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EXECUTIVE SUMMARY

Economic theory shows that, under the market approach, *marginal cost pricing* is a condition for economic efficiency. Still, a huge gap exists between the lessons of economic theory and the possibilities of current technology on one hand, and the achievements in implementing marginal cost pricing thus far in practice on the other.

The AFFORD study has investigated these issues. Marginal cost pricing here means, in the first place, *marginal social cost pricing* or *marginal externality cost pricing*, with the goal to provide optimal incentives to transport infrastructure users to change their behaviour.

AFFORD approach to marginal cost pricing

AFFORD emphasised the need to cover all relevant behavioural dimensions relating to marginal costs and marginal cost pricing – both economic and non-economic (according to a narrow definition of economics). Too often discussions about the implementation of marginal cost pricing in transport thus far in practice have become ambiguous and blurred – and have remained theoretically weak – because all such dimensions have not already been addressed appropriately at the conceptual or theoretical level.

However, due to the great number of behavioural dimensions and categories of external costs to be accounted for, the task of marginal social cost pricing can be extremely complex. A further complication is that the different behavioural dimensions can simultaneously affect several cost categories.

Another important insight and principle of AFFORD was that marginal cost pricing instruments must not be considered in isolation but primarily as part of broader policies – in particular, covering the revenue use (distributional measures) and other potential complementary measures. Both actual policies in urban transport and the literature on urban transport pricing thus far typically have addressed individual pricing measures in taking care of isolated problems. Marginal cost pricing, in particular, has too often been seen just as a technical exercise to implement a single price on a single route (or cordon) or mode.

The AFFORD approach, instead, was defined to look for overall solutions. Given this goal, particular emphasis was given to a careful consideration of the institutional context of marginal cost pricing. To fully allow for all the relevant aspects and dimensions, AFFORD focused on consideration of broader marginal cost pricing-based policy packages rather than of individual pricing measures. The relevant policy package types were defined to include: *reference or scenario package; first-best benchmark package; best-practice second-best package;* and *package reflecting acceptability concerns.*

AFFORD also strongly emphasised the need for *integration of conceptual economic analysis* and *real-world simulation models*. The integration of these two approaches or traditions has not previously received the attention it deserves. However, greater interaction would be necessary for rendering the real-world model applications to better allow for economic efficiency as a goal, alongside the traditionally well represented

broader objectives. This is a precondition for the use of these real-world models for analysing marginal social cost pricing.

Potential welfare effects

An important logical and political precondition for introducing marginal cost-based pricing in practice is that they can be justified in terms of their potential or likely efficiency benefits, while securing that any negative distributional effects cannot undermine them. AFFORD presented estimates of such welfare effects from transport modelling applications for four European cities, *Athens*, *Edinburgh*, *Helsinki*, and *Oslo*. Although considerable differences existed between the different real-world model applications and specific environments in the case study cities, some significant common features and patterns did emerge from the analyses.

The *efficiency estimates* for the *first-best policy* package in the analyses for Edinburgh, Helsinki and Oslo suggest efficiency gains of the order of 200-400 euros per capita per annum, compared to the current situation. These annual efficiency figures assume a positive shadow price of public funds of 0.25. The corresponding range for a zero shadow price is 75-250 euros. The estimates from the Athens analysis suggest efficiency gains of the order of 25–35 euros per capita per annum.

The direction of effects in the second-best solutions is generally the same as in the first-best solution, but the overall efficiency gains are considerably smaller, especially where the constraints of prevailing legal and institutional arrangements are assumed.

For the Edinburgh and Helsinki analyses, *second-best policy under current institutional constraints* produces aggregate efficiency gain predictions of the order of 150-250 euros per capita per annum, in the range of 50-75% of first-best benefits. The equivalent predictions for the Oslo analysis are much lower, 10-60 euros per capita per annum, around 30% of the first-best, but they may have been affected by the impacts of the existing toll ring. In Athens, estimated efficiency gains from pricing measures currently available were as low as 8-12 euros per capita per annum, also around 30% of the first-best prediction.

For *second-best policy after appropriate institutional reform*, aggregate efficiency gain predictions differed quite significantly. The Edinburgh model application produced the highest figures, up to almost 90% of the first-best benefit. In Helsinki, Oslo and Athens, the range of benefits was up to around 75% of first-best.

An important aspect of the model application-based analyses was the consideration of the *use of the revenues* (and the *shadow price of public funds*). This produced, perhaps, the most striking and contradictory issue regarding the AFFORD efficiency estimates. Results from the Oslo analysis, in particular, suggest that a major part of the overall efficiency gain from marginal cost-based road pricing may be the result of assuming an effective use of the revenues, e.g. allowing a corresponding reduction in labour taxes elsewhere.

However, even focussing on the rather smaller impacts in the other cities, it is clear that issues relating to the use of the revenues (and the shadow price of public funds) may

prove absolutely critical in assessing the potential efficiency benefits available from adopting practical marginal cost-based pricing for urban transport in European cities.

The AFFORD *equity analyses* focussed on the comparison of the impacts on the rich vs. the poor travellers. Overall, the equity effects were moderate.

In summary, the results of the AFFORD modelling analyses suggest the general conclusion that the introduction of marginal cost-based transport pricing in European cities would be expected to result in significant welfare gains for the urban populations, when viewed at the most aggregate level. However, when drawing policy implications, one has to allow *two important caveats*.

First, the AFFORD analyses demonstrated that *the size of the estimated benefits can dramatically vary with the model type used* (Athens vs. Oslo as extreme cases). A second caveat is the fact that *a large part of the estimated benefits are due to assumptions concerning the use of the revenues elsewhere in the economy*, i.e. in other sectors (a positive shadow price of public funds). This latter result suggests that urban transport pricing policy should be a more general policy issue covering also other sectors beyond the transportation sector. Second, it is general also in the sense that it should not be left to the local level policy-makers only. Third, this AFFORD result emphasises that the use of the revenues is an extremely important issue. But, one also should emphasise, more research on these issues should be carried out before making more specific policy suggestions.

Legal and institutional issues

Addressing legal and institutional issues of marginal cost pricing has been an important aspect of the AFFORD study. A core part of the AFFORD analysis contained an in-depth empirical discussion based on *case studies* carried out for five cities: *Athens, Edinburgh, Helsinki, Lombardy* and *Madrid*. But also conceptual and theoretical considerations were given sufficient weight. This was necessary, because no studies (to our knowledge) have specifically devoted to these issues in a marginal cost pricing context.

Data collection for the case studies was carried out by means of a *literature review* (background reports) and a *questionnaire* on the legal and institutional issues related to urban transport pricing, and posed to local politicians and planners within the case cities. The questionnaire, supported by in-depth discussions, helped to clarify the perceived implications of issues raised by the background reports and enabled a greater focus on the potential for change to urban transport pricing policy.

Regarding the *degree and importance of the inter-country differences of existing legal and institutional frameworks,* different views seem to exist. It is sometimes stated that there are such large differences between different countries that the ability to use standard theories and formal models let alone quantitative analysis to draw general conclusions about their impacts on issues such as transport pricing policy is rather constrained. However, the views emphasising the importance of these differences seem to reflect a lack of sound theoretical approach or framework and a tendency to focus too

heavily at a detailed level. Our view is that, at a more general level, the similarities between countries (and, in particular, EU member states) far outweigh the differences.

The case study reports showed that the urban areas chosen by the AFFORD study represent a broad sample of situations in the European context. In particular, the following *important dimensions* emerged: *the number of administrative levels* (two for Athens, Edinburgh and Helsinki, three for Lombardy and Madrid); *the balance of responsibility between the public and private sectors* (e.g. the market-oriented approach to public transport provision in Edinburgh vs. much more interventionist policies in Helsinki and Madrid); and *the level of stability of the prevailing legal and institutional frameworks or structures* (e.g. the long-standing and stable arrangements in Athens and Helsinki vs. the evolving legal approaches to transport pricing and the recent and related creation of a new national institution in Edinburgh).

Overall, the reports concluded that the *legal and institutional frameworks or structures* required to implement marginal cost-based pricing in urban transport in Europe have, so far, not been put in place. Even less has their potential for promoting economic efficiency been tested. Even those countries which have long-standing and accepted legal and institutional provisions for road pricing systems related to inter-urban motorway use may face a new and different set of problems when considering road pricing in the urban context.

Currently, urban transport policy innovations are being considered in a number of European states towards the ability to levy more direct charges for road use. However, much less is being done towards new pricing regimes in broader settings covering *multi-modal, spatial & geographical, and inter-sectoral issues*. On the other hand, even where pricing policy innovations are being considered and transport demand management goals represent a significant motivation, the practical solutions envisaged are some way removed from marginal cost pricing principles.

The *legal and institutional barriers* to marginal cost pricing may appear on the charging side and the revenue use side. AFFORD classified such barriers into three broad categories: *structural barriers; opposition from non-governmental interest groups;* and *low socio-political acceptability*. Furthermore, the structural barriers were further categorised as being caused by: *inappropriate or non-optimal organisational structures; insufficient legislation;* and *contradictory national policies.*

AFFORD concluded that the introduction of marginal cost-based pricing for urban transport will in the first place require the *creation of supporting institutions and legislation* and *removing inconsistencies built in national level policies*. But improving the *effectiveness and transparency of communication* and generating a significant change to the existing *governmental culture* with regard to these issues were also deemed to be extremely important, as part of developing a wider understanding of the prevailing transport pricing problems and the potential benefits of marginal cost-based solutions. The subsequent challenge for both academics and policy-makers is to bring together the very different theoretical and pragmatic viewpoints within the public socio-political environment.

Acceptability issues

The AFFORD study on acceptability covered all three key-groups: *the public at large, politicians, and business representatives*. Furthermore, an important feature of the study has been to consider the interaction between acceptability and institutional issues.

A *public acceptability questionnaire survey* was carried out in *Athens, Como, Dresden* and *Oslo*. The survey focussed on specified pricing policy packages. Two such packages – the *strong or best practice second-best package* and the *weak or acceptable package* – were applied in all cities; in addition, for each city, a site specific strategy was defined to allow for specific local circumstances.

The questionnaire used reflects, above all, the different variables outlined in the underlying acceptability model, in which *problem awareness, perceived effectiveness, acceptability and expectations* are central constructs. Earlier experiences with questionnaires in the EU-projects were integrated. The sample consisted of *motorists* exclusively.

The *political acceptability survey* was carried out as a phone survey. Personal interviews with the politicians were performed in the cities of Como and Dresden only. The questions focused in particular on problem perception and on the evaluation of the various policy packages.

Finally, a *business acceptability survey* was held among representatives of business organisations in four cities: Athens, Como, Dresden and Oslo. Respondents were asked to rank policy packages on the basis of various general assessment criteria. The questionnaire further addressed issues concerning the interviewees' perception of the urban mobility problem in their city, and their recommendations and proposals as to how the urban mobility problems could be solved.

The study concluded, regarding *public acceptability*, that among the public at large there is a high *problem awareness*, both general and personal. Especially air pollution, congestion and parking problems were considered to be very critical. But there were local differences in the problem perception. Negative expectations about the development of the perceived problems were predominant, which contributes to a rather pessimistic view of the overall situation.

The subjective level of *information* for the strong and the weak packages was very low. However, there were differences between the sites. The knowledge about the measures was very low in Dresden and Oslo, while it was rather low in Athens and Como. The difference could be explained as follows: in Oslo, the question referred to the objective knowledge because there already exists a specific pricing system, whereas in Dresden, as well as in all former socialist countries, knowledge about pricing instruments in general is low. On the other hand, in Athens and Como the respondents seemed to feel slightly better informed about the measures.

The *perception of the effectiveness* of the two strategies to reduce inner city traffic was much higher than the information level. These overall higher scores for effectiveness

than for awareness may indicate that respondents believe that demand management is to some extent capable of successfully addressing current transport problems. Concerning the personal outcome – a first and easy to communicate approximation to *equity* – the majority of the respondents expects more disadvantages for themselves following from the introduction of road pricing.

It was found, as expected, that at present road pricing is not capable of winning a majority among motorists. In general, the stated *acceptability* of both the strong and the weak package was low. However, in this respect, there were significant differences between the four sites.

In summary, even if a package solution with transparent revenue hypothecation receives stronger support than single pricing measures, the packages tested here find no majority among the motorists. However, compared to the strong strategy the acceptability of the weak strategy pricing nearly doubled.

Because of the very small sample only very tentative conclusions could be drawn for *political acceptability*. Overall, it was found that the politicians' personal traffic related problem *perception* is rather high and does not substantially differ from the car drivers' problem perception. Both the politicians' *evaluation* of the effectiveness and their personal *acceptability* of the presented pricing strategies was surprisingly positive. So, the politicians' acceptability of pricing policies was higher than expected.

Regarding *business acceptability*, the business representatives in general stated that urban transport suffers from severe problems such as lack of parking space, congestion, air pollution, and inadequacy of public transport – although the relative importance varies somewhat between the cities. In all cities but Dresden the majority of interviewees believe that there should be a limitation of traffic.

Concluding comments – call for integration of partial questions surrounding marginal cost pricing

The AFFORD results concern different aspects of marginal cost pricing: *efficiency and equity impacts, legal and institutional barriers, and social and political acceptability*. AFFORD convinces that we are making progress – perhaps slow but steady – in understanding these and many similar partial questions surrounding marginal cost pricing. But it also shows that we are only beginning to understand that there exist *important but largely unanswered questions surrounding the interaction between these areas or sets of issues*. Academia is as yet far from a satisfactory study of the *implied system of issues*.

An important feature of the AFFORD study has been to consider *the interaction between these aspects or sets of issues*. AFFORD has emphasised – and demonstrated – that these three broad sets of issues should not be considered in isolation, but in combination instead.

AFFORD has shown that adherence to the starting point underlying marginal social cost pricing – transport pricing should be motivated by the desire to promote economic

efficiency – allows making progress in the integration of these sub-questions. A central approach here is the use of the theory of second-best. It has also become clear that if the starting point is abandoned, too many degrees of freedom are introduced and basically anything goes.

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1 INTRODUCTION

1.1 AFFORD starting points and objectives

Charges and taxes for transport have traditionally had little connection to costs, instead being part of broader fiscal policies of raising revenue or directly promoting other goals, industrial, social and environmental. The gap between the costs and actual charges is particularly evident in urban road transport where current pricing mechanisms typically make little or no attempt to reflect concentrations of transport activity in time and space and hence of transport induced costs.

Economic theory shows that, under the market approach, marginal cost pricing is a condition for economic efficiency. Still, a huge gap exists between the lessons of economic theory and the possibilities of current technology on one hand, and the achievements in implementing marginal cost pricing thus far in practice on the other. There is an obvious tension or paradox between economic theory, which suggests marginal cost pricing is the right solution, and practical experience, which suggests that such pricing measures are hard to implement. In particular, road pricing appears to enjoy notably scant support among the population in general and is a controversial topic among politicians and professional policy-makers.

Economic theory states that marginal social or externality cost pricing would enhance the economic efficiency of urban transport systems. It also suggests that it would improve equity, to the extent that the polluter-pays principle is considered equitable and fair and the current situation (where some cost components of transport activities are externalised and are, hence, borne by others than those who cause them) is considered inequitable or unfair.

These issues have been addressed in the AFFORD study. The study was designed to cover the following four areas:

- operationalisation of marginal cost pricing;
- applied model analyses;
- legal and institutional issues; and
- acceptability problems.

The more detailed objectives of the project were to:

- identify and define practical measures to implement marginal cost pricing;

- assess the effectiveness of such measures in internalising externalities and affecting demand;
- examine institutional issues affecting the implementation of such measures;
- assess the economic and equity implications of such measures;
- assess public and political acceptability of such measures, and how this may be improved where appropriate; and
- provide policy guidelines for the practical implementation of pricing measures.

1.2 Fundamental questions

An important issue underlying the AFFORD study has been the assumption or view that, without efficiency considerations being a prime motivation for policy, there would be no reason to engage in marginal cost-based pricing in the first place. Much of the debate on the relevance or feasibility of marginal cost-based pricing in practice in urban environments then reduces to the question of whether economic efficiency in fact is, or should be, a prime motive guiding policy-makers (and, in particular, local policy-makers). [1] Another question is how large are efficiency benefits. A third question is: if efficiency benefits are large, and if policy-makers consider efficiency as an important goal, are there then barriers (technological, institutional, acceptability related) to its implementation?

A fourth question concerns the relevance of these well-known theoretical considerations and results for policy-making in practice? Can the theoretical idea of marginal cost pricing be operationalised in terms of a simple and transparent charging system, given all the imperfections prevailing in practice? Can marginal cost-based pricing schemes in practice be as effective (in terms of achieving efficiency) as the theory suggests? More generally, is the urban transport environment in reality such as the streamlined theory assumes? Correspondingly, can the efficiency gains – whether achieved by means of marginal cost pricing or by other means (regulatory policies) – be as large in practice as the theory suggest they might be? Is economic efficiency, as defined in the theory, an important practical policy goal or criterion, compared to the range of issues that, typically, dominate real-world policy-making – such as equity, environmental concerns, business interests, political acceptability and all manner of detailed practical considerations? And so on.

[1] Efficiency considerations can be considered as two separate aspects, to the effect that: (1) given the policy instruments available, a government wants to achieve a situation where the magnitudes of external costs are optimised (i.e. the efficiency gains maximised); and (2) the changes (typically reductions) in the magnitudes of external costs, induced by the available policy instruments, are achieved in the most socially cost-effective manner. Social cost-effectiveness would include costs such as external costs, forgone benefits of transportation (with elastic demand) and may very well include transaction costs, too.

These and similar questions have been addressed in the AFFORD study. A starting point and driving force of the study has been the widely recognised tension or gap between the economic theory, which suggests that marginal cost pricing would enhance efficiency, and practical experience, which suggests that such pricing in real life may be hard (if not impossible) to implement.

The reasons for this situation can be manifold:

- the gap between the underlying economic theory of marginal cost pricing and the requirements for practical implementation (i.e. the way marginal cost pricing concepts are described in theory vs. the way they should be defined and described for practical implementation) may be too large;

- concerns of the distributional effects (and other negative effects and risks and dangers) of marginal cost pricing may overshadow considerations of the positive efficiency gains;

- important institutional and legal barriers to implementing marginal cost pricing may exist; and

- public and political acceptance of marginal cost pricing may be low because of various non-economic factors (psychological factors, social pressure, historical reasons etc. – e.g. related to the fact that roads have traditionally been free goods).

An important issue and view underlying the AFFORD study has been the assumption that marginal cost pricing in urban transport must be motivated by a government's (or regulator's) desire to improve the efficiency of the transport system and – from a broader perspective – of the spatio-economic activities it serves. Without efficiency considerations being a prime motivation for policy, there would be no reason to engage in marginal cost-based pricing in the first place.

AFFORD has focused, in particular, on the following two main efficiency related questions, and their policy implications:

- How large are the potential economic efficiency benefits that could, in principle, be gained in real-world urban transport environments, and how are they composed of – in particular, whether as strictly local benefits or as generated due to a positive shadow price of public funds and thus more widely distributed?

- To what extent is marginal cost pricing a realistic and feasible policy, and how effective can it be in achieving the efficiency gains, as compared to alternative approaches, taking account of legal and institutional barriers and the fact that the public and the politicians may not perceive economic efficiency as a key policy goal, compared to other issues?

1.3 The marginal cost pricing debate

The standard argument for marginal cost pricing in transport and in urban transport in particular – presented in economic theory and in real-world policy discussions – is extremely simple: marginal cost pricing enhances overall economic efficiency. It also enhances equity, to the extent that the polluter-pays principle is considered fair. However, different arguments that have been presented – theoretical and practical and in various contexts – to question the relevance and usefulness of marginal cost-based pricing, reflect, instead, a broad range of concerns and issues.

It may be useful to shortly review such arguments here, so that they can be kept in mind when going through the AFFORD analysis and conclusions below. This enables us to consider and assess these arguments in the light of the AFFORD results (or vice versa). Also, it enables us to develop new insights regarding (the validity of) the central arguments and to identify those issues which the AFFORD study has been able to address specifically.

First, different views about theoretical issues related to marginal cost pricing (still) seem to exist even among economists (let alone researchers and practitioners representing other academic fields). Members of the academic community are neither unanimous nor unambiguous in this respect. One long-lasting debate relates to the appropriate or correct interpretation of the concept of marginal cost in the pricing context: whether it is the short-run or the long-run marginal cost pricing concept that should be adopted and applied.

Another issue – extremely relevant to AFFORD – is the question of whether politicians and the public actually want (or will accept) achievement of the traditional economic definition of efficiency and, hence, the policies that should lead to it. How far do people want policies to go towards this goal? It has, for instance, been claimed that people may not want complicated pricing schemes with the aim to achieve efficiency at a very detailed level, but, rather, prefer simple schemes which allow them to avoid making mistakes (Glazer, 2000). (Here we can distinguish between whether people want the goal & whether they want the practical policies. Both are relevant. If people do not want the goal (efficiency), then there really is no need to use the policy!)

Other reasons for not wanting efficient prices may include the fact that people may tend to focus on the *primary welfare effects* implied (for instance, the effects of higher peak hour prices) and may ignore or simply not believe in *secondary welfare effects* (such as lower average off-peak prices when recycling takes the form of lower fixed vehicle taxes, or, more generally, beneficial welfare effects resulting either from any approach recycling or due to a reduction in external costs affecting travel conditions) – let alone long-run and/or general equilibrium effects. In particular, the primary welfare effects that politicians and the public focus on *will always tend to be short-run*, regardless of whether we prefer short or long –run concepts in the theoretical debate. Regarding the secondary welfare effects, there are a number of dimensions to them that might need to be brought out. For example, it may be necessary to distinguish between people *believing* natural second order effects (e.g. pricing = fewer people travelling = better travel conditions), *trusting* the government (regulator) to do the recycling (i.e. they may

see marginal cost pricing as no more than an extra, unaccountable tax without hypothecation) & *wanting* the results of recycling (e.g. the "why should the money be spent on 'x'? I think it should be spent on 'y'!" attitude).

Third, significant differences of opinion seem to prevail within the EC – evidently partly reflecting the different views prevailing within the academic/research community. One example is the issue of the marginal cost pricing vs. the so-called transport accounts approach. Fourth, various inquiries show that there are widely divergent views among policy-makers both at the national and local levels in different countries. Typically, the different statements reflect the view that marginal cost pricing would not be feasible in practice – neither financially (would not provide enough revenues) nor technologically. Serious doubts concerning the usefulness of marginal cost pricing in the urban environment have also been expressed from a purely practical viewpoint related, e.g., to monitoring, enforcement, and technical issues surrounding toll collection.

Finally, a number of arguments have been presented by different interest groups in the context of a few actual attempts to consider seriously the introduction of marginal cost-based pricing approaches for urban transport in practice – in The Netherlands, the U.K., etc. (Boot, Boot and Verhoef, 1999; Milne, Niskanen and Verhoef, 2001).

From a review of public attitude studies, Jones (1998) has identified the following reasons for opposition to road congestion pricing, most of which would be relevant for the more general case of marginal cost pricing:

- drivers find it difficult to accept the idea of being charged for something that they wish to avoid (congestion), and also feel that congestion is not their fault but rather something that is imposed on them by others;
- road pricing is not needed, either because congestion is not bad enough or because other measures are superior;
- pricing will not get people out of their cars;
- the technology will not work;
- privacy concerns;
- diversion of traffic (and an increase in congestion) outside the charged area, inefficient re-routing;
- road pricing is just another form of taxation; and
- perceived unfairness.

One could add to this list (at least) the following points:

- negative effects on competitiveness of local firms and shops;

- the technology needed will be too expensive; and

- unfair high tolls for some groups (e.g. local traffic), unlucky enough to pass a toll point on a short trip.

As a general list, the above 11 categories seem rather complete, although specific additional arguments may of course be raised at specific sites or for specific schemes (for instance, the unsafety of tolls based on a vehicle's speed as a proxy for the 'apparent' congestion level, as once proposed for Cambridge). Similar concerns were also recently voiced in The Netherlands when the Dutch Automobile Association (ANWB) launched a large public campaign to prevent the implementation of a full-scale congestion pricing scheme for the Randstad area.

It is tempting to engage in a 'yes-no' or 'valid-invalid' discussion of the above considerations. However, this is not the place for such a discussion. Instead, we rather observe that such arguments, valid or not, *will* be held against marginal cost pricing proposals. Therefore, the challenge is not to try to deny them, but much more to design pricing and revenue allocation schemes such that – while keeping an acceptable degree of efficiency – any possible drawbacks are minimised (preferably optimised); and to assess carefully the social benefits and costs of such schemes – both in an aggregate sense and for specific groups – that allow an objective evaluation of the pro's and con's of various alternative second-best pricing packages.

1.4 Structure of the report

The AFFORD study was designed to cover the following four areas: (i) operationalisation of marginal cost pricing; (ii) applied model analyses; (iii) legal and institutional issues; and (iv) acceptability problems. These topics have been investigated in the AFFORD Deliverables 1, 2a, 2b, and 2c respectively (Milne, Niskanen and Verhoef, 2000; Fridstrom et al, 2000; Milne, Niskanen and Verhoef, 2001; Schade et al, 2000; and Schade and Schlag, 2000).

These AFFORD deliverables inquired into the reasons for the tension or gap between the theory of marginal cost pricing and practical experience. They considered different aspects of the problem, suggesting areas where progress in implementing marginal cost pricing might most likely be made and where it seems less likely or a less worthwhile use of resources. They carried out both theoretical analysis and empirical analysis in relation to a set of case cities (Athens, Como/Lombardy, Dresden, Edinburgh, Helsinki, Madrid). In addition, information has been provided regarding the situation in Randstad in The Netherlands.

This AFFORD Final Report will develop these considerations further and provide an in-depth synthesis, with the aim to derive overall AFFORD conclusions covering all aspects of marginal cost pricing in practice. It will review the central scientific and technical results of the previous deliverables. But in particular its aim is to draw together the most important policy relevant results, to synthesise them, and to derive overall AFFORD conclusions for policy.

Figure 1.4 illustrates the structure of this report – from theory (*AFFORD approach to marginal cost pricing*) to practice (*AFFORD suggestions / conclusions / guidelines for implementing marginal cost pricing* in urban transport in Europe). This structure reflects or corresponds to the areas or stages of the AFFORD project as a whole ((i)-(iv) above).

Section 2, dealing with operationalisation issues, describes the AFFORD approach to marginal cost pricing. Section 3 summarises and evaluates the results of the applied model analyses. Sections 4 and 5 focus on legal and institutional issues and acceptability aspects, respectively. Section 6 presents the AFFORD conclusions and suggestions for the practical logistics of implementing marginal cost pricing in urban transport in Europe. Also, some concluding comments, including consideration of the scope and limitations of the AFFORD approach (and resulting conclusions) and suggestions for future research, are presented.

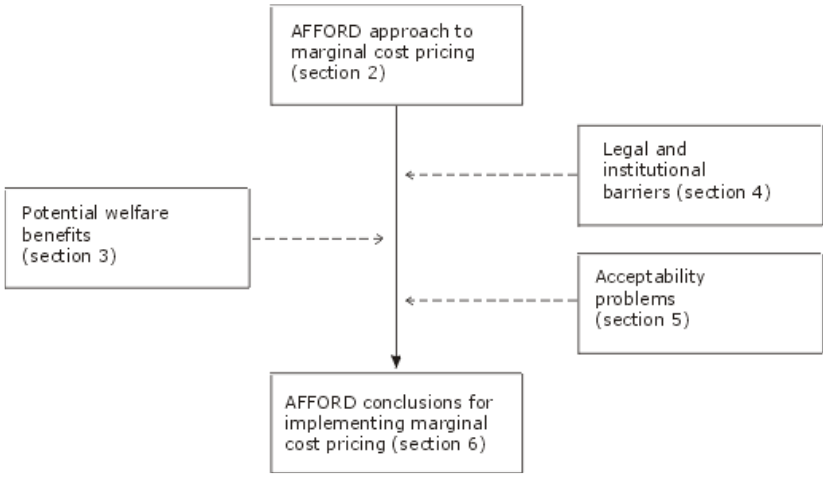

Figure 1.4: Structure of the report.

2 AFFORD APPROACH TO MARGINAL COST PRICING

Though extremely (and deceptively) simple as a textbook presentation, the marginal cost pricing principle can easily become slippery when applied in real-world environments. Therefore, it is extremely important to put special effort into transforming the theoretical idea into concrete marginal cost-based charging principles and measures for practical policy.

AFFORD Deliverable 1 (Milne, Niskanen and Verhoef, 2000), on the *operationalisation* of marginal cost pricing, addressed the gap between the underlying theory of marginal cost pricing and the requirements for practical implementation.

