-riding. It is also difficult to ensure that this does not lead to the abuse of monopoly power, particularly when the infrastructure manager and the operator are part of the same company. An independent regulator is certainly needed but their job is far from easy.

An alternative is for the track charging authority to attempt to calculate directly the costs involved. For instance, if a train has to be run at a different time from that desired, it is possible to use studies of the value people place on departure time shifts to estimate the value to its customers of the cost involved. Similarly, the costs of slower speeds may be estimated from passengers' values of time.

We comment above that tariff complexity should not be an overriding problem in the case of rail infrastructure or services. Nevertheless, the Regulator did simplify Railtrack's proposals in Britain, reducing the number of track sections for which different prices were charged, and 'banding' the charges, with all low charges for congestion reduced to zero. This appears to have been a judgment as to the appropriate trade-off between giving clear incentives to operators and accurately reflecting costs, rather than an attempt to quantify the costs and benefits, but such trade-offs have to be made. Nevertheless the degree of complexity of existing tariffs in the rail sector suggests that the result can still be tariffs which vary in time and space and which reflect variations in marginal social cost reasonably accurately.

With regard to financial implications, Britain's approach has been to adopt a two-part tariff charging regime for infrastructure use, designed to cover infrastructure costs and provide a financial return on the assets. Nevertheless, government still provided subsidy to the industry but this was, initially, channelled entirely through the franchised passenger operators and specific grants for freight facilities. More recently, subsidy has also been granted to the infrastructure manager, particularly to assist with investment expenditures. Roy (2002), in his paper to this seminar, indicates that efficient charges on road would more than cover the costs of efficient levels of subsidy to rail infrastructure managers, at least for the sample of countries he has examined. However, there may be other objections to this use of road user charges in terms of equity, particularly where it involves not just cross subsidy between modes but also between regions.

The concern that subsidy may reduce technical efficiency may seem odd, given that all governments do subsidise their railways. The real issue is whether to give the subsidies to the infrastructure manager or the train service provider. Britain started with the latter approach on the basis that it was more efficient if the infrastructure manager was driven solely by the commercial requirements of the train service provider. But in practice, it proved very difficult to achieve agreement for improvements affecting, and being paid for, by a host of different operators. Moreover, increases in access charges approved by the Regulator led to automatic compensation under the terms of franchise agreements. We have now moved to a position where the SRA both contributes to the cost of investment and towards current operating costs, and arguably that gives it more control on efficiency than if it were paying subsidies indirectly.

With regard to fair competition within the industry, Britain's approach for passenger services has been to focus much more on competition for the market, via tendering for train operating franchises, than on competition in the market, via open access operations. This has meant that barriers to entry, as represented by the fixed component of a two-part tariff, have been of less relevance than, for example in Germany where they have sought to promote open access. However, for freight operations in Britain, where there is open access, all operators now pay according to the same tariff, based only on marginal cost. This is possible because of the willingness of the government to subsidise rail freight in order to increase the rail market share and remove some of this traffic from road.

Fair competition between the modes remains a *prima facie* second-best argument for subsidising rail charges below marginal social cost, in particular in urban areas where road is the main competitor mode and which remains substantially under-charged. A recent study found that road users in general are charged less than marginal cost for use of roads in urban

areas and on congested motorways and trunk roads; heavy goods vehicles are also undercharged, leading to a case for subsidising rail freight access (Sansom et al, 2001).

On acceptability, the big issue in Britain has always been commuter fares, and in terms of one of the biggest remaining distortions this is the area to look at. Both the franchise agreement, which for commuter season tickets requires that price is typically increase at 1% per annum less than the retail price index (higher increases are allowed where performance is good, and lower where it is bad) and the decision not to pass on all congestion costs in variable access charges tend to hold commuter fares down. This tends to mean that charges are below marginal social cost and that it is difficult for train operating companies to fund investment to cater for additional peak traffic from revenue; indeed they have an incentive to discourage growth in this area. On the other hand there are good second best reasons for holding these fares down.

Thus, measurement problems should be gradually relieved as estimates of marginal cost improve. Second best reasons for subsidy because of charging regimes on other modes may also be gradually reduced by reform of charging on other modes. It is difficult to see measures that will ease other constraints, particularly financial and equity ones. It is likely that rail infrastructure charges in many countries will continue to need mark ups above marginal social cost for these reasons, and that the argument between two part tariffs and Ramsey pricing (i.e. essentially basing markups on the willingness to pay of the traffic concerned) will continue, despite evidence that a complete reform of transport pricing would leave governments well able to fund rail track charges at marginal social cost.

