



Implementing Pricing Reform in Transport – Effective Use of Research on Pricing in Europe

FINAL REPORT FOR PUBLICATION

Version: 1.0

15 July 2004

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Funded by the European Commission

IMPRINT-EUROPE

GRD1-CT-2000-28034

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Final Report for Publication

This document should be referenced as: Matthews B and Nash CA (2004), IMPRINT-EUROPE Final Report for Publication, University of Leeds.

Version No: 1.0

Authors: as above

PROJECT INFORMATION

Contract no: GRD1-CT-2000-28034

Implementing Pricing Reform in Transport – Effective Use of Research on Pricing in Europe

Website: www.imprint-eu.org

Commissioned by: European Commission – DG TREN; Fifth Framework Programme

Lead Partner: Institute for Transport Studies, University of Leeds (UK)

Partners: ITS, University of Leeds; FAV, Forschungs- und Anwendungsverbund Verkehrssystemtechnik Berlin; ISIS, Istituto di Studi per l'Integrazione dei Sistemi Rome; TNO, Netherlands Organization for Applied Scientific Research Delft; The Government Institute for Economic Research (VATT), Helsinki; Technical and Economical University of Budapest, Department of Transport Economics (BUTE), Budapest

DOCUMENT CONTROL INFORMATION

Status: Approved

Distribution: IMPRINT-EUROPE Partners, DG TREN

Availability: Public

Filename: K:\Sheila\Fifthframework\Imprint Europe\Deliverables\final report for publication.doc

Coordinator's review: C A Nash

Signed:

Date:

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1. Executive Publishable Summary

The Imprint-Europe thematic network held events which brought together transport policy-makers, practitioners, stakeholders and researchers to discuss research findings and experience relating to transport pricing reform, so as to develop an integrated approach to implementing the European Commission's proposed pricing reforms. On-going liaison with related projects has been an important feature of the network, most notably with CUPID, MC-ICAM and UNITE. Part way through, the project was extended to incorporate greater involvement from the Newly Associated States (NAS), extending the scope of the original objectives accordingly.

Each of the events were attended by representatives from the European Commission and ECMT, national and local governments, stake-holder groups, consultancy and academia. In total nearly 300 different individuals attended Imprint-Europe events. Aided by the papers and by additional presentations, the seminars have served to disseminate information regarding policy and research developments in the transport pricing field and to facilitate knowledge transfer between the policy and research communities. The lively debates at the seminars have led to consensus building and the identification of priorities for action and for research. In addition, a small web-based survey was undertaken towards the end of the project to cross-check a number of the findings emerging from the events.

Imprint-Europe built on the experience of an earlier concerted action on pricing, CAPRI, which achieved consensus on

- the need for greater price differentiation in line with variation in cost;
- the need to consider efficiency, equity and budgetary objectives;
- the necessity to deviate from pure marginal social cost pricing;
- the need for knowledge of both marginal social cost and total cost.

The key areas in which Imprint-Europe reached conclusions are:

Measurement of marginal social cost

Methodologies and data now exist for measuring all elements of marginal social cost, though some uncertainties and disagreements remain. UNITE provides up-to-date evidence, indicating a consensus on the broad direction of pricing reform necessary. It concluded that:

- infrastructure cost is best measured by an allocation process informed by econometric studies – there is a good degree of consensus as to what are the key variables determining costs, though disagreement remains as to the precise nature of the relationships so an element of judgement is involved;
- there is an established approach to measuring congestion costs; though it is not clear whether the highly variable results are related to different modelling techniques or to actual differences in circumstances – there are also concerns about data availability and the lack of studies on modes other than road;
- the extent to which pricing reform can contribute to the efficient allocation of scarce capacity in rail and air remains uncertain due to the complexity of cost measurement and implementation in pricing policies;

- identifying the external component of accident cost remains uncertain because of the limited amount of evidence on risk elasticities; in the meantime it is reasonable to regard this as relatively low as indicated in the UNITE results;
- great progress has been made on measurement and valuation of environmental cost, in particular noise and air pollution, though uncertainties and disagreements, particularly regarding the treatment of global warming, remain;
- most countries have some information suitable for setting more efficient charges, though the disagreements and uncertainties identified above serve as a barrier to estimation of charges according to a common basis;
- a likely way forward is to seek consensus on a lower limit of costs that should be reflected in price, raising this as evidence becomes stronger and more accepted.

Impacts, acceptability and phasing of pricing reform

We heard results from many studies of impacts and acceptability issues, whilst MC-ICAM was a key project on the phasing of pricing reform. Key conclusions were:

- the biggest responses to pricing reform tend to involve re-organisation of travel whilst continuing to use the same mode (e.g., changing time of travel or route, consolidating journeys etc, rather than switching mode), although there is also good evidence of some transfer between modes;
- distributional impacts will vary both with the design of schemes and the use of revenues, and should be borne in mind when these are determined;
- land-use impacts vary with the detailed design of schemes; with appropriate design and use of revenue the limited evidence is that these can be positive;
- broader economic impacts are also uncertain; there is some evidence that they might be negative but small, but could be offset by appropriate use of revenue;
- acceptability tends to be higher where problems are particularly acute and demonstrable, where there is an identified package of complementary measures and where revenue use is transparent and/or earmarked - there is also evidence that acceptability is higher where initial price changes are simple and modest and that acceptability of more sophisticated charging may grow over time;
- revenue use is key and arrangements that are transparent and acceptable but which do not constrain the use of revenue in an efficient way are needed;
- making simple and modest reforms first, progressing towards more sophisticated charging systems, can address concerns about reform;
- each new phase of reform should generally move prices in the right direction in terms of the ultimate goal, even if short term considerations might dictate otherwise;
- Drawing on experience and research, ten steps to implementation have been identified to serve as a guideline for policy-makers.

Key Issues for Newly Associated States

An additional seminar in Budapest heard specifically about the experience and circumstances of newly associated states, whilst representatives of newly associated states participated in all the other seminars. Key conclusions in this area are:

- there is a strong link with financing: financing needs are more acute, and other sources of finance more limited, so pricing is seen very much as a way of financing investment;

- congestion is not nearly so much of a problem so it is more difficult to demonstrate to the public that there is a problem worth addressing via pricing;
- issues concern transit traffic and peripherality; there is a risk that NAS countries incur substantial costs to improve infrastructure for transit traffic but cannot recover this in price because of low congestion;
- there are significant data problems so the need for generalisable approaches that can transfer results from other locations is important
- it is important to share experiences of the existing member states with newly associated states and, where possible, identify good practice, whilst recognising the shortcomings of existing pricing policies in many member states
- note that all the above issues are also relevant to at least some existing member states

Priorities for action

A start has been made in some sectors: for instance the Rail Directive contained a sensible pragmatic approach to marginal social cost based pricing, and the proposed revised Eurovignette Directive was a step in the right direction, although still containing many constraints which would prevent fair and efficient pricing of road freight vehicles.

However much disappointment was expressed that the proposed framework directive and common methodology paper for all modes seems to have been abandoned. Most members of the Imprint-Europe network felt that such a directive would be an important step forward as it would provide a clear objective towards which pricing reform should be concentrated on all modes, and encourage transparency in the setting of prices. In its absence, in the light of seminar discussions, a number of priorities for action emerged:

- to continue working on improved pricing systems, without making ‘perfection the enemy of the good’;
- reform is most needed in congested urban areas – to reduce congestion, environmental degradation and generate finance and local authorities should be supported in this process;
- reform is also needed on trans-European road and rail corridors – to harmonise terms of competition, reduce congestion, environmental degradation and accidents and generate finance. A simple kilometre charge according to vehicle type, along the lines of the revised Eurovignette but with the link between average charge and average costs removed as soon as possible, is a good way forward. This could then gradually be refined in terms of both level and variation with time and space;
- reform in aviation is also important to harmonise terms of competition, to reduce environmental degradation and congestion, and to tackle the allocation of scarce slots. Moves to introduce slot trading, and to charge environmental costs either through a tax on aviation spirit or fueling that on navigation charges were needed;
- much less is known about water transport but it appears that reform in ports is needed to harmonise terms of competition and to address environmental degradation.