Marginal cost pricing here means, in the first place, *marginal social cost pricing* or *marginal externality cost pricing*, with the goal to provide optimal incentives to transport infrastructure users to change their behaviour.

To address the gap between the underlying theory of marginal cost pricing and the requirements for practical implementation, the AFFORD study started by identifying potential reasons for the gap as follows:

- the relevant marginal cost concepts and items may not be identified carefully enough and estimated with sufficient accuracy;

- the institutional context in which marginal cost pricing would be implemented may not be fully accounted for in the analyses and policy recommendations thus far; and

- the economic merits of marginal cost pricing are typically derived and illustrated in highly simplified graphical and analytical settings ignoring many complexities surrounding urban transport pricing in reality, thus casting doubt on the transferability of insights and results to practical cases.

The first type issues have already received quite a lot attention in other recent EC funded projects (UNITE, most recently) – at least as compared to the latter two types. Therefore, AFFORD in particular focused on these latter type of issues.

Deliverable 1 designed the *AFFORD approach to marginal cost pricing* to include:

- definition of relevant marginal cost and marginal cost pricing concepts;

- identification of relevant behavioural dimensions;

- definition of settings – relevant perspectives and scopes of policy-making;

- distinction between first-best vs. second-best pricing;

- adoption of the idea of policy packaging; and
- integration of conceptual economic vs. real-world simulation modelling approaches.

Deliverable 1 provided important insights and conclusions in relation to all these aspects and issues. Sections 2.1-2.6 shortly summarise the main points.

2.1 Relevant marginal cost pricing concepts

Deliverable 1 shortly reviewed and discussed basic concepts and issues, including:

- relevant parties;
- marginal cost concepts and categories; and
- the concept of marginal social cost pricing.

A natural starting point for the categorisation of different cost types in urban transport is to identify the different vested and affected parties:

- private infrastructure users;
- transport service operators;
- infrastructure operators;
- government/regulator; and
- ”third parties”.

The first three items refer to actors operating within the transport markets; the latter two are outside actors. The term *private infrastructure users* refers to consumers travelling for their own direct benefit. *Transport service operators* are profit-maximising commercial firms and non-profit public agencies operating within the urban transport market and producing transportation services, i.e. freight haulage and public transport trips. *Infrastructure operators* providing infrastructure can in principle be profit-maximising commercial firms and non-profit public agencies or the government itself directly. The *government* often subsidises transportation and collects fiscal taxes on it; it also acts as a regulator and imposes regulatory taxes or alternative non-price measures. Finally, the term *third parties* refers to economic actors, i.e. consumers and firms in other sectors, who are affected by transport-related decisions but are not directly involved in them.

Marginal cost in transport can in principle refer to:

- the cost of an additional use of transport infrastructure;

- the cost of providing an additional unit of transport service (e.g. freight haulage or public transport trips); or

- the cost of providing an additional unit of infrastructure capacity.

AFFORD has focused on marginal cost pricing of the use of transport infrastructure. It is the inefficiencies related to the use of infrastructure that most urgently call for application of marginal cost pricing in urban transport. Relating to these inefficiences, an important distinction views the relevant actors (i.e. private infrastructure users and transport service operators) as generating two types of costs: *internal costs* and *external costs*. Internal costs refer to costs which are accounted and included in transport-related decision making, either through monetary resource costs or the time taken during travel. External costs refer to costs which are not included in such decision making (i.e. they are external to the system). Within both broad categories of costs, marginal costs and total costs can be considered separately.

External costs related to the usage of transport infrastructure use can be subclassified into *intra-sectoral externalities* and *inter-sectoral externalities*. The former are contained wholly within the transport market; the latter cover the effects on the ”third parties” (cf. above) and may be seen as an ”unpaid bill” which transport poses upon society at large. The former may be further subdivided to distinguish between *intra-modal externalities*, describing costs which users of a single mode impose upon each other, and *inter-modal externalities*, which users of one transport mode impose on users of another. Intra-sectoral external costs are external to users of the infrastructure but internal to the infrastructure operator. Within these categories, a further distinction could be made to address the time dimension: some externalities are instantaneous, while others materialise in the long-run.

The major *external cost categories* in the context of urban transport Deliverable 1 defined as follows:

- congestion costs;

- infrastructure damage;

- external accident costs,

- noise;

- visual intrusion and barrier effects;

- local emissions; and

- global emissions.

The first two items are intra-sectoral externalities, the last two are inter-sectoral externalities. The fourth item (noise) contains both elements. Notice that infrastructure damage can (in principle) be well defined for property rights, and is not an externality in the same strict sense as are the other items. However, the implications for marginal cost pricing as addressed in the AFFORD study are the same.

AFFORD has focused on marginal cost pricing as applied by the government/regulator, with the aim to correct distortions due to discrepancies in marginal private and social costs. This is called *marginal social cost pricing* or *marginal externality cost pricing* (in distinction from marginal cost pricing as applied by competitive firms in the market).

The notion of marginal social cost pricing in principle applies to all the categories of external costs identified above, and it covers both intra- and inter-sectoral externalities. The goal is to secure that each activity by each user will be extended to the point where the social benefit of the last unit equals the social cost. Otherwise, in urban transport, since marginal private costs and benefits can differ significantly from the corresponding social costs and benefits, the resulting market allocation would typically be inefficient.

2.2 Relevant behavioural dimensions

A critical prerequisite for marginal cost pricing are sound estimates of relevant marginal costs. Another important precondition is understanding of the question of what extent each external cost category should be internalised through corrective marginal cost-based pricing/taxation measures and to what extent through non-price administrative means.

A theoretically sound estimation of pricing relevant marginal costs, as well as the determination of the most effective policy approach to internalise them, can only be based on deep understanding of the mechanisms behind the generation of such costs. This, in turn, requires identification of the different types of activities (cost drivers) in which the users of transport infrastructure are involved. In the AFFORD study, these activities are called *dimensions of behaviour (or behavioural dimensions).*

For instance, for car use, the following dimensions can be identified: the vehicle (technology) used; the actual state of this vehicle; the kilometrage; the time of driving; the place of driving; the actual route chosen; and the driving style. This list could easily be extended.

An important starting point of the AFFORD approach has been (and differently from previous studies) the aim to cover all relevant behavioural dimensions (of consumers, firms) relating to marginal costs and marginal cost pricing in transport – economic and non-economic (according to the narrow definition of economics). Moreover, our view is that only a genuinely multidisciplinary approach to analysing these dimensions can provide a sufficiently comprehensive information for designing effective and efficiency-enhancing pricing policies. Far too often discussions about the implementation of marginal cost pricing thus far in practice have become ambiguous and blurred – and

have remained theoretically weak – because all such dimensions have not already been addressed appropriately at the conceptual or theoretical level.

However, Deliverable 1 concluded, due to the great number of behavioural dimensions and categories of external costs to be accounted for, the task of marginal social cost pricing, in providing optimal incentives to transport infrastructure users to change their behaviour, can be extremely complex. A further complication is that the different behavioural dimensions can simultaneously affect several cost categories. Another important related issue is the determination of the correct level of (dis)aggregation.

Logically, there are various critical decision-making points that clear and reliable information on charging needs to tie in with: from the long-run decisions about residence, employment and car ownership, through the short-run (day-to-day) decisions about mode, travel time, destination etc., to the instant decisions about exact departure time and route. We have to ask: (a) which of these dimensions are the most important in determining the various elements of external costs; and (b) which of these is most appropriate for levying charges to result in the desired behavioural response.

It may be that levying charges in one dimension is behaviourally ineffective (or even counter-productive). If this is due to inelasticity of behaviour in this dimension (for instance, an imaginary inelastic demand for driving style) for each and every actor, marginal cost pricing would induce no behavioural response in this dimension. It would not lead to any welfare gains, but at the same time, neither would it lead to efficiency losses. Maintaining the marginal cost pricing principle then only has the benefit of fairness, and the benefit of identifying the inelasticity on the basis of revealed, not stated preference. If the ineffectiveness stems from charging constraints (monitoring, price differentiation), a second-best situation arises (cf. sections 2.4 and 2.5, below) where there may be the need to levy charges differentiated in one dimension to meet costs most closely related to another.

Table 2.2 illustrates the situation, considering road transport as an example. The table distinguishes between the following broad dimensions of behaviour: car use, car ownership and spatial behaviour. ”Spatial behaviour” refers to the choice of residence and the location of other activities. These broad categories are further subdivided into more refined dimensions. In particular, the inclusion of the ”number of trips” in addition to ”vehicle kilometers” indicates situations where, in a given ”market”, a larger number of cars making proportionally shorter trips would cause higher total external costs (practically: cold starts, queuing up, etc.). The purpose of the inclusion of the item ”place of driving” is to distinguish between externalities that are local in the sense that they vary over space, and externalities that are route-specific.

The table indicates the relevance of each dependence on a three point scale. The assigned stars are merely indicative and debatable; one could evidently find counter-examples. That is also the reason for using a three-point scale only. However, the table is illustrative in drawing explicit attention to the dependence between various externalities and behavioural dimensions. (A similar illustration could be given for freight transport and public transport.)

Table 2.2 Dependence of various external costs of road transport on behavioural dimensions.

	Car use					Car ownership		Spatial behaviour**
	Vehicle kilometres	Number of trips	Time of driving (peak or off-peak)	Place of driving (area or route)	Driving style	Fleet size*	Vehicle technology	
Intra-sectoral externalities:								
– Flow congestion	*	-	**	**	**	*	-	**
– Bottleneck congestion	-	**	**	**	-	*	-	**
– Infrastructure damage	**	-	-	-	-	*	*	**
– Accidents	*	-	*	*	**	*	*	*
Inter-sectoral externalities:								
– Noise	*	-	*	**	**	*	**	**
– Local emissions	**	*	*	**	**	*	**	**
– Global emissions	**	*	-	-	**	*	**	**

** particularly strong and direct relation
* possibly strong indirect relation, or moderately strong direct relation
– no particular strong or direct relation
* Also allows for car size.
** Location of residence vs. work and leisure activities.

2.3 Settings – different perspectives and scopes of policy-making

Deliverable 1 adopted the important principle that marginal cost pricing instruments must not be considered in isolation but marginal (social) cost pricing should be introduced as a comprehensive and multi-layered (multi-dimensional) system, and as part of a broader policy approach. Such an approach should specify the strategies and measures in relation to the revenue use (distributional measures) as well as other potential complementary measures.

The deliverable stated that the literature on urban transport pricing and actual policies in urban transport thus far typically have addressed individual pricing measures in taking care of isolated problems. Marginal cost pricing, in particular, has too often been seen just as a technical exercise to implement a single price on a single route (or cordon) or mode.

The AFFORD approach, while paying particular attention to the institutional context of marginal cost pricing, has instead aimed to look for overall solutions. An important feature or insight of the approach has been to distinguish between different *settings* representing (or incorporating) the whole range of relevant *perspectives and scopes for marginal cost pricing related policy-making* in urban transport. The aim has been to fully incorporate the different behavioural dimensions into the policy analysis and, in particular, to relate them to the relevant policy-making situations and perspectives (also levels).

More specifically, four settings were defined as follows:

- focussing on marginal cost pricing within road transport;
- considering marginal cost pricing for multi-modal transport;
- considering on marginal cost pricing in a spatial & geographic context; and
- covering inter-sectoral aspects of marginal cost pricing.

These settings were thought to provide a comprehensive range of actual real-world marginal cost pricing related policy-making situations with varying scope and coverage. For (within) each setting, different behavioural dimensions may become highlighted (although overlap of course exists); therefore, a separate consideration of the settings can provide an optimal treatment of such dimensions. A consistent use of these settings to provide a structured and transparent framework for the AFFORD analysis has been a new feature as compared to previous studies.

Consideration of the different settings for instance helps to highlight the important issue of the short-run vs. long-run. Any analysis of marginal cost-based pricing which focuses solely on the transport sector (within the road and multi-modal settings) will, implicitly, tend to focus on short-run pricing issues related to prevailing travel patterns. However, transport is essentially a 'derived demand', which depends upon the spatial and temporal arrangement of lifestyle activities. If pricing within the transport sector is inefficient, then the arrangement of the associated activities may also be inefficient as a direct consequence. For example, if private car users currently pay significantly less than the marginal social costs of their journeys, we might expect that the spatial diversity of their activity profiles would be greater than under efficient pricing (leading to more travelling), while the temporal diversity would be less (as a result of a greater tendency to travel during peak periods).

In general, moving to a transport pricing settings which include spatial & geographical issues and inter-sectoral issues will necessitate a broader and more complex approach than the application of short-run marginal cost pricing within the transport sector (within the urban road and multi-modal settings). From an urban transport policy-making perspective, it is also likely to make the problem appear much more demanding.

2.4 First-best vs. second-best pricing

A consistent and coherent distinguishing between *first-best vs. second-best pricing* has been an essential feature of the AFFORD approach – reflecting the general aim to better allow the institutional context of marginal cost pricing. This is another feature which differentiates AFFORD from previous studies (which may have often mentioned this distinction in passing but have not really built their analyses on it).

The distinction between the first-best and second-best pricing relates to the fundamental distinction in economics between the first-best and the best practice second-best optima. The former defines a fully optimal benchmark, the latter focuses on realistic representations of available or existing technologies, legal and institutional frameworks (structures, systems) and barriers and all other conceivable constraints on practical pricing policy. The distinction provides an essential framework for a theoretically sound welfare analysis (at a conceptual level and by means of applied real-world models), and, thus, of theoretically and empirically sound conclusions for policy-making.

Deliverable 1 adopted the interpretation that also *second-best pricing can be viewed as marginal cost pricing; it is marginal cost pricing under second-best constraints*. (An alternative terminology would be to retain the term marginal cost pricing to the first-best pricing only, and to discuss second-best pricing under the title 'optimal departures from marginal cost pricing'.) In the second-best case, a part of the marginal cost price is made up of the shadow price (the Lagrangian multiplier, in mathematical terms) created by the imperfection of the instrument considered. However, a shadow price also reflects a real economic cost. Given this constraint, second-best pricing is a form of marginal cost pricing in which not all margins of behaviour can be affected in a fully optimal way.

First-best pricing is often classified as a hypothetical benchmark (only), not in the least place because the implied charges would vary by so many behavioural dimensions. Secondly, the result of optimality of first-best pricing is valid only when some other (stringent) assumptions are met, the most important of which are probably that first-best pricing applies throughout the network considered, the transport sector, and the economy; and governments use lump-sum taxes to pursue any redistributional targets they may wish to meet. Whenever these assumptions are not met – so practically speaking: for any real-world application of transport pricing – we enter the world of second-best.

Deliverable 1 emphasised the important principle that, if market failures or second-best distortions in other markets (than the transport market) would prevent the first-best pricing principle from applying there, these market failures should in the first place be dealt with by direct intervention than by adjusting transport prices to reflect them. Only if this is not possible – for whatever reason – the transport taxes set should be second-best, i.e. they should reflect distortions elsewhere. The deliverable presented a number of examples of such second-best taxes, for instance, resulting from distortions affecting other links, modes, and elsewhere in the economic system.

Deliverable 1 also considered the distinction between the first-best and second-best from a *long-run vs. short-run perspective*. It emphasised the general economic principle that marginal social (external) cost pricing is a first-best benchmark policy not only because it provides optimal incentives in the short run (that is, given the shape and position of the relevant cost and demand functions), but also – and probably even more importantly – in the long run, by affecting optimally those factors that determine the shape and position of the relevant demand and (private, external and social) cost functions. The deliverable discussed a number of illuminating examples concerning

optimal transport pricing in relation to locational choice, technology choice, and infrastructure capacity choice.

Such simple examples can illustrate how marginal cost pricing will, in principle (when optimally designed and implemented), induce optimal behavioural responses for all behavioural dimensions affecting external costs generated. The reason is that marginal cost pricing fully decentralises the achievement of efficiency by letting each individual judge – by revealed preference – whether the benefits of a certain action (e.g. a transport related decision) outweigh the social costs implied. This important – though often ignored – feature of first-best pricing partly explains the economists' preference for marginal cost pricing, as the principle implies that the risk of government failures is minimised.

2.5 Policy packaging

If first-best pricing measures were possible in practice, and first-best pricing situations were otherwise relevant (no distortions elsewhere), the various behavioural dimensions determining marginal external costs in urban transport could, by definition, be affected optimally. However, in real life, the available pricing measures typically have only limited power to differentiate between different types of infrastructure users and the different categories of external costs they are generating. Moreover, there almost always are distortions elsewhere (other routes, modes, sectors) to be taken into account. In these situations, the relevant second-best measures can only reproduce partially the behavioural responses that first-best pricing would have.

An important insight and principle guiding the AFFORD study has been that marginal cost pricing instruments must not be considered in isolation but primarily as part of broader policies, in particular specifying revenue use and other potential complementary measures. The approach should recognise all the various spatial & geographic, inter-sectoral, institutional, acceptability etc. aspects and dimensions involved. Our view is that too often marginal cost pricing has been seen just as a technical exercise to implement a single price on a single route (or cordon) or mode.

To reflect this view, and in order to allow all relevant cost concepts and behavioural dimensions, as well as all other relevant aspects (distortions etc.), AFFORD focused on consideration of broad *policy packages* rather than individual pricing measures. The relevant policy packages, or *policy packaging*, should cover designing the following three aspects:

- second-best optimal combinations of pricing measures;
- use of the revenues of pricing (including optimal redistribution); and
- complementary non-price policies and instruments (investments, etc.), to optimally support the pricing and redistribution measures.

A natural core of the concept of policy-packaging (as defined here) is the design of practical second-best policies. The main idea – as developed in Deliverable 1 – is to combine various second-best taxes in a way that the package induces the most efficient behavioural responses for the most relevant behavioural dimensions to the greatest possible extent and, thus, resembles first-best pricing as closely as possible.

Table 2.5 illustrates the situation by depicting the impact of various second-best pricing instruments on different behavioural dimensions. Similarly to table 2.2 above, the numbers of stars here should be interpreted as illustrative only and are subject to discussion.

Table 2.5 Impact of various second-best pricing instruments on different behavioural dimensions.

	Car use					Car ownership		Spatial behaviour
	Vehicle kilometres	Number of trips	Time of driving (peak or off-peak)	Place of driving (area or route)	Driving style	Fleet size	Vehicle technology	
First-best benchmark pricing	***	***	***	***	***	***	***	***
Direct demand management								
ERP per km	**	**	**	*	-	**	-	**
Toll booths	*	**	*	*	-	**	-	*
ERP Cordon	*	**	**	*	-	**	-	*
Peak permits	*	*	*	*	-	**	-	*/-
Area licences	*	*	*	*	-	**	*	**
Parking fees	*	**	*	*/-	-	*	-	*
Non-differentiated fuel taxes	**	**	-	-	-	**	**	**
Indirect demand management								
Non-differentiated vehicle taxes	*	*	-	-	-	**	-	-
Subsidising public transport	*	*	-	*/-	-	*	-	*
Subsidising tele-working	*	**	*	*/-	-	*	-	-
Location subsidies/taxes	*	-	-	*/-	-	-	-	*
Supply-side oriented measures	-	-	-	-	-	-		-
Differentiated vehicle taxes	-	-	-	-	-	-	**	-
Differentiated fuel taxes							**	

*** optimal (first-best) impact
** likely direct impact, possibly approaching first-best standards
* possible direct impact
– no particularly strong direct impact, or at least unlikely in practice

A useful framework for the design of practical policy packages is provided by a categorisation of different *package types*. The package types should be sufficiently comprehensive so that they together reflect the main aspects of pricing in urban transport. Deliverable 1 concluded that, typically, the marginal cost-based pricing policy packages to be considered should include:

- reference or scenario package;
- first-best benchmark package;
- best-practice second-best package; and
- package reflecting acceptability concerns.

Each of these package types should specify relevant pricing measures, revenue use side measures, and also more general urban and other pricing-related policy measures. There of course may be more than one relevant package in each category. In particular, it may often be useful to consider separately a *best-practice second-best package under current institutional constraints and after institutional reform*. The AFFORD study paid considerable attention to this distinction.

Typically, a *best-practice second-best package* – both under current institutions and after institutional reform – could then include time dependent *cordon charges* to reflect the time dimension, *fuel taxes* to reflect the trip length dimension, and *parking policies* in the city centre to account for spatial variability.

Deliverable 1 presented illustrative examples of these package types. The deliverable hypothesised that the best practice second-best package should assume relatively high charges, and some part of the revenues should be used as hypothecated within the transport sector but a large part be used to lower labour taxes (with no hypothecation). About the acceptable package type the deliverable assumed that it should contain relatively low charges and fully hypothecated revenue use.

In particular, the following two highly stylised examples (with actual numbers) were developed:

A *best practice second-best package,* also called a *strong package,* assumes *relatively high charges and that much of the revenues are used to lower labour taxes (i.e. without hypothecation).* More particularly, it assumes that:

- parking charges are increased by 0.5 euro/hour, taxes on fuel are increased by 0.5 euro/litre and a cordon toll of 2 euro in peak hour (7:00 to 9:00 a.m.) and 0.5 euro/hour out of this period; and
- the revenues are allocated as follows: 1/3 to increase road capacity and 2/3 to reduce labour taxes.

An *acceptable package,* also called a *weak package,* assumes *relatively low charges and hypothecated revenue use*. More particularly, it assumes that:

- parking charges are increased by 0.25 euro/hour, with a fixed tariff of 1 euro plus taxes on fuel increased by 0.1 euro/litre; and

- the revenues allocated as follows: 1/3 to increase road capacity and/or increase parking space, 1/3 to reduce car taxes, and 1/3 to reduce public transport tariffs and/or provide more facilities to cyclists and pedestrians.

The strong package, thus, in particular should apply in an inter-sectoral setting; the weak package applies in multi-modal and spatial & geographical settings.

Deliverable 1 emphasised that, even though the types of charges selected here do reflect the main behavioural dimensions – time of day (peak-cordon), spatial concentration (parking), and total trip length (fuel) – the levels are illustrative only.[2] More realistic first-best and second-best optimal levels – valid for individual cities – can only result from actual real-world modelling exercises (cf. section 3 below). Moreover, correct prices for each city can only be determined by allowing for local conditions, and these understandably may give rise to large differences.

It thus needs to be emphasised that the aim of the stylised packages as defined above, when considered in the AFFORD study, has been to ensure comparability between the different cities. They were thought to be the best guesses, and optimal compromises between the different cities, under the information available.

AFFORD analysed these stylised packages and their variations – appropriately adjusted to local conditions prevailing in the case cities – from the real-world simulation modelling, institutional analysis and acceptability analysis viewpoints. These analyses and their conclusions will be reviewed below in sections 3, 4 and 5, summarising the contents of the AFFORD Deliverables 2a, 2b and 2c respectively.

[2] The prices assumed are chosen based on an earlier work with the TRENEN model (Van Dender, 1998). For Brussels, the TRENEN model concluded that for a small petrol car "The optimal tax is 0.487 ECU per kilometre (off-peak: 0.208 ECU/km)". Taking as the weighted average car trip length 10 km's, this means that the optimal taxes per trip are 4.87 and 2.08 Euro. Assuming that, in urban traffic, the average car uses 1 litre per 10 kilometer in the off-peak and 1 litre per 8 kilometers in the peak, and that paid parking duration is on average 4 hours for peak travellers (not everybody has to pay for parking, not everybody stays 8 hours) and 2 hours for off-peak travellers, our package produces the following taxes per trip: Peak: Cordon toll 2.0 + Fuel (10*0.125*0.5) 0.6 + Parking (4*0.5) 2.0 = Total 4.6; Off-peak: Cordon toll 0.5 + Fuel (10*0.1*0.5) 0.5 + Parking (2*0.5) 1.0 = Total 2.0. This seems reasonably close to computed optimal prices for Brussels. Surely, these assumptions are open to discussion. The direct translation of 'optimal prices' into 'tax increases' reflect the implicit assumption that current taxes reflect other considerations than those considered here; in particular externality regulation. The validity of this assumption may also vary between sites.

2.6 Modelling approaches

Regarding the *modelling approaches* to represent marginal external costs and marginal social (external) cost pricing within urban transport, Deliverable 1 discussed an important distinction between:

- conceptual economic model approaches; and
- real-world simulation modelling approaches, or real-world model applications, which incorporate economic principles alongside other social, mathematical and engineering concepts.

Much of the underlying economic reasoning for marginal cost pricing is in the form of conceptual models. However, the deliverable stated, only by making the transition to real-world model applications we can hope to gain realistic insights into the likely impacts of marginal cost-based transport pricing systems in real-world urban situations.

Deliverable 1 concluded that the integration of conceptual economic analyses and real-world model applications – though extremely critical to demonstrating the existence and size of the potential efficiency benefits of marginal cost pricing – has not previously received the attention it deserves. In particular, greater interaction of the two approaches would be needed to render the real-world model applications to better allow for economic efficiency as a goal, alongside the traditionally well represented broader objectives. This is a precondition for the use of these real-world models for analysing marginal social cost pricing.

The *conceptual model approaches* the deliverable classified – and discussed correspondingly – as follows:

- the conventional static single-link model of congestion;
- increased modelling detail related to the introduction of dynamics;
- the introduction of spatial networks; and
- the representation of randomness and uncertainty.

Characteristics to these approaches is that they each focus on particular relationships and aspects of the urban transport problem and aim to use analytically solvable and, thus, highly stylistic models.

The *real-world model applications* enable planners and decision makers to test the impacts of changes to transportation systems against a variety of criteria, often within a single software package. In many cases, these model applications enable a wide range of possible schemes to be assessed within the same modelling framework.

An ideal real-world model application would address the full range of appropriately detailed representations of all relevant relationships and dimensions affecting urban

transport pricing within a wholly consistent framework. At present, no such application exists due to limitations of behavioural research, data availability, modelling techniques, computing power and cost. Current applications rely on trade-offs, focusing resources on particular chosen issues and levels of detail at the expense of others. Therefore, in order to build up a comprehensive picture, it is necessary to consider a number of different types of model application with varying levels of coverage of the important relationships.

The currently available real-world model applications Deliverable 1 classified – and discussed correspondingly – as follows:

- detailed simulation models;
- tactical network models;
- strategic transport models; and
- geographic models.

Here the model types are arranged from microscopic (the first item) to macroscopic models. An individual real-world model application may not fit wholly and exclusively within any one of these categories and may involve interactions between models with quite different features within a common framework. Examples from each of these categories were used within the AFFORD study.

Most importantly, this distinction between model applications tends to coincide with the dimension of policy settings (section 2.3, above), dependent on the extent of the policy-making environment that the application was originally designed to serve. All of this provides both a significant challenge and a useful framework for the objective of drawing general conclusions, as the use of different types of application, appropriate to different settings, within different localities leads to significant potential for different results with a number of possible explanatory dimensions.

The role of real-world model applications in the AFFORD study was seen as a broad one, as much about investigating the practical modelling issues, to assist future model development, as about generating conclusions on the application of marginal cost-based urban transport pricing.

Table 2.6 summarises the software packages and their local applications being considered in the AFFORD study. These provide a representative selection of real-world urban transport model applications available within Europe. Of course, there is no shortage of alternative software packages and case study locations. Most major towns and cities within the European Union might be expected to have access to a local model application similar to those described for practical transport planning purposes.

Table 2.6 Real-world model applications available in the AFFORD study.

Category of model:	Detailed	Tactical	Strategic	Geographic
Real-World Case Study:				
Athens	RONETS	SATURN ASCOT		
Edinburgh	RONETS	SATURN ASCOT DREAM+	START	
Helsinki		EMME2		MEPLAN
Oslo		EMME2	RETRO	

3 POTENTIAL WELFARE EFFECTS

An important logical and political precondition for introducing marginal cost-based pricing in practice is that it can be justified in terms of its potential or likely welfare (efficiency and equity) benefits. AFFORD Deliverable 2a (Fridstrom et al, 2000) presents estimates of such effects from transport modelling applications for three of the AFFORD European case study cities, *Edinburgh*, *Helsinki*, and *Oslo*. In addition, within the AFFORD project, Ghali and Smith (2000) have provided separate estimates for *Edinburgh* and TRIAS (2000) for *Athens*, using more disaggregate transport network modelling approaches. (These reports are available as project internal working papers.)

This section summarises the results of the AFFORD modelling work and evaluates them against similar findings obtained elsewhere. The text also refers to other experience with using different types of model applications for this purpose, where appropriate. However, the availability of work where marginal cost pricing has been the driving force behind model runs for real-world model applications is extremely limited. In particular, comparing second-best and first-best policies is, at this stage, unique to AFFORD and defines the state of the art.

The section is organised as follows:

- modelling frameworks;
- main efficiency results;
- more detailed welfare analysis;
- environmental and safety impacts;
- travel and transport system impacts;
- land use impacts;
- equity analysis based on income bracket; and
- equity analysis based on accessibility.

