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# Pricing European Transport Systems

## Recent Developments and Evidence from Case Studies

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**Abstract**

This paper draws on the results of various projects undertaken by the European Commission regarding transport pricing reform in Europe. It begins with an account of current European policy and practice. It then considers the issue of measurement of marginal social cost, the remaining controversies that surround it, and the barriers to its implementation. Finally it draws on case studies to consider what would be the implications for prices and levels of traffic on the various modes if marginal cost pricing was implemented in practice.

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# Introduction

The European Commission has long taken an interest in transport pricing issues, particularly with regard to pricing of infrastructure and international traffic. But until recently this interest has been largely from the point of view of ensuring fair competition and preventing discrimination by governments to favour their own economies. A major step forward was taken with the publication of the Green Paper *Towards fair and efficient pricing in transport* in 1995 (CEC, 1995), in that the importance of pricing to reflect external cost was recognised, and this was taken further in the White Paper on *Fair payment for infrastructure use* in 1998 (CEC, 1998). The latter put a clear case for marginal cost pricing, while recognising that the movement towards this target would need to be phased over a number of years, and that second-best measures to achieve desired levels of cost recovery would continue to be necessary.

The flurry of activity on the policy front has been accompanied by a substantial Commission funded programme of research on marginal cost pricing, including issues of how to measure marginal social cost, including environmental externalities; how to implement marginal cost pricing; and what would be the consequences for price and traffic levels were it to be implemented. These projects included PETS (Pricing European Transport Systems; Nash *et al*., 2000), a project that both explored the methodology for measuring marginal social cost and undertook a series of case studies to examine the implications of measuring marginal cost pricing in practice. PETS also took responsibility for synthesising the results of a number of projects in the transport pricing field, including a project that measured the internal and external costs of the different modes of transport on a number of trans-European corridors (QUITS), a project that developed a strategic model of a number of cities and regions to examine alternative transport pricing and regulatory decisions (TRENEN II), and two projects that examined the results of a number of actual or modelled case studies of pricing reform or of demonstration projects (EUROTOLL and TRANSPRICE). All these projects subsequently participated in a Concerted Action on Pricing (CAPRI), in which the results of the projects were presented to, and debated with, experts from the Commission and the member states.

This paper draws on the results of all these projects to consider the current position regarding transport pricing reform in Europe. It begins with an account of current European policy and practice. It then considers the issue of measurement of marginal social cost, the remaining controversies that surround it and the barriers to its implementation. Finally

it draws on the case studies in the above projects to consider what would be the implications for prices and levels of traffic on the various modes if marginal cost pricing was implemented in practice.

## Current European policy and practice

The White Paper *Fair payment for infrastructure use* (CEC, 1998) and its predecessor the Green Paper *Towards fair and efficient pricing in transport* (CEC, 1995), emerged from an environment of considerable turbulence in the transport field. A range of needs at Member State and European level were apparent, including the need to manage transport capacity more efficiently, to finance transport infrastructure, and the need to improve the efficiency of the transport sector by means of institutional reform involving deregulation and privatisation.

The framework contained in the Green and White Papers represented the Commission's endeavours to provide a comprehensive pricing principle across modes that would ensure that in times of change there was a underlying scientific basis for the development of pricing in the transport market.

The core features of the White Paper focused on the need to relate charges more closely to the underlying marginal social costs associated with infrastructure use, extending these costs to include external costs, and with the need to depart from prices that are purely based on the direct costs of infrastructure use when cost coverage requirements need to be met. The need to ensure transparency, and facilitate fair competition between modes, within modes, and across user types was emphasised. Furthermore, the contribution of transport services to the enhancement of industrial efficiency and European competitiveness was recognised.

The following mode-specific pricing policy developments have either stemmed from the Green and White Papers or have emerged in parallel with them.

**Road Freight** There have been major problems in the road freight sector, caused by the fact that different countries have very different methods and levels of charging for infrastructure use. All countries combine annual vehicle licence duties with fuel tax, but some countries supplement these with specific tolls on motorways, or with a "vignette",

which is a general supplementary licence for heavy goods vehicles to use the motorways of the country in question.