Priorities for future research

Despite the large amount of research on pricing that has now taken place, some priorities for further research were still identified, as follows:

- some particular areas of cost measurement need further research – particular aspects of infrastructure costs across all modes, congestion and scarcity in rail and air, accident risk elasticities, environmental costs for air and water, the role of congestion is leading to costs of greater unreliability on all modes of transport;
- generalisation – how to estimate costs for particular circumstances from available evidence – remains a major issue (especially a problem for congestion and local environmental impacts);
- further evidence is needed on particular types of impacts – land-use, regional economic, distributional – although the evidence that exists is that these do not pose serious drawbacks to suggested pricing reforms, and can be mitigated by other elements of the package;
- complexity and simplicity are important research issues – to what extent should we seek ultimately to portray the full complexity of variations in marginal social costs in prices?
- processes and institutions also need research - what bodies should set or regulate prices and be responsible for allocating the revenue? How do prices feed through to and impact upon end-users? Institutional issues are particularly complex in the aviation and maritime sectors;
- there remains a major need to synthesise and disseminate the results of research and to identify ways of translating them into action. As pricing reforms move closer to implementation, so fully engaging representatives of government and industry in this process becomes more and more important.

2. Objectives of the project

The overall aim of the IMPRINT-EUROPE thematic network has been to facilitate a two way process to enable research results to be fed into pricing policy implementation and to enable policy questions to be used to inform research. In this way it was intended to improve both the quality of policy making and research and to promote consensus by improving understanding of alternative points of view.

The specific objectives of the IMPRINT-EUROPE thematic network have been:

- 1) To facilitate the exchange of experience and transfer of knowledge among scientists and practitioners in the field of pricing;
- 2) To draw together the results of previous and ongoing research in the field of pricing and to make them accessible to policy-makers, practitioners, industry and other professionals in a series of seminars and deliverables designed to assist them in developing and responding to pricing policy reform;
- 3) To identify, through critical comparative work, the prerequisites for the development of an integrated approach to implementing the European Commission's proposed pricing reforms.

Furthermore, IMPRINT-EUROPE has sought to answer the policy development needs of decision-makers by building upon the international state-of-the-art in pricing policy research, with comprehensive coverage of key implementation issues and of modes. At the core of the approach were two key dimensions that structured the project:

- a strong consortium with excellent links to the policy-making, operator and research communities; and
- the network seminars on key implementation issues which have provided the opportunity for experts, network members and other researchers to play a full role in the network.

The network was particularly original in respect of its:

- two way interaction between research and practical issues;
- emphasis on implementation, institutional, phasing and packaging issues;
- comprehensive geographical coverage at a European level; and
- strong multi-modal approach

Furthermore, the project was, subsequent to its launch, extended to incorporate greater involvement from the Newly Associated States (NAS), extending the scope of the original objectives accordingly.

A thematic network represents a major institutional mechanism for ensuring the continuous exchange of ideas within the research community and between the research community and the users of research. For IMPRINT-EUROPE, the target users for all of the main outputs are decision-makers at local, regional, national and European levels with an interest in pricing policy for one or more modes. This incorporates the participants in the network's activities - network members and experts - as well as other interested policy-makers, operators and researchers who constitute a 'virtual network'.

More fair and efficient transport prices will contribute significantly to creating a more sustainable, more environmentally friendly and more efficient transport system for Europe. However, for research results to be of relevance to policymakers around Europe, there is a need for a greater number of applications of the state-of-the-art methods for all modes in different contexts. This need is particularly strong for non-roads modes, and in addition to covering road-based modes, the IMPRINT-EUROPE thematic network has provided coverage of rail and public transport, air, short-sea shipping and inland waterways.

IMPRINT-EUROPE has served as a link between research and policy development and implementation, with the aim to assist the implementation of pricing reform in transport based on marginal cost principles. It has done this both by drawing on the findings of recent and new research under the 5th framework and by learning from the experience of the small number of countries which have implemented pricing reforms based on marginal cost pricing. Through active dissemination the IMPRINT-EUROPE network has striven to ensure that the results of research and policy debates come to be known and used by the wider transport policy-making, operating and research communities across Europe. The project has facilitated discussion of the pricing elements of the new Common Transport Policy amongst some of the key actors in the policy and research fields throughout the EU. In this sense it is contributing to the debate on how to take forward the pricing proposals contained within the new policy. More specifically, it has highlighted key areas of agreement and difference on existing policy and has proposed a number of key issues for further consideration. It is envisaged that this has and will influence developments in transport pricing policy in both the short and longer term.

Furthermore, through the consortium and the network members and experts, IMPRINT-EUROPE brought together the key issues and state-of-the-art in the field of implementation of pricing reform in transport. The ability to understand, relay and develop these issues in a large trans-European research project will further strengthen the prospects for promoting European research in a highly competitive international research environment.

3. Scientific and technical description of the results

3.1 Introduction

The Imprint-Europe thematic network held seven events over three years which brought together nearly 300 transport policy-makers, practitioners, stakeholders and researchers to discuss research findings and experience relating to transport pricing reform, so as to develop an integrated approach to implementing the European Commission's proposed pricing reforms. It has encompassed both urban and inter-urban transport and all of the main passenger and freight modes. This section of the report draws together the findings from each of the IMPRINT-EUROPE events and summarises the conclusions reached.

The current European Commission initiative on transport pricing has been active for almost a decade. In 1995 they published the ground-breaking Green Paper, *Towards Fair and Efficient Transport Pricing* (CEC, 1995), in which the importance of pricing to reflect external costs was recognised. Three years later they followed this up with the *White Paper on Fair Payment for Infrastructure Use* (CEC, 1998), which put forward a clear case for marginal cost pricing, whilst 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. These Green and White papers 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, to improve the efficiency of the transport sector by means of institutional reform, and to remove the distortions caused by different pricing principles in different member states. The framework contained in the papers represented the Commission's endeavours to provide a comprehensive pricing principle across modes and countries that would ensure that in times of change there was an underlying scientific basis for the development of pricing in the transport market.

The Commission's commitment to more efficient pricing of transport in order to internalise externalities was re-affirmed in their over-arching review of transport policy, the *Common Transport Policy White Paper* (CEC, 2001). In this paper, a framework directive on pricing, which would set out the principles to be followed in all modes of transport, was proposed. Also, an important link was drawn between pricing and financing, such that funds raised from some sectors of the industry were permitted to be used for worthwhile projects in other sectors where the result is to reduce social costs.

In support of this policy, the European Commission has sponsored a considerable amount of research into transport pricing, feeding directly into the development of policy and enriching the academic debate throughout Europe. The Commission's Fourth Framework research programme, which ran from 1996 until 2000, included:

- Projects examining the impacts of more efficient pricing such as PETS (PETS, 2000), TRENEN (Proost and Vandender, 1998) and AFFORD (AFFORD, 2000);

- Projects examining acceptability issues, such as PATS (PATS, 2000), PRIMA (Harsman and Wijkmark, 2000) and TRANSPRICE (TRANSPRICE, 1999); and
- Projects examining issues of cost measurement, such as EXTERNE (Friedrich et al, 1998) and QUITTS (QUITTS, 1998).

As part of the fourth Framework programme, the Concerted Action on Pricing Research Integration (CAPRI) project was commissioned to facilitate the exchange of information and results from research projects dealing with the pricing of transport (Nash et al, 2001). As part of CAPRI, the Commission invited all member states to nominate two experts to serve on a committee of experts, which considered and debated syntheses of research findings. Experts from some other countries (Norway, Switzerland) and organisations (ECMT, UIC) were also invited to specific meetings.

The Commission's Fifth Framework research programme, which commenced in 2000, also included a range of transport pricing projects. These comprise:

- PROGRESS - a demonstration project on urban transport pricing;
- CUPID - a thematic network on urban transport pricing, designed to assist and link with the demonstration sites which make up PROGRESS;
- DESIRE - a project examining the design of inter-urban transport pricing schemes for heavy goods vehicles;
- MC-ICAM - a wide-ranging project examining barriers to the implementation of more fair and efficient transport pricing and how implementation should be phased;
- RECORD-IT – a project to improve the competitiveness of intermodal freight transport in Europe through the reduction of cost and price barriers which currently hinder its development, while respecting the principle of sustainable mobility.; and
- UNITE - a project to develop methodologies for measuring marginal costs of transport, and to link estimates of marginal cost with the assessment of total costs as set out in transport accounts.