These topics are discussed, in turn, by sections 3.1 to 3.8.

3.1 Modelling frameworks

AFFORD Deliverable 1 discussed modelling approaches for analysing the potential impacts of marginal cost pricing within urban transport (summarised above in section

2.6). In particular, a clear distinction was made between *conceptual models*, representing particular theoretical relationships, and *real-world model applications*, which attempt to combine a range of such relationships, typically within branded software packages, and use real-world, spatially disaggregate data to produce synthetic representations of particular environments.

At present, no single real-world model application is capable of including appropriately detailed representations of all relevant relationships affecting urban transport pricing within a wholly consistent framework. Therefore, it is necessary to consider a number of different types of model application with varying levels of coverage of the important relationships (listed in section 2.6, above), in order to build up a comprehensive picture. In addition, the distinctions between model applications, dependent on the extent of the policy-making environment that the application was originally designed to serve, tends to coincide with the dimension of *settings* (discussed in section 2.3).

The case studies involved in the AFFORD study included a number of different types of real-world model application, used both separately and in combination, to consider marginal cost-based pricing across the range of policy settings. In summary:

- in Athens, the analysis was carried out using a tactical network model (the SATURN software package), focussing on the road transport setting;

- in Edinburgh, the main analysis was carried out using a strategic transport model (the START software package) within the multi-modal setting, while, separately, a tactical network model (the ASCOT software package) was applied to focus primarily on issues related to the road transport setting;

- in Helsinki, the analysis was carried out using a geographic model (the MEPLAN software package) and a tactical network model (the EMME/2 software package) in combination, focussing primarily on the spatial & geographic setting; and

- in Oslo, the analysis was undertaken using a strategic transport model (the RETRO software package) and a tactical network model (the EMME/2 software package) in combination, focussing primarily on the multi-modal setting.

These model applications include three of the four types of model identified by Deliverable 1. The only omission is in the area of detailed simulation models, where the leading edge nature of the modelling approaches and the tendency to focus on microscopic issues at the expense of economic efficiency outputs currently makes appropriate real world case studies harder to come by. This has constrained the ability of the research to address the implications of real-time issues in the build up of external congestion costs on road networks, but ignoring this dimension has allowed a greater concentration of effort in other, potentially more homogeneous areas. In the context of a study like AFFORD, the benefits of decreased complexity may outweigh the desire for comprehensive treatment.

In summary, the real-world model applications have provided coverage of all the relevant settings. In particular, the Athens and Edinburgh cases focused on the road

transport setting, the Edinburgh and Oslo cases the multi-modal setting, and the Helsinki case the spatial & geographic setting. Moreover, as the work explicitly included the concept of shadow price of public funds (see below) it can also be considered to have covered inter-sectoral setting to a certain extent.

As some form of road pricing was a core element of marginal cost-based pricing policy in each case study, the distinctions between the different model applications (and settings) have been related primarily to: (a) the levels of detail with which pricing measures and their direct impacts have been represented, and (b) the coverage of wider secondary impacts and broader supplementary policies and measures. The scale of the estimated efficiency impacts may, logically, have been expected to vary, dependent on the setting for the analysis and the nature of secondary impacts and supplementary measures.

The analyses focussed on the impacts of marginal cost-based pricing policy packages (as defined in Deliverable 1 and summarised in section 2.5 above), rather than investigating individual pricing measures in isolation. The pricing instruments considered as part of such packages included cordon and distance-based road pricing charges, parking charges, fuel and vehicle taxation and public transport fares. The policy packages also included measures related to the uses of revenue (reallocation), such as improving the level-of-service for public transport (through subsidies and investments) and lowering labour taxes.

The packages tested were defined according to the following structure:

- business as usual – a reference scenario which reflects the current situation or some future do-nothing or do-minimum scenario, without any policy innovations;

- foreseen strategy – a reference scenario which reflects a future situation in which known policies or realistic policy projections are assumed to have been implemented;

- first-best policy – the theoretical economic optimum assuming that any definition of pricing is possible, used as a benchmark for assessing the performance of more practical pricing packages;

- second-best policy under current institutional constraints – a practical transport pricing package considered to be possible for immediate implementation;

- second-best policy after appropriate institutional reform – a desirable transport pricing package, assuming certain prevailing legal and institutional constraints can be overcome; and

- acceptable policy – a transport pricing package, designed to meet particular location-specific acceptability and acceptance concerns.

The more precise definitions of the reference scenarios and of the first-best and second-best and acceptable policy packages varied significantly between sites, dependent on the

local situation. In particular, it was important to distinguish between the two reference scenarios, as different base situations were appropriate for different cities and model applications. Also, the distinction between second-best packages reflecting current legal and institutional constraints and representing the situation after institutional reform is particularly important, because innovative pricing policy measures may not be possible at present, or for the foreseeable future, or because some existing pricing measures may be currently beyond the control of the relevant policy-makers (local government agencies).

The package classification approach was an extremely useful tool for interpreting model outputs, because it facilitates comparisons between otherwise different scenarios. Referring back to approach to policy packaging developed in Deliverable 1 (summarised in Section 2.5, above), the second-best packages considered here represent, or are consistent with, the concept of *strong* or *best practice second-best* package (under different legal and institutional constraints representing the situation under current institutional constraints and after institutional reform). The acceptable packages considered here are thought to represent the *weak* or *acceptable* package of section 2.5. However, as emphasised there (and in Deliverable 1), the packages defined there were highly stylised and were not meant to represent the actual situation in any particular city in a realistic way.

A further important dimension to the model application-based analyses was the consideration of the *shadow price of public funds*. Logically, as far as public funds are a scarce resource, the fact that marginal cost-based road pricing provides revenue to the government adds to its overall efficiency. This important issue affecting modelling computations is captured in the concept of a shadow price of public funds, affecting all monetary transfers to public control. The size of the shadow price represents the amount by which one euro of public revenue is considered to add to the overall economic efficiency.

The rationale behind this assumption is that collection of revenue through efficient transport pricing will reduce the need for government to meet budget constraints through distortionary taxation elsewhere in the economy. While widely known, the concept of shadow price is not without controversy. In particular, the assumption of a positive value may be dependent upon the adoption of certain economically efficient recycling approaches which would meet significant legal, institutional and political barriers.

The AFFORD modelling analyses considered here two assumptions: a zero shadow price (a *simplified set of scenarios* or policy packages) and a shadow price of 0.25 (the *full optimisation scenarios*). In the latter case, alternative ways of collecting public funds (via distortionary taxation) would generate an efficiency loss throughout the economy amounting to 0.25 euros per euro public revenue raised.

Although considerable differences existed between the model applications and specific environments in the case study cities, some significant common features and patterns did emerge from the analyses.

3.2 Main efficiency results

The welfare (efficiency and equity) impacts of marginal cost-based urban transport pricing for travellers were calculated as a combination of monetary costs and time benefits. Pricing schemes, typically, inflict a monetary loss upon travellers, who have to pay more for transport services (which, in the case of roads, may previously have been free). However, at the same time, these travellers may expect to benefit from time savings, as congestion (and resulting delay) is relieved, due to reduced travel demand. While the time savings are a true social benefit, the user charges are not a (net) social cost in the true economic sense but, rather, a transfer of utility from users of the transport system to the transport authorities / operators and the government.

Any analysis that has the aim of computing the welfare (efficiency and equity) effects of marginal cost-based pricing policies in urban transport must presuppose a well-defined objective function for defining the optimum and quantifying its impact. In the AFFORD model application-based analyses, the objective function used was based on local estimates of the willingness-to-pay by the affected urban travelling population. The results presented here represent annual efficiency gains for a 30-year period. These annual efficiency figures ignore the costs of implementation.

Figures 3.2.1, 3.2.2 and 3.2.3 show the net welfare (efficiency) effect for Athens, Edinburg, Helsinki and Oslo for first-best solution, best practice second-best solution under current institutions and best practice second-best solution after institutional reform respectively. The figures show the effect for two alternative values (zero and 0.25) of the shadow price of public funds.

The efficiency estimates for the *first-best policy* package in the analyses for Edinburgh, Helsinki and Oslo suggest efficiency gains of the order of 200-400 euros per capita per annum, compared to the current situation. These annual efficiency figures assume a positive shadow price of public funds of 0.25. The corresponding range for a zero shadow price is 75-250 euros. The estimates from the Athens analysis suggest efficiency gains of the order of 25–35 euros per capita per annum.

The direction of effects in the second-best solutions is generally the same as in the first-best solution, but the overall efficiency gains are considerably smaller, especially where the constraints of prevailing legal and institutional arrangements are assumed.

For the Edinburgh and Helsinki analyses, *second-best policy under current institutional constraints* produces aggregate efficiency gain predictions of the order of 150-250 euros per capita per annum, in the range of 50-75% of first-best benefits. The equivalent predictions for the Oslo analysis are much lower, 10-60 euros per capita per annum, around 30% of the first-best, but they may have been affected by the impacts of the existing toll ring. In Athens, estimated efficiency gains from pricing measures currently available were as low as 8-12 euros per capita per annum, also around 30% of the first-best prediction.

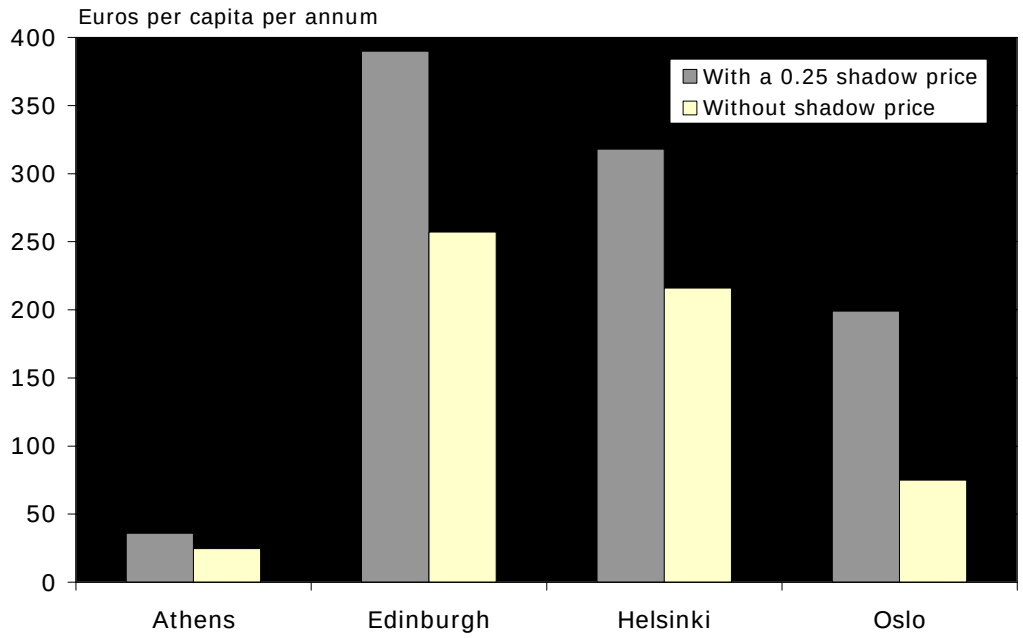

Figure 3.2.1: First-best solutions for the four cities with zero and a 0.25 shadow price of public funds.

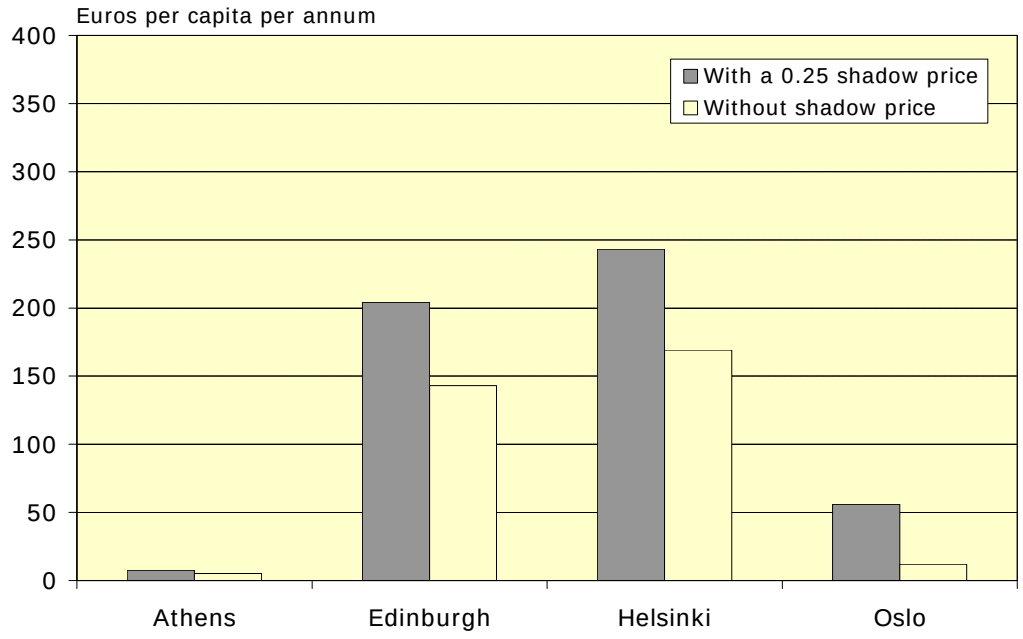

Figure 3.2.2: Best practice second-best solutions for the four cities under current institutions, with zero and a 0.25 shadow price of public funds.

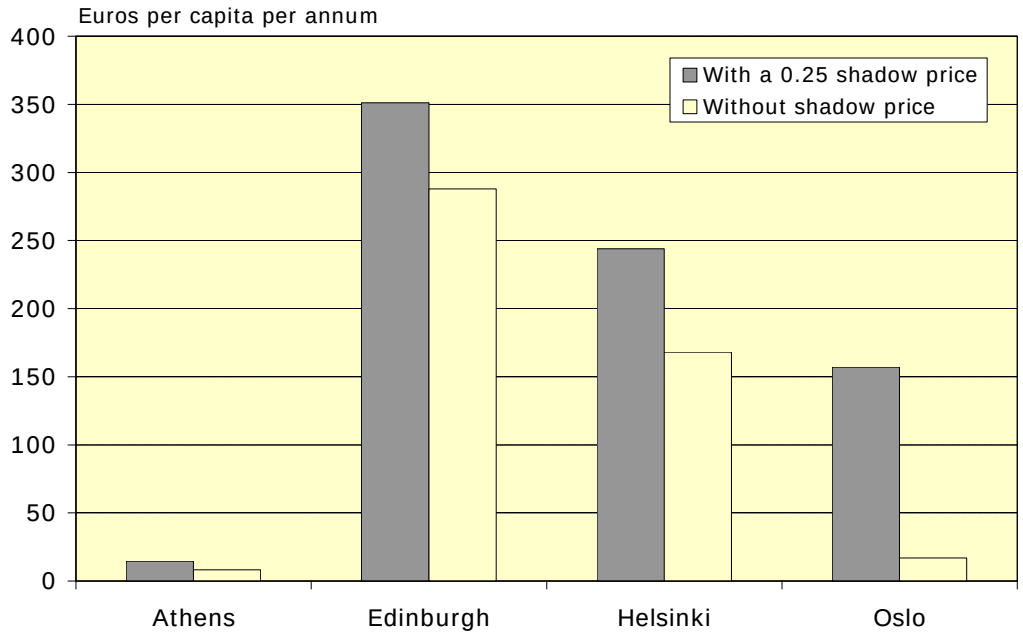

Figure 3.2.3: Best practise second-best solutions for the four cities after institutional reform, with zero and a 0.25 shadow price of public funds.

For *second-best policy after appropriate institutional reform*, aggregate efficiency gain predictions differed quite significantly. The Edinburgh model application produced the highest figures, of the order of 300-350 euros per capita per annum, up to almost 90% of the first-best benefit. In Helsinki, the equivalent figures were 150-250 euros per capita per annum, while in Oslo the range of benefits was of the order of 20-150 euros per capita per annum, both up to around 75% of first-best. The Athens analysis produced a range of benefits of the order of 15-35 euros per capita per annum, again up to around 75% of first-best.

The results from the analyses for Edinburgh, Helsinki and Oslo suggest that marginal cost-based transport pricing, if implemented in the case study cities, may give rise to substantial efficiency benefits for the urban populations. The parallel analysis in Athens also suggested consistent annual efficiency gains, but at a much lower order of magnitude. However, the actual numbers can vary quite dramatically, depending on local circumstances and policy instruments used. The range of efficiency benefits reflects both variations between the case studies and the fact that a number of alternative packages was considered within each model application.

Overall, these results suggest the general conclusion that the introduction of marginal cost-based transport pricing in European cities would be expected to produce significant efficiency gains for the travelling population, when viewed at the most aggregate level. This finding is consistent with those from other research (including the EC funded OPTIMA, FATIMA, PETS and TRENEN projects) in which real-world case study

model applications have been used to assess the potential efficiency benefits of economically optimal transport pricing (and other) policy approaches. For example, in the TRENEN study, model-based welfare analyses in five cities (Amsterdam, Athens, Brussels, Dublin and London) found that *first-best pricing* produced welfare gains in the range of 0.48% to 1.7% of generalised income for the travelling populations. It was also found that optimal *second-best pricing* approaches could produce welfare gains in the range of 59-87% of first-best.

However, one important caveat to consider when relying on the results from model-based analyses is the possibility that different types of model application may tend to suggest different outcomes, particularly in terms of absolute magnitude. In general, the evidence available previously has suggested that those model applications which focus primarily on road transport networks (tactical network and detailed simulation models) may tend to suggest rather lower levels of benefit compared to those that consider broader settings (strategic transport and geographic models) (Milne 1997). This distinction was evident in the AFFORD modelling work, when comparing outputs from the strategic transport model applications in Edinburgh, Helsinki and Oslo with those from the tactical network model applied in Athens. There are a number of potential explanatory factors, related to the levels of aggregation inherent in different modelling approaches and the scope (or *setting*) and geographical scale of typical real-world applications.

First, modelling approaches which have been designed to focus primarily on the representation of (road and public) transport network supply issues will tend to include much more detailed representations of travel conditions and user responses within those networks than models which have been designed to focus primarily on broader issues relating to overall travel demand. While the relationships included within all types of model may usually be calibrated to produce quite similar representations of current conditions (for a comparable level of outputs), aggregation issues may have an important impact on model outputs under alternative policy scenarios. In the road transport sector, in particular, the dynamic nature of traffic congestion in time and space may lead to quite major differences between model predictions, based on the level of detail inherent in the relevant modelling approaches.

In general, it can be observed that models which provide more detailed and disaggregate representations of road travel delays and route choice behaviour may tend to predict rather smaller changes in costs (and, thus, also smaller changes in both travel demand and welfare) in response to network-based charging than do more aggregate approaches. One clear reason for this is that any aggregate (link or network-based) supply relationship is only valid for the single (temporal and spatial) distribution of traffic from which it was derived. The more detailed network modelling approaches currently available suggest that individual drivers may be able to reduce the impacts of charging on their personal travel costs quite considerably by reorganising themselves within the network, but, in doing so, they may be implying changes in the aggregate network supply relationships that effectively reduce the overall benefits to society compared to what might originally have been expected. Therefore, it is important to consider the possibility that more aggregate modelling approaches may significantly overestimate

the potential benefits from sophisticated pricing policies (such as road pricing) within the road sector, as a result of their reliance on inflexible aggregate supply relationships.

Second, the potential to achieve efficiency benefits when considering narrower, primarily short-run policy settings (e.g. covering only the road transport sector) may, quite reasonably, be expected to be smaller than in wider settings (e.g. covering multi-modal transport) and, especially so, in the context of longer-run responses (e.g. covering spatial impacts), due to the broader application of efficient pricing principles.

Third, the geographical scale of any model application will clearly affect the absolute levels of many outputs. Typically, model applications focussing on strategic transport demand and geographical issues (such as those for Edinburgh, Helsinki and Oslo) will tend to provide comprehensive coverage across the urban region, while those focussing on road network travel conditions (e.g. the tactical network model in Athens) will tend to be constrained to what are perceived to be the most congested downtown areas. In the latter case, any outputs quoted in absolute terms for the travelling population included can only be considered partial.

The greatest variations in the model-based efficiency estimates between the case study locations related to the *acceptable policy* packages, where pricing instruments were constrained to levels deemed to be acceptable to the general public and policy-makers in the local context. The prime mechanism for achieving acceptability was assumed to be the placement of constraints on the extent to which pricing levels could be varied from their prevailing values, so that the increase in travel cost experienced by any individual traveller may be considered as ‘capped’.

The model-based estimates of efficiency gains for Helsinki and Oslo suggest that the assumed 'acceptable' scenarios may be capable of producing very little improvements in the welfare of the urban population. The Oslo analysis predicted welfare gains of just 20 euros per capita per annum, just 10% of first-best. In Helsinki, the efficiency impact was actually projected to be negative. On the other hand, in Athens and Edinburgh, the assumed acceptable policy package matches or outperforms some of the best practice second-best policy options. In Edinburgh, estimated welfare gains were around 375 euros per capita per annum, around 95% of first-best. The equivalent figures for Athens were 18 euros per capita per annum and 40% of first-best.

The result for Edinburgh may appear strange at first sight, as best practice second-best packages should be designed to maximise efficiency, and acceptable packages should maximise efficiency while respecting an additional (acceptability) constraint. The reason this happened in the Edinburgh modelling work is however simple: the acceptable package allowed for types of differentiation of taxes that were not available for best-practice second-best (more particularly, a price-cap for entire trips was introduced in addition to a flat kilometre charge, to limit the maximum amount of tolls to be paid. The cap turned out to improve efficiency, as it loosened the original constraint of a fixed toll per kilometre). Only under such circumstances can this apparently counter intuitive result be obtained.

Intuitively, the proportional relationship between the second-best and acceptable packages and the first-best optimum sometimes appears rather unrealistic. In particular, in the Edinburgh case, achievement of in excess of 90% of first-best welfare (efficiency) gains through second-best pricing mechanisms is surely too optimistic and may point to issues of aggregation within the model application that are likely to overestimate second-best solutions relative to the first-best optimum. However, presenting the proportional results for the range of different packages, across case studies and model types is quite enlightening. It shows that less effective second-best pricing approaches, be they as a result of legal and institutional constraints, acceptability constraints or inappropriate policy decisions, may achieve only 10% and, certainly, no more than 50% of the efficiency gains predicted for the first-best benchmark solution. In rare cases, it may even be possible for efficiency impacts to be negative. On the other hand, in all four case study model applications, well defined second-best pricing packages are shown to be capable of achieving at least 75% of the first-best. A clear conclusion is that mechanisms for distinguishing the most effective second-best pricing packages may provide the key to successful practical marginal cost-based pricing policy-making and that this should form a focus for future work.

The inclusion of the shadow price of public funds produced – besides the impact of the different model types used – a most striking and contradictory issue regarding the AFFORD efficiency estimates considered above. Results from the Oslo analysis, in particular, suggest that a major part of the overall efficiency gain from second-best road pricing may be the result of assuming a significantly positive shadow price (0.25) of public funds. For example, for the second-best policy packages *after institutional reform*, the overall welfare (efficiency) gain would be lowered by as much as 90 per cent by the assumption of a zero shadow price! However, the sensitivity of welfare benefits to shadow price in the other case studies is rather smaller.

Across all the scenarios tested, the largest reductions in welfare in Athens, Edinburgh, and Helsinki were approximately 45%, 35% and 32% respectively. The underlying reasons for the greater scale of impact in the Oslo case are not immediately apparent, but a comparison of the breakdown of main benefit categories between case studies reveals that the Oslo model application predicts very large trade-offs between the impacts on travellers and those on operators and government, relative to the scale of total welfare effects. This is particularly true where a positive shadow price has been assumed. One possible explanatory factor is the existence of a toll ring which has been designed explicitly to maximise revenue generation, rather than to have direct beneficial impacts on travel efficiency.

Even focussing on the rather smaller impacts in the other cities, it is clear that issues relating to the shadow price of public funds may prove absolutely critical in assessing the potential benefits available from adopting practical marginal cost-based pricing for urban transport in European cities.

3.3 More detailed welfare analysis

Figures 3.3.1, 3.3.2 and 3.3.3 show aggregate distributional impacts, distinguishing between travellers' surplus, the transport operators' and the government's surplus, and environmental and safety benefits. Regarding these impacts, the trends of the model-based estimates were largely as expected. Travellers (as a group) will, typically, lose in all cities, under all scenarios. In contrast, the transport operators (authorities) and the government will always gain. The size of the benefit in the latter case should normally be greater than the size of the disbenefit affecting travellers. The very small number of occasions where any of these trends were violated occurred related to the acceptable policy package. In particular, in Helsinki, the overall loss of efficiency in the acceptable case was generated by a loss for travellers which significantly exceeded the gain for transport authorities / operators and the government.

An important aid to interpretation of results from the second-best cases is an understanding of the role of current legal and institutional structures and the assumptions regarding reform. The situation for each city is described briefly below:

- in Athens, prevailing legal and institutional structures where perceived to allow modest increases in fuel taxation and quite large (currently proposed) increases in parking charges, while institutional reform was assumed to allow for the introduction of two concentric road pricing cordons;

- in Edinburgh, prevailing legal and institutional structures were assumed to allow for a road pricing cordon around the perimeter of the city (in advance of committed changes to national legislation) and limited increases to parking charges, while institutional reform was assumed to allow for increases in fuel taxation (or the introduction of distance-based charges) across the urban region and greater potential for public control within the privatised and deregulated public transport sector;

- in Helsinki, prevailing legal and institutional structures were perceived to allow for increases in fuel taxation, while institutional reform was assumed to allow for differential distanced-based charges within three concentric areas around the city centre; and

- in Oslo, prevailing legal and institutional structures were perceived to allow for increased parking charges and differential (peak and off-peak) charge levels across the existing road pricing cordons, while institutional reform was assumed to allow for increases in fuel tax across the urban region.

As what is currently allowed and what is ultimately desired seems to be almost diametrically opposed in Athens and Helsinki compared to Edinburgh and Oslo, it is clear that the effectiveness of any particular pricing measure depends more on the detail of its application than on its general description.

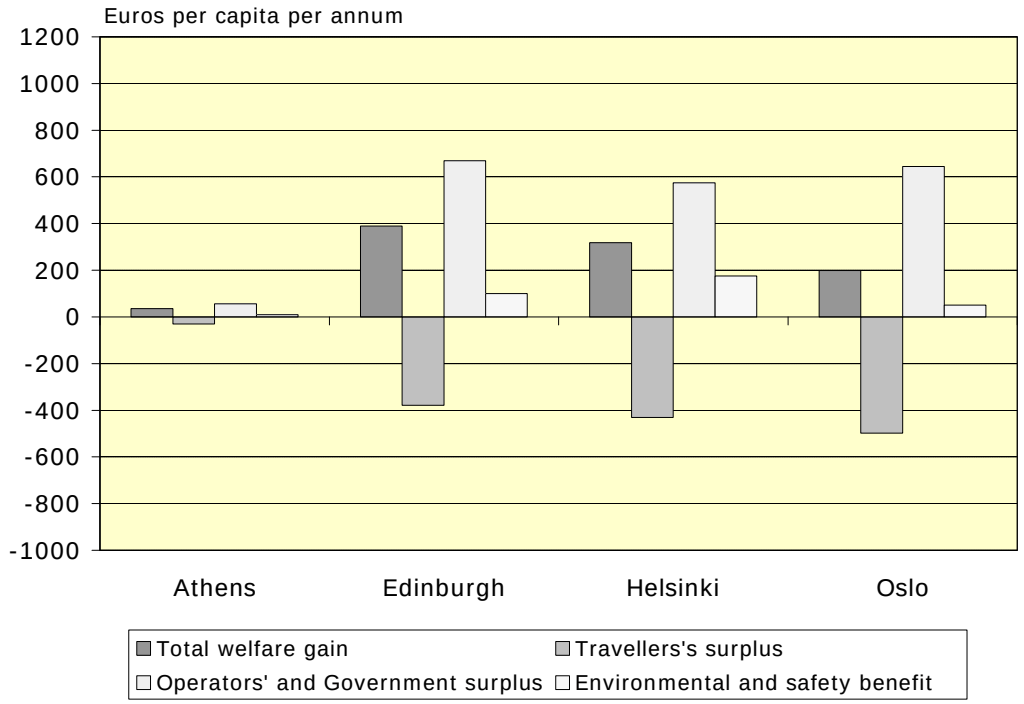

Figure 3.3.1: First-best solutions in the four cities (a 0.25 shadow price of public funds).