The result is that vehicles licensed in a country with low annual licence duty plus supplementary tolls may have an unfair competitive advantage when competing with a vehicle licensed in a country with high licence duty and no supplementary tolls. The "Eurovignette" directive, CEC (1996a), was intended to set a limit for the maximum infrastructure access charges payable, on the basis of average infrastructure costs, with non-discrimination between goods vehicle operators of different nationalities, to limit his problem.

**Rail** The process of seeking to facilitate open access, enabling "on the rails" competition, was begun by Directive 91/440 (CEC, 1996b). This sought to separate accounting for infrastructure and operations in order to make the basis for infrastructure charging transparent, while opening access for specific types of international services. A recent directive on rail infrastructure charging (CEC, 2001), requires marginal social cost to be used as the basis of charging, while permitting supplementary charges where necessary for cost-recovery purposes.

**Ports** The Green Paper on seaports and maritime infrastructure, CEC (1997a), has sought to establish principles for port access charging based on the underlying costs of port operations and the need to ensure fair competition between ports — particularly those in adjacent countries.

**Airports** The directive on airport charges, CEC (1997b), seeks a similar system of charging to that for ports, again based upon underlying cost structures and a desire to ensure fair competition between airports.

Both of the latter directives still seem to emphasise total cost recovery rather than marginal social cost pricing, perhaps because the issue of preventing the use of state aids to give unfair competitive advantage has long been a major issue in this sector.

It will be clear from the above that existing practice, and indeed the requirements of existing European legislation, are by no means fully consistent with the principle of marginal cost pricing. Indeed there is a long-term emphasis on full cost recovery in many countries and modes.

The reasons for this vary, but include:

- The growing approach of treating transport as a commercial activity subject to the market mechanism, provided by private or public commercial organisations, as a way of improving efficiency and innovation;
- Financial constraints on governments;
- A widespread view that total cost recovery is fair;
- A view particularly in ports and airports that total cost recovery is necessary to achieve fair terms of international competition, and to prevent countries from over-investing in order to divert traffic from their neighbours;
- A view that marginal social cost pricing would be very complex both to calculate and to implement, and that there are many unresolved issues regarding its measurement.

The result is that increasingly long distance public passenger transport, freight transport by all modes, ports and airports are seen as facilities and services that should be operated on a commercial basis and not be subsidised except in specific cases where this is necessary to secure an adequate service.

Local public transport is subsidised in most European cities and rural areas. However there is little sign that marginal cost pricing principles are used to determine fares. Rather, a combination of political factors including revenue needs and resistance to price increases combines to create prices that are high in some countries and very low in others.

Road transport is more complicated. Generally, vehicle owners pay an annual fixed sum to license the vehicle for use, plus fuel tax when using the vehicle. Clearly this allows a degree of differentiation by type of vehicle, but that differentiation takes the form either of a fixed sum unrelated to use, or of fuel tax, the relation of which to vehicle type is determined by fuel consumption rather than by any variable that is of use to policy makers. Some countries have supplementary tolls on motorways, or require purchase of a vignette to use the motorway system, while a few cities have toll rings to enter the city. All of this adds up to a pricing structure ill-suited to reflecting the variation in marginal social cost by time and place.

There are very few cases, predominantly relating to infrastructure charges in the Nordic countries, where explicit reference to marginal social cost is made in the determination of pricing structures and levels. It therefore appears that currently very little use of marginal social cost

pricing is made in practice in Europe. The following sections consider some of the reasons for this, and the prospects for overcoming them.

## Measurement of marginal social cost

Many non-economists, and some economists, believe that the concept of marginal social cost is simply too difficult to measure in practice, and that the degree of disagreement amongst economists even about principles, let alone actual values, is evidence of this.

