Theoretical view on pricing

Latest developments in research: Theory, application and impacts

Thematic Network on Trans-Alpine Crossings

Key Note Paper prepared for the Pricing-Workshop held in Berne on September 12 and 13, 2002

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1 Introduction

This paper has been prepared for the Pricing-Workshop organised within the Thematic Network on Trans-Alpine Crossings ALP NET, 12-13 September 2002, in Berne. In the sense of a key note paper it aims to give an overview of the recent research work and its results in the field of transport pricing. It concentrates on the European scale with a special focus on trans-alpine issues.

The paper is structured as follows:

- Chapter 2 contains a very short introduction into the topic.
- Chapter 3 deals with different pricing approaches as discussed in corresponding EU research projects. This chapter extremely benefited from the work carried out within the 5th Framework Thematic Network project IMPRINT-EUROPE[1] and especially the overview contained in Nash and Matthews (2001).
- In chapter 4, some of the available evidence on potential impacts of changes in transport pricing is summarised. The overview is restricted to the two modes which are most relevant for the question of trans-alpine crossings, road and rail and focuses on specific trans-alpine case studies.
- Finally, chapter 5 contains our conclusions from the discussion in the preceding chapters.

2 Setting the Stage

Transport in Europe is confronted with increasing problems. Transport Accounts elaborated within the EU research project UNITE[2] for all Member States and three additional countries, for example, show increasing costs caused by infrastructure extension plans but also remaining congestion problems, by adverse impacts of transport on human health and the environment.[3] There is a wide consensus in research, politics and in the public that the ongoing development is not sustainable in the long term, the need for additional policy measures is almost undisputed.

After decades of domination of non-economic policy instruments - first of all technical regulations - it has been recognised in transport research as well as in transport policy that adjustments in transport pricing must be one core element of any future transport policy strategy.

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1 IMPRINT-EUROPE, Implementing Pricing Reform in Transport - Effective Use of Research on Pricing in Europe, http://www.imprint-eu.org

2 UNITE, Unification of accounts and marginal costs for transport efficiency, http://www.its.leeds.ac.uk/research/index.html

3 For Germany and Switzerland see Link et al. (2002).

At the level of the European Commission, this increasing relevance of economic instruments can be traced back in three major publications on transport policy, i.e.

- the Green Paper "Towards Fair and Efficient Pricing in Europe" of 1995
- the White Paper "Fair Payment for Infrastructure Use" of 1998
- the White Paper "European transport policy for 2010: time to decide" of 2001

In the 2001 White Paper the Commission emphasised that "the thrust of the Community action should therefore be gradually to replace existing transport system taxes with more effective instruments for integrating infrastructure costs and external costs. These instruments are, firstly, charging for infrastructure use…" (European Commission (2001), p. 71).

In view of this need for policy action, a huge number of research projects has been launched within the European Framework RTD Programmes to provide scientific inputs for concrete policy formulations - QUITS, ExterneE, PETS, EUROTOLL, TRENEN, CAPRI, OPTIMA, FISCUS, PATS, AFFORD, PRIMA, DESIRE, UNITE, MC-ICAM and IMPRINT-EUROPE being only some of them.[4] Furthermore, the EC High Level Group on Transport Infrastructure Charging has evaluated results from the several research projects and tried to formulate commonly agreed priorities for future policy strategies.

Against these considerable efforts this paper does not claim to give a complete overview. Its aim is rather to highlight some important of the many relevant issues in the context of transport pricing.

3 Pricing principles: Theory and Application

3.1 Pricing approaches

Not surprisingly, these considerable efforts in research and policy activities to increase the role of pricing in transport lead to different and partly contradictory results and conclusions. One reason for this can be seen in the different functions of prices:

- The price mechanism supports an efficient allocation of scarce goods (static efficiency). Congestion pricing is often mentioned as an efficient mean to allocate scarce network capacity.
- Prices set dynamic incentives to change behavioural patterns, to develop new technologies etc. which is especially important with respects to a reduction of the adverse impacts of transport on the environment and human health (dynamic efficiency).

[4] For short summaries of these projects see for example the Inception Report of ALP NET (Ecoplan with contributions from partners and members, 2001).

- Pricing generates revenues that can be used for financing purposes.

All of these three functions are highly relevant when it comes to pricing in the transport sector. The ongoing debate about which pricing policy approach is appropriate for transport also reveals the different weights given to the different price functions.

Basically, two main approaches can be distinguished in the ongoing discussion:

- The predominant approach in the recent research work at the European level is based on neo-classical micro- and welfare economics and gives therefore special emphasis to efficiency aspects. The advocates of this approach suggest the introduction of a pricing strategy in transport (all modes) that is oriented at short run social marginal costs.
- Opponents of this "mainstream approach" criticize the strong focus put on (static) efficiency considerations. They especially highlight the cost recovery requirements to be met by revenues from pricing. In the sense of departures from neo-classical welfare theory, the emphasis is put on "sustainable dynamic schemes of pricing and investment under institutional constraints" (Rothengatter (2001), p. 3).