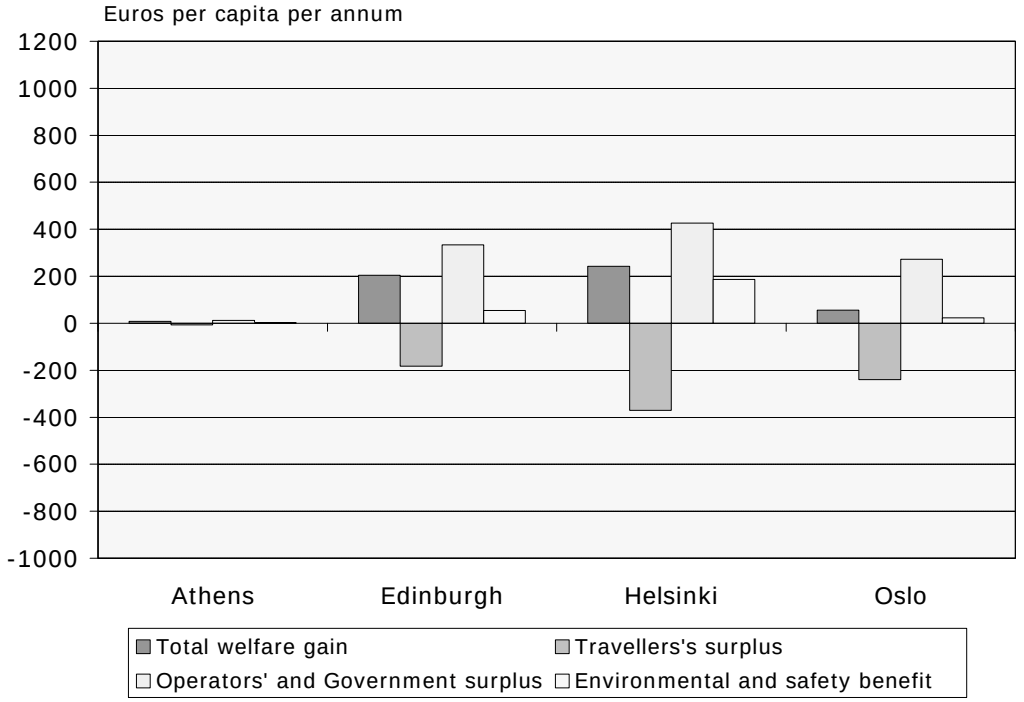

Figure 3.2.2: Best practice second-best solutions in the four cities under current institutions (a 0.25 shadow price of public funds).

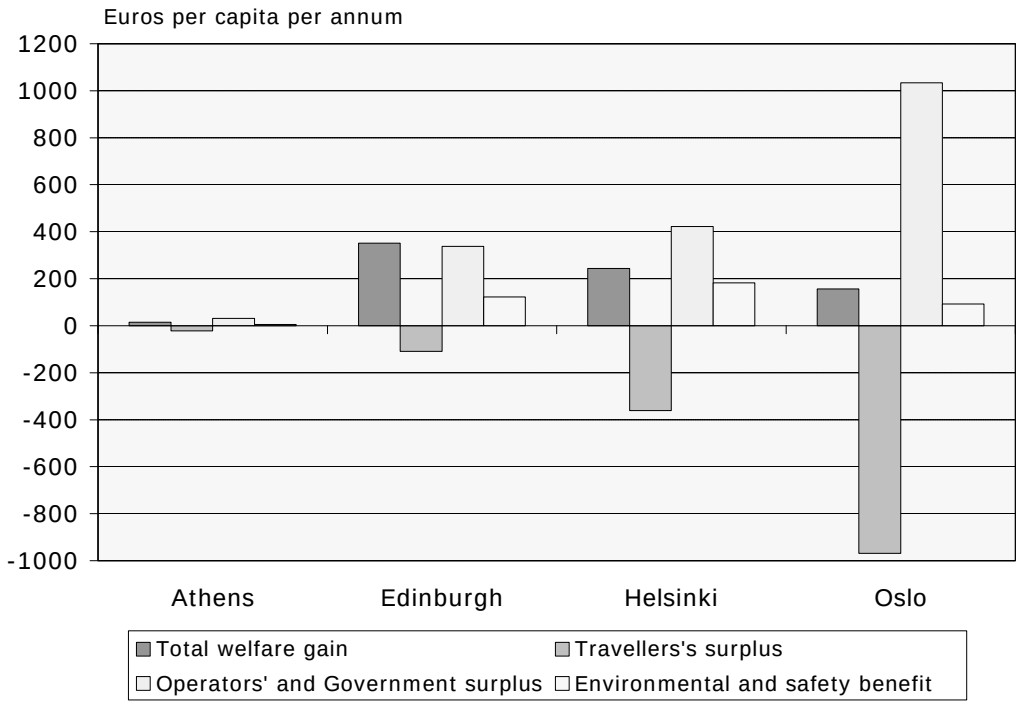

Figure 3.2.3: Best practice second-best solutions in the four cities after institutional reform (a 0.25 shadow price of public funds).

The best way to characterise the differences between the second-best policy packages applied under current institutions and after assumed institutional reform across all case studies may be on the basis of the continuity, flexibility and level of charging imposed. Under current institutions, it is, typically, the case that the pricing measures available are considered to be constrained by: (i) the extent of their application in space or to the travelling population; (ii) their temporal and spatial flexibility, in terms of charge levels; and/or (iii) the extent to which charges may be varied from prevailing levels. After institutional reform, it has been assumed that these limitations are largely removed. This has the impact of increasing welfare gains in the Athens, Edinburgh and Oslo cases. However, it is largely ineffective in Helsinki for two (potentially related) reasons. First, the additional spatial differentiation implied by flexible distance-based charges compared to increases in fuel tax is largely ineffective in a city with limited congestion problems. Second, the majority of the welfare gains in Helsinki are predicted to arise as a result of long-run changes in land-use patterns, which are relatively insensitive to minor increases in the flexibility of the charging measures available.

The results of more detailed distributional analysis or explicit studies of equity are reported in sections 3.7 and 3.8, below, considering income and accessibility impacts, respectively.

3.4 Environmental and safety impacts

One of the key justifications for marginal cost pricing approaches, especially in the public domain, is often considered to be its potential for curbing environmental damage, in the form of local air pollution (which may impact on health) and the contribution of transport to global pollution problems, such as greenhouse gas emissions. In addition, traffic noise and the uninsured costs of accidents are significant issues that are normally included as part of the environmental externalities of transport. Although, in the case of accidents, it is important to acknowledge that the relationship is not a simple one, because reduced congestion through pricing may allow for higher speeds and, possibly, result in a larger average accident loss per vehicle kilometre.

A number of recent research projects, including EU projects, have produced and summarised useful and converging estimates of external costs (environmental costs, accident costs) of transport (see e.g. IER et al, 1997, and CAPRI, 1999). However, the valuation of environmental costs is an extremely difficult area and there is, currently, no universal agreement on precisely how it should be done or what values should be used. The AFFORD model application-based analyses used simple relationships based on vehicle kilometres to generate aggregate predictions for all environmental and safety related externalities, together.

The absolute levels of predicted environmental and safety benefits vary rather more between the case studies than within them. The highest gains are in Helsinki, where a range of 150-190 euros per capita per annum is predicted across all packages. In Edinburgh, this range is 50-120, while the Oslo model suggests quite a wide range of 5-90. The Athens estimates are the lowest, 3-8 euros per capita per annum. An interesting feature of the results is that it is, typically, one of the second-best packages which generates the highest absolute level of environmental benefit for any given case study.

The relative contribution of environmental and safety benefits to the total welfare impact varies between cities. In Helsinki, environmental benefits, typically, constitute the major part of the total welfare gain (up to 95%). This probably reflects the fact that the potential for welfare benefits from reduced congestion may be rather lower than in some of the other case studies. In Oslo and Athens, environmental benefits vary significantly, between 15-75% and 25-75%, respectively. The broad range here is probably indicative of the rather low absolute values of total welfare impact. In Edinburgh, environmental benefits may have the smallest overall impact on total welfare, being in the range of 15-40%.

Drawing general conclusions from these predictions is difficult, as there are a number of factors affecting their interpretation. Clearly, the proportion of total benefits attributable to environmental gains will vary overall, dependent on the precise approach to environmental valuation, by location, dependent on levels of congestion, and between packages, dependent on the measures included and their detailed impacts.

3.5 Travel and transport system impacts

One of the greatest distinctions between different types of real-world model applications is the level of detail (aggregation) involved in representing travel patterns and resulting conditions within the urban transport system. In particular, strategic transport models which are, typically, well designed for representing a wide range of travel demand responses and for providing economic efficiency outputs, are often much less able to provide reliable insights into conditions that might be observed within urban road networks. Indeed, as noted in Section 3.2, above, the different levels of ability of models to address the more detailed, network-based dimension may actually alter the overall estimates of benefit levels from pricing schemes.

In the AFFORD study, explicit network-based representations of the urban transport systems were available for all four case studies. In Athens, the primary focus of the SATURN model application for all aspects of the study was a detailed representation of the urban road network. In Edinburgh, the START model application contained only very coarse representations of the transport system. Therefore, the ASCOT model was used in parallel, to provide greater sophistication in this area. In both Helsinki and Oslo, the main economic model applications were linked to a tactical network model (based on the EMME/2 software package).

Travel and transport system impacts were assessed by considering changes in: (i) the volume of trip-making; (ii) modal split; and (iii) road network travel conditions. The availability and precise nature of the indicators varies between the model applications.

Reductions in total trip-making are found to be of a similar order of magnitude (around 5%) in all the case study locations, with only relatively small variations across the majority of different models and package scenarios. This may suggest that the impacts of marginal cost-based pricing upon overall mobility are likely to be quite modest. However, it should be noted that models which focus primarily on the road transport setting may tend to suggest higher trip-making reductions in some cases. In particular, the definition of total trips may differ between models. For example, the strategic demand modelling applications in Edinburgh, Helsinki and Oslo report total person trips across all urban transport modes, while the tactical network models for Athens and Edinburgh are primarily concerned with aggregate units of vehicle flow and the Athens application includes only private road transport (i.e. it has no explicit representation of mode choice). In this latter case, there is no obvious sound basis for an overall mobility indicator.

The model applications are unanimous in suggesting that marginal cost-based pricing would lead to significant reductions in car travel. However the scale of reduction predicted varies between the case studies:

- In Athens, the application of first-best charging to current demand patterns suggests a reduction in private road trips of 5% (for charging based purely on external costs of congestion) and 10% (for charging based on all relevant externalities, including environmental costs). These figures are doubled (i.e. to 10% and 20%, respectively) when considering a forecast demand pattern for

2020, which assumes a 25% increase in overall private car trip-making. Significantly lower reductions (of the order of 3-4%) are found across all the second-best packages.

- In Oslo, decreases in car trip-making are predicted in the range of 5-15%, with the larger impacts tending to be produced by second-best packages.

- In Helsinki, all scenarios produce reductions in car trip-making in the range of 20-25%. Again, second-best scenarios tend to result in the greatest reductions.

- In Edinburgh, the strategic model application suggests reductions in car trip-making in the range of 15-30%, with no clear trend to distinguish between first and second-best. The tactical network model application suggests reductions in the comparable range of 15-25%, for optimal charges based purely on congestion costs, assuming a future year demand level.

The differences between the model predictions may have a number of explanations.

First, it is consistent with other pricing-based modelling work that models (such as the Athens application) which include more detailed representations of the spatial aspects and associated behavioural dimensions of urban transport may be expected to predict lower impacts on car trip-making. This is particularly true in the second-best case, where the representation of re-routeing opportunities is much more sophisticated, allowing drivers to reduce and avoid charges incurred without leaving the network.

Second, it is not unreasonable to expect the opposite effect (i.e. greater reductions in car trip-making under second-best pricing) in models with coarser road transport representations. Under the second-best constraints that charging cannot be applied universally or be greatly differentiated, it may be that the optimal charge (e.g. applied to all users crossing a cordon) will be rather higher for many individuals than would be the case under first-best. The effects of this may be exacerbated in models by: (a) a lack of realistic re-routeing alternatives; (b) assumptions of a positive shadow price; and (c) second-best packages which include incentives towards modal shift.

Third, the absolute level of reduction in car trip-making may be expected to vary between locations, based on the levels of congestion and, in the case of second-best pricing, the detailed design of the pricing scheme which drivers encounter. The consideration of both current and future demand levels in Athens illustrates the fact that, in general, larger reductions in car trip-making should be expected from more congested situations. Also, it is not unreasonable to imagine that a road pricing cordon imposed around a relatively small city centre will affect (and, thus, discourage) rather fewer trips than a wider cordon designed to intercept the majority of journeys interacting with an urban area.

Those model applications with a modal shift capability are also unanimous in the suggestion that marginal cost-based pricing would increase the use of public transport, across all scenarios. Again, there is variation in the scale of the impact. However, this relates primarily to second-best situations, where the variations between packages may

actually include measures to affect the attractiveness of public transport. In the first-best case, both Edinburgh model applications and that in Helsinki suggest increases in public transport trips in the range of 20-30%. For Oslo, a rather lower increase of 10% is suggested. This is consistent with the rather lower impacts found in Oslo, on car trip-making (above) and (more generally) throughout in the study.

In Edinburgh, an interesting contrast emerges in the second-best case, related to the issue of institutional constraints. Where current institutions are assumed, the increase in public transport use is lower than in the first-best case, reflecting the inability of government to intervene in the privatised and deregulated public transport market. After institutional reform, it is assumed that public transport operating parameters (e.g. fare levels) can be included in the package, resulting in the potential for higher modal shift than under first-best.

Analysis of average trip lengths across the case studies suggests three main trends:

- Average car trip lengths tend to reduce across all case studies and scenarios. However, this is primarily the result of changes in demand patterns. The more detailed models suggest that re-routeing in response to charges may result in many drivers travelling further than previously. This is particularly true in the case of road pricing cordons and all spatially limited road pricing systems which are contained within major orbital diversion routes.

- Average trip length by public transport tends to increase, as a result of attracting longer journeys that used to be made by car.

- Reductions in car trip lengths are particularly marked in Helsinki, where the land use model has allowed relocation of many car drivers to more central residential locations.

The most effective measures of road travel conditions available in the model applications are trends in network speeds and travel times. The main findings are that:

- In models with more detailed road network representations (Athens and the ASCOT model of Edinburgh), average network speeds may rise by a small amount (up to 7%) in the first-best case. However, under second-best constraints, these improvements are, typically, not maintained and travel conditions may even deteriorate. This is wholly consistent with previous findings about the impacts of road pricing cordons (May and Milne, 2000).

- Analysis of bus travel times in the ASCOT model of Edinburgh suggests that road-based public transport may achieve consistent reductions in journey time in both the first and second-best cases, in the range of 3-8%, even when conditions for car drivers appear to be significantly worse. This is, potentially, a result of the fact that buses make significant use of major radial access routes which are likely to be charged by most road pricing systems, leading to significant local reductions in traffic levels and congestion. Thus, it is possible to argue that marginal cost-

based road pricing may be designed to allocate the available road capacity in favour of public transport.

- In contrast, the Oslo model suggests that the main benefits in terms of travel speeds may accrue to car drivers (increases in the range of 5-15%), while public transport speeds rise by, at most, 5%. This may, perhaps, be explained by the current existence of a toll ring which ensures that congestion levels are already low in those areas (e.g. the city centre) where the concentration of public transport is high. It is also a (rather unique) feature of the Oslo network that there are very few orbital routes to allow drivers to react inefficiently to a cordon charge.

- An interesting feature of the Oslo analysis is that, although the speed for each mode increases or stays constant, the average travel speed for individuals falls, in some cases by up to 15%. This is a feature of modal shift and suggests that, even with efficient pricing, individual door-to-door journey times for public transport services cannot compete with those by private car.

- In Helsinki, travel speeds fall quite significantly for car trips (5-15%), public transport (around 7%) and, especially, for individual journeys (20-30%). This comes about as a direct result of land use changes. Greater concentrations of people living in the central areas results in a shift of journeys from longer, faster suburban routes to shorter, slower urban ones. In the case of individual journeys, in addition to the impact observed in Oslo, a shift from longer distance to urban public transport may also imply lower speeds, due to increased need for interchanging. However, even though travel speeds are lower, the greater spatial concentration of travel does not lead to significant congestion.

In summary, the travel and traffic impacts of marginal cost-based pricing for urban transport are numerous and may appear to vary due to levels of congestion, the detailed design of pricing packages, the types of model used to assess them and the precise nature of the indicators chosen.

In general, the model application-based research in AFFORD is consistent with other similar studies in demonstrating that the positive impacts of practical pricing systems on the ground may be quite limited, with only small reductions in total trip-making and relatively small increases in network speeds. In the case studies carried out here, the greatest impact appears to be encouraging modal shift from private car to public transport and there is some evidence that pricing systems may help to encourage this by focusing travel time benefits on the routes used by road-based public transport.

However, the main relevance of travel and traffic impacts may be to act as a warning of the danger that second-best pricing systems may not achieve the tangible benefits that users might expect. The evidence from models with detailed road network representations presented here suggests that car drivers may actually experience a deterioration in travel conditions, due to the diversionary impacts of road pricing cordons, while those who switch from car to public transport may experience slower journeys as a result. Such impacts do not, intuitively, sound like vote winners. It is, therefore, critical that two things happen on the way to implementing a pricing scheme:

- the design of the scheme needs to be carried out with considerable care and attention to detail, to ensure that the potential for negative impacts is reduced as much as possible; and

- the process for achieving public and political acceptance needs to ensure that expectations are realistic, particularly in the short-run.

Both these areas merit further research input. The design of effective second-best pricing packages may require the development of novel analytical approaches to address their spatial and temporal dimensions in addition to the traditional focus on optimal charge levels in a spatially predetermined, static environment. The achievement of acceptance may be aided by research to address the relationship between the short and long-run situations and to develop appropriate migration routes to ensure that potential long-run benefits are not jeopardised by the perception of short-run problems and inequities.

3.6 Land use impacts

Much of the focus of the analysis of marginal cost-based pricing in transport tends naturally to be on its impacts within the transport sector. However, in the long-run, any significant changes in the costs of travel in time and space are likely to impact upon the spatial and temporal arrangement of human activities and associated land use and development patterns. Any analysis which excludes these issues may be considered to be severely constrained in its ability to provide practical long-run guidance for policy-makers and planners. On the other hand, it is important to acknowledge that the relationship between transport, activity, land use and development is not fully understood and that reliable quantitative models are difficult to verify. A particular problem is the timescale involved and the evolutionary nature of the non-transport side.

Although it may be possible to observe changes in both land uses and transportation systems over long periods of time, the ability to establish direct causal links between, say, the implementation of particular transport pricing strategies and the evolution of land uses in particular ways may be beset with problems. For example, exogenous changes in the economy, ongoing (related and unrelated) political processes and the parallel evolution of lifestyle culture will all complicate the analysis. Therefore, at present, model applications of land use and transport interactions should be considered very much at the leading edge of practical modelling approaches. Within AFFORD, only the Helsinki model application included the facility to consider changes in land use and the feedback effects that this will have for travel behaviour and economic efficiency.

The largest secondary (indirect) impact that marginal cost-based pricing in transport might be expected to have is the reversal of the urban sprawl effect (or, more generally, trends towards the diffusion of activities in space), which may result in greater need to travel, increased congestion, additional pollution and rising (inefficient) use of resources. The reference *foreseen strategy* scenario for Helsinki included a significant

urban sprawl effect, as a result of increased income, insufficient availability of land in central areas and a large transport investment program. This resulted in predictions of a 10% increase in average trip length.

The *first-best policy* package appeared to have only a small impact on predicted land use patterns, as relatively small variations in the spatial distribution of trips and modifications to the routes chosen were sufficient to avoid the majority of congestion costs on the road network. It was primarily the application of *second-best policy* packages which induced significant land use impacts.

When distance-based charges (a proxy for fuel taxation or distance-based road pricing) was applied at a constant rate throughout the Helsinki region, there were significant reductions in total vehicle kilometres, vehicle operating costs and externalities. This occurred as a result of car-owning household moving towards employment centres, as car travel costs increased. The corollary is that non car-owning households were driven away from these areas. Overall, the population tended towards more centralised living, closer to employment, while employers tended towards more decentralised location, closer to the workforce.

The optimisation of urban public transport pricing produced lower fares, as a result of the positive impacts of the relocation of the population along public transport corridors. In other words, social welfare benefits occurred because the concentration of land uses along public transport corridors resulted in economies of scale for service providers. However, the greater concentration of car owners in the city may have had a negative impact on the provision of the most central public transport services.

Overall, the indirect effect of marginal cost-based urban transport pricing on land uses and their associated cost impacts was found to be far more significant in Helsinki than the direct effects related to congestion and environmental externalities. Of course, it would be risky to attempt to draw too detailed general conclusions from this analysis, as it addresses just one case study and the relative scale of the direct and indirect effects of pricing policy may be expected to vary by location, dependent upon the prevailing local situation. However, even on such limited evidence, it seems justifiable to suggest that the long-run impact of transport pricing on land use should certainly not be underestimated and that it would be no surprise if future studies conclude that long-run land use relocation is, ultimately, more fundamental to the efficiency of urban environments than first-round changes in mobility and travel demand, assuming fixed land use patterns.

3.7 Equity analysis based on income bracket

Further distributional analysis was provided by an explicit study of equity, which focussed on the incidence of impacts across the travelling population, based on income bracket.

Equity issues related to the implementation of marginal cost-based urban transport pricing can be addressed at different levels of aggregation. At the most aggregate level,

we can consider the (potential) conflict of interest between consumers (as a whole) paying efficient prices and the public authorities receiving the revenues (as discussed in Section 3.2 above). At the most disaggregated level, comparisons can be made between any consumer (and other) groups (directly or indirectly) affected by the pricing system. Other relevant comparisons may be: between consumers who are travelling in the initial situation (before the implementation of marginal cost-based pricing) and those who were not travelling; between car drivers and public transport users; and between rich and poor travellers.

In particular, those consumers who do not travel in the initial situation (and, thus, are not directly affected by marginal cost-based pricing) may gain if the revenue generated is recycled in the form of general tax relief, or if it is used to provide public services for which they are willing to pay. Public transport users may benefit in the form of reduced congestion and improved quality of service. However, as car drivers and public transport users may not be considered mutually exclusive groups, determination of equity impacts may not be clear-cut. To the extent that an improved quality of public transport services increases their demand, obvious accessibility benefits will accrue to new public transport users (who may previously have been motorists, cyclists, pedestrians, or non-travellers).

In relation to the impacts on rich and poor travellers, a standard argument is that marginal cost-based urban transport pricing schemes would be unfair to the poor. In particular, it is suggested that poor car drivers may be forced to stop travelling altogether, in which case they may incur large welfare disbenefits in the form of reduced accessibility. Alternatively, they may have no choice but to spend a larger share of their (scarce) income to maintain their current level of accessibility. If they continue driving, they will actually pay a higher price than the rich, in terms of utility, because their marginal utility of income is higher than that of those who earn more. Even ignoring differences in the marginal utility of money (i.e. measuring the welfare effects in terms of nominal willingness-to-pay, as cost-benefit analyses typically do), marginal cost-based pricing schemes may worsen the (generalised) income distribution, unless the higher income groups are made to pay a higher price. Of course, in practice, it may be very difficult to differentiate between travellers on the basis of income at the point where charges are paid. Therefore, the logical approach for addressing equity problems caused by transport pricing schemes may be through targeted approaches to recycling.

In AFFORD, income related equity impacts were assessed on the basis of two well established methods, the *Lorenz curve* and the *Gini coefficient*. The Lorenz curve, when plotted, relates the cumulative proportion of income units (on the x-axis) to the cumulative proportion of income received (on the y-axis), when units are arranged in ascending order of income. If all units in the population receive the same income, a straight line through the origin with a 45 degree angle results. In all other cases, the analysis will produce a monotonously increasing curve beneath the 45 degree angle line. The lower the Lorenz curve, the more income is concentrated in the upper income brackets. The Gini coefficient provides a convenient mechanism for summarising the information contained in a Lorenz curve. It is based on an aggregate measurement of the gap between the 45 degree angle line and any lower Lorenz curve: the greater the gap, the higher the value for Gini will be. By comparison of the Lorenz curves and Gini

coefficients between the reference scenarios and the estimated impacts of marginal cost-based policy packages, it has been possible to provide a very simple indication of the equity impacts that might be expected, at least with respect to income.

Estimates of equity effects with respect to income, based on Lorenz curves and the Gini coefficient, were generated for Edinburgh and Oslo. In the other case study cities, the nature of the model applications and the lack of availability of appropriate local data made a reliable analysis infeasible. An important dimension to the income-related equity analysis concerns approaches to revenue reallocation, as the equity impact perceived by each individual in the population will be the net sum of both the amount they are charged as a result of a transport pricing system and the benefit they receive from the total revenue collected. A number of scenarios were. These comprised:

- focusing only on charging side with no consideration of the redistribution side;
- all available revenue being redistributed to households, proportional to their initial income level (a regressive recycling scenario);
- all available revenue being redistributed equally to households, regardless of initial income level (a flat recycling scenario); and
- all available revenue being redistributed to households, starting with the lowest income group until it is brought up to the level of (and, thus, merged with) the next income group, in a rolling fashion until all revenue has been used (a progressive recycling scenario).

Overall, the equity effects related to income distribution were found to be moderate. For Oslo, in the *no redistribution* case, the value of Gini increases significantly (i.e. inequality worsens). This is wholly consistent with the efficiency results described above, which showed a particularly large transfer of benefits between travellers and transport authorities / operators and the government. However, once redistribution to households is considered, the variation in Gini and the Lorenz curves is quite small. In Edinburgh, the equivalent variations are relatively small for all scenarios. In both cities, only the *flat* and *progressive recycling* scenarios actually result in equity benefits in terms of income distribution. An interesting feature of Lorenz curve for the latter (progressive) approach in Edinburgh is that it produces the greatest benefit across the full income spectrum, despite focussing its impact primarily on lower income groups.

These model-based estimates are significant, as it is often considered that efficiency and equity are conflicting objectives in practical economic transport policy-making. Both model applications suggest that it should be possible to implement more efficient marginal cost-based pricing for urban transport without significant negative impacts provided that appropriate recycling strategies are adopted. The Edinburgh results even suggest that, in principle, it should be possible to conceive a marginal cost-based pricing / progressive revenue recycling package which would produce measurable improvements in efficiency and equity simultaneously. However, the approach to recycling is, in practice, likely to be dominated by political issues and, therefore, it may

ultimately be politicians who have the final say in deciding the income related equity effects of marginal cost-based pricing systems.

3.8 Equity analysis based on accessibility

In addition to income effects, equity may be considered to have an important spatial dimension, through the concept of accessibility (i.e. the extent to which the population of various spatial zones of an urban area have their travel opportunities to other parts of the city diminished or enhanced as a result of transport pricing policy). Where accessibility is reduced, the implication is that current trips can be made only at a higher generalised cost, or perhaps not at all (i.e. only at 'prohibitive' costs). The model applications for Edinburgh include facilities for quite detailed analyses of spatial accessibility. These were utilised as part of the AFFORD study.

A *first-best policy* package entails large reductions in accessibility by car for all zones, with significantly greater reductions affecting the outer zones of the urban region. This contributes to a general overall trend of reduced accessibility for the population, as accessibility by public transport is largely unchanged.

Second-best policy packages that include road pricing cordons also tend to reduce accessibility by car, with the greatest impacts focussed on those areas closest to the cordon and divided by it (i.e. boundary effects). Thus, a cordon around the city centre hits those who reside within far more than those who reside outside, because it is small enough to be avoided at relatively low cost by anyone not travelling to or from the downtown area. In contrast, a larger cordon towards the perimeter of the city affects primarily those who reside outside it, because it is large enough to allow relatively free movement within the urban area, but severely limits the opportunities for avoiding it for anyone beyond. However, the scale of the total accessibility impact, for all but a minority of car users who are particularly badly affected, is much smaller than in the first-best case. As public transport is, again, largely unaffected, the overall impact on accessibility for the population is relatively small.

However, policy packages which use distance related charges (e.g. fuel taxation or distanced-based road pricing) as a pricing mechanism within the road sector tend to produce a spatially distributed impact on accessibility by car rather more similar to the first-best case. In particular, there is a significant impact across the full urban region and a greater focus of impact on areas further from the centre. If, however, it is assumed that a distance-based road pricing system operates only within the main developed area of the city, a boundary effect opposite to that of the larger perimeter cordon occurs. This time, it is those who reside within the city who are hardest hit, while those who reside outside have the opportunity of free orbital movement to other areas outside and to reduce the units of distance they are charged for when accessing areas within the city.