Despite a lack of clarity in the Green Paper, the Commission appears to follow essentially a short-run marginal cost approach. This is the first continuing source of debate, as many academics and policy makers prefer a long-run marginal cost approach. Since it is well known that the two are equal when capacity is optimal the debate is only relevant in the case of non-optimal capacity. In this case there is a trade-off. Short-run marginal cost pricing makes optimal use of existing capacity. However, long-run marginal cost pricing is a better reflection of what prices will adjust to as capacity is optimised, and therefore a better guide to decisions such as location or car purchase, which are not quickly and costlessly reversible. There is a surprising lack of research on this trade-off. What does appear clear is that in circumstances in which there are constraints that prevent capacity from adjusting, which may be true in many urban areas, short-run marginal cost pricing is most relevant, whereas in circumstances in which capacity fairly smoothly and rapidly adjusts to demand, long-run marginal cost pricing may be more appropriate. In the PETS project this was taken to justify a general short-run marginal cost pricing approach to infrastructure pricing, on the grounds that time lags and indivisibilities lead to very slow adjustment, but an approach to pricing transport services that took account of changes in the size and nature of the fleet of vehicles.

A second ongoing debate concerns the nature and degree of economies of scale in the transport sector. It is generally accepted that transport infrastructure is subject to economies of scale, so that marginal cost pricing implies subsidies. However, it is sometimes argued that areas where there are particularly high costs of expansion (urban areas), and therefore congestion or scarcity of capacity, balance the areas where marginal cost is below average cost, making a total cost recovery constraint reasonable.

What is often ignored, however, is economies of scale in transport operations. Indeed the evidence of constant returns to scale in terms of firm size in transport operations is often taken to imply that this is not an

issue. What is relevant for pricing, however, is the marginal cost of increases in traffic on a specific route. Whenever extra capacity can be provided by running larger vehicles or longer trains this is likely to be below average cost. Even where this is not the case, however, on scheduled transport services the so-called Mohring effect, whereby increases in patronage lead to more frequent services, benefiting existing passengers, leads to a general case for subsidising scheduled transport services, with the case being stronger the more important schedule delay or waiting time is in the total generalised cost (Jansson and Lindberg, 1998).

A third debate concerns the methodology for valuing environmental externalities. The preferred approach is to measure the damage directly, via a dose response approach combined with an estimate of the compensation required to accept the resulting effects. However, in some areas, such as global warming, the uncertainties involved are enormous. For instance, the ExternE project (quoted in Christensen *et al.*, 1998) produced a range of values of $50 to $160 per tonne of carbon based simply on disagreement about the discount rate to be used. In such cases, some argue for an approach based on the shadow price implied by a politically determined target. This can make a very large difference to the values used (Mauch and Rothengatter, 1994).

The analysis in PETS incorporated the Mohring effect, and took upper and lower values for both global warming and the value of the external costs caused by accidents. It will be seen below that, despite the range of values resulting, fairly clear conclusions can be drawn about the required direction of change in prices in the majority of cases.

## Barriers to marginal social cost pricing

Apart from the problem of measuring marginal social cost, we have already seen that a number of other barriers to the implementation of marginal social cost pricing exist. The key barriers are as follows:

### Commercialisation

There is a strong belief in many European countries as well as in the Commission itself that transport services will be more efficiently provided if their provision is subject to normal commercial decision taking, and indeed in some cases if provision is privatised. This is not necessarily a barrier to marginal social cost pricing; for instance in a competitive

industry with constant returns to scale, it will be sufficient to introduce specific taxes and subsidies to reflect the external costs and benefits of the product.

But we have already seen that the transport sector is subject to extensive economies of scale. Marginal cost pricing would then inevitably require some combination of government control over prices and of subsidies. The most obvious means of implementation of this is by franchising, and such an approach is at work in some European countries both for the provision of public transport services and for road infrastructure. Franchising appears to be effective as a way of reducing production costs, but of course will not satisfy those who argue that the private sector should be left free to take pricing and service decisions on its own initiative.

**Cost recovery**

There is a widespread belief that the demands for public expenditure exceed what can be financed from politically and economically acceptable levels of taxation, and that therefore levels of cost recovery from sectors such as transport must exceed what would be achieved by economically efficient prices. We have already pointed out that it is not necessarily the case that efficient pricing in transport would lead to an overall increase in government spending as there may be many circumstances in which prices are too low rather than too high. However, if it is necessary to aim for higher levels of cost recovery than would be achieved by marginal social cost pricing, then the appropriate second-best pricing policies — combining multi-part tariffs with Ramsey pricing — are familiar and readily applicable in transport.