In the following two sections we give an overview of these two approaches with a focus on the dominating short run social marginal cost pricing (SMCP) approach.

3.2 Social marginal cost pricing

The intention to transfer the basic micro-economic pricing principle of short run marginal cost pricing, i.e. to introduce a pricing scheme where prices are set equal to the additional costs of an additional kilometre travelled or trip made, is not new but rather re-emerged in the mid-nineties in the political and academic discussion. First comprehensive analysis date back to the sixties (SMEED-Report 1964, Allais-Report 1965). In 1971 the Commission of the European Communities published a concept that stressed social marginal cost pricing as basic guideline for a common charging policy for transport infrastructure use. About a quarter of a century later, the Commission's Green Paper of 1995 again emphasised the central role of social marginal costs as pricing basis.[5]

The striking point of this approach is - at least as long as implementation issues are neglected - the theoretically well-based proof that short run social marginal cost pricing (SMCP) leads to an efficient use of the existing capacity of transport infrastructure. Combined with sound cost-benefit-analysis as decision tools for the infrastructure extension, welfare-maximising solutions even result in the longer term. Also among the advocates of SMCP it is well recognised that these arguments are only valid under assumptions that are far from

[5] However, in the two White Papers following the Green Paper (see section 1.2 above), the statements made about pricing in transport leave much more room for interpretation whether the Commission still considers short run social marginal cost pricing as the only pricing approach to be implemented in all the different sub-sectors of the transport sector.

being met in the real world (e.g. perfect information, perfect markets in the non-transport sectors etc.).

Against this background, the focus of the recent research work in transport pricing hasn't been so much on extending the theoretical basis of SMCP[6]. The research work rather concentrated on the analysis of ways to comply with the critics of the approach and of possibilities to overcome the considerable difficulties connected with an implementation of SMCP in transport. Below we discuss some of these areas of research.

a) Calculation of price-relevant costs and resulting price signals

SMCP needs comprehensive marginal cost information. The "price-relevant costs" can be arranged in three groups, i.e. producer costs, user costs and transport system external costs. For each cost category, difficulties can be found in the cost calculation[7] but also in the resulting price signals. Some illustrating examples are summarised below.

- Producer costs (or marginal infrastructure costs)

  Because of large research efforts and the possibility to use different approaches (engineering and econometric approaches) to estimate the additional *wear and tear costs* connected with an additional kilometre driven, knowledge has increased in the recent years. A number of estimates is available from specific case studies for road and rail transport but only very limitedly for other transport modes. And, the results still differ substantially.[8]

  Additional traffic does not only influence the current maintenance costs (wear and tear) but also *reinvestment or renewal costs* (e.g. pavement reconstruction). Here, the use of the SMCP would lead to - at least for non-economists - contra-intuitive price signals because the marginal reinvestment costs are higher for roads with a rather poor road strength. Thus, the price for road users would be higher if they travel on the secondary road network (lower quality of pavement) than on the main road network. The current pricing strategy in Europe is in conflict with this insight: If pricing - and therefore higher prices than on average - is introduced or recommended at all, it refers to the main network (motorways and other trunk roads).

- User costs

  Congestion costs have been analysed in detail, the functional relation between traffic volume and congestion is described in well-known speed-flow-curves. However, the main problem for the derivation of price signals is the fact that the reactions of the users must be anticipated because SMCP demands that the marginal external congestion costs at the optimal traffic volume should be used as pricing basis, and not the costs at the current

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[6] The application of the theory of social marginal cost pricing in transport has, for example, been analysed in detail within the EU research project PETS (Pricing European Transport System, see Jansson and Lindberg (1997)) and the different publications of CAPRI (Concerted Action on Transport Pricing Research Integration).

[7] For an overview of the state of the art see for example van den Bossche et al. (2000) or Lindberg (2002).

[8] See for example the results for different European countries given in DIW et al. (1998).

traffic volume. Very sophisticated models are needed to predict reasonably well the user's behaviour in reality. When it comes to implementation, congestion pricing faces a similar acceptability problem like the marginal renewal costs discussed above: The worse the traffic situation, the more the users have to pay; or: the better the quality (low congestion) the lower the price. This type of pricing signal is especially problematic in a dynamic perspective with infrastructure extensions: In a "pure" interpretation of SMCP, charges would have to be high before the extension takes place and again very low after the realisation. Advocates of SMCP also recognise that such an up and down of price levels over time is not acceptable and that deviations from SMCP are necessary to smooth fluctuations (see Nash and Matthews (2001), p. 6).