A number of the Edinburgh policy scenarios also included measures to improve the attractiveness of public transport, such as reductions in fare levels, increases in frequency and public transport priority on the road network through "guided bus" schemes. The latter has a significant positive impact on accessibility by public transport,

which may be sufficient to reduce and even reverse the reduction in accessibility by car as a result of other pricing measures. However, its impact is always restricted to the particular zone or corridor where the priority scheme is provided. In contrast, reductions in fares and increases in frequency have a large and well spatially distributed positive accessibility impact. Indeed, in all the second-best cases, the model-based predictions suggest that these policies may be sufficient to maintain, and even increase, existing accessibility levels for most of the population.

Therefore, the analysis in Edinburgh suggests that equity reductions related to accessibility may largely be alleviated through the use of revenues from marginal cost-based pricing in the transport sector to subsidise the operations of public transport services. Of course, it may be argued that to do this would not be consistent with the efficiency objectives of the pricing scheme and that it may hinder progress towards the sort of long-run indirect changes in land use patterns reported by the Helsinki model application (Section 3.6, above). However, if marginal cost-based transport pricing policies are to be achieved in practice, a pragmatic approach may need to be adopted, in which potential negative welfare impacts of policies in the short-run are catered for explicitly alongside the more obvious long-run objectives, as part of a phased approach. This would help to address the frequently expressed concern that marginal cost-based pricing policies could not be implemented unless suitable alternative (travel or non-travel) options have been provided for the majority of those affected. As with the income related aspects of equity, the actual likely impact is ultimately in the hands of politicians, through decisions regarding revenue recycling. However, what this analysis does not address is the potential problem of legal and institutional (and, thus, political) barriers relating to situations where urban public transport services are provided by the private sector in a competitive environment and the acceptability barriers that may exist to policy packages which attempt to retain levels of accessibility only through enforced modal shift.

4 LEGAL AND INSTITUTIONAL ISSUES

A sound consideration of legal and institutional issues is likely to be critical to the successful introduction of marginal cost pricing for transport. This is particularly important in the area of urban transport pricing, because much of the organisational decision-making would need to take place at the local or regional level, where policy-makers may consider that broader legal and institutional issues fall beyond their professional remit. An important contribution of research should be to specify those organisational and institutional features which may hinder progress and to motivate the will of politicians and professionals at the appropriate levels towards overcoming them.

Much previous work – including a number of EU research projects – have considered legal and institutional issues in relation to transport policy measures. Stough and Rietveld (1997), for example, discuss these issues on a general level. The existing empirical work has addressed a range of transport pricing issues at varying levels of detail, but has not explicitly addressed them in the context of marginal cost pricing. The literature mostly consists of largely pragmatic accounts of detailed legal and institutional issues related to specific policy measures, undertaken as part of real-world feasibility studies and demonstration projects.

Addressing legal and institutional issues of marginal cost pricing has been an important aspect of the AFFORD study. A core part of the AFFORD analysis contained an in-depth empirical discussion based on *case studies* carried out for five cities: *Athens, Edinburgh, Helsinki, Lombardy* and *Madrid*. But also conceptual and theoretical considerations were given sufficient weight. This was necessary, because no studies (to our knowledge) have specifically devoted to these issues in a marginal cost pricing context.

Data collection for the case studies was carried out by means of a literature review (background reports) and a *questionnaire* on the legal and institutional issues related to urban transport pricing, and posed to local politicians and planners within the case cities. The questionnaire, supported by in-depth discussions, helped to clarify the perceived implications of issues raised by the background reports and enabled a greater focus on the potential for change to urban transport pricing policy.

This section summarises the main aspects and conclusions of the AFFORD study on legal and institutional issues. The original work is presented in Deliverable 2b (Milne, Niskanen and Verhoef, 2001). The discussion is organised as follows:

- framework for analysis;
- basic concepts, definitions and classifications;
- key issues – within road and multi-modal transport settings;

- key issues – within settings allowing spatial & geographical and inter-sectoral aspects;
- legal and institutional frameworks – review of structures;
- legal and institutional barriers – summary of empirical considerations;
- barriers to specific marginal cost-based policy packages; and
- directions for institutional reform.

These topics are discussed in sections 4.1 to 4.8.

4.1 Framework for analysis

To be able to address the great multitude of legal and institutional issues covered, Deliverable 2b did not rely on any single theory or formal model. In particular, the deliverable stated that many such issues in real-world are likely to fall outside the scope of the economic theory. Therefore, the discussion drew together elements from a range theories and disciplines – from economics to all relevant non-economic perspectives and academic traditions such as political, acceptability, etc.

In addition, in practice in an urban transport context at the local level, there typically are affecting (endemic to) real-world marginal cost pricing related policy-making many legal and institutional issues, which are extremely microscopic and case-specific, i.e. likely to greatly vary by site. The deliverable paid careful attention to such detailed practical aspects, which are hardly suitable neither for abstract theoretical nor comparative empirical (economic and non-economic) analysis.

However, the core dimensions of the approach or framework for analysis – i.e., the fundamental ideas structuring the discussion – were defined by:

- policy settings; and
- comparison of first-best vs. second-best pricing.

These same issues already were included as fundamental parts (steps) of the overall AFFORD approach, in section 2 above.

The *policy settings*, as defined in section 2.3, determine alternative perspectives and scopes for policy-making. Evidently, depending on the setting, different legal and institutional issues will attain relatively more attention. The relevant four settings include: focussing on road transport; considering multi-modal transport; covering spatial & geographic aspects; and covering inter-sectoral aspects of marginal cost pricing. The discussion of key legal and institutional issues below (sections 4.3 and 4.4) is organised according to such settings.

The *comparison of the first-best vs. second-best pricing* refers to the fundamental insight (cf. section 2.4) of considering legal and institutional barriers as second-best constraints which (on their part) may prevent the transportation system from achieving a fully optimal first-best state. However, this dimension or aspect is affecting only implicitly (at the background), as the analysis here does not try to link the observed or identified barriers to any explicit second-best rules in a systematic way.

A further important distinction in Deliverable 2b was made between:

- investigating institutional status quo; and
- investigating institutional reform.

Investigating institutional status quo contains identification of the most important legal and institutional barriers, most obvious reasons to them as well as their most obvious impacts (e.g. in terms of second-best pricing rules). All this assumes the existing institutional framework or structure as given. Investigating institutional reform, its needs and prospects and effects, is then a natural extension of the analysis to broader and longer run issues.

A major driving force behind any sound plan to introduce marginal cost pricing must be the efficiency benefits that might be available through it. Therefore, a comprehensive analysis of legal and institutional barriers to marginal cost pricing and of related institutional reform must ultimately include or be linked to quantitative welfare analysis. A sound theoretical basis for such an analysis is provided by the economic theory of second-best.

Indeed, a highly relevant question from the viewpoint of reaching theoretically sound and realistic policy conclusions, concerning the optimal pricing rules and optimal institutional reform, is the ability of the prevalent conceptual economic and real-world model applications to properly allow for the legal and institutional issues, and, in particular, the distinction between first-best and second-best in this respect. (Deliverable 1 addressed the ability of these model applications to allow marginal cost pricing concepts and issues; see section 2.6, above.)

Existing real-world model applications often provide good representations of behavioural responses to practical policy innovations. However, while providing important information to policy-makers these approaches, when assessing specific foreseen reforms within the transport sector, typically make no systematic and theoretically sound distinction between the best practice second-best and the first-best benchmark cases. In particular, even though these approaches may incorporate existing legal and institutional conditions and structures into their analysis (explicitly or implicitly), they do not adopt a clear theoretical economic welfare foundation. Therefore, they are unlikely to consider a comparison between the second-best and first-best optimum cases reflecting legal and institutional barriers and constraints either.

An important reason for why real-world simulation models typically are not able to distinguish between the second-best and the first-best is that they tend to assume the current legal and institutional situation as fixed. A reason for this, in turn, is that these models are generally created and used at the local level where policy-makers work within a given legal and institutional framework and consider that they have little scope to change it. The appropriate elements may be implicit and fixed in the model structure and data rather than reflected by the variables to be tested.

More generally speaking, while applied empirical model applications may often have a very sound theoretical foundation for representing and understanding other than economic aspects of actual human behaviour, they typically have overlooked the importance of having a sound economic and welfare theoretical background. Therefore, they cannot provide a tried and tested link to the welfare economics and the optimisation idea that is central to marginal cost pricing.

Similarly, existing works on acceptability and acceptance (see section 5 below) also tend to focus on prevailing legal and institutional structures, because of their inherently reactive approach: they are asking questions in response to a limited number of given scenarios vs. focus groups which explore all the issues and then start to talk about policy, which might be referred to as proactive (i.e. respondents are expected to give answers based on the assumption that the current status quo will continue except for any specific aspects indicated to them). In some cases this may limit consideration of legal and institutional reform within these approaches, due to either a lack of appropriate variables or to certain critical issues being otherwise wholly external to the model structure.

4.2 Basic concepts, definitions and classifications

Much of the conceptual (theoretical) part of Deliverable 2b contained identifying relevant actors etc., and discussing basic concepts and definitions. There was an obvious need for this, as practically no literature on legal and institutional issues in the marginal cost pricing context exist (to our knowledge).

The deliverable acknowledged the virtues of having a general definition of organisation / institution, to be used in a marginal cost pricing context. It concluded that, while the existing theoretical and applied literature presents a number of abstract *definitions of organisation and/or institution*, such definitions have not previously (to our knowledge) been explicitly linked with marginal cost pricing issues in urban transport.

As to the *range of relevant actors*, potentially affecting or being affected by marginal cost pricing, the deliverable included all organisations and institutions likely to play a significant role in the designing and implementation of a marginal social cost-based urban transport pricing system in practice. The relevant actors include public administrative bodies, and various organisations in the private and the third sector with varying levels of formality.

More particularly, the relevant actors/organisations were defined to include those:

- directly involved in decision making – different levels of government, political parties, etc.;

- responsible for putting the system into practice – local government agencies, etc.;
- facilitating the implementation – financiers, technology manufacturers, etc.;

- helping marginal cost pricing become reality, by providing information and resources – political parties, academics, consultants and banks, etc.;

- with influence on opinion forming – automobile associations, employers' organisations, unions, newspapers, other media, etc.; and

- reacting to the system – political parties, automobile associations, other pressure groups and chambers of commerce, etc.

Naturally, some organisations may belong into more than one group here. There are also interconnections: opinions influence decision-making, etc. Individual persons may belong to more than one organisation; on the other hand, some persons alone may even be considered as a relevant actor/organisation (e.g. a particularly influential politician, journalist or academic).

Besides actors, Deliverable 2b distinguished between two other types of institutions:

- agreements or contracts external to an actor; and

- agreements or contracts internal to an actor.

The *agreements or contracts external to an actor* govern its external relationships in relation to other actors (also beyond the transport sector). They define the legal and institutional framework or structure within which the actors operate. These can be formal agreements/contracts like laws but can also mean informal interdependence between actors, through competition or co-operation in the market, through the political system, etc. They may also cover broader socio-economic systems and structures – the political system, markets, etc. The *agreements or contracts internal to an actor* govern internal functions and structure (actions, forms) of an actor and link individuals involved in (working for) it together. Again, the relevant agreements/contracts can be explicit or implicit, formal or informal, and can differ widely in character from public agreements/contracts like laws to cultural conventions.

From the viewpoint of marginal cost pricing, the legal and institutional agreements or contracts (external and internal to the relevant organisations/institutions) may affect as either enablers or barriers. That is, on one hand they can (in fact, are needed to) facilitate the implementation of marginal cost-based pricing policies, but on the other can create distortions to the efficient functioning of the markets (i.e. transport markets but also more generally) or can place limits or constraints on the available and feasible policies.

A straightforward approach to legal and institutional barriers to marginal cost pricing would be to assume that the relevant institutions/organisations already exist, and consequently focus primarily on the policies that they apply (or support/object) – here marginal cost pricing in particular. However, this approach would not be sufficient. The impact of new policies and policy innovations on legal and institutional structures, and the continuous interaction between these two, is an aspect that cannot be ignored. In particular – it was emphasised – this interaction affects legal and institutional barriers, the main issue from the point of view of implementing marginal cost pricing. That is, even though acceptability problems were not considered as a primary reason for a barrier (in a situation where the necessary laws and institutions already would exist), in the longer run the lack of acceptability can be an indirect reason for the non-existence of the necessary laws and/or institutions, i.e. for marginal cost pricing not being legally or institutionally feasible.

The *legal and institutional barriers to marginal cost pricing* may appear on the charging side and the revenue use side. Deliverable 2b classified such barriers into three broad categories:

- structural barriers;
- opposition from non-governmental interest groups; and
- low socio-political acceptability.

Obvious potential reasons behind the *structural barriers* are:

- prevailing institutions and organisational structures may be inappropriate or non-optimal from the viewpoint of marginal cost-based pricing and associated redistribution mechanisms and requirements;
- existing legislation may be insufficient to support marginal cost-based pricing and associated redistribution mechanisms, including laws which may even support contradictory objectives and/or to prevent certain measures explicitly; and
- prevailing economic and/or transport-related policies at national level may be in contradiction with marginal cost pricing principles, and in particular in the context of the urban transport pricing environment.

Reasons for the *opposition from non-governmental interest groups* – i.e. non-governmental actors and/or organisations with a perceived stake in the urban transport system, who deliberately oppose marginal cost-based policies and measures – may include (perceptions of):

- insufficient communication regarding the objectives and potential efficiency benefits (and dangers) of marginal cost-based pricing policies;
- insufficient communication and true conflicts of interest regarding distributional issues (precisely who wins and who loses); and

- insufficient effort and resources to cater for, and, perhaps, compensate those who might be expected to be worse off as a result of marginal cost-based urban transport pricing policies.

Finally, the *low socio-political acceptability* – manifested in the behaviour of politicians and government organisations – may reflect:

- the fact that marginal cost pricing is not universally accepted by relevant academic disciplines (including economics), and that politicians and civil servants representing the relevant organisations are not convinced by (or even familiar with) its principles;

- the need for local governments to justify their policies in terms of practical – and often detailed – arguments, rather than in terms of arguments referring to efficiency and equity (fairness) benefits at a general (aggregate, abstract) level, i.e. the criteria emphasised in the context of marginal cost pricing;

- tensions between the local and national levels of government;

- the competition between different neighbouring local communities; and

- the interests of individuals working within government organisations with a stake in preserving the institutional status quo.

Of course, the division line between the structural barriers and the opposition from interest groups may not be always clear-cut. In particular, structural barriers of today may be a result of strategic behaviour of interest groups of yesterday.

Also, the different structure of government may lead to different policies (or types of policies) at different levels, and the attitudes of organisations (government and non-government) towards each other. Evidently, both questions are hard to classify in structured terms, and thus tend to be relevant on subjective assessment. For example, in the UK, institutions which are traditionally at loggerheads due to their general attitude to each other (e.g. national political parties, local branches of political parties, even city (local) and county (regional) government agencies, where they coexist and share responsibility for related issues) tend to oppose each other on policy issues, regardless of underlying ideology.

4.3 Legal and institutional frameworks – review of current structures

The *case study reports* produced within AFFORD provided detailed descriptions of prevailing legal and institutional frameworks or structures for the five case study environments (Athens, Edinburgh, Helsinki, Lombardy and Madrid). The reports described the existing transportation systems and transport pricing approaches for the

urban areas concerned (focussing on legal and institutional aspects) and considered the potential barriers that prevailing legal and institutional structures might present for marginal cost-based urban transport pricing.

Regarding the *degree and importance of the inter-country differences of existing legal and institutional frameworks*, different views seem to exist. It is sometimes stated that there are such large differences between different countries that the ability to use standard theories and formal models let alone quantitative analysis to draw general conclusions about their impacts on issues such as transport pricing policy is rather constrained. However, the views emphasising the importance of these differences seem to reflect a lack of sound theoretical approach or framework and a tendency to focus too heavily at a detailed level. Our view is that, at a more general level, the similarities between countries (and, in particular, EU member states) far outweigh the differences.

However, distilling reasonably sound conclusions was also here impeded by the problem that legal and institutional issues have not previously been investigated systematically in a transport pricing policy context. There is a very limited availability of other relevant work to provide reference information and facilitate the analysis at anything other than a very general level.

Regarding the legal and institutional framework or structure, a natural first question concerns the number of the administrative levels (nation-wide) relevant to transport policy and transport pricing policy in particular. The significance of this issue to transport pricing policy is, quite simply, that the number of administrative levels which need to be involved in formulating and implementing policy will affect the logistical complexity of achieving policy goals. It might be reasonable to expect that the greater the number of administrative levels the greater the legal and institutional complexity (and associated barriers) will prove to be.

It is, perhaps, no coincidence that the longest-standing example of a successful urban road pricing system is in Singapore, a single city state with, in effect, a single administrative level for deciding and implementing transport policy.

On the other hand, in transportation, a general feature is that responsibilities and powers tend to be shared between different administrative levels and are not always treated in a comparable manner in different parts (e.g. competing modes) of the transport sector. For example, responsibility and power in the railway sector is, usually, primarily at the national level, while that for roads tends to be divided between levels based on road type.

The AFFORD review suggested two broad groups of administrative models across the EU:

- a model of two administrative levels – local and national; and

- a model of three or more administrative levels – local, national and intermediate (usually regional) levels.

The former model tends to be common in smaller countries with fewer than 15 million inhabitants, while the latter is most common in larger countries. This is a natural function of human and geographical scale: in some cases the population and/or spatial area of a region within a large country may be similar to that of a smaller nation.

The UK might be considered as an exception to the typical European scenario outlined above, because it is a member state with a large population but a tendency to have only two administrative levels (local and national) covering most major towns and cities. This has come about as part of a piecemeal solution to local and regional government, after a quarter of a century of experimentation with different structures. The creation of regional municipalities covering the largest cities and urban conurbations during the 1970s was later reversed, because the political disbenefits of powerful bodies that often pursued policies very different to those advocated by national government was perceived (by national politicians) to outweigh the obvious practical benefits of regional integration and co-ordination.

In addition, many of the larger EU member states (including Spain and Italy) are currently showing a trend towards greater devolution, with the aim of providing regional administrations with increased responsibility (and, perhaps, power). Consistent with this is the creation of new intermediate parliaments for Scotland and Wales in the UK. A further devolutionary trend can be observed towards strengthening the local level by means of an aggregation of local institutions. This has been the case in Germany, where a new administrative level (Kreis) has been created between the Land and the Municipality. In most countries which fit into group 2, as defined above, the regions have some degree of power covering local institutions. Sometimes this reflects the legal framework at Constitutional level, but it is not infrequent to find cases where this occurs primarily due to a pragmatic consensus.

When focusing on urban issues, the case study reports showed that the urban areas chosen by the AFFORD study represent a broad sample of situations in the European context. In particular, the following important dimensions emerged:

- the number of administrative levels (two for Athens, Edinburgh and Helsinki, three for Lombardy and Madrid);

- the balance of responsibility between the public and private sectors (e.g. the market-oriented approach to public transport provision in Edinburgh vs. much more interventionist policies in Helsinki and Madrid); and

- the level of stability of the prevailing legal and institutional frameworks or structures (e.g. the long-standing and stable arrangements in Athens and Helsinki vs. the evolving legal approaches to transport pricing and the recent and related creation of a new national institution in Edinburgh).

Deliverable 2b concluded that the primary policy-making responsibility for most urban roads lies at the local or regional level; however, there are important differences in relation to the relative levels of power and the division of responsibilities between local and regional government. Managing the urban transport system is a practical function

which operates in parallel (but, often, subordinate) to managing the local and/or regional economy with the aim to provide for the general economic, social, environmental, health and educational needs of the resident population.

Therefore, the emphasis of (urban) transport policy is very much on providing a service which facilitates other important lifestyle activities and all policy has an inevitable competitive angle with respect to neighbouring localities/regions. This has, traditionally, tended to encourage policies promoting maximum mobility in pursuit of short-term economic growth and perceived social welfare. Only quite recently have concerns about the potentially damaging economic and environmental impacts of (urban) road traffic growth begun to challenge the predominance of other objectives in the local/regional policy-making context, usually as the result of quite severe problems affecting the more general local/regional policy goals which are perceived to be unacceptable.

Overall, Deliverable 2b concluded, the legal and institutional frameworks and structures required for the implementation of marginal cost-based road pricing are not yet in place in European urban areas. Even those countries which have long-standing and accepted legal and institutional provisions for road pricing systems related to inter-urban motorway use may face a new and different set of problems when considering road pricing in the urban context.

Marginal cost pricing principles have, to date, played little part in determining the prevailing pricing approaches for road transport, particularly for urban areas. As a result, the prevailing legal and institutional frameworks have been established and have evolved, primarily, to cater for other political and economic concerns. The AFFORD case studies undertaken confirmed – not very surprisingly – these conclusions.

One clear example of this is the strong precedent that the primary form of explicit road transport pricing in EU member states is currently an annual licence fee, paid to national government, to permit unlimited access to the road network. Though this approach may be quite an effective approach for meeting the objective of collecting revenue for the national treasury, it of course is wholly inappropriate if the objective is considered to be promoting efficient use of the road transport system, as it fails to relate the amount paid to usage or to differentiate in time and space to discourage congestion.

4.4 Key issues – within road and multi-modal transport settings

Deliverable 2b provided – based on the empirical data available – in-depth discussion of a range of relevant legal and institutional issues of marginal cost pricing:

- key policy issues;
- institutions or organisations involved as prime actors;
- key institutional relationships; and

- legal and institutional barriers to marginal cost pricing.

Following the conceptual format adopted as the AFFORD approach, these issues were considered separately within each of the four policy settings adopted: the road transport setting; the multi-modal transport setting; the spatial & geographic setting; and the inter-sectoral setting.

This section 4.4 considers these issues within the road and multi-modal settings; section 4.5 will then consider similar issues within settings allowing spatial & geographic and inter-sectoral issues.

Considering marginal cost pricing within road transport setting

When considering marginal cost pricing within urban road transport setting, the *key policy issues* are related to the practical ways of charging road users, and, in particular, with the aim to differentiate between different users according to their types or time of day.

The *organisations involved as prime actors* are government agencies responsible for managing the urban road network. At one extreme, this could be a single homogeneous organisation; at the other, it could involve divisions of jurisdiction between local and national government, between neighbouring geographic localities and between different management functions, some of which may even be provided by the private sector.

Generally, the local government agencies involved will be directly accountable to elected politicians at the local level and will form part of an overall urban management framework. However, the situation in some cities may be more complex. In particular, for some medium-sized and smaller cities (e.g. Cambridge in the UK), the responsibility for managing urban transport may lie with a regional authority. In this case, there may be additional divisions of jurisdiction between the local and regional level, affecting issues of local political accountability and the co-ordination of transport with other related management functions (e.g. tourism).

Other organisations which may be involved as significant actors in the introduction of marginal cost pricing for urban road transport are: the organisations responsible for policing urban road transport and for dealing with offenders (for enforcement purposes); and private financiers and technology hardware manufacturers (to facilitate the implementation of electronic charging technology). In addition, the range of interest groups, who would be affected by the conceptual implications of the policy and its practical implementation, might include: road haulage organisations; chambers of commerce; consumer groups representing the interests of road travellers (for all road-based modes); groups representing local residents; and representatives from industries with a direct financial stake in urban road travel (e.g. vehicle manufacturers, retailers and fuel providers).

In particular, so-called ‘unexpected’ institutions may become important for the overall feasibility of road pricing. One example is the indisputable importance of the press and mass media in the shaping of public attitudes. Personal opinions and perceptions of a

few highly positioned individuals in the mass media industry, including leading journalists, may eventually 'make or break' the public acceptability of road pricing. The same holds for, for instance, consumers' organisations, employers' and employees' unions, etc. Even opinion leaders of different kinds may be decisive.

The key issue regarding *institutional relationships* in urban road transport pricing may be the national-regional-local dimension. At present, the major user payments made in respect to road transport – annual vehicle licensing and fuel duty – are paid to national government agencies. Only fees for local services, such as parking, are generally paid to local agents.

Any pricing system which attempts to address the efficiency of urban road transport will, inevitably, need to involve local government agencies and to allow for differentiation between individual urban areas and regions. This will require quite significant modification of existing financial relationships, both between different levels of government and between different geographical units within the same government level, probably leading to rather greater complexity. In particular, the geographical boundaries used to divide nations into regions and/or the urban landscape into adjacent local municipalities would have the potential to become rather greater sources of conflict in the road transport sector than they are at present.

The *relevant legal and institutional barriers* may affect the ability of marginal cost-based road pricing to differentiate between different types of users, and/or between users (similar or dissimilar) in time. Marginal cost-based road pricing, when implemented, must be compatible with the overall legal structure. One important reason why legal and institutional barriers may affect, or even prevent, the implementation of marginal cost road pricing, can be a potential conflict with national level laws and policies. Such laws, affecting the ability to charge marginal cost-based prices may e.g. be constitutional laws guaranteeing freedom of move (road tolls) or privacy (electronic road pricing). The relevant laws and policies may also be related to fiscal taxation.

For example, in The Netherlands, a practical legal problem is that the law states that the moment of paying a tax should not affect the level of the tax (which is to protect income tax payers from uncertainty concerning the total sum to be paid provided it is paid within the legal term). This is clearly at tension with the ideal of time-varying tolls in congestion pricing. Another illustration of the importance of legislative feasibility in The Netherlands concerns the car-pool lane between Amsterdam and Amersfoort, which, after a few months of operation in the early 90's, had to be made available for everybody because Court decided that the concept of 'car-pool lanes' has no legal interpretation in The Netherlands (following a law-suit initiated by a previous Minister of Transport).

Deliverable 2b concluded that the potential implications that national government may be required to cede both revenue and power to local and regional agents, and that the different government levels will need to establish more complex institutional relationships based around common goals, may present extremely difficult practical *barriers to marginal cost pricing*, at least in the short run.

To solve these problems, Deliverable 2b concluded that the introduction of marginal cost-based pricing for urban road transport will require not only the creation of supporting institutions and laws, but also a significant change to the existing governmental culture with regard to road transport. (This same conclusion applies to the other three settings addressed below too.)

Considering marginal cost pricing within multi-modal transport setting

When considering marginal cost pricing within multi-modal transport setting, the *key policy issues* are related to pricing within the urban public transport sector; and the integration of urban public transport pricing with approaches in the road transport sector. A critical issue which arises under both headings is the existence of, or potential for, public transport subsidy. Other important issues are setting consistent user charges across different modes including public transport (integrated multi-modal marginal cost-based pricing schemes), the internal organisation of public transport, and using the revenues optimally (cross-subsidies, earmarked revenue use) within the transport sector. In particular, related to the privatisation and deregulation, there is the theoretical issue of whether marginal cost pricing makes sense for public transport. For example, if it involves operating at a loss, there may be very big legal and institutional implications. Also, this is an area where potential conflicts between national and local policies may be an important issue.

Specifically, in an era of privatisation of public (collective) transport, marginal cost pricing in the associated modes may be hard to achieve as it may be *perceived* to run counter to the free-market arguments that motivated the move towards privatisation and deregulation in the first place. Such arguments would have little (if any) economic validity in the sense that there are no fundamental reasons to dispute the social benefits of marginal external cost taxes applied to privatised transit agencies as well. From a practical viewpoint, however, we observe that the use of such taxes may provide a further argument for the lump-sum subsidisation of losses insofar as resulting from economies of scale in transit.

The *organisations involved as prime actors* are government agencies responsible for managing the urban multi-modal transport system. In many cases the organisations involved may be the same as – or an extension of – the set of organisations responsible for managing urban road transport (within the road setting, above). There may be greater tendencies towards unity across urban regions within the multi-modal setting, due to natural city-wide requirements to co-ordinate effective public transport services for social welfare purposes.

Although it is certainly valid to draw a distinction between the multi-modal setting and the road setting from a policy perspective, as the range of relevant instruments and of policy packages is much narrower in the latter, it is, however, unlikely that they would differ greatly in practice regarding the organisations involved. In particular, a marginal cost pricing policy which covers only the road sector will, nevertheless, be expected to have major impacts at the multi-modal level. Therefore, it may well be that, where a division of management responsibility exists between government agencies for the road

and multi-modal aspects of urban transport, the prime institution for addressing marginal cost pricing issues may tend to be the agency with the multi-modal role.

Other organisations which may be significant actors include: the government agencies responsible for managing urban public transport (to ensure that the city's wider economic and social travel needs are catered for); road-based emergency services; road-based public transport operators and taxi services; the organisations responsible for policing urban transport and for dealing with offenders, across all modes (for enforcement purposes); private financiers and technology hardware manufacturers (to facilitate the implementation of electronic charging technology); and local and national public transport operators whose services are used within the urban region. The additional set of interest groups affected by should be similar to that for the road setting, but possibly broadened to a multi-modal context.