**Equity**

A more difficult argument to deal with regarding marginal social cost pricing is that of equity. There is a strong conviction amongst many politicians and the public at large that it is fair for the users of each mode to cover its total cost in the charges they pay. To the extent that this principle rests on a belief that people should be charged the costs they impose on society, it would appear that there is a much stronger case for arguing that marginal social cost pricing is fair. Fixed or joint costs would then be financed in the most economically efficient way possible, modified by consideration of the income distribution of those bearing the charges (Feldstein, 1972) if it is accepted that distributional considerations cannot be fully dealt with by the tax and income supplementation system.

The result would certainly be that divergences between price and marginal social cost would on average be greater for modes and services used more by the better off, as well as for those where demand was less price sensitive. But there is no reason to suppose that this would in general result in total cost recovery at the level of the individual mode as a whole even for those modes.

**International competition**

The argument that total cost recovery is necessary for the terms of international competition to be fair is similarly a strange argument at first sight to an economist. The basis for this seems to be a belief that, for instance in ports, there is a tendency to provide excessive capacity to attract traffic to the country concerned, and that this will lead to low marginal costs. Total cost recovery therefore appears to be aimed more as a way of constraining capacity expansion than as a pricing measure in its own right. In this it may be effective, and any benefits from this source would need to be set against the costs in terms of inefficient use of the capacity actually provided.

**Complexity**

It is often argued that marginal cost pricing would be very complex, requiring highly differentiated pricing systems in time and space. These would be expensive to provide and confusing to users. This may well be true of a system that accurately reflected marginal social cost in all circumstances. But of course the basic principle of marginal cost pricing is compatible with much simpler approaches in practice, which incorporate well-known results on the optimal degree of complexity in pricing systems (Turvey, 1971).

None of the above arguments against marginal social cost pricing principles seem to be very convincing, and it is hard therefore to understand why so little progress has been made towards marginal cost pricing in practice in the transport system. Obviously, much of the opposition comes from those who perceive themselves as losing from the change, and this indicates a need to draw up packages of measures that are complementary not purely in an economic sense but also in terms of practical politics — to put it crudely there is a need to redistribute some of the benefits of marginal cost pricing to buy off the opposition.

But there is an argument that has stronger economic justification, and that is the often expressed fear that marginal social cost pricing will have undesirable side effects, for instance, in terms of locational decisions, land use, or general economic development. If marginal social cost pricing was

being universally introduced, then there would be less justification for this fear. But these are areas where externalities and pricing distortions abound, and it is a well known principle of second-best theory that introducing marginal social cost pricing in some sectors and not others cannot be guaranteed to improve welfare, particularly where there are close relationships between the sectors in question. Surprisingly little research under the fourth Framework Programme examines these issues, which are a priority for further research.

## Results of case studies

A number of case studies relating to strategic transport routes in Europe were carried out within the PETS project. These case studies examine practical implications of improved transport pricing, that is, prices for transport use that more effectively reflect the social costs that transport users impose on others, and the implications for modal shares for the year 2010.

The five PETS case studies that were carried out for 2010 were:

| *Case Study* | *Coverage* |
|---|---|
| Cross Channel | Passenger and freight |
| Transalpine | Freight |
| Finnish | Passenger and freight |
| Oslo-Gothenburg | Passenger |
| Lisbon | Passenger |

Table 1 presents the changes in passenger prices implied by the low and high valuations of externalities. It is seen that for all the inter-urban case studies, the price of motoring should be reduced, with the reduction naturally being very much more for the low values than the high values. The reason for this is the relatively high level of taxation on motoring, and the expected reductions in externalities by 2010. In particular, it has been assumed that full implementation of the AUTO-OIL proposals regarding tighter emissions controls has taken place, greatly reducing the level of air pollution, and in all the inter-urban corridors further road building is