- Transport system external costs

  A large number of studies has dealt with the issue of external costs of transport in the last decade. Most of them concentrated on road and rail transport, figures for air transport and for shipping are only partly available as, for example, the work on the transport accounts within UNITE show. Many of these estimates result from top-down approaches where total external costs are assessed and then allocated with certain keys to the different modes and sub-modes. For SMCP, not top-down but bottom-up approaches (e.g. impact-pathway approach) are needed because the additional cost of an additional unit of traffic volume must be estimated. The results of the application of this approach in case studies show significant variations. They reflect the specific differences in the characteristics of the case study areas. This makes generalisation and transferability very difficult.[9]

  – Most advanced is the application of the impact-pathway approach in the field of *air pollution* (especially impact on human health) because of the ExternE project (for a comprehensive overview see Friedrich and Bickel, 2001). Information about the impacts on cultural and historical values, forest damages, recreational value of the nature, fauna and biodiversity is still insufficient.
  – In the case of traffic *noise*, above a very low level marginal costs hardly increase with rising traffic volumes. Therefore, a pricing scheme based SMCP would result in very low prices along/around noisy transport infrastructure with high traffic volumes. It is obvious that such a pricing scheme would not solve the noise problem for those concerned. At least, it would lead to a channelling of transport flows.
  – A similar situation exists for the *accident costs* where other factors than the traffic volume have a higher influence on the number of traffic accidents. Econometric analysis even show that the accident risk decreases with an increase in transport volume, the marginal external accident costs would be negative. It is hardly imaginable that any transport policymakers would propose the strict consequence, namely to subsidise the marginal additional user of the relevant part of the road network. Rather

[9] The problem of generalisation and transferability of marginal cost estimates is treated in detail in Deliverable 15 of UNITE "Guidance on Adapting Marginal Cost Estimates" (forthcoming). First results have been presented at the UNITE final conference in Leuven, 18-19 June 2002.

the insight has grown that other approaches are needed than a pricing scheme oriented at marginal external accident costs per kilometre travelled.[10]

b) Level of differentiation of pricing schemes

The considerable variations of several marginal cost types according to location, time, vehicle category etc. demands a rather strongly differentiated pricing strategy to "realise" the potential welfare gains of SMCP. The limits with regard to implementation are well known:

- Sophisticated pricing instruments are needed. Such instruments will probably be available in the future but implementation costs may remain high. High transaction costs reduce the potential welfare gains from SMCP.
- Highly differentiated pricing schemes have an acceptability problem: People prefer simplified solutions (see also section 3.4).
- The discussion under item a) shows that a complete set of marginal cost estimates being reliable and robust enough for the political discussion is not yet available. However, if highly differentiated schemes cannot be implemented due to technical and acceptability barriers one might ask if such a complete and robust set is needed at all.

c) The issue of cost recovery

In its pure interpretation, cost recovery is not explicitly treated but understood as a residual variable of SMCP. There are studies suggesting that SMCP generates enough revenues to cover the total costs of the transport sector as a whole - others contradict.[11] The reasons are surpluses in certain parts of the network[12] and the revenues from the inclusion of transport system external costs in the pricing scheme.

Even if cost recovery is assumed, the question remains how relevant a cost recovery for the transport sector as whole is for transport policy. It implies serious distributional effects because those who pay the charges do not necessarily profit from the use of the revenues generated by the charges. In the debate about the implementation of urban road pricing schemes, one insight is confirmed in almost every study: For the acceptability of such schemes it is crucial that the revenues remain in the urban area, other solutions are hardly considered as fair. Thus, there are limits to use the revenues from urban congestion pricing "elsewhere" in the transport system.

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[10] The EC High Level Group on Transport Infrastructure Charging supports, for example, the principle "charging transport users for the costs of the accidents they cause should, as far as possible, be implemented through extension and refinement of the existing insurance system" (Goodwin (2002), p. 27).

[11] Roy (2000) suggests overall surpluses for France, Germany and the United Kingdom, Maibach et al. (1999) and Wickart et al. (2002) find overall deficits for Switzerland. Different marginal cost estimates used as pricing basis and different road congestion situations are two important reasons for the different results. Nevertheless, because marginal cost estimates still differ that much, cost recovery ratios are strongly influenced by the choice of specific values by the study authors.

[12] Typically, urban areas are mentioned where congestion pricing in road transport generates higher revenues than needed to cover total infrastructure costs.

