

Policy conclusions from MC-ICAM

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ABSTRACT

This paper summarises main policy conclusions of the MC-ICAM project. Building on detailed theoretical considerations relating to second-best pricing, barriers and constraints to pricing, and implementation or transition paths, MC-ICAM identifies most relevant barriers and constraints for all main modes (urban, interurban road, rail, air and water). The barriers to implementation were divided into three broad types – technological, institutional and acceptability related. MC-ICAM concluded that although the first two types are important to consider and form true barriers in the short run, the key or real barriers are related to acceptability, public and political. MC-ICAM carried out a number of modelling case studies to test plausible implementation paths and impacts of their key features: the scope of the pricing system, level and composition of charges, differentiation (geographically, over time, by vehicles), use of revenues, and land use effects. A great number of interesting results were established, but the key conclusions are as follows:

- many problems come from the attempt to apply marginal social cost pricing in a naïve way; in practice, second best considerations and policy packaging mean that it is better to speak of marginal cost based pricing as the aim
- there are good theoretical and practical reasons to believe that phasing and packaging will be an important part of implementation
- substantial benefits may be obtained by well thought through simple first steps to implementation, and these first steps may also help increase acceptability of more sophisticated pricing measures later
- the best implementation path can be seen as a set of constrained second best optima, with the constraints determined by the barriers to pricing reform
- a key issue for both policy makers and researchers is the need to understand these barriers and the ways in which they may be reduced or removed

1 Introduction

In transportation the need for pricing reform has been a major topic in policy discussions for a decade, starting from early 90's. The aims of the reform have broadly speaking been threefold: more efficient use of the existing infrastructure; internalisation of environmental and other externalities; and collection of revenue to facilitate funding problems. A key issue has concerned the role of marginal cost pricing in the reform. Should it be (a part of) a practical solution, or should it be considered only a benchmark?

The view that marginal cost pricing should be part of practical pricing systems has over time received more support, although slowly then steadily however. Partly this development has been implicit as not always the term marginal cost pricing is not used, although clearly the idea has been to apply similar principles.

A visible trend in discussions on marginal cost pricing and pricing in transport in general during the last few years has been the shift of focus from the derivation of pricing rules to practical implementation problems. It is recognised that marginal cost based efficiency pricing cannot be universally implemented simultaneously, for many reasons. This has been recognised for instance by the 1998 White Paper on infrastructure charging and the 2001 White Paper on the Common Transport Policy. Both spoke of implementation paths with a number of stages and different rates of progress on some modes compared to others.

But this observation immediately raises a number of questions, such as: which modes or parts of the network do we address first? How far do we move towards full marginal cost pricing on each? What accompanying measures should we undertake? And to what extent can these initial steps capture the benefits of full marginal social cost pricing? Are they so good that the later steps are relatively unimportant? Or so poor that they are hardly worth pursuing?

Very little work has previously been undertaken on the identification of feasible implementation paths and on the measurement of their costs and benefits. The aim of MC-ICAM has been to shed light on such questions. The work undertaken in it has been described already in earlier papers at this conference and it is not our aim here to repeat that description. Nor will we even repeat all of the many policy insights produced by previous papers. What we do aim to do is to draw out what we see as the key general policy conclusions to emerge from the project.

MC-ICAM has covered all main modes: urban transport, interurban road, rail, air, water. It has produced both scientific results – with hopefully indirect impact on policy in the longer term – and direct policy conclusions. This paper summarises the main findings in both areas, however, focusing on direct policy conclusions. Much of the reporting of the empirical work in MC-ICAM reports has been organised by modes. Here the approach is cross-modal, with the goal to present an integrated view.

It should be stressed that we see the conclusions in the current paper as quite provisional. They rest very heavily on the work of our partners in the project, but there has not been enough chance yet to discuss them within the consortium. Also, some case

studies have yet to be completed at the time of writing, and no doubt they will add insights to be incorporated in a final draft.