**Table 1**
*Changes in Passenger Prices, Unconstrained Marginal Cost Pricing Scenario (ECU/100 passenger km)*

| *Case Study* | *Cost Estimates* | *Car* | *Bus* | *Train* | *Air* |
|---|---|---|---|---|---|
| Cross-Channel | low | −2.14 | — | −3.02 | −2.27 |
| | high | −0.74 | — | −2.85 | −1.16 |
| Finnish | low | −2.24 | −2.96 | −4.06 | — |
| | high | −0.49 | −2.56 | −4.04 | — |
| Oslo–Gothenburg | 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 | — |

Note: 1995 prices, 2010 values.

assumed, leading to modest levels of congestion in 2010. Of course the question should be asked whether the proposed infrastructure investment is justified, and it may be that investment is justified to enhance quality rather than to reduce congestion, but that issue lay outside the scope of the current project.

It is also the case that inter-urban bus, rail, and air all appear to be overpriced according to these case studies. In the case of air, this is because all the countries concerned have some form of taxation on air transport, such as the air passenger duty in the UK. For the other modes, the principle reason is the application of commercial pricing systems in a sector where there are effectively economies of scale, created in the case of rail partly through economies of scale in infrastructure, but also for all modes the combination of economies of large vehicles or trains together with the Mohring effect whereby additional passengers lead to the provision of more frequent services, which confers a benefit on existing passengers. The net effect of these price changes is a general increase in inter-urban traffic on all modes, but particularly for rail and air. Rail operators appear well aware of low marginal costs in relation to average costs, as in the practice of price discrimination most discounted fares lie well below the average cost. The changes are not generally dramatic, however.

Naturally, the urban case study is very different. Even at the low value of externalities, car prices should increase significantly, particularly in the peak. Table 1 indicates an overall reduction in bus fares, although this disguises a dramatic increase in peak fares (due to subsidies in excess of marginal production and external costs) that is more than offset by

off-peak fares that effectively fall to zero (as substantial excess capacity means that service levels would not increase with additional passenger demand). For rail a modest overall reduction is called for, again the net effect of substantial peak period rises and large off-peak reductions.

In the case of freight (Table 2), the results are more diverse. Road freight appears to be undercharged, with the exception of the Transalpine corridors through Switzerland, where the existing high charges mean that at the low valuation of externalities charges are too high. Compare these directions of change for 2010 with the findings in Suter's article in this issue that, on introduction in 2001 the net impact on Transalpine freight of the Heavy Vehicle Fee and raising the weight limit from 28t to 40t will be to reduce charges on international transit movements.

Under-charging for long distance road freight is particularly the case in countries such as Britain, where the costs of heavy goods vehicles are charged for to a large extent via an annual lump sum tax (vehicle excise duty), which does not vary with the distance the vehicle travels.

Rail freight charges are also found to increase in the Cross Channel case study, and in the Transalpine case study when the high valuation of externalities is adopted. In these circumstances, it is found that existing subsidies to rail freight are excessive. In the Finnish case study there is a modest reduction in rail tariffs. In no case is the change in freight tariffs sufficient to cause a dramatic change in mode split, although in the Swiss case study the low valuation of externalities leads to rail losing its existing high market share for transit traffic.

Of course these conclusions must be subject to caveats. No attempt has been made to value all external effects — for instance water pollution has been ignored, and upstream effects of production of inputs for the

**Table 2**
*Changes in Freight Prices, Unconstrained Marginal Cost Pricing Scenario (ECU/100 tonne km)*

| *Case Study* | *Cost Estimates* | *HGV* | *Train* |
|---|---|---|---|
| Cross-Channel | low | +1.26 | +1.50 |
| | high | +2.09 | +1.60 |
| Finnish | low | +1.13 | -0.27 |
| | high | +1.58 | -0.26 |
| Transalpine | low | −4.80 | +0.28 |
| | high | −1.19 | +2.02 |

Note: 1995 prices, 2010 values.

transport sector such as vehicles was outside the scope of the project. Moreover, there is a history of both the number of externalities identified increasing and of increases in the valuation of the known externalities, and there is particular uncertainty about the effects of high altitude emissions from aircraft. However, it is asserted that these omissions would not lead to a major change in the conclusions.