If cost recovery is not assumed, funds collected outside the transport sector would be needed to cover the transport sector deficit. Issues like inter-sector distortions and the costs of public funds become relevant topics.

d) Organisational and institutional issues

It doesn't seem that the prevailing organisational and institutional structures in transport policy are very suitable for the implementation of SMCP. Within the AFFORD project[13] this has been shown for urban road pricing, but the findings appear to be relevant for the transport sector as a whole (see Glazer et al. (2002) and Vickerman (2000)):

- Especially in rather federalistic countries, different geographical units are responsible for the implementation of road pricing. They are accountable for different electorates with different interests. Co-ordinated pricing strategies need agreement among the representatives of the units. The distributional effects of pricing schemes - as mentioned under item c) above - will be more decisive for this agreement than efficiency considerations.
- Normally, separate institutions (private, public, mixed) are responsible for the management of different transport modes or even for the provision of transport services within a mode. The idea of introducing a co-ordinated multi-modal pricing scheme requires agreement between disparate institutions. Such an agreement is difficult to achieve if the interests of the different institutions are not identical.
- There are tensions between different levels of government when it comes to financial relationships. Each change in the current financial flows may result in conflicts because they change the balance of power. For the implementation of SMCP this barrier is highly relevant because advocates of SMCP do not propose to simply add new pricing schemes to existing ones. Rather, a replacement is required. It is obvious that such a strategy would substantially change revenue patterns.

Taking into account the difficulties summarised above, the analysis and derivation of second-best solutions has become the focus of research and is the challenge for the future. Second-best because of the need to "average" cost figures for imperfect pricing instruments, second-best because of cost recovery requirements and second-best in order to overcome organisational institutional and acceptability barriers. Most probably, this new focus will bring SMCP in transport closer to alternative pricing strategies as presented in the next section and the conclusions in chapter 5.

3.3 An alternative pricing approach

The re-emergence of SMCP in transport is not taken without contradiction, neither in the academic nor in the political world. Especially in Germany, alternatives have been developed. The report of the Scientific Advisory Council on Transport at the Federal Ministry of Transport, Construction and Housing of 1999 outlines an alternative approach. One central difference refers to the treatment of cost recovery: Cost recovery ratios should not be a

[13] AFFORD, Acceptability of Fiscal and Financial Measures and Organisational Requirements for Demand Management, http://data.vatt.fi/afford/.

residual variable of a pricing scheme. Pricing in transport should rather be designed in a way that well defined cost recovery goals are achieved, and this due to different reasons:

- Transport infrastructure is considered as a "club good": It should fully be paid by those who use it (club members). Taxpayer should only contribute if there is a special interest of the general public in the provision of the specific infrastructure or service (e.g. promotion of regional economic development).
- If the users have to pay the full costs - minus public contributions in the case of a special public interest - there is no incentive to overemphasis the need for new infrastructure. In the case of SMCP, such an incentive exists in situations where the extension leads to lower user prices (e.g. because of lower congestion and lower maintenance costs). The low user prices will not cover total costs of the extension. The burden is transferred to taxpayers or to users of other, congested parts of the network.
- Pricing schemes oriented at cost recovery make private sector involvement in the financing of new transport infrastructure easier. Any pricing scheme that is not in the interest of private investors - which is the case for SMCP in its pure interpretation -, needs additional regulations which again reduce the attractiveness of private investment. It should be noted that this argument does not refer to the option to involve the private sector in the operation and enforcement of transport infrastructure pricing schemes.
- Inter- and intramodal competition in transport does not require that a certain pricing principle is defined for the different transport sectors and modes. Fair competition rather requires
  - same conditions for all transport providers (no discrimination)
  - harmonised cost recovery ratios for all transport infrastructures in all Member States.
- High prices in urban areas caused by congestion pricing under SMCP can have undesirable impacts on land-use by accelerating urban sprawl.

At first sight, the differences between this pricing approach and short run social marginal cost pricing seem large. They are not if the strong emphasis of second-best solutions of section 3.2 is kept in mind. When it comes to implementation, the proposals of the Advisory Council are partly very similar to second-best solutions in a "SMCP-world" (see chapter 5).

3.4 Implementation of pricing approaches

There is an enormous gap between theory and reality: Short run social marginal cost pricing (SMCP) may be dominant in the present discussion in the academic world, but it is certainly not in the political world. An overview about current pricing doctrines in 6 European countries carried out within UNITE (Quinet, 2001) confirms a well known judgement. Despite differences between the countries and some growing interest in SMCP because of environmental concerns, a main finding of the survey is that the doctrines

- rarely rely on SMC which is viewed too complicated
- rely mainly on financial concerns and are based on long run marginal costs or on average costs

Obviously, there is a low socio-political acceptability of SMCP. In the research project AFFORD, reasons for this fact manifested in the behaviour of politicians and government organisations have been identified as follows (Milne et al., 2001):

- Marginal cost pricing (or the goal of economic efficiency) is not universally accepted by relevant academic disciplines (including economics). Politicians and civil servants representing the relevant organisations are not convinced by (or even familiar with) its principles.
- Local governments need to justify their policies in terms of practical - and often detailed and local specific - arguments rather than in terms of arguments referring to efficiency and equity benefits at a general (aggregated, abstract).
- The interest of individuals working within government organisations with a stake in preserving the institutional status quo.