IMPRINT-EUROPE may be viewed as having fulfilled a similar role in relation to the fifth Framework to that which CAPRI had for the fourth Framework. That is to facilitate exchange of information, dissemination of research findings and to promote inter-action between policy-making, stake-holder and research communities. In addition, the IMPRINT-EUROPE thematic network had a distinct focus on implementation, seeking to develop recommendations relating to the implementation process. Therefore, it has had strong links with all of the above-mentioned projects, perhaps the strongest of these links, though, were with MC-ICAM – which had the same focus as IMPRINT-EUROPE but which was a research project – and CUPID – which was another thematic network but which had an urban transport focus.

Despite this flurry of activity on policy development and research at the level of the Commission, progress on implementation of the policy appeared, at the outset of the IMPRINT-EUROPE project in 2001, to be moving forward relatively slowly. At that time the Eurovignette directive on charges for heavy goods vehicles (CEC, 1999) and the rail directive on infrastructure charges and allocation of capacity (CEC, 2001) were in place but there were potential difficulties with both. The Eurovignette is limited in that it only applies to motorways, it is only related to the

cost of providing those roads (and thus excludes external costs), it is based on time, rather than on the distance travelled and it is only applied in Germany, Belgium, the Netherlands and Luxemburg. The rail directive was more comprehensive in that it required charging on all member state railways and permitted charges to include a wider range of private and external costs, but its flexible approach allowed for variations in the way in which it was to be implemented in different countries, and the effects of the directive were unknown at that time.

There were also implementation difficulties associated with air, maritime and urban sectors. Whilst a proposal for a directive on airport charges, whereby charges would be based on the principles of cost-relatedness, transparency and non-discrimination, was presented by the Commission in 1997, this was subsequently withdrawn in 2001 after being blocked by the Council of Ministers. There had been no firm proposals put forward with regard to maritime transport. Regarding urban transport, which whilst being outside of the direct remit of the European Commission is still of great interest when it comes to transport pricing, there had been several proposals to introduce some form of urban road pricing in different cities throughout the EU but none had, at that time, been implemented.

The result was, and is, that research has focussed increasingly on implementation issues and understanding the barriers to progress and how they may be overcome. The MC-ICAM, CUPID and PROGRESS projects had implementation as their specific focus and it is also in this area that the IMPRINT-EUROPE thematic network has aimed to make a particular contribution.

As well as there being a recognition of the problems experienced in implementing transport pricing reform amongst the EU15, there was a growing awareness that enlargement to an EU of 25 member states could bring with it particular implementation issues, some of which may be specific to the Newly Associated States (NAS). The different states of development of transport infrastructure and of the debate on pricing in the NAS as compared with the EU15 member states, as well as the lower incomes per head in the NAS, all suggested that a common way forward on transport pricing reform throughout an enlarged Europe would need to take into account the special conditions within the new member states.

Hence, there was a significant need to provide mechanisms for networking and dissemination opportunities where policy-makers, industry stakeholders and researchers could come together and discuss recent policy developments and research findings, identify best practice and formulate a consensus approach to implementing pricing reform. There was also a significant need to identify areas where there continued to be disagreement, and to pinpoint the nature of and reasons for that disagreement so as to work towards its resolution.

During the project there has been a wealth of policy developments unfolding and research findings emerging, and all have been debated via the IMPRINT-EUROPE network. At the overarching level, the European Common Transport Policy White Paper set out an agenda for pricing reform across the different modes of transport, including a proposal for a framework directive as well as a number of proposals specific to the different modes. Furthermore, at their 2003 ECMT council, European transport ministers approved a report on reforming transport taxes which asserted that “there are no arguments of principle that give reason to delay reform [and] therefore a focus on implementation and carrying public opinion is now indicated” (ECMT, 2003).

In July 2002 the European Commission issued a proposal on the taxation of diesel fuel used for commercial purposes. The proposal, Directive proposal COM/2002/0410, sought to achieve a phased harmonization of the excise duties included in the price of diesel fuel in the Member States by the year 2010. However, the European Parliament rejected the proposal late in 2003.

In mid 2003 a proposed directive amending Directive 1999/62 on charges for heavy goods vehicles was published (CEC, 2003) and an amended version of that proposed directive was approved by the European parliament in spring 2004.

The directive on rail infrastructure charging – Directive 2001/14 - has been implemented throughout the EU and has been incorporated into member state law since spring 2003.

In autumn 2003 Directive 2003/96 on Restructuring the Community framework for the taxation of energy products and electricity was adopted, and allows Member States to tax kerosene on domestic flights and, on the basis of bilateral agreements, intra-EU flights. Adoption of this directive represents a significant step forward in the Commission's long-running efforts to develop a Community Framework on Energy Taxation, a proposed directive on which was first introduced in 1997.

There have also been some interesting developments amongst the member states of which the introduction of road pricing in Central London, and the plans for heavy goods vehicles charging in Britain and Germany, following the example of Austria and Switzerland, are the most significant.

Contact has been established with most of the EU national government transport ministries, all of the main European level transport stake-holder groups, several local authorities, all of the coordinators of current EC transport pricing research projects and a variety of other government departments and research institutes. One area of disappointment has been the extent to which it has been possible to involve industry representatives; whilst a number have attended the seminars, and a number have expressed interest in IMPRINT-EUROPE but not actually attended, we would have liked to secure a greater involvement from this important group. The 7 Imprint-Europe events – 5 seminars, one workshop and the final conference – have represented the principal points of contact with users and provided the opportunity for the presentation and debate of the key pricing policy implementation issues amongst the main actors/stake-holders. Each of the seminars have involved approximately 60 participants, whilst the workshop involved approximately 40 participants and the final conference approximately 80 participants. Each of the events have included the presentation of papers and significant opportunities for discussion and debate. A network of contacts - to be made available to the policy-making, operating and research communities to enable people in similar situations to continue their dialogue during and beyond the life of the network has been developed.

3.2 Background

A number of 4th framework projects, including in particular PETS, TRENEN, AFFORD and subsequently the concerted action CAPRI, sought to clarify the implications of the approach advocated by the Commission to transport pricing. Essentially this approach is that known to

economists as short run marginal cost pricing, whereby prices are set to reflect the additional costs to society associated with an additional km travelled or an additional trip made, given that the capacity of the transport network is held constant.

When car users, rail operators or the operators of other vehicles decide to travel additional kilometres or to make additional trips they impose additional costs on themselves, on the infrastructure-provider, on other users and on the rest of society. Costs to other users and to the rest of society are referred to as ‘external’ costs. External costs or benefits arise when the social or economic activities of one agent have an impact on the welfare of another agent, without that impact having been taken into account by the first agent. If monetary values can be placed upon externalities then they can be incorporated into the pricing mechanism by means of direct charges or subsidies; in this way they will then be taken into account by all economic agents.

Prices which reflect the additional infrastructure and external costs will act as signals to travellers about the ‘social’ costs associated with their additional travel. They will then base their demand decisions – whether, how and how far to travel - upon these price signals.

What the principle of short run marginal cost pricing translates into, in terms of infrastructure charging, is a need to measure three components of cost for the addition of extra traffic to the existing infrastructure. The first is the cost imposed by additional use on the infrastructure provider. This comprises additional maintenance and renewals costs plus any 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. The third element is the cost imposed outside the transport system and that is mainly environmental cost, but 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.

The same sort of approach may be taken to scheduled transport services. In the case of private transport, if the infrastructure prices are right, essentially, the problem of efficient use of the system is solved. But with scheduled public transport services and with freight transport services that is not so. Or at least it is not so unless there is a fully competitive environment so that it can be left up to the market to determine what is produced. In practice, we rarely have that and there are various cost characteristics, of scheduled transport in particular, which make that difficult and unlikely. For instance when traffic is added to public transport systems, either this raises load factors or leads to operation of larger vehicles or longer trains, in which case the marginal cost to the operators is very low, or services are increased, in which 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 again a 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. (Mohring, 1972). This means that there is very often an a priori case for subsidising scheduled transport services in order to implement pricing policies which do not cover full cost. In the absence of 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 given less attention to 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.

There are a number of critiques of the approach adopted by the Commission. Several of these critiques were debated during the CAPRI meetings and have continued to be discussed through some of the IMPRINT-EUROPE seminars. The criticisms tend to be directed at the simple, text book interpretation of short run marginal social cost pricing, and argue that, in reality, there are a number of reasons why this relatively straight forward principle may not be optimal in practice. These may be summarised as follows (Rothengatter, 2003):

- (a) measurement is complex
- (b) equity is ignored
- (c) dynamic effects, including investment decisions and technology choice, are ignored
- (d) financing issues are ignored
- (e) institutional issues are ignored
- (f) price distortions elsewhere in the economy are ignored
- (g) implementing marginal social cost pricing may involve substantial administrative costs which may not always be justified by the benefits it brings.