Deliverable 2b stated that the same issues as raised for urban road transport above – the need for the creation of supporting institutions and laws, the need for clear (transparent, logical, sound) relationships between institutions at different levels, and the need for new governmental culture – are all relevant within the multi-modal transport context too. However, an additional key issue is the sheer volume of institutions which would need to be involved, including all government agents responsible for any aspect of transport provision and pricing within the urban region, plus the full range of public transport operators. In the case where private public transport operators exist, there may even be several competing operators within any given mode.

The *relevant legal and institutional barriers* may restrict the ability to implement a comprehensive and integrated marginal cost-based pricing scheme, covering several modes. Also, the relevant barriers may affect or prevent using earmarked revenues within the transportation sector. A third type of barrier is the influence of national level policies. For instance, if a national government follows a philosophy heavily influenced by the perceived benefits of privatisation and deregulation, it may put in place legal and institutional arrangements for some parts of the urban transport sector (e.g. public transport provision) which make it much more difficult for local government agencies to intervene in the market.

The tendency towards much of the decision-making power resting with geographically limited local government agents in some cities results in a much more complex *legal and institutional structures*, and requires much more complex *institutional relationships* than would be efficient when attempting to achieve coherent multi-modal transport pricing policy across the full urban area and its sphere of influence.

Therefore, Deliverable 2b concluded, in some situations, a prerequisite for introducing a comprehensive multi-modal transport pricing system across an urban region may be a degree of legislative and institutional modification to simplify the arrangement in the existing situation. A clear deficiency in many European urban situations is the lack of strong, well-established dedicated institutions with the powers to oversee and control multi-modal transport pricing across urban regions.

4.5 Key issues – within settings allowing spatial & geographic and inter-sectoral aspects

Analogously to section 4.4 above on legal and institutional issues specific to road transport and multi-modal transport settings, this section addresses similar issues within broader settings considering also spatial & geographic and inter-sectoral issues. Again, the discussions are organised to cover: key policy issues; institutions or organisations involved as prime actors; key institutional relationships; and legal and institutional barriers to marginal cost pricing.

Considering marginal cost pricing within a spatial & geographic setting

When considering marginal cost pricing within spatial & geographic setting, the *key policy issues* are related to the differentiation between different users of the transport system spatially and geographically, to allowing for longer term land-use effects, and to competition and/or co-ordination between neighbouring localities within the relevant urban region on issues related to economic development and land use. The *organisations involved as prime actors* may comprise a partnership of government agencies responsible for multi-modal transport across the urban region and those responsible for the urban economy and land use planning and development policy. As these are, typically, completely separate functions within the local urban management framework, effective co-ordination for practical decision-making could be difficult to achieve, although it should be by no means impossible where all functions are ultimately accountable to the same elected political representatives.

Spatial and geographical aspects of marginal cost pricing refer to the ability to differentiate by means of pricing across space – by means of area licences, peak permits, etc. Car parking pricing has an extremely strong spatial and geographic dimension. Furthermore, in the longer run, land use impacts or development and location subsidies/taxes as related pricing measures are issues with strong spatial or geographic dimension.

The *key institutional relationships* may reasonably be expected to include relationships between these same organisations. In some cases, this may actually involve relationships within the same formal government institution and relate primarily to the lack of integration in the treatment of transport efficiency and economic prosperity goals. Other important relationships will involve policy-making at different government levels (i.e. greater integration of land use and transport policy-making may need to be considered at national and European level if it is to be implemented locally) and the relationships between government agencies and private developers and land use operators.

For example, in The Netherlands, there has been identified three governmental levels involved in the actual implementation of road pricing: the national, province and city level. For a successful preparation and implementation of road pricing schemes, it is indispensable that such different government agencies co-operate and agree on both the goals of the policy and on politically important issues such as the question of which

government body – and on which spatial & geographic level – will eventually receive the tax revenues, and decide on the allocation.

A precedent already exists in some European urban areas for spatial and temporal access permits, but these are primarily restricted to downtown areas and, currently, tend to be based on regulation rather than pricing. However, plans to permit permits based on pricing appear to exist in a number states. Parking charges are organised in a similar fashion in most European urban areas, but only the WPL (Workplace Parking Levy) proposals in the U.K. currently appear to have the potential to extend parking fees to the broader spatial context. Other measures which are aimed more directly at land uses are much less common and tend to be considered largely outside the scope of transport policy-making. However, as land use planning is quite commonly the responsibility of local government agencies, the potential for greater integration of land use policy-making with local transport pricing initiatives clearly exists.

Deliverable 2b emphasised (following Deliverable 1) that the short-run marginal cost pricing (which is the natural focus within the road and multi-modal settings) will inevitably encourage also greater spatial and temporal efficiency – it will tend to induce both travellers and activity providers to modify their long-run decisions, such as location of residence, employment and activity provision / involvement, temporal constraints on employment and activity provision / involvement, etc.

The *relevant legal and institutional barriers* that may limit the ability of marginal cost-based pricing to differentiate across space or geographically are related to 'distortions in other routes' and to the ability to differentiate between different types of roads. Especially important barriers may be related to co-operation between communities within a large conurbation, which is primarily an institutional issue (i.e. different geographic areas, road types etc. fall under different organisations).

Deliverable 2b concluded that, in practice, resolving long-run issues related to the spatial and temporal arrangement of activities may provide the key for achieving economically efficient and sustainable urban environments. It also concluded that a major difficulty for considering marginal cost-based pricing in the spatial & geographic context is the need to implement charges over a wide geographical area, rather than limited to a compact city centre. In particular, the need to involve geographically distinct local government agencies within a single charging system would, inevitably, lead to practical and political complexity.

As for the multi-modal setting, the lack of a single, independent transport authority responsible for pricing issues across the urban region is a drawback in most urban situations. However, even where such an authority might exist, a restriction of its powers to the transport sector would still hinder its ability to address spatial & geographic issues in a truly effective manner.

Covering inter-sectoral aspects of marginal cost pricing

When covering inter-sectoral aspects of marginal cost pricing, the *key policy issues* include (i) impacts on the base of fiscal taxation; (ii) inter-sectoral revenue transfers

without hypothecation (e.g. to lower labour taxes); and (iii) the question of whether similar marginal cost-based pricing principles are applied in other related sectors (with potential implications for the efficiency of resource allocation between sectors). A further related technical issue is the determination of the shadow price of public funds.

The *organisations involved as prime actors* include the ministry of finance. When distributing the revenues through inter-sectoral transfers, the prime actor role moves from local to national level, as only those government agencies with an overview of all sectors of the economy would appropriately take on the role.

General taxation policy is generally found to be predominantly the responsibility of national government and national transport taxation (including fuel taxes and road vehicle licenses) has traditionally been based on general fiscal principles, raising money for the national treasury. However, local (and, in some cases, regional) institutions do have some limited taxation powers (e.g. levying local property-based taxes and parking charges, sometimes varying the levels of national taxes to a limited extent).

The *key institutional relationships* are those between different levels of government. National governments naturally wish to retain control over taxation policies and ensure that they receive the majority of total revenues, while local government agencies wish to ensure that the benefits resulting from taxes paid locally are perceived within the area. As a result, inter-sectoral revenue transfers are always likely to prove politically contentious. This needs to be addressed as part of second-best analysis.

Existing taxation regimes which traditionally raise revenue for national government are unlikely to be altered in the short-run. However, as transport problems have moved up the political agenda, there seems to be a greater willingness in government to alter the basis on which transport related taxes are decided, provided that: 1. existing revenue streams are not significantly adversely affected; and 2. the new taxation approach is not perceived to be politically unacceptable.

Distortions in other economic sectors are inevitable and influencing them is likely to be beyond the scope of even the broadest consideration of transport pricing policy at present. Therefore, any attempt at significant changes in urban transport pricing will need to consider carefully the nature and scale of these distortions as part of the second-best situation. In particular, it may be most important to focus on distortions which may be expected to impact on the welfare of lower socio-economic groups and result in social exclusion.

The *relevant legal and institutional barriers* are related to the ability to use revenues in an efficient (optimal) way. Important questions included: Are there legal and institutional barriers affecting the use of revenues? In particular, are there such barriers to using the revenues to lower distortionary labour taxes?

4.6 Legal and institutional barriers – summary of empirical considerations

The discussions in sections 4.3, 4.4 and 4.5 above show that, while it is apparent that urban transport policy innovations are being considered in a number of European states towards the ability to levy more direct charges for road use, much less is being done towards new pricing regimes in the multi-modal, spatial & geographic and inter-sectoral settings. Another conclusion is that, even where pricing policy innovations are being considered and transport demand management goals represent a significant motivation, the practical solutions envisaged are some way removed from marginal cost pricing principles.

A special feature of the discussions above, and of the presentation of the actual AFFORD case studies in Deliverable 2b, has been to consider legal and institutional issues separately within each of the four settings adopted. Overall, it is probably true to expect that the progression through the four settings, from a rather narrow and detailed analysis within the road and multi-modal settings towards a broader analysis within the spatial & geographic and inter-sectoral settings, results in greater potential for organisational complexity and institutional barriers that seem difficult to overcome. The one respect in which this may not hold is the shift in focus from short-run to long-run issues, which takes place in parallel. In this case, a focus on the long-run may actually imply rather simpler levels of differentiation (between different users, of road and public transport) (albeit in broader application) and, therefore, rather less reliance on introducing electronic charging technologies.

This section 4.6 continues with a further discussion of the most important barrier types. The most important barrier types identified are:

- inappropriate or non-optimal organisational structures;
- insufficient legislation;
- contradictory national policies;
- opposition from non-governmental interest groups; and
- low socio-political acceptability.

Inappropriate or non-optimal organisational structures

Deliverable 2b (the case studies) demonstrated that the existing arrangements or organisational structures for urban transport may be far more complex and disaggregate than would be desirable for implementing a comprehensive marginal cost-based transport pricing system across an urban region, in many European situations. In particular, it is common for *urban transport to fall within the responsibility brief of local government agencies*, implying that any coherent transport pricing system for the full urban region will require a consensus to be agreed among representatives of a number of geographically separate units who are accountable to different electorates.

Another key barrier is a strong precedent towards arrangements under which the traditional *approaches for managing different travel modes have largely been separate*. So, typically, the institutions responsible for providing and operating public transport services play little, or no, role in private road transport (and vice versa) and their pricing policy objectives and approaches may be wholly unrelated. Therefore, the process of putting together a consortium of institutions that would need to co-operate for an efficient, comprehensive multi-modal urban transport pricing system to be introduced might result in such a large group with such disparate interests that the prospect of successful (effective) implementation would be greatly reduced. At present, the impact of this is best gauged by proposals to introduce road pricing schemes, which have, in general, attempted to side-step institutional complexity by constraining the areas affected to very compact city centres. The corollary is that the resulting road pricing systems may be expected to have only a very small impact on city-wide travelling.

A third key barrier related to organisational structures is due to *tensions between the different levels of government*. Here, the barriers to marginal cost pricing relate to: (a) the politics of the general financial relationships between different government levels (which may involve complex arguments and power struggles overriding issues of ideology); and (b) the prevailing precedent for pricing road transport (which typically involves annual licensing of vehicles and duty on the purchase of fuel, both of which provide significant unhypothecated revenues to general national funds).

Any major change in existing revenue streams and money flows between government levels would, almost inevitably, result in conflicts based on the perceived changes in the balance of power they implied. In particular, national governments might be expected to oppose vigorously any significant reductions in revenues from existing transport taxation, or any attempts to constrain how it might be spent and/or redistributed, on both political and budgetary grounds.

Regarding the different levels of government, the precedent is quite clearly for detailed urban transport issues and implementations to be dealt with at the local and/or regional level, while inter-urban transport and general strategic transport policy-making is normally the responsibility of national government. It is also important to acknowledge the difference between capital and provincial cities, because the former tend to receive more involvement at the detailed urban level from national government.

Insufficient legislation

With regard to the *prevailing legislation*, it is useful to distinguish between two key strands: (a) laws governing the structures of institutions and the relationships between them (relating to the organisational issues discussed above); and (b) laws required to support specific marginal cost-based pricing measures which are not currently operational (in an appropriate form to encourage efficiency).

Laws which provide for the competitive operation of privately owned urban public transport services will have an important impact for both the potential number (and nature) of institutions that would need to be included within a multi-modal transport

pricing system and for the degree of control that government agencies can exert over user fares.

At a more general level, although there is no shortage of examples of current national legislation to state that user prices for certain elements of urban transport should be based on competitive commercial principles (e.g. U.K. bus fares) or on a non-profit cost coverage approach (e.g. publicly operated parking in Madrid), the authors are aware of no current examples of national legislation to state that any element of urban transport pricing should be based explicitly on marginal cost approaches!

Marginal cost-based pricing for road use might, ideally, require levels of differentiation between users that could only feasibly be applied by advanced electronic charging technology, which would, in turn, need supporting legislation to regulate use and safeguard both the rights of users and the credibility of the system. In some instances prevailing legislation relating to civil liberties may hinder the enforcement of electronic systems, by restricting the power to collect and use electronic data.

Contradictory national policies

In the light of the observations above, it can come as no surprise that *prevailing national policies* – economic and/or transport-related – in the EU affect often contradictory to the attempts to introduce marginal cost-based pricing principles for urban transport. In most cases, the main policies towards pricing road transport appear to be motivated by the desire to raise revenues, while those towards public transport pricing appear to be motivated by the desires to cover service costs and encourage usage. In the case of private road transport, there is, typically, a balance between competing objectives of reducing the perceived congestion and environmental impacts of traffic growth, while accommodating existing mobility levels (to avoid negative impacts for the urban economy). In the case of urban public transport, the focus tends to be on providing an efficient service to support the economic health of the city and on addressing equity concerns for the poorer and less mobile members of society.

However, in recent years, policies which attempt to develop integrated approaches to urban transport have become more popular and tend to view increasing the cost of road use as a mechanism both for restraining growth in road use and acquiring resources for improving the public transport alternatives (i.e. a carrot and stick approach). While not wholly inconsistent with efficiency principles, there are, nevertheless, respects in which these policy-making approaches are, in practice, contradictory to marginal cost-based pricing. In particular: (a) any resulting user pricing would probably be decided more on the basis of politically acceptable unit charges which would provide revenue streams sufficient to fund particular projects, not on calculations of external costs; and (b) revenues generated within the urban transport sector are most likely to be redistributed there, providing alternatives to road travel but attempting to support (and, perhaps, even increase) current mobility levels.

Thus, in those situations where innovate approaches for pricing road use, such as road pricing, are being considered, policy-makers tend to favour very simple charging systems with very limited differentiation and hypothecation of revenues to significant

urban transport investment packages, including new road infrastructure, new public transport modes, improved infrastructure for existing public transport services etc.

Opposition from non-governmental interest groups

The strategic *behaviour of non-governmental interest groups* may reflect the role and/or power of an actor/organisation – in the market, public arena, etc. – vis-à-vis other actors, and it is determined by both by its physical size and the nature of its external and internal agreements/contracts. This can be either formal power of an elected or appointed body or informal power in terms of the rights of a direct action.

In reality, possible winners and losers of a certain policy may be united according to different degrees of organisation, varying from having no joint organisation at all to having a well-run, well-known or even a generally regarded as respectable organisation. In the latter case, these winners or losers will have a greater possibility in voicing their opinion and affecting public attitudes towards their own, and possibly also in affecting political decision-making.

Regarding the *opposition from non-governmental interest groups* – i.e. from non-governmental actors and/or organisations with a perceived stake in the urban transport system – Deliverable 2b expressed the view that such actors to oppose marginal cost pricing policies may be much more common than similar organisations acting for their support. A strong theoretical argument supporting this view is based on the asymmetry between winners and losers due to marginal cost-based pricing policies: typically, the intensity of welfare changes for the losers is notably bigger than for the winners, suggesting that potential losers create organisations to oppose the policies more likely than potential gainers to support them.

Boot, Boot and Verhoef (1999) have developed a simple model to illustrate this argument and to draw together fundamental insights regarding legal and institutional barriers such as they may arise from opposition by organisations involved in (affecting or being affected by) the implementation of marginal cost pricing. The model has been applied to the development occurred in the Randstad case in The Netherlands. The discussion in Deliverable 2b extensively reflected the experiences from this model.

The model assumes, while distinguishing between government and non-government organisations, that the behaviour of each organisation can be characterised as pursuing the interests of two groups of individuals: those working for the organisation and those whose interests are represented by the organisation. The former are called the organisation's *representatives,* the latter the organisation's *population.*

The non-government organisations typically can freely define and attract the population they represent, and at the same time decide not to represent some other groups. Typical such organisations are unions, employer's organisations and automobile associations. The government organisations serve a population that is more exogenously given, and is normally defined by the geographical boundaries of the jurisdiction. Governments have an incentive to serve the population's interests as well as possible for electoral reasons; the non-government organisations have a similar incentive through the necessity of

maintaining long-run membership. Another (related) important difference is that the government organisations typically have a relatively more heterogeneous population than the non-government organisations – in the latter case the population selects itself through voluntary membership or, if membership is obligatory, at least shares important characteristics that define their eligibility for membership (such as enterprises in case of Chambers of Commerce).

Second, the model assumes that an organisation *pursues*, rather than *maximises*, the interests of its representatives and population. These interests may often diverge among relevant individuals, both within the population, and between population and representatives. In reality, a rule-of-thumb type behavioural function characterises an organisation's behaviour, where it satisfizes rather than maximises. Most satisfizing rules would include the objective *to prevent too great losses* for too great a share of the representatives or population, as soon as interests would diverge among relevant individuals. An underlying reason would be that the degree to which individuals would support or object to a certain arrangement may often increase more than proportionally to the size of the perceived welfare change due to this arrangement. Small welfare changes, below some threshold level, may make individuals simply not bother to get fully informed, and shape and voice a clear opinion. Disproportionate welfare gains or losses in contrast, make it worthwhile to get invest time and effort trying to influence the arrangement.

The representatives' short run objectives may not always coincide with the population's objectives, even when the population is homogeneous in the first place. In the longer run, however, such representatives are less likely to survive in their position. Therefore, although central representatives' personal opinions may have an important impact on the organisation's attitude, the *expected* organisation's attitude may more or less correctly reflect the population's interests. Though the distinction between an organisation's population and representatives may explain some 'noise' in the organisation's attitude, it should probably not be a driving force in predicting or explaining its behaviour.

A third assumption is that organisations typically have the equivalent of what in standard economics is known as *market power*. As a result of such 'market power', organisations may exhibit *strategic behaviour* in order to actively try and influence market or political outcomes, to better serve interests of their representatives and populations as much as possible. Typically, the organisations' longer-run viability would not even allow any other type of behaviour. A government not satisfizing the population's interests sufficiently would face electoral damage in a relatively short run. A non-government organisation would face increased competition (or the sheer creation) of competing organisations serving the same population. So, even if organisations do not *succeed* to fully affect market or political outcomes to the representatives' and population's interest, a failure of *attempting* to do so may affect its viability likewise, or perhaps even more strongly.

A fourth important assumption is that the implementation of a marginal cost-based pricing policy may lead to a redistribution of welfare. Marginal cost pricing, accompanied by a system of tax recycling, typically may lead to relatively pronounced

welfare losses for a well-defined group of individuals, while creating relatively small benefits per individual for others (those that benefit from a reduction of other taxes, or from reduced environmental externalities – a substantial share of which may even only be enjoyed by as yet unborn individuals).

Evidently, this kind of model can generate plausible insights and explanations regarding the opposition from non-governmental interest groups to the implementation of marginal cost pricing. In particular, the model suggests the following three hypotheses:

- The probability that the organisations representing the losers object, and the intensity of objection, are larger than for the winners (cf. above).

- The organisations have an incentive to exaggerate expected losses and/or neglect possible gains, in order to try and realise a share in the revenue allocation as large as possible, should implementation materialise. In other words, due to a strategic behaviour the resistance may seem even greater than it actually is. Support for the measure may bear the risk of signalling likely acceptance of a smaller share of the revenue allocation.

- The failure to even attempt to influence the pricing scheme as much as possible in the institution's population as much as possible is unattractive when the organisation's representatives are judged by the extent to which they serve their population. So strong opinions voiced by organisations during the phase of negotiations on any scheme's details should be the rule rather than the exception. If this is true, legal and institutional barriers can be expected with certainty, and should not be treated as a 'surprising disappointment'.

Low socio-political acceptability

The results of the questionnaire (also case city reports) show that, in general, real-world policy-makers still remain unconvinced that marginal cost-based pricing approaches are both feasible and desirable in practice. In particular, policy-makers come from a wide range of core discipline backgrounds, many of which advocate significantly different perspectives to those put forward by welfare economics. Thus, as the traditional practical pricing and decision-making culture in transport (and many other sectors) is not immediately consistent with marginal cost pricing approaches, there is an undeniable tendency for policy-makers to dismiss the theoretical arguments of efficiency as an academic irrelevance.

Deliverable 2b concluded that the majority of policy-makers involved in urban transport pricing at all levels are not, primarily, motivated by a commitment to marginal cost-based pricing approaches and are, in many cases, sceptical of the applicability of the detailed economic theory to the real world urban environments. In some cases, this scepticism may be attributed directly to issues raised within the academic community, in others it may be based more on the lack of clear compatibility between theoretical academic concepts and pragmatic policy-making concerns (e.g. addressing issues of social equity and acceptability).

The key problem appears to be that the theoretical basis for marginal cost pricing involves some rather complex (abstract) economic concepts that are neither common within public understanding of urban transport issues nor, necessarily, shared and valued by all relevant academic disciplines. Therefore, perceptions of marginal cost pricing are affected by a lack of knowledge and/or consensus within the majority of (government and interest group-based) institutions at all levels, throughout the EU.

In the academic and conceptual policy-making community, the basic principles of welfare economics are generally embraced (either explicitly or implicitly). However, there is rather less agreement on the specific issues relating to the role of marginal cost-based pricing in practical policy-making. In particular, while most people appear to accept the validity of first-best pricing as a useful theoretical benchmark for textbook illustrations of transport efficiency, there are still widely varying opinions of how this very simple theory is affected by the collapse of many of its supporting assumptions in the (second-best) real world.

The questionnaire also showed that the politicians, planners and managers interviewed tend to think of core issues and barriers in terms of socio-political acceptability rather than in terms of legal and institutional feasibility. This cannot be considered too surprising, because most legal and institutional barriers could potentially be removed at national level if sufficient socio-political acceptability exists.

Deliverable 2b considered the potential interdependence of the *low socio-political acceptability* on the institutional status quo. That is, while in many cases changing the legal and institutional structures/systems first might be the key to gaining the required socio-political acceptance, such a change does not appear likely without gaining the required acceptance first. This may partly explain why, in the minds of policy-makers (as demonstrated by the questionnaire), acceptability issues and institutional issues seem to get easily mixed. The deliverable concluded that the existing studies about socio-political acceptability of marginal cost pricing (or the studies focusing on the legal and institutional barriers) have not explicitly addressed this important issue.

4.7 Barriers to specific marginal cost-based policy packages

Deliverable 2b particularly considered legal and institutional barriers from the viewpoint of specific marginal cost-based policy packages, such as originally defined in Deliverable 1.

More particularly, the *strong or best practice second-best package* and the *weak or acceptable package* were considered. As explained in section 2.5 above, the former package assumes *relatively high charges and that much of the revenues are not hypothecated but are used to lower labour taxes*, whereas the latter package assumes *relatively low charges and fully hypothecated revenue use*.

It was, in general, expected that the barriers to the strong package would be perceived to be rather greater than to the weak one. This proved to be so in the case cities. In particular, the redistribution element of the strong package met with both legislative

barriers and considerable hostility from the representatives of key institutions, as a result of the suggestion that urban transport pricing revenues should be used to lower national labour taxes.

The overall implication of this may be that a combination of legal and institutional barriers and socio-political acceptability will, in most situations, dictate that a significant majority of revenues levied at the local or regional level may also need to be redistributed at that level, for the perceived benefit of the population which pays, regardless of whether or not the funds are used for transport.

In addition, it is clear that the principle of hypothecation is quite politically sensitive. In some environments, it is viewed as an important mechanism to improve the acceptability of taxation, while elsewhere it is explicitly forbidden. Such strong attitudes are unlikely to be reversed (or, indeed, unified across Europe) for urban transport pricing objectives alone.

Viewed broadly, the key issue from a socio-political acceptability viewpoint may be the difference between a package of pricing-based policy-measures which present drivers with a cost trade-off between different travel options (e.g. between paying a particular unit of fuel tax wherever they go, or paying a higher road pricing charge only when they enter the most congested areas of the city) and a package which appears to make all aspects of road use more expensive at the same time. Of course, such issues are most critical at the point of implementation and it may be possible to achieve the full range of proposed measures over time, as part of a phased approach.

In conclusion, the two packages considered served their purpose in pointing to a number of important legal and institutional issues that were not apparent from considering individual marginal cost-based pricing measures separately. However, taken at face value, neither was shown to be widely successful from a legal and institutional viewpoint.

The questionnaire showed that politicians and planners find it difficult to conceive comprehensive marginal cost-based packages for urban transport pricing, as a result of the prevailing legal and institutional structures/systems and the problems that attempting to change them seem to imply.

4.8 Directions for institutional reform

The conceptual and empirical analyses of Deliverable 2b on legal and institutional issues were driven by the goal of *identifying the most important legal and institutional barriers to marginal cost-based pricing in urban transport*. An important question concerns the directions (the needs and requirements, mechanisms and prospects) for institutional reform with respect to these barriers. The deliverable concluded with a discussion of these issues. However, due to the limitations of the AFFORD study, the discussion was descriptive only, mainly classifying the potential directions for action that could be taken, rather than trying to reach any definite conclusions.

Deliverable 2b concluded that institutional reform to remove *structural barriers* to marginal cost-based pricing for urban transport may involve (reflecting the different reasons for these type of barriers identified in section 4.2, above):

- creation of new institutions and organisational structures designed to facilitate coherent and integrated marginal cost-based transport pricing and associated redistribution mechanisms (and transport policies more generally) covering whole urban regions;

- clarification (investigation) of the politics of the financial relationships between transport policy-making institutions at national and local levels of government, with the aim to increase transparency and thus to remove tensions and inconsistencies that may hinder achievement of the most efficient solutions;

- consideration of legislation at national level which makes explicit reference to the potential benefits of efficient transport pricing, with the aim to influence the underlying themes of strategic policy-making;

- introduction of new legislation to facilitate the implementation of key marginal cost-based pricing measures (including supporting technologies) and associated redistribution mechanisms; and

- reconsideration of prevailing economic and/or transport-related policies at national level which are (may be) in contradiction with marginal cost-based pricing principles within the local urban transport environment.

Institutional reform to remove *opposition from interest groups* and to improve *low socio-political acceptability* may involve (cf. section 4.2):

- improving the effectiveness and transparency of communication on urban transport pricing issues (supported by further research where appropriate), particularly regarding the potential efficiency benefits (and dangers) of introducing marginal cost-based pricing systems;

- improving communication (supported by further research) to provide detailed and reliable information on the redistributive impacts of practical marginal cost-based pricing systems, focussing on the short run equity issues that are of such big concern to relevant interest groups;

- devising practical approaches to compensation – through redistribution of the revenues generated or otherwise – that will best meet interest group concerns in practice, while making sure that the overall efficiency and equity targets will not be endangered;

- supporting and encouraging open public debate about transport policy in the urban context, involving representatives from a wide range of institutions (including government and interest groups), to ensure that all views are properly represented

and addressed, including (where appropriate) tensions between institutions, towards a consensus in which all major players have a stake; and

- ensuring that all the relevant barriers raised are addressed in the communications and debates above and the potential solutions indeed will be used as input to the overall consensus building process.

An extremely relevant question is whether it is possible to develop, based on the theoretical and empirical considerations, some more concrete and realistic views on precisely what policy-makers should be aspiring to. Such potential suggestions regarding optimal and feasible *legal and institutional structures* – or *institutional implementation models* – for the implementation of marginal cost pricing should consider and include the relevant patterns for institutional reforms in relation to the structural, interest group and low socio-political acceptability related barriers, as outlined above.

In addition, such implementation models should specify transition paths or migration routes from the current status quo in urban transport pricing towards the best practice second-best situations (after institutional reform). They should cover the following two aspects (which are highly interlinked):

- the legal and institutional preconditions (barriers, reforms, processes) for the implementation of marginal cost-based pricing; and

- a detailed description of the content or substance of marginal cost-based pricing (individual measures, policy packages).

Deliverable 2b concluded that, providing sound policy conclusions regarding the optimal and feasible transition paths and institutional implementation models would require information on the time profiles of potential welfare effects of alternative scenarios in the short and the long run. Such welfare estimates should provide information on the comparisons between the current situation, the first-best benchmark, and the best practice second-best (under current institutional constraints and after institutional reform). However, detailed analysis of these issues was beyond the scope of the AFFORD study.