Even in the publications of the Commission of the European Communities a change in mind - or at least in distinctness - can be observed:

- The White Paper of 1998 states that the only approach that fully satisfies the goals of a Community approach to infrastructure charging is marginal social cost pricing (Commission of the EC (1998), p. 8). In its interpretation, EC officials emphasised second-best solutions in the sense of "marginal social cost pricing + capital cost recovery, implemented gradually and flexibly" (Rees, 2000) .
- In the White Paper of 2001 a pricing framework is outlined that does not contain the notion "marginal" but stresses some of the points that are important in both pricing approaches described above (e.g. the internalisation of external costs).

Against this background, it is not surprising that pricing solutions explicitly oriented at social marginal costs can hardly be found in transport. Rather, some examples exist where elements of both pricing approaches can be found - again suggesting that the differences between the two approaches are probably not as large when it comes to implementation under real world conditions:

- In the case of rail transport, infrastructure access charging schemes explicitly oriented at social marginal costs - however permitting non-discriminatory mark ups to improve cost recovery - are required by the railway directive of the European Commission[14]. In Switzerland, the relevant law[15] demands that the infrastructure access charges should cover at least the marginal costs but can be amended by charging elements taking into account different total costs of the network, environmental and scarcity aspects.
- The well-known urban toll rings around the three Norwegian cities of Oslo, Bergen and Trondheim have primarily been introduced to generate revenues for transport

[14] Directive 2001/14/EC of the European Parliament and of the Council of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification.

[15] Railway law of 20 December 1957.

infrastructure extensions and improvements of public transport. This purpose does certainly not correspond with the core idea of SMCP. But they also reduced traffic volume and therefore congestion which gives them a touch of a congestion pricing, a major issue of SMCP.

- For Central London, the introduction of a congestion charging scheme is in discussion.[16] Whereas the idea of congestion pricing corresponds with a core concern of SMCP, the design of the scheme only very roughly transforms SMCP. From 7:00am to 6:30pm, a standard charge of £5 will have to be paid for entering the very heart of central London. It is obvious that this standard rate cannot take into account speed-flow relationships on different roads in different time periods.
- The Swiss Heavy Vehicle Fee (HVF)[17] is distance-dependant which meets one of the basic requirement of SMCP. The fee rate distinguishes between more or less polluting trucks (EUROI, II and III) but there is no further differentiation (time, location). The rate of the fee was not derived from marginal but rather from average social cost estimates. Looking at the uncertainties in social cost estimation and the wide range of available estimates, the rate may even be a possible "average" value for social *marginal* costs.

These examples can be considered as first steps in the direction of a social marginal cost *based* pricing in transport. Extensions and further differentiation in the long run are not out of question though the transaction costs connected with a next step should not be underestimated (new political effort, new technological equipment in-/outside the vehicles, new administrative procedures etc.).

Advocates of SMCP have well realised that only a stepwise implementation path is appropriate to overcome the many and substantial constraints for a successful implementation of "their approach". The ongoing EU research project MC ICAM[18] examines optimal implementation paths from a situation with low pricing of transportation to a situation with socially optimal pricing. Implementation paths are understood as a sequence of second-best optima, which arise as the set of constraints on pricing changes over time (typically, the number of constraints and/or their "tightness" can be expected to decrease during the course of an implementation path). The following motivations for implementation paths reflect the types of constraints considered (Verhoef (2001), p. 14):

- to gain public acceptance over time
- to teach the public to understand increasingly complex pricing schedules
- to reflect that capacity, too, cannot be optimised instantaneously

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[16] For an overview of the scheme see for example Dix (2002).

[17] A detailed discussion of the question to what extent the HVF complies with SMCP is given in Suter and Walter (2001). For a description of the HVF in detail see Federal Office for Spatial Development (2002) (http://www.are.admin.ch/imperia/md/content/are/are2/publikationen/englisch/1.pdf),

[18] MC ICAM. Marginal Cost Pricing in Transport - Integrated Conceptual and Applied Model Analysis, http://data.vatt.fi/mcicam/index.html.

- to help the regulator get used to pricing - i.e. set up toll collection agencies, acquire experience in automated billing, etc. - in a small scale project or using a simple pricing schedule
- to reflect that the degree of policy coordination between vertically or horizontally ordered governments will change (typically increase) over time
- to reflect that practical and/or technical consideration may prevent simultaneous implementation across modes

According to Verhoef, three archetypes of implementation paths can be identified and may serve as guideline for evaluation within MC ICAM (Verhoef (2001), p. 15):

- stepwise expansion over sub-markets (e.g. increase the number of priced links of a network overtime)
- stepwise convergence to optimal prices over all sub-markets simultaneously (e.g. all links of a network get prices, which move to optimal levels in a discrete number of steps)
- stepwise (further) differentiation of second-best prices (e.g. increase of the degree of differentiation of prices within a mode over time)

If not everything can be done at once, the question is where to start. Priorities are often set as follows (see for example Goodwin (2001) and Nash (2001)):

- Road transport: Introduction of road pricing in congested areas, reform of the charging system for commercial vehicles and especially heavy goods vehicles (incl. taking into account the external costs)
- Rail transport: Adjustment of infrastructure access charges in a non-discriminatory way, prices at or - to comply with cost recovery constraints - above social marginal costs only together with the pricing reform in road transport.