All of these criticisms are well established and can hardly be denied. Proponents of marginal social cost pricing, however, argue that the appropriate response to the criticisms is to adjust prices, where necessary, so that they are based on marginal social cost but take account of the issues raised by the criticisms. This is the subject of second best pricing, on which a wide literature exists (Verhoef, 2001), and whilst the resulting pricing rules may be very complex, it is likely to be better to make the best possible estimate of the necessary data than to ignore the issue.

Others assert that there is no need for a uniform pricing system and that a real-world pricing system cannot be based on an abstract economic orthodoxy, arguing that the appropriate response to the criticisms is to adopt an alternative pricing principle.

However, consensus in a number of important areas was achieved by the CAPRI project. Firstly, it was agreed that, as part of addressing the above-mentioned criticisms, there is a need to consider other objectives in addition to that of efficiency, most notably equity and budgetary objectives. Secondly, it was agreed that considerations such as budget constraints, equity, institutional issues, simplicity and price distortions elsewhere in the economy lead to a need to depart from pure marginal social cost pricing, though they do not change the position that the measurement of marginal social cost is the correct starting point in the development any efficient pricing policy. For this reason, recent projects for the Commission which have sought to address these issues have tended to use the phrase 'marginal social cost based pricing' rather than 'marginal social cost pricing' to summarise the philosophy they adopt (Verhoef, 2001). Thirdly, it was agreed that there is a need for knowledge of both marginal social cost and total cost, so that the impacts of introducing prices based on marginal social cost on the level and recovery of total costs can be evaluated. Fourthly, it was agreed that there is a need for greater price differentiation in line with variation in cost, location and time of travel being the two main factors. Independent of the pricing principle one favours, there is widespread agreement that the

lack of such differentiation is the most striking inefficiency in most transport markets. However, changes to existing mechanisms should only occur when the benefits from more variable pricing exceed the costs of implementing more complex systems.

Early on in the IMPRINT-EUROPE project it became clear that considerable divergence of views on pricing doctrines, used to form the basis of policy-making, and of practices exists in different countries throughout Europe, reflecting in part different existing circumstances and objectives, e.g. between congested core members and peripheral regions, environmentally sensitive areas and others. Quinet (2001) identifies 3 distinct doctrines being expressed by political authorities in different countries, one broadly in line with marginal social cost (though tending to favour long run rather than short run marginal social cost), and two based on average cost pricing (one stemming from concerns about the overall government budget and the other stemming from particular concerns about the transport budget). Furthermore, existing transport pricing practices also vary between countries and, to an even greater extent, between the different modes, so we can not think of a simple movement, where all prices in all countries move in the same direction; the implementation path will be very different from place to place and from mode to mode. Understanding the nature of these different pricing doctrines and practices, the ways in which they differ and how they might be reconciled, would lift a significant barrier to the implementation of a consistent, comparable transport pricing policy across the EU.

That said, it is also clear that EU-wide political consensus on the need for transport pricing reform is growing. The forum of ECMT has done much to facilitate consensus-building. Two ECMT resolutions on the subject have been adopted in recent years by transport ministers: Resolution 1998/1 on the Policy Approach to Internalising the External Costs of Transport (ECMT, 1998); and Resolution 2000/3 on Charges and Taxes in Transport and Particularly International Road Haulage (ECMT, 2000). These resolutions promote a gradual, stepwise reform of charges and taxes to improve the efficiency of transport, avoid discrimination and distortion of competition and provide incentives to reduce the environmental impacts of transport and manage congestion. At the 2000 ECMT Council meeting transport Ministers agreed “to aim at gradually shifting the structure of taxation in transport to increase the share of more territorially based taxes and charges (e.g. tolls and km-charges) as this contributes at the same time to: ensuring non-discrimination; improving efficiency (and Ministers noted that marginal social costs are the most efficient basis for formulating charges); avoiding problems of competitiveness between national haulage industries; and promoting sustainability”. Most recently at the 2003 ECMT Council, transport Ministers approved a report on Reforming Transport Taxes that concludes (ECMT, 2003):

- i) The potential benefits of the reforms set out in the resolutions are large;
- ii) There are no arguments of principle that give reason to delay reform;
- iii) Focus is now on implementation and carrying public opinion.

So whilst the Commission’s approach is based on a relatively simple prescription from transport economics, in reality complexities inevitably crowd in. This does not mean, however, that a

totally different theoretical approach to pricing policy needs to be adopted, or that full cost recovery as a principle is a good starting point. For implementation, the questions then turn to what to do in the face of these complexities and what further practical points can be agreed even amongst those who disagree about the principles?

3.3 Measuring marginal social cost

That measurement of short run marginal social cost is complex is undeniable. A recent review (Lindberg, 2002) concludes that even those elements of cost that have been long studied, such as infrastructure maintenance and renewals and congestion cost, are not without considerable uncertainty as to the true marginal social cost. Scarcity costs, which arise on those modes where use of the infrastructure is scheduled and the presence of operators filling all the slots make it impossible for anyone else to get access to the infrastructure at the time in question, are little researched. Whilst enormous progress has been made on the measurement and valuation of environmental costs and external accident costs these too are of course still subject to big uncertainties.

However, much progress on cost estimation has been made over recent years, thanks in large part to EU research projects such as EXTERNE, QUITTS, RECORD-IT and UNITE, and the inability to measure marginal social cost cannot now be held to be a major barrier to implementation. Although inevitably problems and disagreements remain, there is generally enough information available to permit the setting of prices that are more closely linked to marginal social cost than they are at present, and which provide for a more efficient use of the transport system, even if such prices do not represent the optimum. It has been said on several occasions during the IMPRINT-EUROPE seminars that ‘we should not let the best be the enemy of the good’.

The UNITE project generally represents the state of the art on this issue. The UNITE project was designed to support policy-makers in the development of pricing and taxation policies for transport infrastructure use, and included three elements: development of transport accounts, case studies of marginal costs and integration of the two sources of information. The marginal costs part of UNITE involved:

- The identification of the best practice marginal cost estimation methodology for all relevant transport modes and cost categories and
- Implementation of these methodologies by means of case studies including provision of new empirical evidence, and building on existing empirical evidence.
- Examination of the possibilities of generalisation and transferability of methodology and results to other contexts, and elaboration of guidelines for the generalisation of the marginal costs estimates.

Five types of infrastructure related cost were considered:

use-related wear and tear costs;
congestion costs;
scarcity costs;

external accident costs; and
 environmental costs.

Based on the results of UNITE, we concluded that infrastructure wear and tear cost is best measured by an allocation process informed by econometric studies. In many countries infrastructure management reforms have resulted in data being recorded at a more disaggregated level, making it more amenable to the application of econometric techniques. For road and rail, Lindberg (2002) reported that The cost structures follow a parallel pattern, with “low standard networks” being characterised by higher marginal wear and tear costs and “high standard networks” by lower marginal wear and tear costs; moreover marginal costs are generally below average cost. A number of national studies exist on rail track costs, suggesting that the similarities between countries are considerable but not systematic. Few published studies are available on airfield wear-and-tear though and we cannot judge on the magnitude and structure of this cost component. For inland waterways and maritime transport the infrastructure maintenance cost is in general small. Hence, there is a good degree of consensus as to what are the key variables determining costs, though disagreement remains as to the precise nature of the relationships so an element of judgement is involved.

There is an established approach to measuring congestion costs, though it is not clear whether the highly variable results are related to different modelling techniques or to actual differences in circumstances. That is, the approach involves being able to model traveller behaviour so as to capture the range of responses made in the face of congested conditions, and there is a concern that variability in the results relating to different places might be linked to the type of model used – its degree of aggregation, its definition of the network etc – rather than linked to actual differences between congestion in those different places. Another source of variability may arise out of simple differences in the ways in which the city centre is defined from one place to another or from one study to another. There are also concerns about data availability and the lack of studies on modes other than road.

The extent to which pricing reform can contribute to the efficient allocation of scarce capacity in rail and air remains uncertain because of the complexity of cost measurement and implementation in pricing policies. The most attractive solution to this problem of scarcity is, in theory, to 'auction' scarce slots, but many practical difficulties exist. Scarcity costs might be calculated directly. For instance, if a train or plane 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 customers of the cost involved. Another 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. Some countries, including Britain allow for a degree of ‘secondary trading’ in which slots change hands between operators at enhanced prices, but there are fears that this may pose competition problems. Given the difficulties with all these approaches, it may be 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, 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.