The structure of the paper is as follows. First (section 2) we consider the conclusions deriving from our theoretical consideration of barriers, constraints and implementation paths (deliverables D2, D6) and from modelling and evaluation (D3, D7, D8). We then (section 3) consider policy conclusions from studies of barriers, constraints and transition paths (D4, D5, D6), and (section 4) policy conclusions from urban and interurban modelling results (D7, D8). Finally (section 5) we draw some overall conclusions.

2 Theoretical considerations

2.1 New results from analysis of barriers, constraints and implementation paths

The main results of MC-ICAM theoretical work on barriers, constraints and implementation paths are in the following three areas:

- 1 Second-best vs first-best pricing on links, nodes and transport networks
- 2 Distinction between underlying barriers vs implied (second-best) constraints
- 3 The concept of implementation path: motivation and definition

Here we will review just a few central insights and conclusions, and without attempting (due to lack of space) to provide any comprehensive coverage.

When considering marginal cost pricing in transportation (also in other sectors) economics literature and a number of earlier EU projects have emphasised the need to consider second-best policies. Moreover, it is advocated that these policies should be considered in the context of policy packaging. Project AFFORD adopted the term marginal cost based pricing – to reflect and emphasise these views.

MC-ICAM confirmed these important conclusions. That is, that when we discuss the practical implementation of marginal social cost pricing we invariably need to consider second-best solutions. This is the case partly because there are inevitably departures from first-best conditions elsewhere in the economy, for instance in the form of labour taxes in order to achieve the best feasible combination of efficiency and equity, and these alone may require departures from marginal social cost pricing in other sectors. But it is also because of barriers within the transport sector, which make the full achievement of marginal social cost pricing impossible.

The second key conclusion confirmed by MC-ICAM is that policy packaging is important. If first-best marginal social cost pricing were feasible, then we could examine that as a free-standing policy option in isolation from other policies. However, when dealing with the second-best we are inevitably led to seek packages in which the failure to achieve the ideal result with one policy instrument forces us to look at ways of improving the situation by the use of other policy instruments.

A number of earlier projects including AFFFORD, PATS and PRIMA have identified barriers to pricing reform. Some of these works were reviewed in the first IMPRINT seminar. MC-ICAM has continued this work, and has considered barriers to marginal cost based pricing in relation to all main modes. A key contribution has been to make a conceptual distinction between underlying barriers and implied constraints to which they lead. And it has considered factors that may lead the barriers and constraints to be eased over time.

We see the appropriate way of devising implementation paths as being to identify the barriers that prevent full implementation of marginal social cost pricing and the constraints (in terms of level, coverage or differentiation of prices or necessary accompanying measures including the use of revenues) to which they lead. Once these constraints are known, the second-best optimum in the light of those constraints can then be found. If we have reason to suppose that the barriers will or can be eased over time, the implications of this for the constraints may then be considered and the new second-best optimum found. Thus we see the optimal implementation path as a succession of second-best optima, each better than the last, that becomes feasible as these constraints are eased.

2.2 Technical results from modelling and evaluation analysis

The main technical results of MC-ICAM work relating to modelling and evaluation analysis are in the following three areas:

- 1 Lessons from previous modelling exercises and comparative review of existing models
- 2 Integrated modelling & cost-benefit framework for evaluation
- 3 Modelling implementation paths in 8 case studies

Under these headings we also considered what issues should be the subject of the modelling case studies, what were the necessary attributes of the models to be used and how the results should be appraised. Due to the lack of space, we do not go any further in describing the details of these analyses.