Looking at the development in policy[19], there is a concern among economists that adjustments in rail transport are realised whereas the inclusion of external costs in the pricing schemes is foreseen only in a next phase. In particular, it is feared that the market conditions of competition between road and rail transport would worsen for the latter.

[19] These priorities can be found in the Commission's White Paper of 1998 where the internalisation of external costs is suggested only for a second phase of a pricing reform in transport. The Action Programme of the White Paper 2001 is less clear in this context. Similar statements are made by Danish representatives as the Danish EU presidency approaches (see transport Europe, July 2002): Whereas the liberalisation of rail is mentioned as priority, pricing reforms for road freight transport is not.

4 Impacts of SMCP: Results from Selected Studies

4.1 Effects on prices and transport volumes

4.1.1 Selected results in different European contexts

In the tables below we have summarised some of the recently published results for marginal costs illustrating the wide range of values given in the literature mentioned in section 3.2. We concentrate on road transport, i.e. the mode with the most and probably best available cost estimates. The figures refer to different European contexts. Alpine-specific findings for the dominant issue in the context of transalpine transport, i.e. freight transport, are presented in section 4.1.2 below.

Table 4-1: Selected marginal cost estimates, in € / 1'000 pkm / tkm

Road passengers transport: Marginal infrastructure costs		
Specification	Value	Source
European average	12	ECMT (1998)
Figures for France and UK	3.2 and 4.0	PETS, Cross Channel case study, ITS (2000)
France	4.1	Link H et al. (1999)
Switzerland, motorways	3.0	UNITE, case study, Schreyer C et al. (2002)
Switzerland, motorways	3.7	Maibach M et al. (1999)

Road passengers transport: Marginal noise costs		
Specification	Value	Source
European urban average	21.3	Infras and IWW (2000)
European urban average	7.5	ECMT (1998)
European inter-urban average	0.17	Infras and IWW (2000)
European rural average	2.9	ECMT (1998)
Stuttgart, daytime and nighttime	10.4 - 31.3	UNITE, case study, in Nash and Johnson (2002)[20]
Berlin, daytime and nighttime	3.3 - 10.1	UNITE, case study, in Nash and Johnson (2002)[21]

[20] The original value is given in € / vehicle kilometre. We use an average German load factor for cars of 1.44 to calculate the figure in € / passenger-kilometre (Source: Infras and IWW (2000), p. 167).

[21] The original value is given in € / vehicle kilometre. We use an German European load factor for cars of 1.44 to calculate the figure in € / passenger-kilometre (Source: Infras and IWW (2000), p. 167).

Table 4-1: Selected marginal cost estimates, in € / 1'000 pkm / tkm (continuation)

Road freight transport: Marginal costs of air pollution		
Specification	Value	Source
European average (HGV)	14 - 50	Infras and IWW (2000)
European average (LGV)	28 - 118	Infras and IWW (2000)
European average (HGV a. LGV)	23 .6	ECMT (1998)
Belgium, inter-urban	18.2	Beuthe M et al. (2002)
Belgium, inter-urban (HGV)	5.5 - 10.3	Friedrich R and Bickel P (2001)[22]
Belgium, inter-urban (LGV)	20.4 - 50.9	Friedrich R and Bickel P (2001) [23]
Corridor Basel - Karlsruhe (HGV)	15	UNITE, case study, Nash and Johnson (2002)[24]
Corr. Strassburg - Neubrandenburg (HGV)	6.3 - 16.2	UNITE, case study, Nash and Johnson (2002)[25]

Table 4-1 makes clear how difficult it is to answer to the very relevant question for policy makers: How would the prices change? Obviously, the answer depends on two points:

- the reference case, i.e. the existing pricing and subsidisation schemes in transport
- the choice of the concrete values for the cost estimates

Looking at the range of the values given in table 4-1 it is clear that from a scientific point of view it is very difficult to make a robust suggestion for the latter. The choice is to some degree arbitrary - and this will not change even if large research efforts may somewhat reduce the range of uncertainty. This should be kept in mind when studies are evaluated that calculate in detail the impacts of new pricing strategies in transport. The "price set" assumed strongly influences the results. Nevertheless, we present some results of such exercises below.

Within the research project PETS[26] a number of case studies has been carried out to assess the price changes and the changes in transport volumes connected with an implementation of SMCP. The issue of uncertainty has been taken into account by defining low and high social marginal cost estimates. Table 4-2 presents the changes in prices in *passengers transport* for the low and the high cost estimates.

[22] Values for EURO II and uncontrolled technologies.

[23] Values for EURO II and uncontrolled technologies.