5 ACCEPTABILITY ISSUES

The importance of the acceptability issues when considering marginal cost pricing in urban transport can hardly be underestimated. Low acceptability of pricing measures has caused many urban transport pricing plans to fail in practice. Undoubtedly, for each individual case there may be site-specific features that are particularly relevant. However, it can be expected that many aspects explaining the low acceptability are of a more general nature. The same is likely to hold for strategies to improve acceptability. This has motivated the consideration of acceptability for a number of sites in the AFFORD study.

This section describes the results of the acceptability research as it was carried out in the AFFORD study, and discusses the policy conclusions that can be distilled from it. The original work is presented in Deliverable 2c (Schade et al, 2000) and in Schade and Schlag (2000).

The AFFORD work on acceptability covered the three key-groups: the public at large, politicians, and business representatives. The study identified major issues & problems. It aimed to achieve quantitative results concerning the level of acceptability in different contexts. It considered reasons for low (public, political, business) acceptability of marginal cost-based pricing, and made conclusions concerning what could be done to improve acceptability. Furthermore, an important feature of the AFFORD study has been to consider the interaction between acceptability and institutional issues (the socio-political acceptability of policy-makers was discussed in section 4 in the context of the legal and institutional barriers).

The discussion here is organised as follows:

- case cities and questionnaire survey;
- main qualitative results;
- public and political acceptability analysis – quantitative results;
- business acceptability analysis;
- main policy conclusions – implementation;
- main policy conclusions – communication;
- interaction between acceptability and efficiency; and
- interaction between acceptability and institutional issues.

These issues are discussed in sections 5.1 to 5.8.

5.1 Case cities and questionnaire survey

Deliverable 2c reported results of a *public acceptability questionnaire survey* (N=952) that was carried out in Athens, Como, Dresden and Oslo. The survey focussed on specified pricing/policy packages, which were derived from AFFORD Deliverable 1. Two such packages – the *strong or best practice second-best package* and the *weak or acceptable package* (called in the deliverable strategy A and strategy B respectively) – were applied in all cities; in addition, for each city, a site specific strategy (strategy C) was defined to allow for local circumstances.

The *strong or best practice second-best package* comprises time-differentiated cordon pricing and an increase in parking charges and fuel taxes as well as (some way of) revenue hypothecation. The *weak or acceptable package* also comprises – but to a lower extent – cordon pricing as well as an increase in parking charges and fuel taxes, and revenue hypothecation.

The questionnaire used in the AFFORD public acceptability survey reflects, above all, the different variables outlined in the underlying acceptability model, in which problem awareness, perceived effectiveness, acceptability and expectations are central constructs (see Figure 2.2-1 in Deliverable 2c for a detailed picture). Earlier experiences with questionnaires in the EU-projects MIRO and TransPrice have been integrated. Most of the variables were operationalised by a four-graded scale with the exception of the variable equity which is three-graded. Only closed questions were used.

The sample consisted of *motorists* exclusively. A quota sampling was used considering demographic criteria with regard to age, gender, occupation and place of residence. The selection of the respondents was random corresponding to the quota. In each of the four cities, the samples were drawn from the local telephone directory. The subjects were contacted by phone and asked whether they are in possession of a valid driving licence for private vehicles and willing to take part in the survey. If this was the case, a questionnaire was sent to the respondents. After they had filled them in, the respondents were invited to resend the questionnaires (by free mail). The surveys were carried out from December 1998 to January 1999.

The whole AFFORD sample for public acceptability contains 952 persons interviewed (Table 5.1).

Table 5.1 Sample sizes in the public acceptability questionnaire

	Total	*Athens*	*Como*	*Dresden*	*Oslo*
sample size	952	150	238	281	285
female	38.1%	38.3%	35.1%	35.5%	43.1%
male	61.9%	61.7%	64.9%	64.5%	56.9%
mean age (years)	44.3	36.5	45.6	45.4	46.3

The *political acceptability survey* (N=13) was carried out as a phone survey in spring 1999. Personal interviews with the politicians were performed in the cities of Como (6 respondents) and Dresden (7 respondents) only. Because of the small sample size, no attempt was made to perform statistical analyses on the resulting dataset. The questions focused in particular on problem perception and on the evaluation of the various policy packages.

Finally, a *business acceptability survey* (N=26) was held among representatives of business organisations (such as Chambers of Commerce, Business Associations, etc.) in four cities: Athens (5 organisations), Como (4 organisations), Dresden (12 organisations) and Oslo (5 organisations). Respondents were asked to rank policy packages on the basis of three general assessment criteria: (*1*) business patronage (sub-divided into temporal variation in demand, reduction of sales, and customer convenience); (*2*) business operation (sub-divided into planning of logistic operations, reliability of deliveries, and scheduling of personnel activities); and (*3*) costs (sub-divided into personnel costs and supply costs). The questionnaire further addressed issues concerning the interviewees' perception of the urban mobility problem in their city, and their recommendations and proposals as to how the urban mobility problems could be solved.

5.2 Framework for analysis

A single theoretical framework was used to study acceptability issues as pertaining to the public at large and politicians. The framework defines the following essential issues determining the acceptability of the proposed evolution:

- problem perception: the perception of traffic related problems is a necessary precondition for regarding problem-solving measures as important;

- mobility related social norms as the perceived social pressure to accept measures like road pricing;

- important aims to reach by the measures: these aims can compete with certain mobility related aims of various interest groups. The potential conflict that may arise between these perhaps different aims is crucial for the question of acceptability;

- information and awareness of options: people have to know and understand projected measures. They have to be aware of the background, the aims as well as the specific ways, in which the measures are implemented in practice;

- perceived effectiveness and efficiency: the proposed measure have to be perceived as an effective and efficient mean to control traffic problems;

- equity: first of all in the sense of a distribution of costs and benefits as being fair. Here, equity is tentatively operationalised as personal outcome expectations. An important distinction is made between intra-personal, interpersonal and alternatives on which the evaluation of outcome expectations may be based,

- revenue allocation: public acceptability strongly depends on how the revenues are used. Hypothecating revenues increases public support considerably;

- attribution of responsibility for the solution of perceived traffic problems. If people consider themselves as at least partly responsible for solving the problems (internal as compared to external attribution), this should lead to increased agreement with measures that raise the price of or restrict car use.

5.3 Main qualitative results

Public Acceptability

As expected, among the public at large there is a high *problem awareness*, both general and personal. Especially air pollution, congestion and parking problems were considered to be very critical. But there were local differences in the problem perception. Negative expectations about the development of the perceived problems were predominant, which contributes to a rather pessimistic view of the overall situation.

The direct evaluation of the two AFFORD strategies reveals that the subjective level of *information* for both strategies is very low. This is no surprise because the measures are new. However, there are differences between the sites. The knowledge about the measures is very low in Dresden and Oslo and rather low in Athens and Como. This gap could be due to the following: a) in Oslo the question referred to the objective knowledge because there already exists a specific pricing system; b) in Dresden as well as in all former socialist countries knowledge about pricing instruments in general is low. On the other hand, in Athens and Como the respondents seem to feel slightly better informed about the measures.

The *perception of the effectiveness* of the two strategies to reduce inner city traffic is much higher than the information level. These overall higher scores for effectiveness than for awareness may indicate that respondents believe that demand management is to some extent capable of successfully addressing current transport problems. Accordingly, the public seems prepared to trust these measures to a certain degree, even where they are new and unknown. Concerning the personal outcome – as a first and easy to communicate approximation to *equity* – the majority of the respondents expects more disadvantages for themselves following from the introduction of road pricing.

The *responsibility* for the solution of the perceived problems is mainly attributed to public entities like the municipality, the state or the public transport companies whereas a majority of respondents denies to be personally (jointly) responsible for the solution of problems. Furthermore the overall opinion concerning a *limitation of inner city traffic* is

clear. Almost three fourths of all respondents support a limitation. But if it comes to a reduction of personal car trips the opposite result appears: 65% of all respondents state that it would be difficult to reduce car trips substantially. So, which car trips would the respondents be willing to reduce? In general slight effects on shopping trips are expected and also some effects on leisure trips. Work trips have the lowest self-reported price elasticity.

It was found, as expected, that at present road pricing is not capable of winning a majority among motorists. In general, the stated *acceptability* of both strategies, the best practice second best strategy (strategy A) and the one assumed as rather acceptable (strategy B) is low. As expected, rejection is stronger regarding the stronger strategy A. But there is a significant increase of support from strategy A to strategy B. Nevertheless, the majority of respondents does not accept the so-called acceptable strategy B either.

But, there are still differences between the four sites. In Dresden rejection of both strategies is very strong, which at least partly could be put down to the socialist past. Although this finding should be further examined it has to be considered when introducing road pricing in the future EU-member states of Eastern Europe. Refusal is also very strong in Como. In Oslo there is a strong rejection of strategy A but strategy B is rather accepted. In Athens the attitudes towards both strategies are generally less negative.

In brief, thus, even if a package solution with transparent revenue hypothecation receives stronger support than single pricing measures, the packages tested here find no majority among the motorists. However, compared to the strong strategy A the acceptability of the weak strategy B pricing has nearly doubled.

Political Acceptability

Because of the very small sample only very careful conclusions can be drawn for political acceptability.

Generally it is found that the politicians' personal traffic related problem *perception* is rather high. Thus, it does not substantially differ from the car drivers' problem perception. While for Como no clear statements can be made, for the Dresden politicians it can be said that they underestimate the public problem perception. This especially refers to air pollution. However, for traffic related problems like congestion and parking the perceptions correspond rather well.

Compared to other municipal problems, traffic problems are generally given high priority. This particularly holds for Como. In Dresden other problems like unemployment or city development, which result from the special political situation (German reunification), still overweigh the present traffic problems.

In general the majority of the interviewed politicians agrees a reduction of inner city traffic.

Both the politicians' *evaluation* of the effectiveness and their personal *acceptability* of the presented strategies is surprisingly positive. Although strategy A is still mainly rejected, the majority of interviewed politicians consider strategy B, which also contains cordon pricing, as at least rather acceptable. So, the politicians' acceptability of pricing policies is higher than expected. In the contrary, especially in Dresden, the public's acceptability is clearly underestimated. This – as experience shows – should be higher than the 31% acceptability as shown by the motorists in the public acceptability survey.

Considering the findings that an acceptability level of ca. 50% of the public is seen as necessary for a positive political decision, the introduction of a measure like strategy B does not seem so unrealistic anymore. However, besides the voters also other groups show to have a substantial influence on political decisions, and thus are able to hinder the introduction of pricing policies. Especially the influence of the media in relation to the (lacking) acceptability of road pricing has not sufficiently been considered yet.

Business Acceptability

The major findings of the survey results can be summarised as follows. The business representatives in general stated that urban transport suffers from severe problems such as lack of parking space, congestion, air pollution, and inadequacy of public transport – although the relative importance varies somewhat between the cities. In all cities but Dresden the majority of interviewees believe that there should be a limitation of traffic.

Many interviewees expressed the opinion that the municipality has a large responsibility in solving the mobility problem in their cities. Also the state and the public transport organisations are considered to have large responsibility in solving the urban mobility problem in all four cities by the majority of interviewees. Some responsibility has been also allocated in all cities to private automobile users in solving the urban mobility problems.

Strategy A has gained the highest acceptability in Athens and Dresden, and the second highest acceptability in Como and Oslo. The pricing strategy with the highest acceptability in Oslo is the site specific strategy (strategy C). The pricing strategy with the highest acceptability-score in Como is strategy B. At all sites the currently implemented strategies receive the lower degree of acceptability. Only in Oslo and Como the implementation of pricing strategies were to some extent supported.

The criterion of business patronage is the one that most influences the preferences of the interviewees in Athens and Dresden, followed by the criterion of business operation and cost respectively. The criterion of cost was the most important one for the interviewees in Oslo, while business operation and business patronage criteria were of almost the same importance. Business operation criterion is the most important criterion according to the interviewees in Como followed by business patronage. In all surveys it was revealed that the majority of interviewees perceive that in order to solve the urban mobility problems alternative measures than pricing strategies should be used, i.e. park and ride facilities, improvement of the level of service of public transport, enlargement of parking facilities, improved traffic management, parking fee policies.

5.4 Public and political acceptability analysis – quantitative results

In the following the four AFFORD sites will be compared with respect to the main measured variables of the public acceptability. Mainly frequency distributions and mean values will be reported.

Table 5.4.1 shows the percentage of respondents (N=952) by sites who rated the traffic issues as a 'major problem' or 'a very serious problem'. There are considerable differences in general problem perception between the four sites. In Athens all items are rated as a problem by nearly all respondents. This result confirms the findings of the TransPrice survey (Keränen et al, 1999), where also a very high problem perception for Athens was found. There is also a high awareness of problems in Como, with the exception of direct traffic related problems. In particular these problems ('congestion' and 'a lack of parking space') are perceived as very serious in Dresden, which may be due to the fact of the special traffic situation in Eastern-Germany after the reunification. However, in Dresden all other items are rated as less serious than in Athens and Como. The lowest problem perception is found in Oslo where especially air pollution and an inadequate public transport are perceived as problematic.

Table 5.4.1: General problem perception - Confirmative response (%).

Problems	Problem perception				
	Average	Athens	Como	Oslo	Dresden
air pollution from motor vehicles	83	95	90	81	73
traffic congestion	82	97	94	79	65
not enough parking space	77	97	81	73	65
inadequate public transport	67	91	76	69	46
traffic noise	67	79	76	63	59
unsafe roads	62	88	74	54	46

In the whole, it can be said that the AFFORD results confirm earlier findings about the problem perception (e.g. Bartley, 1995; Schlag and Schade, 2000). In general there is a high perception of several problems caused by traffic. The three *main problems* which are perceived by a vast majority of all respondents are air pollution, congestion and a lack of parking space. Beside traffic related problems the interviewed car drivers perceive traffic induced *environmental* problems as well.

Responses to the question whether car traffic should be limited show the same ranking (Table 5.4.2). Further analysis reveals that there is a relationship between the perception of rather environmental problems and the support of traffic limitations. This means that respondents who evaluate e.g. air pollution as a major problem state a more positive

attitude towards traffic limitations than people who do not perceive air pollution as a problem (r= .37, p<.01).

Table 5.4.2: A need to limit the traffic? (Confirmative responses in %).

Average	Athens	Como	Oslo	Dresden
73	89	82	68	59

Table 5.4.3 summarises the descriptive results (mean values) for the evaluation of the two AFFORD strategies (the *best practice second-best* strategy (strategy A) and is the *acceptable* strategy (strategy B)). As can be seen for the total sample, the subjective information levels for both strategies are very low. This is not surprising because the strategies are new. However, there are differences between the sites. There is very little knowledge in Dresden and Oslo and rather little in Athens and Como. This gap could be due to the fact that a) in Oslo the question is likely to be interpreted to refer to objective knowledge of the details of an already existing pricing system (rather than subjective knowledge of government pricing as a general concept) and that b) in Dresden as part of a former socialist country the knowledge about *pricing* instruments is in general low. The Athens and Como respondents - on the other hand - seem to feel to be better informed about the strategies.

Table 5.4.3: Overall evaluations of strategies A and B.

	Strategy	Information	Perceived effectiveness	Personal outcome expectations (equity)	Acceptability
Average for total sample	A	1.50	2.39	-.21	1.80**
	B	1.48	2.34	-.16	2.22
Athens	A	1.70	2.51	.07*	1.96**
	B	1.69	2.56	.30	2.29
Como	A	1.92**	2.23*	-.39*	1.80**
	B	1.72	2.38	-.28	2.17
Dresden	A	1.32	2.37	-.60	1.65**
	B	1.39	2.37	-.37	2.07
Oslo	A	1.23	2.50**	.16**	1.85**
	B	1.27	2.15	-.11	2.38

All mean values can vary from 1 (e.g. know nothing at all, absolutely unacceptable) to 4 (know a lot, totally acceptable) with the exception of personal outcome expectations (equity) where values can vary from -1 (expected disadvantages) to +1 (expected advantages).

Wilcoxon Signed Ranks Test:

* Difference between strategy A and B is significant at the 0.05 level.

** Difference between strategy A and B is significant at the 0.01 level.

The effectiveness-evaluation of the two strategies with respect to the reduction of inner city traffic is much higher than the information level. Thus, respondents may believe that demand management is to some extent capable of successfully addressing current transport problems, and accordingly, that the public is prepared to trust these measures even if they are new and unknown. In Athens and Como the perceived effectiveness of strategy B is higher than of strategy A (but only in Como slightly significant), in Dresden it is at least the same, in Oslo the stronger strategy A is perceived as more effective than strategy B. Again, this finding could be due to the fact that the respondents of the Oslo sample have experience with an existing pricing scheme, allowing a more realistic evaluation of the effects than in the other cities where the evaluation may be very subjective.

Concerning the *personal outcome expectations* it can be said that for the total sample there are no significant differences in the expectations about personal (dis-) advantages between the two packages. All in all, the majority of respondents rather expects disadvantages following from the introduction of the two strategies. However, there are differences between the sites. In Athens, Como and Dresden respondents expect more advantages of the strategy B than of strategy A. In Athens the personal outcome expectations tend be generally rather positive with even a majority expecting advantages of the "acceptable" strategy. Only the Oslo respondents expect more personal advantages of strategy A than of strategy B, a finding which cannot be explained, yet.

In general, both strategies are rejected by the respondents (see Table 5.4.4). As expected, rejection is stronger regarding strategy A. But there is a significant increase in support from strategy A to strategy B. Nevertheless, the so-called acceptable strategy B is still not accepted by a majority. In Dresden rejection of both strategies is strongest. In Como the attitudes towards both pricing strategies are also very negative. In Oslo there is a strong refusal of strategy A but strategy B is rather accepted. In Athens the attitudes towards both strategies in general are less negative.

Table 5.4.4: Acceptability (% who rate the strategy as rather or totally acceptable).

Strategies	Support in %				
A	Average	Athens	Oslo	Dresden	Como
	20	25	24	17	15
B		Oslo	Athens	Como	Dresden
	39	48	43	34	31

Table 5.4.5 shows a cross-comparison of the responses towards the strategies A and B. As much a 53 % of all respondents reject both strategies. 27% accept the weaker strategy B, but reject strategy A. Only 12 % of the respondents accept strategy B as well as strategy A. It is surprising that 8% of the people interviewed accept the stronger and more expensive strategy A, but reject the softer and cheaper strategy B (these are around 40% of all supporters for strategy A).

Table 5.4.5: How supporters and opponents of strategy B reacted to strategy A and vice versa.

		Strategy A		%
		not accepted	accepted	
Strategy B	not accepted	53%	8%	61%
	accepted	27%	12%	39%
		80%	20%	100%

Based on the descriptive figures above the increase of acceptability from strategy A to strategy B cannot be explained. All variables do not vary significantly between the two strategies on the overall level. However, there are some rather unsystematic differences on the city level. To analyse the relations between the different variables further statistical investigations on a multivariate basis are necessary.

For this Deliverable 2c adopted a two-step procedure. First, with a factor analysis the extensive data are reduced to an appropriate minimum. Many of the used variables (e.g. problem perception, important aims to reach, internal attribution of responsibility, intentions, etc.) are based on a multitude of items, which cannot all be examined with regard to their relation with acceptability. The factor analysis allows the statistical reduction of data to prepare them for the use of a regression analysis – the second step. The regression analysis is applied to investigate which variables contribute to the explanation of acceptability.

The statistical analyses carried out show that, in particular, the variables *social norm*, *perceived effectiveness*, *personal outcome expectations* and the *approval of societal important aims* are positively connected with the acceptability of pricing strategies. On the other hand, the results reveal that socio-economic characteristics (e.g. income) of respondents influence the perceptions, attitudes and evaluations towards the pricing strategies only to a low extent.

The small-scale questionnaire concerning *political acceptability* (N=13) in Como and Dresden revealed that (local) politicians state a high awareness of traffic problems even compared to other municipal problems like economic growth or city finances which are considered as less important (Table 5.4.6). The majority of the politicians agree with a limitation of inner city traffic (Table 5.4.7). The politicians' evaluation of both the effectiveness (Table 5.4.8) and the personal acceptability (Table 5.4.9) of the suggested strategies was surprisingly positive. Although the strong package (strategy A) was still mainly rejected, the majority of interviewed politicians considered the weak package (strategy B), which also contains cordon pricing, as at least rather acceptable. So, the politicians' acceptability of pricing policies was clearly higher than expected. In the contrary, especially in Dresden, the public's acceptability is clearly underestimated (Table 5.4.10). The politicians seem to fear an even stronger rejection of pricing strategies by the public than actually is measured.

Table 5.4.6: Ranking of problems by politicians

Item	Como median	Dresden median
Traffic problems	*1.0*	4.0
Security	2.0	7.0
Unemployment	4.0	*1.0*
Economic growth	4.0	4.5
Environmental problems	4.0	4.5
Cultural and educational policy	5.5	6.0
City development (e.g. housing etc.)	6.0	3.0
City finances	6.0	5.0

Table 5.4.7: Number of politicians who agree traffic restriction.

Point of view	*Como* N	*Dresden* N
Politicians	6	5
Perception of public opinions	5	4

Table 5.4.8a: Perceived effectiveness of strategy A (frequency distribution).

	will not work at all	will have little effect	will have some effect	will work very effectively
Como	2	1	1	2
Dresden	0	2	1	5

Table 5.4.8b: Perceived effectiveness of strategy B (frequency distribution).

	will not work at all	will have little effect	will have some effect	will work very effectively
Como	-	1	4	1
Dresden	-	2	5	1

Table 5.4.9a: Acceptability of Strategy A (frequency distribution).

	absolutely unacceptable	rather unacceptable	rather acceptable	totally acceptable
Como	3	2	1	-
Dresden	2	3	2	1

Table 5.4.9b: Acceptability of strategy B (frequency distribution).

	absolutely unacceptable	rather unacceptable	rather acceptable	totally acceptable
Como	1	3	2	-
Dresden	2	-	5	1

Table 5.4.10a: Expectation about car drivers to accept strategy A (frequency distribution).

	0 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Como	4	-	2	-	-
Dresden	8	-	-	-	-

Table 5.4.10b: Expectation about car drivers accepting strategy B (frequency distribution).

	0 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Como	2	2	2	-	-
Dresden	6	2	-	-	-

5.5 Business acceptability analysis

Business acceptability survey was carried out among representatives of business organisations such as Chambers of Commerce, Business Associations, etc. in the four cities (Athens, Como, Dresden and Oslo) (N=26). Respondents were asked to rank four policy packages (strategies) on the basis of three general assessment criteria. The questionnaire further addressed issues concerning the interviewees' perception of the urban mobility problems in their city, and their recommendations and proposals as to how these could be solved.

The four packages (strategies) considered were: the strong or best-practice second-best package (A); the weak or acceptable package (B); a site-specific package (C); and a package reflecting the current situation (D).

The three assessment criteria considered were: 1. business patronage (sub-divided into temporal variation in demand, reduction of sales, and customer convenience); 2. business operation (sub-divided into planning of logistic operations, reliability of deliveries, and scheduling of personnel activities); and 3. costs (sub-divided into personnel costs and supply costs).

The survey revealed that the (relative) importance of the (different) assessment criteria, and therefore the preferences for the alternative packages (strategies), vary greatly among the four cities. For Athens and Dresden the most effective package and therefore the one that gains the higher degree of acceptability from the business community is – surprisingly – the strong package (strategy *A*). For Oslo it is the cite-specific package (strategy *C*) and for Como the weak package (strategy *B*). Furthermore, at all test sites the majority of interviewees perceived that in order to solve the urban mobility problems also other measures (besides pricing) should be used, i.e. park and ride facilities, improvement of the level of service of public transport, enlargement of parking facilities, improved traffic management, parking fee policies (which in fact is

pricing). The implementation of pricing strategies were to some extent supported only in Oslo and Como.

As an illustration, Figure 5.5.1 shows the overall acceptability of the four strategies for the four case city studies.

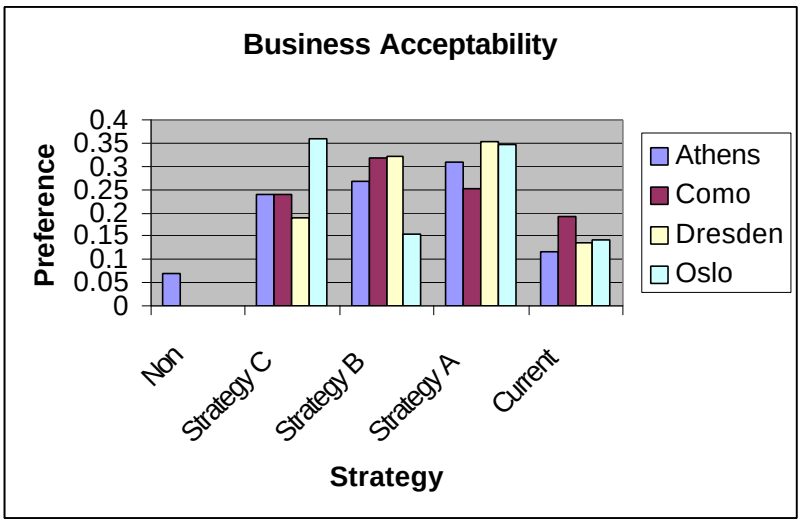

Figure 5.5.1: Ranking of the alternative pricing strategies by business representatives

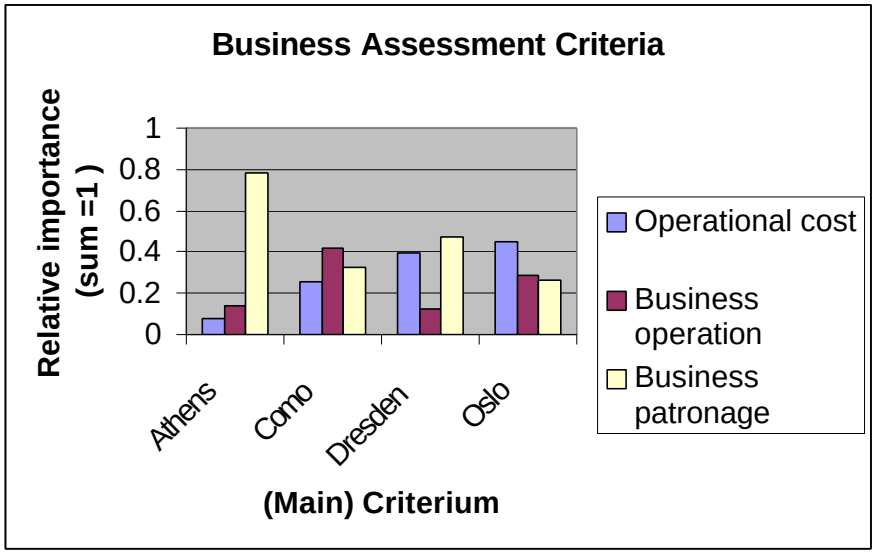

Figure 5.5.2: Ranking of assessment criteria by business representatives

The general assessment criteria considered in the business acceptability study are (*1*) business patronage (sub-divided into temporal variation in demand, reduction of sales, and customer convenience); (*2*) business operation (sub-divided into planning of logistic operations, reliability of deliveries, and scheduling of personnel activities); and (*3*) costs (sub-divided into personnel costs and supply costs). The survey revealed that the importance of the assessment criteria (Figure 5.5.2), and perhaps therefore the preferences for the alternative strategies vary greatly among the four cities.

5.6 Policy implications – implementation & communication

Implementation

Deliverable 2c suggested the following general guidelines to successful implementation of marginal cost pricing in relation to the acceptability issues:

- Pricing strategies have to be perceived as very *effective solutions*, if not as the only effective solution for the perceived traffic problems. People are used to regard public roads as "free" goods; therefore, there will be strong emotional resistance to any attempt to charge for them. If we want people to accept marginal cost based transport pricing, there must be very good and convincing reasons. Perhaps the best reason is that, this is the best way or only to solve perceived urgent problems. The effectiveness of transport pricing may be high but this is not guaranteed and depends on the definition of objectives. The efficiency will be comparatively very high – from the cities', but not from the motorists' point of view. Thus, not only the objectives of the intended measures must be valued highly by the public, people must also believe that their behaviour contributes to reach these objectives. The values as well as the expectations (the perceived probability to reach these objectives) should be made transparent and first trials of a new behaviour must be successful so that the new behaviour is perceived as effectively contributing to reach the shared values, thus creating positive contingencies between the behaviour and its consequences.

- *Revenues* must be *hypothecated* and alternatives have to be provided. People want to get something for their money. Thus, there must be a package solution, combining traffic restraints and road charging with a set of transport and environmental improvements.