Identifying the external component of accident cost remains uncertain because of the limited amount of evidence on risk elasticities. Traditionally has been thought that extra traffic will make it less safe for those already on the roads, but it is not clear that this is always the case. There has been evidence that in some cases extra traffic which adds to congestion actually makes roads safer, so there is still work to do. In the meantime it is reasonable to regard this as relatively low, as was found in the case studies in the UNITE project.

Great progress has been made on measurement and valuation of environmental cost, in particular noise and air pollution, though uncertainties and disagreements remain, particularly regarding the valuation of global warming. A common methodological framework – the impact pathway approach – has been applied in almost ten different countries to derive estimates for all modes of transport. There are a large number of input functions used in the approach and concerns have been expressed about the transferability of some of these functions from one set of conditions to another. Hence, further development of local knowledge, in particular relating to how functions apply in different conditions, is necessary.

Most countries have some information suitable for setting more efficient charges, though the disagreements and uncertainties identified above serve as a barrier to estimation of charges according to a common basis, consistent with promoting equal terms of competition. Nevertheless, research is rapidly reducing the uncertainties, and ‘the use of proper theory and modern methods will lead to a convergence also of the more difficult marginal cost categories in the near future’ (Lindberg, 2002). In other words there is no reason for measurement problems to hold up moves towards marginal social cost pricing. In any event it is hard to argue that, were marginal social cost the right concept to use in pricing, measuring something else instead of using the best estimate possible would be a sensible approach. A likely way forward is to seek consensus on a lower limit of costs that should be reflected in price, and to raise this as evidence becomes stronger and more accepted.

3.4 Impacts, barriers and constraints, dynamics and financing and phasing

IMPRINT-EUROPE heard the experience from the implementation of pricing reforms in many countries, including urban road pricing in Norway and London, heavy goods vehicle charges in Switzerland and rail infrastructure charges in Britain, Sweden and Austria, as well as the results of many modelling case studies and demonstration projects. In particular, the MC-ICAM case-studies show the effects of pricing on welfare, efficiency and equity, and key areas of the pricing system were the coverage and scope of the system, the composition and levels of prices, the degree of differentiation, and the use of revenues. These had to be considered in the short, medium and long term. Our conclusions in this area are as follows:

(a) Impacts

In terms of behavioural responses, the most important reactions tended to be re-organisation of travel whilst continuing to use the same mode as prior to the pricing reform (e.g., changing time

of travel or route, consolidating journeys etc, rather than switching mode), though clear evidence of changes in mode was also presented in some cases

The impacts of a pricing system depend on its scope or coverage. (What is priced and who are priced?) The market segments that could be priced may be distinguished by geographical or spatial coverage, model coverage, user groups covered and externalities covered. The MC-ICAM modelling case-study results estimated welfare effects and other indicators as a function of varying scope or coverage as compared to the welfare levels related to the base case and the first-best cases. In general, the results showed that the impacts were not encouraging if the scope of the pricing scheme was narrow. Given that sufficient scope is secured, even simple pricing schemes may be worth implementing, as it may be the only way to get started and many of the benefits achievable in the first-best benchmark may be generated. This may emphasise the need for a phased pricing reform by introducing simple measures as soon as possible rather than waiting for the ideal solution. Possibilities of differentiation in the long run may improve efficiency and be regarded as a means to promote equity and acceptability.

The issue of 'fairness' and the distributional impacts of pricing reform have also been a key concern. Fairness, according to the Green and White papers on pricing (CEC, 1995; and CEC, 1998) 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, requiring 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. requiring that all users of a particular mode of transport should collectively bear the total costs this mode of transport imposes.

However, it may be argued that a more appropriate way of dealing with the issue is to examine the overall welfare of each individual or group of individuals in society, rather than the effects of a single policy or project (Mayeres and Proost, 2003). 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 would 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, it may be seen as fairer to expand 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. But the appropriate approach to dealing with equity concerns of this type is to use distributive weighting systems, which still use marginal social cost pricing as a starting point, but adjust prices in accordance with the distributive characteristics of the goods concerned (Feldstein, 1972). There is no reason to suppose that this rule will in general lead to full cost recovery on any particular mode or facility. Hence, distributional impacts will obviously vary both with the design of schemes and the use of revenues, and these need to be determined with distributional considerations in mind

Land-use impacts also vary with the detailed design of schemes; with appropriate design and use of revenue the limited evidence is that these can be positive. MC-ICAM modelling results, for example, show that if you allow for land-use and apply a reasonably sophisticated pricing

scheme, the positive impacts of the pricing reform are enhanced. Alternatively, other modelling results show that application of simple cordon pricing could have negative land-use impacts through damage to the attractiveness of property and land in the immediate vicinity of the cordon. More research in this area is needed to clarify the picture, and it will be important to monitor the land-use impacts of implemented schemes such as the London Congestion charge.

Broader economic impacts are also uncertain; there is some evidence that they might be negative but small. Few advocates of marginal social cost pricing would deny that the case for marginal cost pricing assumes the existence of marginal social cost pricing elsewhere in the economy. 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 reduce distortion of 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 there are other concerns. For instance, if the costs of urban sprawl are not adequately reflected in property prices and local taxation, then it may be desirable that transport prices are configured in part to offset this distortion and to 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.

(b) Barriers and constraints

It is widely recognised that various barriers place constraints on the potential for implementation of full marginal social cost pricing. The MC-ICAM project made a conceptual distinction between underlying barriers and implied constraints to which they led. Factors that may lead the barriers and constraints to be eased over time were also considered.

The best way to devise infrastructure prices was seen as identifying the barriers that prevented the full implementation of marginal social cost pricing and the constraints to which they led. Knowing these constraints, the second-best optima could be found. The next stage is to identify the succession of second-best optima, each better than the last, which becomes feasible after the constraints are eased. This set of second best optima is essentially the implementation path. If all barriers can eventually be overcome then the implementation path leads eventually to full marginal social cost pricing; if not, it leads to the best ‘second best’ solution.

MC-ICAM identified separately the barriers and constraint for urban and interurban road, rail, air and sea. The three types of barriers to implementation were technological, institutional, and public and political acceptability. Conclusions on barriers were as follows:

Technological barriers:

- The big issues in terms of urban and interurban road transport are cost and reliability of the technology and confidence that it will work rather than availability per se.
- Inter-operability is seen as important especially in terms of interurban road pricing, where different countries are going in different directions and inter-operability is seen as crucial to the avoidance of waste.
- For urban public transport, smart card technology was removing the technological barriers to full marginal social cost pricing.

- The big issue for rail, air and sea is not the technology but creating appropriate ways of measuring the costs of congestion and scarcity of capacity and reflecting these in charges. Further work on measuring cost of scarcity is underway in projects such as SPECTRUM.

Institutional barriers:

- There is the need for EU and national legislation to permit and support marginal social cost pricing.
- The relationship between different levels of government leads to institutional problems. Marginal social cost pricing may be best implemented if all decisions were centralised and taken by the state or EU but there is a risk of government failure.
- Issues arise in the roles of deregulation and privatisation versus government control when implementing marginal social cost pricing. An approach would be to deregulate and privatise firms because competitive markets would force firms to implement marginal cost pricing to survive, and externalities could be accounted for by the use of Pigovian taxes and subsidies. However due to the market power some firms possess especially in cases of natural monopolies, firms may not apply marginal social cost pricing; therefore government intervention may be needed. Government control may risk government failure, as governments may not have enough information or motive to act in the public's best interest.

Acceptability barriers:

- Public and political acceptability is the key barrier.
- A number of points were seen as important in order to gain acceptability. It was best to start off with a simple system (e.g. cordon charges) and move to a more complicated system as confidence builds up. Packages and measures within and across all modes such as environmental charges on all modes at once help acceptability. There is the need for increases in charges to be gradual and the way the revenue generated is used is crucial.
- Many factors make acceptability less of a barrier in interurban road transport than in urban road transport. These include more complexity in urban networks and the fact that existing taxes are seen as unfair since they focus on where a vehicle is registered and fuelled rather than where it is running which is common in interurban road transport.