[24] The original value is given in € / vehicle kilometre. We use an average German load factor for HGV of 4.6 to calculate the figure in € / tonne-kilometre (Source: Infras and IWW (2000), p. 167). EURO II technology.

[25] The original value is given in € / vehicle kilometre. We use an average German load factor for HGV of 4.6 to calculate the figure in € / tonne-kilometre (Source: Infras and IWW (2000), p. 167). EURO II technology. Lower/upper value = outside/inside built-up areas.

[26] PETS, Pricing European Transport Systems, http://www.cordis.lu/transport/src/pets.htm.

There is marked difference between the inter-urban case studies and the urban case study for the City of Lisbon. Only in the latter case, SMCP would lead to a price increase for one mode: As expected because of congestion problems, there is a substantial increase of prices for car usage. In all other case studies, a price decrease for all modes is suggested - even if the higher social marginal cost estimates are applied.

Table 4-2: Changes in passenger prices compared to the reference case, unconstrained marginal cost pricing scenario, in € / 1'000 pkm (1995 prices, 2010 values)

Case study	Cost estimate	Car	Bus	Train	Air
Cross Channel[27]	low	-21.4	-	-30.2	-22.7
	high	-7.4	-	-28.5	-11.6
Turku (SF) - Russian border	low	-22.4	-2.96	-4.06	-
	high	-4.9	-2.56	-4.04	-
Oslo - Gothenburg	low	-25.7	-11.8	-12.6	-57.1
	high	-8	-5.1	-12.2	-45.4
Lisbon	low	+11.9	-17.2	-9	-
	high	+33.7	-16.5	-8.7	-

The demand changes (traffic volumes) given in table 4-3 are predicted in the case studies if the high cost estimates are applied.

Table 4-3: Changes in demand relative to the base case, high cost estimate

Case study	Car	Bus	Train	Air
Cross Channel	-0.7%		+10.3%	-2.2%
Turku - Russian border	-1.4%	+3.7%	+12.1%	
Oslo - Gothenburg	+6.2%	-4.4%	+0.2%	+8.9%
Lisbon: Peak period	-32.3%	-2.2%	+16.3%	

In general it seems that public transport profits from SMCP if rather high cost estimates are assumed. However, the change in modal split is rather limited because of the strong dominance of road transport in the reference case. Only in the urban case study, a significant change in modal split in favour of public transport is assessed. This result is confirmed by

[27] The case contains the corridors London - Paris and London - Brussels. The price changes refer to the stretches in Britain, France and Belgium. The price changes for the Cross Channel modes themselves (ferries, Le Shuttle, Eurostar) are not included.

other urban case studies. In Proost et al. (2002), modal split changes in favour of public transport are reported for Amsterdam, Brussels and London - but not for Dublin where the abolition of the high initial subsidies of public transport connected with the introduction of social marginal cost pricing leads to considerable price increases in public transport.

Whereas inter-urban passengers transport seems to be generally overpriced - if started from the social marginal cost rates as assumed by PETS -, this is not the case for freight transport (see table 4-4).

Table 4-4: Changes in freight prices compared to the reference case, unconstrained marginal cost pricing scenario, in € / 1'000 tkm (1995 prices, 2010 values)

Case study	Cost estimate	HGV	Train
Cross Channel[28]	low	+12.6	+15.0
	high	+20.9	+16.0
Turku - Russian border	low	+11.3	-2.7
	high	+15.8	-2.6

The price increases are quite marked, at least if the high marginal cost estimates are applied: In the Cross Channel case study, the price increase of 20.9 € / 1'000 tkm on the stretches to/from the Channel corresponds to an increase of the diesel price by about 0.5 € / litre.[29]

Nevertheless, the changes in traffic volumes and modal split are limited in the Cross Channel and in the Finnish case study:

- For the Cross Channel case study, a maximum reduction in HGV demand of 2.5% is assessed.
- The Finnish case study predicts a decrease of road freight transport by 5.9% and an increase of rail freight transport by 7.4%. Again, the modal split effect is limited: The share of road freight transport goes down from 58.8% to 56.7% (rail: from 41.2% to 43.3%)

Other case studies complete the picture of the PETS case studies in different ways:

- Proost et al. (2002) do not report an increase of the share of rail under a SMCP regime for Belgium and Ireland. Only for Belgium a slight decrease of road freight traffic volume is assessed (-3%) whereas for Ireland even an increase results (+1.5%).

[28] The case contains the corridors London - Paris and London - Brussels. The price changes refer to the stretches in Britain, France and Belgium. The price changes for the Cross Channel modes themselves (ferries, Le Shuttle, trainload) are not included.

[29] Assumptions: 8 tonnes net load according to the case study, 32 l diesel consumption / 100 km.

- Beuthe et al. (2002) calculate substantial modal split changes away from road freight transport (road: from 71% down to 54%, rail from 16% up to 24%, waterway from 13% up to 21%).