3 Policy conclusions from studies of barriers, constraints and transition paths

In the light of the theoretical conclusions discussed above, we proceeded to seek to identify the relevant barriers and constraints for urban and interurban road transport, and for urban public transport, rail air and sea, using a mix of past literature, case studies of attempts at implementation etc and interviews with those responsible. The studies of barriers to implementation divided the barriers into three broad types – technological, institutional, and public and political acceptability

3.1 Technological barriers

It was concluded that for urban and interurban road transport, the big issue now is cost and reliability of the technology and confidence that it will work rather than availability per se. However, we believe that availability of on-board equipment on vehicles, in the

first place for other purposes (for navigation etc rather than pricing), will have a big impact and is likely to change the situation (including drivers' attitudes) radically in the future.

The other major technological issue that remains for interurban road pricing is inter-operability, where already different countries are proceeding with different technological solutions but where international movement particularly of freight vehicles makes inter-operability crucial to the avoidance of waste. The DESIRE project has investigated these issues. For urban public transport, smart card technology is rapidly removing the technological barriers to full marginal cost pricing, whilst these were never very important for rail, air and sea. For rail, air and sea, the biggest issue is not the technology, but devising appropriate ways of measuring the costs of congestion and scarcity of capacity (as examined e.g. in UNITE) and of reflecting these in charges. Further work on these issues is underway, for instance in the SPECTRUM project.

3.2 Institutional barriers

Fundamental institutional problems are related to the relationship between different levels of government. On the one hand, it may be that marginal social cost pricing can best be implemented by a very centralised approach, with transport pricing decisions taken at the level of national government or indeed the European Union. Where decisions are decentralised, different levels of government may pursue policies that are best for their own electorate but which collectively fail to optimise for the country or European Union as a whole. On the other hand there are strong arguments in favour of decentralised decision-taking in terms of stakeholder participation in democratic decision-making processes. For this reason, there is strong opposition to centralisation of decisions, which may make such an approach unacceptable anyway. In this case some sort of compromise to achieve the best reconciliation of conflicting goals is needed.

Similar issues arise in terms of the relative roles of deregulation and privatisation versus government control. One approach to the implementation of marginal social cost pricing would be to seek the maximum possible degree of deregulation and privatisation, because in a competitive market firms are forced to implement marginal cost pricing in order to survive. Externalities may then be taken into account by the use of Pigovian taxes and subsidies. However, to the extent that market power exists, particularly in the form of natural monopolies, firms will not of their own accord implement marginal cost pricing, and government control or regulation will be needed. However, such control itself risks government failures of one form or another, as governments do not necessarily have adequate information or the motive to act in a way that will maximise social welfare. Again, there is no simple answer as to the form of institutional reform that will be best either in terms of the achievement of marginal social cost based pricing or of the best result overall. Institutional issues remain another priority for further research, and they are being addressed in projects such as TIPP.

One important institutional barrier is that legislation both at the EU level and in many individual countries does not permit marginal social cost pricing. For instance the current Eurovignette Directive requires that charges be related to infrastructure costs and not external costs. Similarly there may be problems of for co-ordination with other

policies (fiscal, regional, land use, social etc) and their goals. Other than in the (very) short term, however, these problems often can easily be rectified. That is, the real issue is the acceptability of the necessary legislation and of the goals of marginal cost pricing and where need willingness to adjust other policies and their goals accordingly.

3.3 Acceptability barriers

It is a clear conclusion of the reviews and analyses undertaken in MC-ICAM that acceptability, public and political, is the key barrier. Even at the heart of supposed technological and institutional barriers as discussed above, the real issue is often acceptability. Do politicians and the public trust the technology? Do they facilitate or promote the development of necessary technologies? Do they accept the need for institutional reform? A number of recommendations as to how to achieve acceptability have been put forward based on previous studies, and we will not repeat those here. However, in the light of these studies and MC-ICAM considerations as well as of previous experience particularly of actual pricing reforms that have taken place, we conclude the following:

- it is best to start simple (e.g. cordon tolls, km charge for hgv s) and move to the more complicated as confidence builds up. This has been the way in which every successful implementation to date has proceeded
- packages of measures within and across modes (e.g. environmental charges on all modes at once) help acceptability
- increases in charges may need to be gradual
- use of revenue is crucial

The best use of revenue is often to reduce other distorting taxes, such as taxes on labour. However, the big problem is that these tax reductions may be widely spread and not perceived as a benefit of the reform. By contrast it is often the case that those who really lose by specific pricing measures are a smaller group who certainly perceive their losses and have the means and motive to organise opposition. It may be necessary to accept a less than optimal use of revenue in order to provide clear benefits from the revenue and to buy off the opposition of the losers.