## Related research evidence on pricing innovations

In parallel with the PETS project a range of pricing-related research projects was sponsored by the European Commission. This research included methodological development of estimation techniques, analyses similar to PETS of the difference between existing charges and marginal social costs, demonstrations of new pricing instruments and examination of implemented schemes, and issues of how to develop pricing strategies.

Perhaps the most notable methodological development has been in the estimation of environmental externalities. Bottom-up methods for determination of values for local and regional air pollution have been developed in the ExternE Transport project (Friedrich *et al.*, 1998). These methods are known as the "impact pathway approach" since they follow the chain of events from tailpipe emission, through dispersion to quantification of physical impacts in health and non-health terms. The final step is to convert to monetary values by applying values per unit of impact. In both ExternE Transport and QUITS (QUITS, 1998) projects this tool has been used in estimating costs that show a high degree of variation with factors such as location, time period, and vehicle/engine technology.

Both PETS and a similar project, TRENEN II (Proost and Van Dender, 1999), have made use of these methodological developments in examining differences between current prices and marginal social costs. In the case of TRENEN II the reference year was 2005 and case studies were created for five urban and two inter-urban situations. As with the single urban case study in PETS, the TRENEN II urban case studies highlight a very significant degree of under-charging for car. They also establish the need for much greater peak/off-peak differentials for rail and bus transport, and the overall pattern is for rail prices to fall and bus fares to increase. For the inter-urban case studies in TRENEN II a more varied picture emerges, with passenger and freight road-based modes modestly under-charged, but with rail under- or over-charged depending on the degree of subsidy.

In the field of analysing the travel demand impacts of new pricing instruments EUROTOLL (LETS, 1999) has examined both implemented and demonstration road charging schemes, while CONCERT-P (TTR, 1998) has focused on the latter. The implemented schemes studied in EUROTOLL included time-period variation on toll roads by time of day (A1 into Paris, where tolls in the Sunday afternoon busy period for return to Paris are 20 per cent higher than at other time periods) and by season (A5/A6 holiday routes, for which the tolls on the A6 route were increased by 16 per cent and those on the less congested A5 route reduced by 53 per cent). These schemes demonstrate that more differentiated charging systems can be introduced successfully with existing technologies. The pricing innovations introduced were supported with an intensive information campaign, which was facilitated by only having to convey information about two charges (peak/off-peak). Toll road operators were also required to ensure revenue neutrality, a policy that enhanced the acceptability of introducing differentiated charges.

The demonstrations conducted in EUROTOLL and CONCERT-P provide a different kind of evidence on possible impacts of pricing innovations. Both studies conducted experiments on the responses of a panel of over 100 volunteers to the introduction of urban road-user charges. Several factors urge caution in the interpretation of the results of these demonstrations. These include the volunteer nature of the demonstrations, the form of "charging" used (compensation based on the saving an individual achieved by choosing cheaper forms of travel, relative to the saving achieved by the overall panel of volunteers; compensation paid once the experiments were concluded, rather than on a day-to-day basis) and the introduction of high frequency, bus-based park and ride systems. Although the magnitudes of response should be treated with caution, the order of the groups of alternative travel choices made by the volunteers has strong policy implications. Those individuals who changed their behaviour did so in the following order: first, adapting the way in which they used their car (re-timing to avoid peak period charges, re-routeing, change of destination); second, making use of "quasi-private" forms of transport (in particular, the newly introduced park and ride services); and, lastly, using conventional public transport modes. Marginal social cost-based charging implies more differentiated charges, so that this diversity of responses to new forms of charging urges caution in forecasting and providing for new demand patterns.