The use of revenues is found to be a crucial issue in transport pricing, both in terms of its link to public and political acceptability, and in terms of its impact on the welfare effects of pricing reforms. In general, one might expect that effective use of pricing revenues would re-enforce the positive welfare effects of transport pricing reform. Importantly, the MC-ICAM case studies found that whilst constraining the use of revenue to be returned to users through other tax reductions or to be used in the transport sector may well increase acceptability, it actually reduced the benefits of pricing reform

In summary, acceptability tends to be higher where problems are particularly acute and demonstrable, where revenue use is transparent and/or earmarked and where there is an identified package of complementary measures, whilst there is evidence to show that acceptability is higher where initial price changes are simple and modest and that acceptability for more sophisticated charging may grow over time;

(c) Dynamics and financing

It is important to make the link between pricing and investment, in terms of both ensuring that future investment decisions take account of the impacts of more efficient prices and ensuring that future prices reflect changes in capacity. The fact that short run marginal social cost pricing totally ignores the capital costs of expanding the system is an often-stated cause for concern. 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 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. Resolution of this issue depends on the relative speeds of adjustment of capacity to demand and of consumers to price. It is clear that infrastructure capacity adjusts slowly to demand. If consumers adjusted instantaneously to price, then short run marginal social cost pricing would clearly mean that at all points in time demand would be optimally adjusted to capacity. There remains an issue of the incentives for the appropriate adjustment of capacity over time. Given that there is in fact a lag in adjustment of demand to price, particularly for commuters and for freight traffic – where the adjustment may involve relocation – it is not necessarily the case that charging short run marginal social cost will always achieve optimal adjustment of demand to capacity, and there is clearly a case for at least smoothing the adjustment of price as capacity changes to give signals as to the longer term level of marginal social cost.

If we moved entirely to long run marginal cost as the basis for charging then the case for charging higher prices in urban areas would be based on the high cost of expanding capacity in such locations rather than on existing levels of congestion. 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 public transport and inter-urban road network, where infrastructure capacity expansion is actually likely to take place, that there is a case for long run marginal cost pricing. But there are many other problems, such as indivisibilities, which mean that in practice, the measurement of short run marginal social cost, but allowing for a different level of infrastructure capacity, may still be the best approach.

More generally, where-ever short-run marginal costs fluctuate strongly, it is important to inform people of the expected future profile of prices so that people can take their investment decisions (in durable goods, housing etc.) on the basis of a correct anticipation of future prices. Some type of weighted averaging of short-run marginal costs over sub-periods or over different types of demand conditions (e.g. energy demand under differing weather conditions etc.) may be necessary. However, it is important that prices remain responsive to costs. In short, dynamic effects may mean modification of the simple short run marginal social cost pricing rule, but the concept of marginal cost is still fundamental to the derivation of an efficient alternative.

Financing and the use of revenues from charges are key issues. The financing issues reflect the most common objection to marginal cost pricing - that it does not recover total cost. However,

this conclusion may depend on the level of aggregation at which the comparison of costs and revenue is made. At the aggregate level, pricing to recover total cost typically implies big increases in rail and other public transport charges, together with 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, the 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 consequently high charges for the use of infrastructure. So the likelihood is that marginal cost pricing will imply substantial surpluses of revenue over costs on urban roads, whereas on rural roads and much public transport, there will be deficits. Nevertheless, there remain two important 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 that typically surpluses in urban areas are so big that budget constraints are not a problem (Roy, 2002). There is also evidence that earmarking revenues from road pricing for spending within the transport sector, including cross-subsidising public transport, improves the acceptability of road pricing. But then there is a second issue, and that is whether a system whereby urban road users greatly cross-subsidise rural road users and public transport users is perceived as acceptable, both in terms of equity and in terms of influence on locational choice.

If for any of these reasons the budgetary outcome of marginal social cost pricing is seen as unacceptable, 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. The solution is to consider multi part tariffs and differentiating pricing according to willingness to pay, but with marginal social cost as a starting point, and then looking for the optimal departures from that base. But, unless multipart tariffs can be found which exclude no users and face all users with a marginal price equal to marginal social cost, there will be an efficiency loss due to these measures (except in circumstances where there is a budgetary problem and there is no more efficient way to raise the necessary revenue from general taxation). That efficiency loss will be minimised by applying the budget constraint at the most aggregate level possible, so budgetary problems will not lead to a case for requiring each mode to cover its total cost from revenue. In short, arrangements are needed that are transparent and acceptable but which do not constrain the use of revenue in an efficient way.

(d) Phasing

The barriers and constraints referred to above give rise to issues concerning the speed of implementation, which may differ between the modes, essentially 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. In addition, 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.

Phasing was a particular issue examined by the MC-ICAM project, which defined implementation paths in terms of sequences of consecutive second-best optima. It was found that second-best optimisation may lead to initial price levels that have to be changed radically later when constraints are changed or relaxed. The finding that second-best pricing along an implementation path may cause certain prices to fluctuate and problematic reverses in the direction of movements of charges may give rise to a caveat. Second-best optimisation that allows for current distortions in other modes or markets may lead to problems in implementing policy in the longer term which may lead to issues with acceptability. An important lesson from MC-ICAM was that ‘rather than focussing on fine-tuning of the derivation of second-best prices, and often very detailed technical problems related to implementation, the policy makers and analysts should pay more attention to identifying the key barriers and their implied constraints, and how to avoid or remove them.’

Thus implementation of marginal social cost pricing is far from straightforward, but there seems to be good evidence that simple systems of road pricing in heavily congested cities or on congested inter-urban links can bring worthwhile benefits (Nash, Niskanen and Verhoef, 2003), whilst more complex systems are becoming steadily easier to implement as technology advances. So making simple and modest reforms first, progressing towards more sophisticated charging systems, can address concerns about reform, whilst each new phase of reform should generally move prices in the right direction in terms of the ultimate goal, even if short term considerations might dictate otherwise.

In summary, then, whilst it is best wherever possible to go straight to the first-best solution, there were also good scientific and practical reasons for the need of phasing and packaging. Some barriers definitely stood in the way of achieving first-best solutions therefore second-best solutions were needed. Uncertainty tended to remain about the barriers and the exact nature of the constraints to which they lead to and the degree to which they could be eased over time, including the level of government intervention. But the MC-ICAM methodology is seen as a valuable step forward.

3.5 Key mode-specific issues

Implementation of pricing reform on roads is now gathering pace both in urban transport (with actual schemes existing in Norway, Italy and UK) and in interurban road transport (with heavy goods vehicle charging reform in Switzerland, Austria and plans in Germany and the UK, as well as the proposed revised charging directive); Reform in rail is also proceeding and the charging directive is now in force, requiring all EU rail systems to have infrastructure charging regimes; There is much less activity in air and maritime transport. One seminar concentrated on mode specific issues, and at others there were specific sessions on the different modes. The section considers urban areas separately before turning to inter urban road, rail and air.

(a) Urban

Urban areas have the most urgent need for action, but congestion charging is not relevant everywhere because of implementation costs. Most efficient outcomes will involve an integrated approach including investment, traffic management and public transport schemes. Evidence from the MC-ICAM modelling work found that second best pricing to allow for distortions in other

modes/markets may lead to big fluctuations in price which is problematic from the viewpoint of long run development (Brussels case-study).

The strong message from city policy-makers was that starting with simple pricing schemes seems to be the only viable solution. It is important to be pragmatic and not to attempt to impose the same solution everywhere. Evidence from the MC-ICAM modelling work found that it is certainly worth implementing simple pricing structures if this is the only way to get started. But further differentiation in time and space is usually worthwhile (Paris, Brussels, Oslo case-studies). Hence, whilst knowledge of marginal social cost may not be the most important factor in setting prices in the first instance, it is important to know marginal social cost to estimate future policy direction. This can be a problem because marginal social cost is so variable in urban areas.

Three other key findings emerged during the IMPRINT-EUROPE seminars. Firstly, it is important to identify any exemptions and specify use of funds. Secondly, public acceptability tends to increase post implementation and thirdly, a strong political champion and clear methods for dealing with the media are a big help in 'selling' a scheme.

Land use impacts are an important but under-researched concern. Evidence from the MC-ICAM modelling work found that location and land use effects may be important and differ significantly between cordons and differentiated link charges, being much more favourable in the latter case (Oslo case-study).

In addition, the MC-ICAM modelling work found that which level of government should be responsible is an important issue, since local government may ignore costs and benefits to citizens outside its own area (Brussels case-study).