A number of factors make acceptability less of a barrier in interurban road transport than in urban transport. One is the difference in the complexity of the transport network: urban networks can be much more complex. Another key factor is the widespread desire for pricing reform amongst industry in many countries in order to overcome the problem of the current system that the taxes paid (and the revenues received) depend on where the vehicle is registered and fuelled rather than where it is running. This certainly provides an opportunity in interurban road transport that does not seem to exist in urban.

4 Policy conclusions from modelling implementation paths

MC-ICAM modelling case studies considered both urban and interurban traffic. These models explored several dimensions of road pricing since they differ in a number of respects: mathematical structure, user choices involved, and sets of policy instruments

covered. Because of these differences, the models should be viewed more as complements than as substitutes.

In urban transport the focus was on four representative cities: Paris, Brussels, Helsinki and Oslo. Each city used its own model. TRENEN (used for Brussels) is best suited to conduct first-best analysis and to account for revenue allocation. The strength of RETRO and MEPLAN (used for Oslo and Helsinki respectively) is that these models include land use, and can capture long-term changes in location choice and urban structure. The primary strength of METROPOLIS (used for Paris) is its fine level of temporal and spatial disaggregation, conferred respectively by its ability to handle large-scale road networks and to track the evolution of traffic flows on a second-by-second basis.

In interurban transport five parallel simulation modelling case studies were carried out. The case studies concentrated heavily on the issue of freight transport, as being the priority problem, and considered issues such as the interaction between freight and passenger charging, the interaction between modes of transport, and the interaction between charges and the rest of the economy, including via the use of revenue. In three of the case studies, large, existing, dynamic network models were used (SMILE for freight transport in the Netherlands, SCENES for freight and passenger transport covering all Europe and PINGO/NEMO for freight transport in Norway). In two case studies new, more aggregate, models were developed.

These case studies have provided concrete results of how welfare levels (including the composition of aggregate numbers) and other efficiency and equity indicators change as pricing is gradually phased in more and more sophisticated forms and in the different dimensions of the pricing system. Key questions are: What is priced and who are priced (coverage/scope)? and How is it priced (composition and level of prices and degree of differentiation)? Both questions need to be asked in the short term and then in the medium and long term. Also regarding the use of the revenues. These kinds of results can help to form quantitative and qualitative insights and provide the basis for further discussion and development of implementation paths in practice. Again, many important conclusions have been put forward in the papers reporting on the case studies in detail, so we will here simply pick out what seem to us to be most important at a general level.

(We also need to emphasise that explicit references to the results of individual case studies below in subsections 4.1-4.5 are not fully representative of the MC-ICAM modelling work on these issues as not all case studies are equally quoted. Also, the descriptions given here need to be checked with the case study leaders, as they may contain misunderstandings and errors.)

4.1 Impacts of pricing system (reform) depend on its scope

Perhaps a natural first question regarding a pricing system concerns its scope or coverage: What is priced and who are priced? The relevant answers (constraints) here mean the number of market segments that can be priced distinguished e.g. by: geographical or spatial coverage, modal coverage, user groups covered and externalities

covered. An important question related to these issues is about priority: in what order? Evidently, the answer is partly affected by potential existence of synergy benefits.