In terms of an implementation strategy for more differentiated pricing, many studies highlight the challenge of persuading public and political

opinion of the merits of more differentiation. For example, the TRANSPRICE surveys of public acceptability (Eurotrans, 1998) find that a bare majority of car drivers find urban road pricing acceptable, but only when such a policy is packaged with complementary measures such as enhanced public transport. The TRENEN II study provides an economic welfare perspective that revenue raised should not necessarily be invested in transport sector initiatives. This may be interpreted as highlighting the need to allocate any revenue gains to productive uses that capture the support of the general public. Another insight from TRENEN II is that simple innovations such as the introduction of a cordon pricing scheme can capture most of the benefits of a highly complex scheme such as electronic road pricing, even before the relative costs of a more "sophisticated" system are considered. The TRENEN model, however, is not a network model, and thus cannot deal with the complexities of re-routeing that a cordon pricing scheme may create; other studies (for example, May and Milne, 2000) suggest that this may be a significant problem depending on the geography of the network in question.

The FATIMA study (May *et al.*, 1998) examines transport strategies for a range of European cities, concluding that road pricing performs better than other policies (such as modifying parking charges, increasing financial support for public transport) in only one third of the cities studied. Such comparative analysis reinforces the point that pricing reforms need to be subjected to a cost-benefit analysis alongside other forms of intervention; it cannot be assumed that they will be the most cost-effective approach in every case.

Taken together, these pricing-related projects offer powerful insights into the methodologies underlying pricing policy development, directions of change of prices, possible outcomes, and the development of viable strategies.

## Conclusions

The European Commission has moved in recent years towards firm support for the principle of marginal social cost pricing. Nevertheless, there remains substantial opposition to this principle and indeed some EC measures themselves still appear to support pricing for total cost recovery in certain parts of the transport sector.

We believe this opposition is generally misguided. EC research has shown that the methodology to calculate marginal social cost for all

modes exists, although many of the valuations remain subject to considerable uncertainty. We do not believe the argument that says that the concept of marginal cost pricing cannot be implemented in practice because it is unmeasurable. Nor do financial, equity or practicability considerations justify departing from the basic principles, although they certainly justify modification of them to take into account second-best arguments concerning financing needs, distributional weights and the optimal degree of complexity. The strongest case for opposition probably concerns the risk of unforeseen damaging consequences regarding land use and economic development. Given the importance of externalities and imperfect competition in this area, second-best considerations justify caution in asserting that the introduction of marginal social cost pricing in the transport sector in isolation will necessarily improve welfare; this remains a priority for further research.

We have shown that a purely commercial approach to transport pricing is not appropriate and may push prices in the wrong direction. The reason is the prevalence in the transport sector of economies of scale, including the Mohring effect whereby increases in demand for scheduled public transport services lead to increased service frequency and therefore better services for existing passengers, and because of the importance of externalities. While the former lead to commercial prices being too high, and the latter too low, the relative strength of the two effects differs enormously between modes and locations.

The effects of moving to a more efficient pricing system are likely to be diverse, both because of differing circumstances between countries and because of different starting points. For instance in some countries rail fares are held very low, whereas in others they are close to commercial levels. This makes it difficult to generalise about the effects of efficient pricing from a small number of case studies. However, the simple belief that a move to more efficient pricing would universally benefit the more environmentally friendly modes at the expense of other modes is found to be not true. For instance, the current price of inter-urban motoring in the case studies is seen to be too high relative to 2010 marginal social cost. This gives little support for the introduction of additional charges on inter-urban roads except for specific cases of serious congestion or especially strong environmental effects. On the other hand, the case for urban road pricing in congested cities is reaffirmed. Similarly, regarding public transport, while there is generally a case for lower prices and increased traffic, in some cases existing subsidies are already excessive. Only in the urban case study is a substantial diversion of traffic to public transport justified.

In the case of road freight, the picture is mixed but generally there is under-charging of long distance road freight. This is partly a problem of

the structure of the existing taxation system. Fuel taxes do not increase sufficiently with the weight (and particularly the axle weight) of the vehicle to reflect the marginal social cost of heavy vehicles. An annual charge overcharges low mileage vehicles and under charges vehicles used intensively on long distance work. Even the vignette, as currently utilised, is related to time rather than distance run. Thus there is a clear case for reform of road freight vehicle taxation, to introduce a charge based both on vehicle characteristics and distance travelled.

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