- *Fairness* issues have to be considered very carefully. The system must be perceived as fair in particular relating to the personal cost-benefit-relation. The benefits people see for themselves must balance their costs at least in an immaterial way (e.g. by reaching other valuable objectives). In addition people should not feel to be treated unjust in comparison to others. An important role plays in this context the use of the revenues. With the help of the raised charges it is possible to influence the distributional impacts in the desired direction. Hypothecation of the revenues must result in guaranteeing a desired level of mobility for all, even supporting mobility chances for some groups thus meeting equity issues on a population level.

- Public acceptability can only be expected if people have *confidence* among others in the effectiveness of the marginal cost pricing, the use of the revenues, the fairness and anonymity of the system. One precondition to support confidence is *transparency* of the intended pricing and revenue allocation scheme at an early stage. Connected to transparency, for the acceptability of any change we have to create some commitment of people to the new ideas, perhaps creating some identification with the proposed package of measures. This commitment depends on early and credible communication, on positive experiences (at least by models), on the conviction that marginal cost pricing is an effective solution, and on perceived chances of *participation*. People want to see themselves as having at least some degree of control over the things they are affected by. Thus there is a connection between participation, commitment, acceptability and later effectiveness of marginal cost pricing. This points out the importance of early information and participation of people even in concept development. A second precondition for creating confidence is defined responsibility. Who will be responsible for the functioning of the system, for charging and accounting, for revenue allocation, for failures and undesired effects? This has to be defined clearly before implementing marginal cost pricing. Responsibility issues are of particular relevance in connection with the debate of privatisation. And finally, to meet the above requirements it is necessary to design a strategy to communicate the measures.

- *Charging* only *new facilities* can be a rather easy way to introduce road pricing. Using road pricing only for new infrastructure has a better chance of acceptance, as there is a net benefit form the new investment.

- The necessary publicity calls for an *intelligent communication strategy* (see below).

Communication

Concerning the final point in the previous section, a number of communication principles were identified. From a psychological point of view a successful communication strategy should – among others – reflect the following principles:

- The communication strategy only works if it covers the whole package.

- All the externalities have to be discussed in advance: creating awareness for the problem, then presenting a package of credible solutions.

- Positive objectives must be connected with most effective solutions to reach them. Thus transport pricing has to be communicated as a very effective means to reach commonly shared goals. This can make private costs more acceptable.

- There must be personally positive experiences in first trials changing the transport mode, e.g. time savings, less parking problems, ecological advantages, the possibility to participate in solving traffic problems, attraction of inner-cities, etc. Positive experiences on first trials help to get used to the new behaviour. If the first experiences with a newly implemented system have to be positive to hold them,

then investments in public transport must go ahead before pricing is introduced to reduce painful first experiences and to have the capacities available.

- The communication has to point out the positive sides of the package, ie the uses for which the road charges are used. This connection between push and pull measures (see hypothecation) was not given in a sufficient way in former road pricing strategies (e.g. in Stuttgart, Germany) or it was not communicated transparently enough.

- People must feel to have a choice, even if the choice alternatives are restricted and the inputs of their decisions have changed. If they only feel to be forced to compliance, some of them will show reluctance, a strong motive to change the situation for themselves and to restore former perceived possibilities to choose between alternatives. Crucial is the *perceived freedom of choice*.

- If we cannot convince people, external control to enforce the desired measures has to be very strong. But this external control will only work if a great majority of people generally agree with the measures and accept that people offending against these measures are enforced and punished. This will certainly work if no more than 20 or 30 per cent of all the people targeted oppose the measure. Thus, we have to convince a great majority of road users and even of car drivers. The conviction of a great majority is not only a precondition for the acceptance of the measure, but also a precondition for the acceptance of the control against offenders.

- In addition, positive information should be disseminated which corresponds with the desired attitudes and behaviour and negative information for undesired.

- Achieving changes in normative values is another strong element for establishing the new behaviour. Creating new norms on a collective and new intentions on a personal level may motivate to behave in a new manner to meet these new beliefs. But that must be experienced as valuable in a material and in an immaterial sense. Generally, the perception of the situation has to be changed – and this will influence the behaviour of people.

- The pricing scheme, and its supporting measures, must develop a new transport system, offering real alternatives (bus, tram, shared modes of transport), which are well known (information) and attractive in terms of price, convenience, availability and accessibility, etc. Constraints to changes in behaviour must be identified and eliminated. Thereby mobility should not been diminished by transport pricing. Such a favourable situation is a precondition to break old habits and to realise new intentions. Thus, positive first experiences with alternatives (in mode, time, route choice) can be understood as a learning exercise which demonstrated what can be gained from changed behaviour. In the first instance, positive expectations, positive values and positive outcomes may be partly communicated by models which explain the scheme, and get vicarious rewards.

- The pricing message has to be communicated by very credible communicators (credible from the point of view of car drivers and other users).

5.7 Interaction between acceptability and efficiency

From a broader perspective, it becomes important also to consider explicitly the interaction (or trade-off) between public acceptability and efficiency. Clearly, when too easily a scheme were adopted so as to meet public acceptability requirements, its efficient properties may be undermined so much that the efficiency considerations motivating the scheme in the first place would then call for a cancellation of the scheme. Two examples mentioned in the literature are:

- *Pay-lanes* The use of tolls on only a part of a highway's capacity will generally induce inefficient route split effects: the unpriced part becomes more heavily congested. The second-best price for a pay-lane is accordingly low. If this is ignored, and 'quasi first-best prices' are used instead, efficiency losses instead of gains may in fact result. So, a gradual, piecemeal introduction of marginal cost pricing to gain public support may at least temporarily create efficiency losses rather than gains. From the efficiency viewpoint, such a 'gesture to acceptability concerns' can be justified only if the foreseen end-state would be one in which marginal cost pricing is implemented at the vast majority of links in the network.

- *Public transport subsidies* The use of road pricing revenues for subsidies in public transport is another often mentioned strategy to enhance public acceptability. Insofar as public transport is priced inefficiently low already, this may induce further efficiency losses – apart from the possibly negative impacts of subsidies on the efficiency of management. So, at least, such subsidies should be targeted to those cost elements of a transit system that indeed should be subsidised from an efficiency viewpoint. These may include the infrastructure and possibly the 'rolling stock', the fixed costs of which may be impossible to recapture using marginal cost pricing principles. But in general, the point is that public transport subsidies may have different efficiency impacts, depending on the shape they take, and this should be accounted for in the design of a scheme.

A final conclusion that can thus be drawn is that acceptability concerns would often suggest amendments in marginal cost pricing schemes that may at least partly undermine its efficiency impacts – which form the primary motivation of the scheme in the first place. When dealing with these issues in the design of actual policies, it is therefore important to keep in mind that the goal to be pursued should not be the implementation of pricing per se, but rather the improvement of the efficiency of transport (and related) systems.

5.8 Interaction between acceptability and institutional issues

Although the AFFORD study considered acceptability and institutional issues in separate work packages, we by no means want to suggest that we believe these two aspects are separate, independent issues in reality, too. In fact, during the course of the

project it has become clear that these two aspects can hardly be seen in isolation, and in hindsight one would wish the interactions would have been recognised more explicitly in the overall project set-up.

Inspired by insights from the Dutch case study, some of the main interactions between acceptability and institutional feasibility of marginal cost pricing in transport were illustrated in the AFFORD study by means of probably the simplest possible *model* (perhaps *framework* is a better characterisation) of institutional issues suited for this purpose. In particular, the model predicts, on the basis of a number of rather plausible assumptions and qualitative logical reasoning, that social acceptability and institutional feasibility of marginal cost pricing would typically be two mutually reinforcing barriers against its implementation.

A first distinction made is between 'government institutions' and 'non-government institutions'. Secondly, it is assumed that the behaviour of each institution can be characterised as pursuing the interests of two groups of individuals: those working for the institution (which we will call the institution's *representatives*) and those whose interests are represented by the institution (the institution's *population*). In some cases, the institution itself has some freedom in defining and attracting population it represents, and at the same time decide not to representing other groups. The population may even have created such an institution in the first place, which is for instance the case for unions, employer's organisations or automobile associations. Government institutions, on the other hand, serve a population that is more exogenously given, and that is normally defined by the geographical boundaries of the jurisdiction. Governments have an incentive to serve the population's interests as well as possible for electoral reasons; non-government institutions have a similar incentive through the necessity of maintaining long run membership. An important difference will be that government institutions typically have a relatively more heterogeneous population than a non-government institution's population, which has selected itself through voluntary membership or – if membership is obligatory – at least shares important characteristics that define their eligibility for membership (such as enterprises in case of Chambers of Commerce).

In the previous paragraph, we deliberately stated that an institution *pursues*, not *maximizes*, the interests of its representatives and population. These interests may often diverge among relevant individuals, both within the population, and between population and representatives. The theoretical option of maximizing some joint utility function reflecting the representatives' and population's preferences would be a rather artificial assumption to make. More likely is that in reality, a rule-of-thumb type behavioural function characterizes an institution's behaviour, where it satisfizes rather than maximizes. Most satisfizing rules would include the objective *to prevent too great losses* for too great a share of the representatives or population, as soon as interests would diverge among relevant individuals. An underlying reason would be that the degree to which individuals would support or object to a certain arrangement may often increase more than proportionally to the size of the perceived welfare change due to this arrangement. Small welfare changes, below some threshold level, may make individuals simply not bother to get fully informed, and shape and voice a clear opinion.

Disproportionate welfare gains or losses in contrast, make it worthwhile to get invest time and effort trying to influence the arrangement.

As suggested implicitly, the representatives' short run objectives indeed need not always coincide with the population's objectives, even when the population were homogeneous in the first place. Central representatives' personal opinions may rather strongly affect the institution's attitude towards marginal cost pricing in transport – if anything because these are the spokesmen – but possibly in a way that deviates somewhat from what could be expected when identifying the population's interests. In the longer run, however, such representatives are less likely to survive in their position. Therefore, although we emphasize that personal opinions of central representatives may have an important impact on the institution's attitude, we believe that the *expected* institution's attitude should more or less reflect the population's interests. The distinction between an institution's population and representatives may thus explain some 'noise' in the institution's attitude, but should probably not be a driving force in predicting or explaining the institution's behaviour.

A next important observation to make is that institutions typically have the equivalent of what in standard economics is known as *market power*. Institutions may thus actively try to – successfully – affect market or political outcomes. As a result of such 'market power', institutions may exhibit *strategic behaviour* in order to try and influence such outcomes to serve their representatives' and populations' interests as much as possible. Typically, the institutions' longer run viability would even not allow any other type of behaviour. A government not satisfizing the population's interests sufficiently would face electoral damage in a relatively short run. A non-government institution would face increased competition (or the sheer creation) of competing institutions serving the same population. So even if institutions do not *succeed* to fully affect market or political outcomes to the representatives' and population's interest, a failure of *attempting* to do so may affect its viability likewise, or perhaps even more strongly.

These ingredients, in fact, are sufficient to explain much of the institutional barriers that may prevent the implementation of marginal cost pricing in transport in urban areas, as well as the existence of a mutually reinforcing process between a limited social acceptability and a limited institutional feasibility, for the following general reasons:

- Marginal cost pricing, accompanied by a system of tax recycling, typically may lead to relatively pronounced welfare losses for a well-defined group of individuals, while creating relatively small benefits per individual for others (those that benefit from a reduction of other taxes, or from reduced environmental externalities – a substantial share of which may even only be enjoyed by as yet non-existing individuals). The probability that institutions representing the 'losers' object, and the intensity of objection, are therefore larger than for the 'winners'.

- The implementation of such a policy will lead to a redistribution of welfare. Prior to implementation, institutions have an incentive to exaggerate expected losses or neglect possible gains, in order to try and realise a share in the revenue allocation as large as possible, should implementation materialise. In other words, resistance

may seem even greater than it actually is, due to such strategic behaviour. Support for the measure may bear the risk of signalling likely acceptance of a smaller share of the revenue allocation.

- The failure to even attempt to influence the scheme as much as possible in the institution's population as much as possible is unattractive when the institution's representatives are judged by the extent to which they serve their population. So strong opinions voiced by institutions during the phase of negotiations on any scheme's details should be the rule rather than the exception. If this is true, institutional barriers of the kind considered in this section can also be expected with certainty, and should not be treated as a 'surprising disappointment'.

- Individuals may often find justification in their opposition against marginal cost pricing when a comparable view is expressed by established, respectable institutions. Insofar as the institution's population's negative perception of the concept of marginal cost pricing thus becomes more pronounced, the institution's representatives would subsequently face an increased incentive to publicly oppose against marginal cost pricing, etc.

To these general reasons, we can add the following considerations for some specific institutions. These arise form the discussion of the 'Rekeningrijden' case in the Dutch Randstad area, but are likely to be relevant elsewhere too when cordon charging for congestion management in a number of relatively close, larger cities would be considered:

- For local governments and political parties, a local tax with a national recycling scheme is a particularly unattractive scheme to support. Moreover, regardless of whether the rather abstract goal of efficient transport is served, the threat that the city may become less attractive a business location, or even only be perceived to be so, is sufficient to prevent support. A change in firms' location behaviour may be perceived as a clearer measure for political success than a more efficient transport system.

- Local governments of cities just outside the main urban areas where marginal cost pricing is to be applied will realise that their inhabitants are particularly likely to be net losers, and will therefore oppose.

- Local Chambers of Commerce, representing firms, will realise that the 'solution' of traffic congestion – the most visible and probably generally considered as the most urgent market failure in transport – by extra road space, financed through the national government's budget instead of through local transport charges, is a more attractive option from the local business' perspective. Those initially paying for these national taxes typically gain less, per individual, from a policy change, and are less likely to become involved in the debate. Local governments will be inclined to value the local business' opinions, to secure the image of an attractive business location.

- Local and national unions may represent both winners and losers. However, the intensity of welfare changes for the losers, again, is likely to be bigger than for the winners, suggesting that opposition may be a safer strategy.

- National employees organisations are likely to make a similar trade-off.

- For automobile associations, only full recycling of the revenues to car owners would leave their population as a whole financially equally well off. But even then, the intensity of welfare changes for the losers, again, is likely to be bigger than for the winners, suggesting that opposition may be a safer strategy. When revenues are used for more general goals, such opposition would only increase further.

- Public transport agencies may have the following considerations. First, it is questionable whether they would have enough capacity to serve the increase in peak hour demand that may result from road congestion pricing in the short run. The inability to do so may lead to damages to the often already vulnerable image. Moreover, capacity expansions only to cater additional peak hour demand may be relatively expensive for transit agencies, who instead often seek to spread demand. Secondly, the agency may be in doubt as to whether marginal cost pricing, once applied to public transport too, would be in their interest.

Institutional barriers to the implementation of marginal cost pricing of the type considered here – opposition by government and non-government organisations – are unlikely *not* to arise. The key therefore is to keep this at a minimum, if the goal is to be seriously pursued. How this should be done will probably vary strongly by site. The Dutch case study hypothesises that the following somewhat more general lessons can be drawn:

- In presenting innovative pricing measures, great care should be taken in communication. In particular, the motivation for pricing, the projected effectiveness and the economic rationale may otherwise not reach or convince the opponents. Also, justifications of fairness, which are in fact relatively easy to make – the 'user pays principle' – should be spelled out clearly, in particular because fairness seems so much more important than economic efficiency in public debates.

- Institutions will not easily change opinion after having ventilated one publicly, so an early involvement in the policy design procedure, and an early explanation of the goals and details of the policy to relevant institutions, seems very important.

- Opponents will look for any possible weakness in a proposal in order to fight it. For that reason, if not for other reasons, it is extremely important that the proposal has no loose ends or other clear weaknesses.

- Particularly detrimental for the implementation of marginal cost pricing could be the joint opposition of a coalition of institutions of different backgrounds. This increases the perceived reliability of the argumentation, and the number of

channels through which opposition can be made public. If possible, the formation of such coalitions should at least not be encouraged, which probably implies that a balanced recycling scheme should from that perspective be an integral part of the scheme.

- Specifically, a central government that is dedicated to the introduction of some form of road pricing should either have enough power to impose the system upon cities, or should be prepared to offer compensating measures to 'bribe' cities and other key institutions into acceptance. This may make some possible allocations of revenues impossible. When pricing and funds for transport investments are offered as a package, competing cities may fear a 'lagger disadvantage' in not accepting the package. From the economic efficiency perspective, the main task would be to secure at the same time that the tax allocations do not imply imperfections or worsen market functioning elsewhere.

Finally, we add the following hypothesis. Opposition to marginal cost pricing may sometimes partly be motivated by the fear of becoming *relatively* worse off. Although there may be advantages in using *demonstration projects* and *experiments*, an integral implementation of marginal cost pricing may in contrast have the advantage of taking away such feelings of injustice. Which of the two strategies would eventually work better remains an open question.

6 Concluding comments

A basic dimension and issue throughout the AFFORD study has been the comparison of the second-best vs. first-best. Apart from the increased informational needs implied for the regulator, second-best instruments also require the application of second-best policy- and tax rules in order to be used optimally. The second-best rules are usually far more complex than the standard first-best Pigouvian rule, in which the regulatory tax is equated to the marginal external costs. For both reasons, therefore, there is a large risk of additional government failures, adding to unavoidable welfare losses arising from the second-best nature of the instruments themselves. Therefore, the first-best benchmark should not be ignored in the process of policy-making, for the reason that it is 'only a hypothetical policy'. Instead, the AFFORD study (the AFFORD approach), even though focusing on second-best situations, seems to have made *a strong case for using the first-best package as a central focal point in the design of policy packages*.

The set of dimensions of behaviour to be considered, as well as the definition of what is first-best and what is second-best, is in (modelling-aided) research dependent on the *setting* chosen (e.g. covering one mode only versus multiple modes, a static approach versus a dynamic approach, a non-spatial versus a spatial approach, etc.). Despite the obvious nature of the remark to follow, it is nevertheless important to emphasise that reality has no such boundaries. The interpretation of modelling results, therefore, cannot be done in any meaningful way without bearing in mind that any first-best or best-practice second-best pricing scheme as evaluated using a model only 'deserves' that qualification because it is first-best or best-practice second-best with respect to the dimensions of behaviour as distinguished in that model.

The issue of *effectiveness and transparency of communication* was deemed to be particularly important, as part of developing a wider understanding of the prevailing transport pricing problems and the potential benefits of marginal cost-based solutions. At present, the wide-spread lack of this transparency can often lead to policy-makers attempting to justify marginal cost-based measures, such as road pricing, in rather inaccurate and even spurious terms. Just as the AFFORD study has attempted to bring together the differing viewpoints of the various relevant disciplines within the academic community, so the subsequent challenge for both academics and policy-makers is to bring together the very different theoretical and pragmatic viewpoints within the public socio-political environment.

At a more general level, the work in AFFORD has demonstrated that acceptability, in fact, should not be considered in isolation, but in combination with efficiency aspects and institutional issues instead. The policy implications are that in the design of policy plans: (1) the short-run trade-off between efficiency and acceptability of various pricing and recycling schemes should be a central element; and (2) it may often be preferable – and should at least be given serious consideration – to consult and inform key institutions during the process of scheme design, as the confrontation with a full-fledged pricing-recycling scheme may often lead to even larger opposition than strictly

necessary. Indeed, once a process of mutually reinforcing limited social acceptability and institutional feasibility is set in motion, it may be impossible to be reversed, leaving the pricing-dedicated transport policy maker empty-handed.

AFFORD has given many insights into various aspects of the multi-faceted problem that is most briefly identified as 'the implementation of marginal cost pricing in (urban) transport'. These insights concerned efficiency aspects; equity aspects; institutional issues, and political, public and business acceptability. An important question is whether, from this broad set of insights, a number of major 'guidelines for implementation' can be distilled. Such general guidelines can be of a very general nature only.

Examples of such statements could include:

- Prior to implementation of marginal cost pricing, it is extremely important that general consensus – or at least transparency – is created with respect to the social objective of transport (and general tax) policy in general. In an environment where both a majority of politicians and of key institutions, as well as of the public at large, have the opinion that economic efficiency and the maximisation of social surplus are not among the primary, prioritised policy goals, it is highly questionable whether a policy that aims to improve or even maximise efficiency would be a logical choice. Alternative policies, such as promotion of equity and raising revenue, which may be (far) less efficient, may be preferable for such sites.

- Once it is agreed that an improvement of efficiency is a valuable goal, an assessment has to be made of whether marginal cost pricing in transport is among the first candidate policies. For instance, for sites where the vast majority of predicted welfare gains of transport pricing result from a shadow price of public funds, reflecting tax and price distortions elsewhere in the economy, in combination with relatively low marginal external costs of transport – a situation that appeared to be relevant for some of the sites studied in AFFORD – the goal of improved overall efficiency may be served better with a revision of the existing distorted tax structure than with the implementation of marginal cost pricing in transport, letting the existing distortions 'survive' and 'dictate' relatively high taxes in transport.

- Once it is, however, agreed that marginal external costs in transport are relatively large and that efficiency is a central prioritised policy goal, the necessary conditions for marginal cost pricing in transport being a promising policy strategy are fulfilled. The design of the pricing and revenue allocation schemes to be implemented, then, becomes the great challenge. For a successful implementation of marginal cost pricing, in this design at least, the trade-offs between efficiency, acceptability, and institutional feasibility should be considered explicitly and made transparent. These trade-offs must be made simultaneously for the charging side and for the revenue allocation side of the scheme.

- A particularly important dimension in reality that tends to be greatly simplified in conceptual theoretical considerations is the spatial and geographical context. Except where marginal social (external) cost pricing may be introduced throughout a full (regional, national, or even international) transport system, the coverage of the measures will, by implication, be spatially partial. This may have serious implications for: (i) the ability to promote efficiency and achieve economic benefits related to the part of the system that is charged; and (ii) the impacts of pricing on the wider transport system. Both will require careful consideration. In particular, defining (and, subsequently, implementing) the most appropriate spatial boundaries for a marginal cost pricing system designed to focus on an urban area may be beset with geographical, institutional and acceptability-related problems.

- A further simplification common in conceptual theoretical approaches relates to assumptions about human behaviour. In particular, it may be dangerous to assume that individuals are able or willing to respond to marginal cost-based pricing in an efficient and economically rational manner, regardless of the practical way in which fees are levied. As our ultimate aim is to modify behaviour, it is essential to consider not only the theoretical efficiency of pricing measures according to simple economic assumptions, but also their practical efficiency based on a more detailed level of behavioural understanding. Thus, it may be as important to consider the mechanisms by which taxes and charges relevant to urban transport are levied as it is to focus on whether the total charge paid covers marginal external costs. Also, there may be a need to trade-off any desires for complexity in practical charging approaches (e.g. in terms of differentiation) against other criteria that may be shown to have important behavioural implications (e.g. ease of user understanding, predictability etc.) which could impact on practical efficiency, perceived equity and, ultimately, acceptability.

- Guidelines for more detailed design issues are hard to provide, as the 'optimal' design may be expected to vary by site, depending on many local circumstances (including, to give just two examples, the physical lay-out of the infrastructure network and the local culture with respect to attitudes towards government interventions). Typically, however, a scheme's viability would benefit from transparency, which, in AFFORD terminology, would require the identification of a few key marginal external cost categories and dominant behavioural dimensions to be affected with the pricing policy. It would also benefit from selecting that specific type of tax revenue allocation that shares the following two characteristics: (i) it should not increase inefficiencies (which, for instance, may be the case if excessively subsidised public transport would receive further subsidies); and (ii) it should take into account the interests of those paying the taxes. Which allocation this might be will differ over sites; for example, in The Netherlands, a lowering of fixed yearly vehicle taxes has been identified as an important candidate allocation.

- Following such guidelines does not guarantee a smooth implementation process. Not following such guidelines, however, nearly for sure will increase the difficulties of implementation.

Overall, the AFFORD study shows that efficiency gains of best-practice second-best marginal cost pricing can be substantial – depending on the initial degree of 'mis-pricing' – and, according to the modelling exercises, may approach those of hypothetical first-best pricing rather closely.

The overall efficiency gains depend both on the design of the pricing scheme and on the design of the tax revenue recycling scheme. For both elements, efficiency considerations may often lead to a different 'ideal' design than do considerations of social (public), political and institutional acceptability. The divergence, however, may often be sharper in the short-run than in the long-run.

Different schemes may be considered to offer the best compromise between long-run efficiency considerations and short-run acceptability concerns, depending on local circumstances and priorities. In all cases, the quality of policy design would benefit from making the trade-offs explicit. Two important steps in this respect are the consideration of transitional dynamics and the definition of the social objective.

Too often, probably also in AFFORD, the effects of the implementation of marginal cost pricing have been studied from a static perspective only, comparing end states only and ignoring transitional dynamics. This is not correct, or sufficient, even from an efficiency viewpoint, as it is important to account for transitional costs which may be substantial, and it is efficiency-enhancing to minimise (actually optimise) these. It is even more 'misleading' from the viewpoint of social, political and institutional acceptability, for which inherently dynamic concepts like 'status quo', 'vested interests', 'myopia', and 'path-dependence' (and others) may be the key factors to be considered.

It is not the task of researchers – economists specifically – to define the social objective(s). Rather, the economists' task would be better formulated as to assist policy makers in designing policies that would realise a given set of objectives. The concepts of first-best pricing and best-practice second-best pricing as considered in AFFORD assume that the fundamental objective is to realise the most efficient possible transport system, defined in terms of the maximum possible difference between social benefits and social costs of transport. Any transport activity whose social costs outweigh its social benefits is considered in principle unwarranted. For any alternative objective, it is still possible to design socially cost-effective policies. These would typically still include (second-best) pricing as a central policy instrument, as it is the only instrument that decentralises efficient decision making and requires by far the least heroic assumptions on the regulator's knowledge and information-processing capabilities (given the substantial heterogeneity of transport users and the large number of behavioural dimensions determining external and social costs of transport activities), and thus implies a considerably smaller danger of government failures than do alternative instruments. Only if economic efficiency and social cost-effectiveness (which is a part of efficiency) are absent from the social objective, would marginal cost pricing become irrelevant as a policy instrument.

This implies that societies and policy makers cannot have it both ways. Either economic efficiency and social cost-effectiveness are accepted as policy goals and the implication

of having to design innovative ways of coping with limited acceptability of pricing is simultaneously accepted as a challenging part of the deal, or it is accepted that wasteful transport activities will remain in operation, and policies will be designed for instance to satisfy short-run acceptability considerations. The consequence would be a transport system that maintains creating excessive and unpaid costs upon current actors and future generations.

The AFFORD study convinces that we are making progress – perhaps slow but steady – in understanding various partial questions surrounding marginal cost pricing (efficiency, equity, social acceptability, political acceptability, institutional issues). But it also convinces that we are only beginning to understand that there exist important but largely unanswered questions surrounding the interaction between these issues. Academia is, as yet, far from a satisfactory study of the implied 'system of issues'. The AFFORD study has shown that adherence to the starting point underlying marginal cost pricing – transport pricing should be motivated by the desire to promote economic efficiency – allows making progress in the integration of these sub-questions. A central approach here is the use of the theory of second-best marginal cost pricing. It has also become clear that if the starting point is abandoned, too many degrees of freedom are introduced and, basically, 'anything goes'.

List of deliverables

Deliverable 1:

Milne D., E. Niskanen and E. Verhoef (2000), *Operationalisation of Marginal Cost Pricing within Urban Transport*. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. VATT Research Report No 63. Helsinki.
Status: accepted.
Availability: public

Deliverable 2a:

Fridstrom, L., H. Minken, P. Moilanen, S. Shepherd and A. Vold (2000), *Economic and Equity Effects of Marginal Cost Pricing in Transport*. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. VATT Research Report No 71. Helsinki.
Status: accepted.
Availability: public

Deliverable 2b:

Milne D., E. Niskanen and E. Verhoef (2001), *Legal and Institutional Framework for Marginal Cost Pricing in Urban Transport in Europe*. Deliverable 2b. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. VATT Research Report No 76. Helsinki.
Status: accepted.
Availability: public

Deliverable 2c:

Schade J., B. Schlag, I. Giannouli and A. Beier (2000), *Acceptability of Marginal Cost Road Pricing*. Deliverable 2c. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. Technische Universität Dresden.
Also: Schade J. and B. Schlag (2000), *Acceptability of Urban Transport Pricing*. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. VATT Research Report No 72. Helsinki.
Status: accepted.
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Milne, D., E. Niskanen and E. Verhoef (2001), *Legal and Institutional Framework for Marginal Cost Pricing in Urban Transport in Europe*. Deliverable 2b. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. VATT Research Report No 76. Helsinki.

Schade, J. and B. Schlag (2000), *Acceptability of Urban Transport Pricing*. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. VATT Research Report No 72. Helsinki.

Schade, J., B. Schlag, I. Giannouli and A. Beier (2000), *Acceptability of Marginal Cost Road Pricing*. Deliverable 2c. Project AFFORD, funded by the European Commission, 4th Framework Transport RTD. Technische Universität Dresden.

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