The MC-ICAM modelling case studies investigated these issues. The results include estimated welfare effects and other indicators as a function of varying scope/coverage as compared to the welfare levels related to the base case (do-nothing) and the first-best cases:

- In Paris link tolls did not bring much benefit, because only a very small portion of the road network in Ile-de-France was tolled, and therefore tolls needed to be set very low in order to avoid undesirable diversion of traffic to untolled alternative routes. Also, the welfare gains from tolling several routes were approximately additive; i.e. equal to the sum of the gains from tolling them independently. This result is attributable to the fact that the tolled infrastructure was well separated geographically so that traffic spillover effects between tolled routes are minimal. However, a flat cordon charge gets more than half the potential benefit of a time differentiated cordon plus a kilometre charge (interpreted as fuel tax). Both the cordon tolls in Phases 2 and 3 and the fuel tax in Phase 3 yield considerably higher efficiency gains than do the link-based tolls in Phases 0 and 1. The link-based tolls are limited in their effectiveness simply because the scope of link-based tolling is itself limited. Were link tolls extended to a larger portion of the road network, tolls would be paid by a larger proportion of traffic, and link-based tolling would eventually surpass both cordons and fuel taxation in effectiveness.
- In Brussels, appropriate pricing of parking alone produced more than one third of the benefits of the optimum.
- In the Netherlands, optimal pricing of road freight alone (including congestion externality and environmental externalities gets 50% of the benefits of optimal pricing of all freight modes (road, rail and inland waterways).
- In Norway the positive welfare effect of road freight only pricing is smaller than if all freight modes (road, rail, water) are charged for external costs, but still amounts to 83% (revenues redistributed to consumers/users) or 92% (revenue used in the public sector) of the effect if all modes are priced.
- In the Netherlands and Norway, marginal social cost pricing for only road freight yields a positive welfare effect which is smaller than when all freight modes are priced, but the effect is still considerable. This suggests that pricing road freight as a first step in an implementation path is a big step from a welfare perspective.

Overall, these results show that if the scope of a pricing scheme is too narrow, its impacts cannot be very encouraging. However, given that sufficient scope is secured, even simple pricing structures, which may be the only way to get started, may be worth implementing (as far as efficiency or welfare gains are concerned). They may generate relatively large proportion of the benefits achievable in the first-best benchmark. These kind of conclusions provide reassurance that it really is worth opting for a phased reform of transport pricing, introducing simple measures as soon as possible, rather than waiting until it is possible to introduce the ideal solution.

4.2 Second-best prices in phased implementation

As said, MC-ICAM has defined implementation or transition paths in terms of a sequence of consecutive second-best optima. Also the implementation paths modelled and tested in the different case studies were based on or reflected this approach or interpretation. Indeed, as has been discussed in various MC-ICAM documents, no feasible alternative to this was seen.

In the second-best analysis, the key question concerns the optimal pricing rule: How should it be priced? What should be the level and composition (i.e. which pricing instruments to use) of prices? Besides possible distortions in other modes, regions and sectors, here may need to be allowed for maximum tolls or price caps, budget constraints determining minimum or maximum total revenues etc. But such second-best analyses have typically been carried out in a static framework (model). In particular, although for all the dynamic simulation models used in MC-ICAM it is possible to simulate the effects of a succession of policy packages that incorporate progressively more instruments and/or more finely-tuned instruments with first-best pricing as the ultimate goal, none of them is specifically designed to identify optimal implementation paths.

Therefore, an important question is how do second-best analyses and resulting policy conclusions appear – and convince – in a dynamic context in practice where the relevant equilibria under consideration may not be long lasting (if they exist at all)? In particular, there is the question about regret: the possibility that second-best optimisation at an earlier stage can lead to price levels that need to be radically changed – increased or decreased – later on when second-best constraints have changed (possibly relaxed). (As is well-known, this has been one objection to short run marginal cost pricing.)