6. Conclusions

The principal barriers to the introduction of marginal social cost pricing for rail infrastructure are difficulties of measurement (especially for congestion and scarcity), fears that does not give the right incentive for investment, financial constraints and the desire to constitute railways as commercial bodies. The EC Directive on infrastructure charges (2001/14) recognises these issues by permitting non discriminatory markups above marginal cost for financial reasons and to recover the costs of specific investment. It also permits rail infrastructure charges to be below marginal cost for second-best reasons.

No country other than Britain includes congestion costs in its tariffs, and no country includes pure scarcity costs. Scarcity costs remain a priority for further research. However, we believe that measurement problems can be gradually overcome over time, and second best reasons for subsidy will gradually reduce as prices on other modes are reformed. The crucial issues in achieving marginal social cost pricing for rail infrastructure relate to the desire for rail infrastructure managers to cover their total cost, or a greater proportion of costs than implied by marginal cost pricing, from charges, and the consequent need for two part tariffs or for tariffs differentiated according to willingness to pay.

References

Caves D.W., L.R. Christensen, M.W. Tretheway, and R.J. Windle (1987), 'Network effects and the measurement of returns to scale and density for U.S. railroads', in A.F. Daughety, ed., *Analytical Studies in Transport Economics*, Cambridge: Cambridge University Press, pp. 97-120.

Commission of the European Communities (1989) Communication on a Community Railway Policy (COM (89) FINAL)

Commission of the European Communities (1995): Towards Fair and Efficient Pricing in Transport. Brussels.

Commission of the European Communities (1996) White Paper. A Strategy for Revitalising the Community's Railways. COM (96)421 FINAL. Brussels.

Commission of the European Communities (1998) Fair Payment for Infrastructure Use: A Phased Approach to a common transport infrastructure charging framework in the EU, Brussels.

Commission of the European Communities (2001) allocation of railway infrastructure capacity and levying of charges, EU Directive 2001/14, Brussels.

Department of the Environment (1976) Transport Policy: A Consultation Document. HMSO, London.

European Conference of Ministers of Transport (1998) Round Table 107 User Charges for Railway Infrastructure. OECD, Paris

Gibson, S (2000) Charging for the use of railway capacity, Seminar on infrastructure charging on railways, Helsinki.

Harris, R G (1977) Economies of traffic density in the rail freight industry, Bell Journal of Economics, pp556-564.

Johansson P-O and Nilsson, J E (2001) The marginal costs of track maintenance, UNITE marginal cost case study, VTI.

Keeler, T A: (1974) Railroad costs, returns to scale and excess capacity. Review of Economics and Statistics, 56, 201-208.

Kessides, I N and Willig, R D (1995) Restructuring regulation of the rail industry for the public interest. World Bank Working Paper 1506, Washington DC.

Lindberg, G (2002) Recent progress in the measurement of external costs and implications for transport pricing reforms, paper to be presented at the second IMPRINT seminar

Nash, C.A., Matthews, B and Whelan, G.A. Rail Infrastructure Charging in Europe – principles and practice, paper presented at the Ninth World Conference on Transport Research, Seoul, 2001.

Nilsson J E (2002) The institutions of Sweden's railway sector; the Past, the Present and the Future of Pricing for Track Use, paper to be presented at the second IMPRINT seminar.

NERA (1998) An Examination of Rail Infrastructure Charges, NERA, London

Office of the Rail Regulator, (2000) Periodic review of Railtrack's access charges: final conclusions. ORR, London.

Oum T H and Yu C (1994) Economic Efficiency of Railways and Implications for Public Policy: A Comparative Study of the OECD Countries' Railways, Journal of Transport Economics and Policy, vol 28 no 2 May 1994 pp. 121-138

Quinet (2001) European pricing doctrines and the EU reform, paper presented at the first IMPRINT seminar

Roy R (2002) The fiscal impact of marginal cost pricing: the spectre of deficits or an embarrassment of riches? Paper to be presented at the second IMPRINT seminar.

Sansom T, Nash C A, Mackie P J, Shires J, and Watkiss, P (2001) Surface transport costs and charges Great Britain 1998, Institute for Transport Studies, University of Leeds.