(b) Inter-urban road

Charging for use of inter-urban roads is a key priority for action. Evidence from MC-ICAM modelling work shows that most of the potential benefits from reform of inter-urban transport prices can be obtained by tackling the dominant mode - road (Netherlands, Norway case-studies). Furthermore, current European road taxation legislation limiting user charges only to motorways and similar roads will, given the conclusion that marginal cost is highest on low standard networks, lead to higher overall transportation costs in Europe

As with urban pricing, second best pricing to allow for distortions in other modes/markets may lead to big fluctuations in price. In one of the MC-ICAM case studies, a big increase in price when freight alone is charged external cost is followed by a reduction when passengers are also charged (UK case-study).

The use of the revenue is crucial. The MC-ICAM modelling work found that benefits may be several times greater if revenue is used to reduce distorting taxes rather than returned to users as lump sum payments (UK, Norway case-studies). Optimal charges are higher when revenue is used in the best way.

The draft revised Eurovignette Directive (CEC, 2003) is a good step forward in relieving some of the barriers to efficient pricing. The proposal relates to tolls and user charges applied to HGVs

weighing over 3.5 tonnes operating on the TEN network and other roads to which traffic might divert, with an allowance also to extend the system to other roads as well. According to the original proposal, user charges would, on average, be tied to the costs of construction, operation, maintenance and development of the network plus the uncovered costs of accidents (including costs not covered by insurance), and allocated to vehicle types on the basis of stipulated equivalence factors. Tolls could vary according to a number of factors such as distance travelled, location, infrastructure type, vehicle type, time of day and according to specific routes.

Its big benefits should come from greater differentiation in time and space and by vehicle type, influencing vehicle type and the way vehicles are used within road haulage and through providing funding for rail investment. However, there is concern that whilst km based charging is best for Europe as a whole, it may damage peripheral areas, thus compensatory measures which provide additional funding for those areas may be needed.

The constraints on the overall level of charges posed by the proposed Directive (mainly that which ties the average level of charges to average infrastructure plus uncovered accident cost) prevent complete internalisation of external cost with adverse consequences particularly for mode split. Hence, it is not clear whether the draft directive represents a step on the existing implementation path or a change of direction. The constraints which tie average charges to average costs should, as proposed in the 1998 White Paper, be seen as very temporary, and that full marginal social cost pricing should be the goal.

With development of national schemes, inter-operability remains a serious concern. Two basic forms of tolling were identified within the DESIRE project as being most adequate: NET, the traditional tolling system for motorways, where you pay on whatever exit you leave the motorway; and DARIA, something like the Swiss scheme, where you pay per kilometre driven in a region in which all roads are charged. DESIRE studied technological solutions available for convenient and transparent application of electronic fee collection, and found that the choice of the most adequate technology depends on the basic form of tolling, as well as other factors such as the transaction costs and enforcement difficulties, and other desired functions that need to be developed in addition to the technology.

(c) Rail

A number of key conclusions arose from discussions of the rail sector. Firstly, the existing rail infrastructure charging Directive is a sensible compromise which seeks to make pricing as efficient as possible whilst allowing for a wide divergence in levels of cost coverage. Work continues on the promotion of a common understanding of the different cost elements included in the directive so as to promote harmonised implementation.

There are pressures leading towards a degree of convergence, since very low charges may be unaffordable and high charges lose traffic, but the enormous divergence in structure and level of charges still distorts both the level of rail traffic and the routing of international traffic. An important step forward would be to achieve an agreed overall structure of charges; efforts may then switch to seeking to make the level of charges more efficient.

The main solution to congestion and scarce capacity on railways comes from good timetabling and path allocation and appropriate investment, but price signals may also have a part to play.

The appropriate approach to rail infrastructure charging is inevitably tied up with other issues such as whether the infrastructure manager is public or private sector and whether competition is via franchises with long track access contracts or short term on track competition. Two part tariffs are a sensible solution when franchising is the rule, but are most problematic with on-track competition, where Ramsey pricing may be needed.

(d) Air

The situation in air transport is that currently charges are largely based on commercial rather than social costs. There are serious concerns about environmental costs, but doubts about measurement of certain aspects, e.g. high altitude emissions, and concerns about the need for internationally coordinated action. Key conclusions are that:

- Pricing is recognised as being a useful tool for tackling environmental costs but other tools are needed as well to achieve environmental objectives;
- There is an urgent need to address congestion and scarcity of slots; more time-differentiated charges are recognised as a useful tool to address congestion costs, but again other tools are needed in combination;
- There is disagreement as to how the pricing and other tools to address environmental and congestion costs should be phased;
- Standardisation of charging principles and identification of a means to address scarcity of slots are priorities for action;
- Slot trading is the best way of dealing with scarcity of slots in the short run.

3.6 Key issues for Newly Associated States

One seminar was held in Budapest and focussed particularly on the circumstances of the Newly Associated States. The key conclusions of the seminar were as follows:

- The link between pricing and financing is strong: financing needs are more acute, and other sources of finance more limited, so pricing is seen very much as a way of financing investment
- Congestion is not nearly so much of a problem so it is more difficult to demonstrate that this is a problem worth addressing via pricing
- Issues concern transit traffic and peripherality; there is a fear that newly associated states, which are typically much poorer than current EU members, may only be able to charge transit traffic low prices, because of low levels of congestion, whilst bearing the costs of improving infrastructure and paying higher charges in more congested core countries
- Significant data problems so the need for generalisable approaches that can take evidence from one location and apply it elsewhere is important
- There is a need to translate lessons from the existing 15 member states, but do they always set a good example?
- note that all the above issues are also relevant to at least some existing member states

3.7 Ten steps to implementation

Drawing on the research and experience discussed during the IMPRINT events, we identified ten generic steps to implementation, most or all of which appear to have been taken in successfully implemented pricing reforms. The ten steps were discussed at the IMPRINT-EUROPE final conference and whilst a few modifications were suggested, it was generally agreed that they provide a useful blueprint. Having reflected the suggested modifications, the ten steps are as follows:

- 1 Demonstrate problem to be addressed; pricing reform needs to address real perceived problems rather than theoretical improvements.
- 2 Demonstrate pricing as a potential solution; it is widely argued that pricing has little effect.
- 3 Design something simple, as part of an integrated package of measures; the package needs to be designed to address concerns such as equity.
- 4 State clearly how any revenues will be used; earmarking whilst theoretically not ideal may be useful in gaining support.
- 5 Use the best available evidence to demonstrate likely outcomes including concerns such as equity and land use charges that are often overlooked.
- 6 Prepare for potential political windows of opportunity;
- 7 Consult and promote widely, using clear simple information and explanation;
- 8 Monitor to ensure schemes retain political support and to enable others to learn;
- 9 Review acceptability and effectiveness openly after a pre-specified period;
- 10 Refine towards more sophisticated system over time.

3.8 Priorities for action

A start has been made in some sectors: for instance the Rail Directive contained a sensible pragmatic approach to marginal social cost based pricing, and the proposed revised Eurovignette Directive was a step in the right direction, although still containing many constraints which would prevent fair and efficient pricing of road freight vehicles.

However much disappointment was expressed that the proposed framework directive and common methodology paper for all modes seems to have been abandoned. Most members of the Imprint-Europe network felt that such a directive would be an important step forward as it would provide a clear objective towards which pricing reform should be concentrated on all modes, and encourage transparency in the setting of prices. In its absence, in the light of seminar discussions, a number of priorities for action emerged:

- to continue working on improved pricing systems, without making ‘perfection the enemy of the good’;
- reform is most needed in congested urban areas – to reduce congestion, environmental degradation and generate finance and local authorities should be supported in this process;
- reform is also needed on trans-European road and rail corridors – to harmonise terms of competition, reduce congestion, environmental degradation and accidents and generate finance. A simple kilometre charge according to vehicle type, along the lines of the revised Eurovignette but with the link between average charge and average costs removed

as soon as possible, is a good way forward. This could then gradually be refined in terms of both level and variation with time and space;

- reform in aviation is also important to harmonise terms of competition, to reduce environmental degradation and congestion, and to tackle the allocation of scarce slots. Moves to introduce slot trading, and to charge environmental costs either through a tax on aviation spirit or fueling that on navigation charges were needed;
- much less is known about water transport but it appears that reform in ports is needed to harmonise terms of competition and to address environmental degradation.