The MC-ICAM modelling case studies highlighted the existence of these problems:

- In Brussels, in the short term the best policy for public transport in the absence of road pricing is to reduce peak fares, whilst when full marginal social cost pricing is introduced on roads peak public transport fares need to be greatly increased. However, the initial reduction in public transport fares achieves only a small part of the benefits of road pricing. This reversal of public transport fares policy could certainly cause problems in terms of acceptability, and indeed also lead to harmful ‘lock-in’ decisions on home and job location if the public do not correctly perceive and understand the policy. It will be necessary to consider carefully in the light of the achievable timescales for full road pricing whether the initial reduction in public transport fares is a sensible policy, although in terms of what has actually been modelled it is on the optimal implementation path.

- In Belgium optimal price for road freight is higher if freight alone is charged but passenger transport is not. This could lead to problems later, if also passenger transport pricing is introduced implying a need for a reduction in the price for freight transport (according to second-best analysis). This finding may again have relevant policy implications for a stepwise introduction of congestion pricing on both passenger and freight transport. If taxing passengers becomes acceptable later on and the authorities decide to increase passenger transport taxes, then from a welfare viewpoint it may be desirable to accompany this tax with a simultaneous reduction in freight transport taxes.

In this case, the optimal implementation path appears to involve a large increase in road freight vehicle charges followed by a reduction. Again one can imagine that politicians will find such a policy hard to accept.

These kind of considerations – that second best pricing along an implementation path may lead to big fluctuations in certain prices and problematic reverses in the direction of movement of charges – give rise to an important caveat. Second-best optimisation that allows for prevailing distortions (in other modes, markets etc) can lead to problematic policy implications from the viewpoint of longer-run development – in particular, they may lead to acceptability problems. Evidently we need to be aware of the risks involved in proposing second-best solutions in a dynamic context. On the other hand, however, ultimately the matter may be empirical, so it is possible that no general conclusions can be made: although in some cases radical changes in charges suggested by second-best analysis may cause difficult acceptability problems in a later phase, in some other cases similar changes may be feasible and perfectly acceptable.

What we can however conclude is that one obvious benefit of considering second-best optima along the suggested implementation path – in the way done in MC-ICAM – is to provide an effective means for revealing such potential problems. This also suggests an important lesson from MC-ICAM: Rather than focusing on fine-tuning of the derivation of second-best prices, and often very detailed technical problems related to implementation, the policymakers and analysts should also pay more attention to careful identification of key barriers and their implied constraints, and the possibilities for removing (or avoiding) them. This requires, as emphasised in the MC-ICAM work, that the goals of the pricing policy – and also in relation to other policies – need to be clearly understood and defined in a transparent way.

4.3 Impacts of further differentiation

An important conclusion stated above (section 4.1) was that, if sufficient scope of the pricing system is secured, even relatively simple price structures can generate significant welfare benefits. And such systems may be a good starting point as e.g. the recent experience in London shows. This result, though important for the design of early steps of the implementation, of course does not undermine the need to explore the possibilities for differentiation in the longer run – across vehicles / infrastructure users, over time and spatially. The question of longer-run benefits of differentiation is particularly relevant because, as has been argued in the MC-ICAM work, future developments of the technology most likely will make (almost any kind of) differentiation technically feasible in (almost) all relevant respects, and in many cases also in a way that most likely will prove out to be acceptable. One reason for this optimistic view is that, besides improving efficiency, differentiation may in many cases be also regarded as a means to promote equity and hence acceptability too.

The MC-ICAM case studies have showed considerable social benefits of differentiation; but they also showed that differentiation can have significant impacts on modal shares:

- In Paris differential tolling yields greater efficiency gains than does flat tolling. Furthermore, the comparison of flat and differential tolls shows that inclusion of more time steps can boost welfare gains appreciably.
- In Oslo increased differentiation along the implementation paths increased the overall welfare. Optimal peak toll charges were relatively small after long term use of link based road link charges, which verify that the link based toll charges internalise much of the external costs on the links that are not internalised by fuel charges. It was also discovered that the optimal peak toll charges were slightly lower in scenarios with an extra fuel tax that already internalises some of the external cost, and makes less need for toll charges to internalise remaining external costs.
- In the Netherlands, the results regarding alternative implementation paths for charging road freight suggest that the welfare effect increases almost linearly with increased geographical differentiation of charges (i.e. the later steps in differentiation yield only slightly smaller benefits than the first steps). For phasing of pricing measures, this suggests that every step towards further differentiation will create welfare gains, which suggest that in the long run full differentiation should be a serious practical goal.
- Both in the Netherlands and Norway, when full geographical differentiation as part of social marginal cost pricing is introduced (here after 2015), the share of road transport is higher than in the do-nothing alternative. This appeared to be true even for the case in which only road is charged. This was interpreted to be partly due to the fact that geographical differentiation makes some road transport links cheaper, namely those through less densely populated areas. (Partly the result was due to adopted scenario assumptions concerning technological development and its impact on environmental externalities.) In case only road is charged, a reduced degree of geographical differentiation might lead to a reduced growth of road transport.

A particular feature of these results is to show how increased geographic or spatial differentiation can work to the benefit of those who are the object of pricing. Further modelling exercises should be done to further explore these issues.

4.4 Use of revenues is important

It has been argued long – both by researchers and policymakers – that the use of revenues is a crucial issue for transport pricing. It is a critical question from the acceptability viewpoint – both public and political – and it can have great welfare (efficiency) impacts – often much greater than the direct impacts. But issues related to the use of revenues also arise when determining which level of government should be responsible for introducing the pricing (and allowed to retain the proceeds and decide on their use).

In partial (equilibrium) models the welfare effects of using revenues outside the transport sector (optimally or not) have typically been captured by the simple concept of shadow price of public funds. This feature was present also in most of the MC-ICAM model applications. However, three case studies were able to consider revenue use as an endogenous choice, and hence could address the issues more deeply:

- A case study of Brussels was concerned both with different charging instruments (cordons, parking charges and public transport fares) and with the decisions of two

different levels of government, city and regional, and the implications for economic efficiency of alternative distributions of authority between the two levels. The case study addressed institutional problems relating to different levels of government, on two alternative assumptions; the first that each level of government does what is best for its electorate given the decisions of the other level (leading to a Nash equilibrium); the second that the regional level lead, and the city government does what is best for its electorate given the decisions of the regional level. Whilst it appears to be best in principle for decisions on cordon pricing, parking charges and the use of revenue all to be concentrated at the regional level, it also appears that for the city to have control of parking charges and to share the revenue is not too damaging. What is damaging is if the city has control of the cordon charge, which will have its biggest impact on those living outside the city. Overall, the results of the case study encourage a belief that practical compromise solutions can be found.

- In Belgium and Norway the overall welfare benefits of freight transport charges may be several times greater when revenues are used in the public sector (whilst allowing corresponding reductions in distorting taxes) than when they are returned to consumers or users as lump sum payments. For instance, in the Belgian case, if the tax revenues are used as lump sum subsidies (to consumers/users), the welfare gain of a freight tax increase is only 20 to 30% of the welfare gain in a situation where revenues are used to reduce labour taxes. These Belgian and Norwegian studies also show that the way in which the revenues are used has a dominant impact on the optimal price level: Where revenues are used in best way, optimal charges are higher. Evidently in this way the indirect benefits can be made even larger.

4.5 Long-term impacts through land use

Indirect and long-term impacts through land use impacts and location decisions by households and industry were investigated in two case studies:

- In Oslo the direction of land use effects depends clearly on which measures are applied for marginal social cost pricing. Toll ring charges have the long-term effect that people and work places move away from the toll ring; whereas introduction of link based charges have the long-term effect that people and workplaces tend to move back to the city. The long-term effects of a strategy indirectly but significantly affected many overall transport indicators (also environmental indicators) through people's and work places relocation to reduce travel costs.