3.9 Priorities for future research

Despite the large amount of research on pricing that has now taken place, some priorities for further research were still identified, as follows:

- some particular areas of cost measurement need further research – particular aspects of infrastructure costs across all modes, congestion and scarcity in rail and air, accident risk elasticities, environmental costs for air and water, the role of congestion is leading to costs of greater unreliability on all modes of transport;
- generalisation – how to estimate costs for particular circumstances from available evidence – remains a major issue (especially a problem for congestion and local environmental impacts);
- further evidence is needed on particular types of impacts – land-use, regional economic, distributional – although the evidence that exists is that these do not pose serious drawbacks to suggested pricing reforms, and can be mitigated by other elements of the package;
- complexity and simplicity are important research issues – to what extent should we seek ultimately to portray the full complexity of variations in marginal social costs in prices?
- processes and institutions also need research - what bodies should set or regulate prices and be responsible for allocating the revenue? How do prices feed through to and impact upon end-users? Institutional issues are particularly complex in the aviation and maritime sectors;
- there remains a major need to synthesise and disseminate the results of research and to identify ways of translating them into action. As pricing reforms move closer to implementation, so fully engaging representatives of government and industry in this process becomes more and more important.

4. Deliverables

The following Table 1 sets out the deliverables submitted. Copies of these are available on the website (www.imprint-eu.org).

Table 1: Deliverables

Deliverable Number	Title
1	Identifying Key Requirements for Implementing Pricing Reform
2	Mode-Specific Issues
3	Barriers and constraints - Learning From Best Practice
4	Phasing and Packaging
5	Special Conference for Newly Associated States
6	Recommendations for implementing pricing reform in transport
	Final Report for Publication

5. Results and Conclusions

A full discussion of technical conclusions is found in Section 3. In this section we highlight the results of a small web-based survey of Imprint participants, and also comment on other dissemination activities.

Prior to the final conference, the IMPRINT-EUROPE consortium decided to distribute to the network members a questionnaire with the aim of verifying the degree of consensus achieved around the topics touched by the network during its 4 years of activity and the effectiveness of the project with respect to the initial goals. The questionnaire was sent by e-mail to all those which participated in at least one seminar and was composed of 4 parts, focusing on the following aspects:

1. The effectiveness of the project in achieving its objectives;
2. The current state of knowledge and availability of data on the implementation of transport pricing strategies for each mode of transport;
3. The degree of maturity of different transport sectors with respect to the implementation of pricing reform and the identification of the main problem areas;
4. The degree of consensus on a set of provisional conclusions for IMPRINT-EUROPE.

Thirty nine responses were received. The majority of responses were from EU15 countries, but responses were also received from countries outside of the EU. A mix of organisations were represented amongst the responses. The majority came from industry and consultancies and from university and research organisations, but several responses were also received from national and local government and from international organisations and associations. A majority of respondents believed that IMPRINT-EUROPE had achieved its objectives either to a high or very high degree.

The responses to the questionnaire provide an idea of the extent of the consensus or disagreement around the very many methodological issues and policy questions arising when dealing with transport pricing reforms. A report of the results of the survey can be found in an appendix to D6, so we summarise only the key findings of the exercise here.

Methodologically robust estimates of infrastructure costs, the support of policy makers and acceptance of citizens emerge as equally important pillars of an effective reform effort. the introduction of standard collection formats and procedures would represent a significant step towards the improvement of availability and reliability of data for cost estimation. This is particularly important for NAS countries. There is a desire for clear messages on both policy orientations and methodological approaches to follow for pricing infrastructure use in all modes. For NAS, the most effective solution would be to agree with the EU Member States a common approach and then allow for a “gradual convergence” in the medium/long term. Research must address more explicitly the issue of the assessment of impacts from price changes - impacts on users’ behaviour, impacts on industry, distributional effects, impacts on macroeconomic variables (employment, production, etc.). European research both on cost calculation and impact assessment will greatly benefit from exchange of experience with non-EU countries which have already experimented with pricing reforms in some areas and can make available evidence and

data - so the sharing of experiences in Norway, Singapore, Switzerland and the US, which took place within IMPRINT-EUROPE should be maintained and developed.

A request for practical tools to support price setting emerged as an urgent matter, showing that robust methodologies for cost and impacts calculation are not in themselves a guarantee of a successful implementation if the gap with the policy world is not correctly bridged. Policy makers certainly need to know that research findings are robust and clear but will then have to deal with the number of known and unexpected barriers to reforms which will arise when a theoretical principle must be translated into concrete reform programmes. A common, EU wide regulatory framework will help to set the scene and avoid lobbies prevailing, but also national governments still have an important role to play. The design and implementation of a reform programme must therefore result from the interaction between theoretical principles and real life conditions: a pragmatic approach is likely to be more effective in many cases, allowing to take into account the substantially different conditions of the various modal markets. For instance, it will certainly be more difficult in terms of acceptance from the stakeholder introducing a price for infrastructure use where it was previously unpriced than changing price levels where charges already existed. How revenues from pricing reforms will be used is likely to be, in most cases, a decisive factor.

One of the hottest debates about European transport policy concerned the identification of the pricing principle which should inform pricing reforms. The appropriateness of marginal social cost pricing, indicated by the European Commission as a leading principle, to the reforms in European transport markets is still a debated issue among researchers and policy makers. The implementation of transport policy designed at a EU level often finds diverging reactions within Member States so it would be useful to clarify the role and position of the EU in terms of how Member States can be pushed to comply with Directives and what to do when Member States retreat (at least apparently) from previously agreed principles. Moreover, as it emerges from the questionnaire, it is now quite clear that since market conditions, institutional settings and stakeholders involvement greatly differ among modes, pricing schemes might sensibly vary accordingly. For instance, acceptability is directly geared to the capability of pricing schemes to increase the quality of service: this is an item which should be taken into account in price setting, together with cost coverage and demand management requirements. Transport capacity is still a debated issue: it is not clear to what extent lack of capacity is due to an infrastructure constraint or to an inefficient use of the existing infrastructure.

Overall conclusions emerging from the survey can be summarised in the statements listed below:

- Marginal social costs can be measured with a sufficient level of accuracy;
- Additional research is needed on scarcity (air and rail), equity and land use;
- Policy makers are more interested in impacts and benefit calculations than in theoretical justifications of pricing principles;
- A common methodology to cost calculation is needed:
 - it should take account of the specific needs of peripheral countries;
 - it should be established by the EU;
- An institutional platform is needed to design reform pathways;

- Pricing should be introduced gradually, implementation needs to be phased (and the sequence of interventions needs to be carefully designed since will affect the outcome of the reform);
- Pricing schemes cannot alone solve transport problems and must be packaged with investment and regulation interventions
- A strong political will, simplicity and transparency of pricing reforms, and clear commitment on revenue use are key elements to gain public acceptance.

As a thematic network, the activities of Imprint-Europe have naturally concentrated on dissemination through a number of channels:

- The five seminars, the additional workshop and the final conference were attended by 274 different participants from 27 countries, including 25 European countries, the US and Israel.
- The mailing list, used to provide information on IMPRINT-EUROPE events and reports, comprises 126 members.
- The IMPRINT-EUROPE website (www.imprint-eu.org) now has all 62 papers plus most of the presentations prepared for the seven IMPRINT events, the synthesis reports of each of these events for download, and provides links to key related web resources. Furthermore in close cooperation with all of the EU Fifth Framework transport pricing projects, a joint 'transport pricing website (www.transport-pricing.net) has been developed.
- IMPRINT-EUROPE is leading to the further development of the published transport pricing literature. The two notable examples of this are a special issue of the European Journal of Transport Infrastructure Research, and a book in the 'Research in Transportation Economics' series. Both will draw extensively on the project's outputs and are scheduled for publication in the near future.
- Conference Papers deriving from the work of Imprint-Europe have been presented at a number of international conferences, including the OECD/TRB symposium on Road Pricing in Florida, November 2003; the UIC MAPS seminar in Tunis, March 2004; the TAIEX workshop on rail and road infrastructure charging in Maribor, Slovenia, March 2004; and the World Conference on Transport Research, Istanbul, July 2004.

6. Acknowledgements

IMPRINT-EUROPE was a truly collaborative project. We would like to express our thanks to the following parties:

- The project partners for their support and hard work throughout the project;
- All participants at the seven IMPRINT-EUROPE events – encompassing those who gave presentations, those who prepared papers and those who contributed to the discussions – as it is in large part thanks to their involvement in the events that they have been a success;
- The European Commission for funding the project and, in particular, our project officers Catharina Sikow and then Christophe Deblanc for providing helpful comments and support throughout; and
- Colleagues at the Institute for Transport Studies, in particular the secretarial and administrative team, for their on-going support.

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