These results demonstrate the importance of accounting for land use changes when designing implementation paths for marginal social cost pricing.

5 Overall conclusions

We believe that MC-ICAM has achieved considerable new insights into the problems of implementing marginal social cost based pricing, as illustrated above. But what are our overall conclusions from the project?

Marginal cost pricing approach in transportation policy is still considered radical despite its long treatment in the economics literature and more recently also in policy documents. However, though opposition and objections to the marginal cost pricing principles use are still strong, the inevitable trend appears to be that their potential for solving many transport related problems becomes more and more understood and accepted. Many examples of this exist, although in many cases the term 'marginal cost pricing' is not used (and perhaps with good reason).

One problem, as we have seen, have been naive and overly eager attempts to implement or sell these policies to the public that have done more harm than good. It seems that not all its advocates have understood how radical policies and changes they have been talking about. Partly the problem here has been that the issues have been looked at from the transportation sector's perspective which can be quite limited for solving or even realising all the difficulties involved. Applying these principles in transport has great repercussions to other sectors too and these need to be allowed.

For the implementation of marginal cost pricing, or marginal cost based pricing as we prefer to call it (with the appropriate interpretation of this term), a phased approach is a key strategy to solving many problems surrounding it. Important concepts here are barriers and constraints.

Nothing we have done in MC-ICAM has suggested anything other than that it is best, where-ever possible, to go straight to the first-best solution. But there are good scientific (and also practical) reasons for believing phasing and packaging to be necessary. Moreover, some barriers to achievement of the first-best, both within the transport sector and elsewhere in the economy are likely to remain indefinitely, so that the solution will always be some form of second-best.

We believe that the methodology we have introduced in terms of the analysis of barriers to implementation as causing constraints that may be eased over time, and of identification of optimal phasing as a series of second-best optima each one being better than the last as the constraints are eased, is a valuable one.

Much uncertainty remains about the exact nature of the barriers and the constraints and the link between them. Understanding the degree to which the barriers and constraints can be eased over time is necessary for determining what government actions can help with this.

Besides many identified simpler barriers, a big 'umbrella' barrier hovering over the implementation is the vicious circle between technology, institutions and acceptability. New technological developments and solutions would be important for acceptability. But such developments and solutions are very much dependent on and hampered by (e.g. investments, possibilities for testing) the current institutional conditions. Thirdly, there is the interdependence between political acceptability and institutional status quo.

This circle or dilemma needs to be – and we believe can be – broken, through a thoughtful application of the phased approach. However, it is important to make sure

that already the first steps provide concrete benefits and also in this way increase acceptability.

MC-ICAM modelling results indicate that sensible phasing of simple pricing measures can lead to worthwhile benefits already in early phases. But equally, or perhaps even more important, is the role of early solutions in building up acceptability for more sophisticated developments later. This is suggested both by experience and theoretical reasoning. We do not have to wait for the ideal solution; a best strategy is to start implementing what is feasible now.

Typically, in the past, economists and modellers (and others) have in their analyses more or less taken the barriers and constraints as exogenous factors and, one sometimes gets the impression, have minimised the effort paid to their understanding and appropriate formulation of the policy or optimisation problem for the purposes of analysis. Instead, optimisation and testing of alternative prices and price structures under the given constraints have been considered more interesting – evidently this has been rational behaviour because it directly produces numbers (and this is what most policymakers want). No wonder then that there have been difficulties in implementing the suggested policies. Clearly a shift of focus is needed here.

Rather than focusing on fine-tuning of the derivation of second-best prices, and often very detailed technical problems related to implementation, the policymakers and analysts should instead pay more attention to careful identification of the key barriers and their implied constraints, and the possibilities for removing (or avoiding) them. This also requires, as discussed in the MC-ICAM work, that the goals of the pricing policy – and also in relation to other policies – are clearly understood and defined in a transparent way. We hope that we have laid the foundations for further fruitful research on these issues.