What conclusions can be drawn from the different case studies above? We see two major insights.

- General statements about the effects of SMCP on transport prices and volumes can hardly be made. The results crucially depend on the reference case (current pricing scheme) and the concrete choice of the pricing basis out of the widely varying cost estimates. Transferability problems limit the possibilities to generalise values calculated in case studies and therefore specific contexts.
- Urban areas with congestion problems are an exception: Here, SMCP generally results in substantial price increases for motorised private transport. The effect on public transport prices is less clear, the current level of subsidisation is highly relevant.

4.1.2 Alpine-specific results for freight transport

In the third PETS freight case study "Transalpine Freight" (Suter et al., 1999), the price changes resulting from an introduction of SMCP for the two modes road and rail freight transport differ between the transalpine corridors in Italy, France, Switzerland and Austria. Table 4-5 shows the results for the most important crossings.

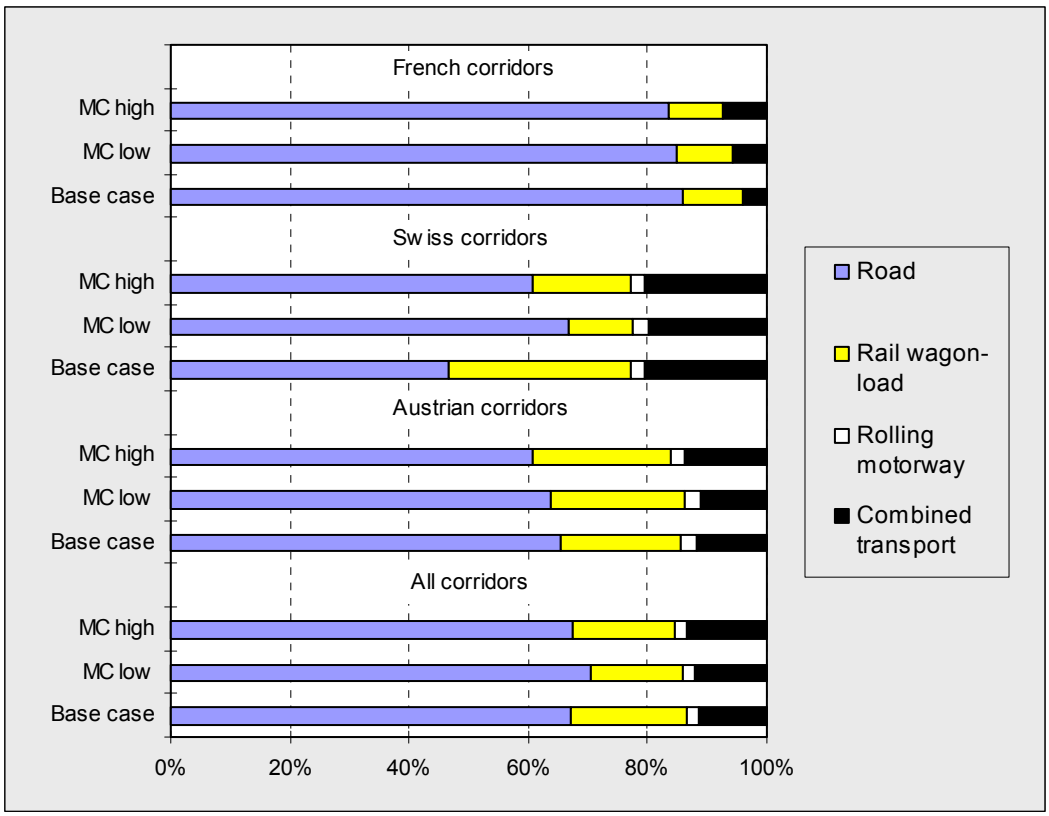
Table 4-5: Changes in prices for freight transport, unconstrained marginal cost pricing scenario, in € / passage and in relative terms compared to the base case BAU (1995 prices, 2010 values)

Corridor	Cost estimate	€ / passage	Price change vs. BAU
Ventimiglia (F)	low	27.6	-44%
	high	90.0	+82%
Mont Blanc	low	39.6	-76%
	high	128.9	-23%
Gotthard (CH)	low	37.2	-76%
	high	121.2	-21%
Gr. St. Bernard	low	26.3	-86%
	high	85.5	-55%
Brenner (A)	low	36.5	-75%
	high	118.7	-19%
Schoperpass	low	28.4	-36%
	high	92.5	107%

- The price set of table 4-5 reflects the somewhat arbitrary choice of the "right price" for infrastructure usage mentioned further above: Both, the low and the high values can be supported with available social cost estimates.
- The large differences in the price changes between the corridors reflect the different pricing schemes being in force at present: Whereas in some of the corridors considerable charges are levied (e.g. Gotthard and Brenner) this is not the case for others (e.g. Ventimiglia).

One can assume that the differences shown in table 4-5 result in substantial impacts on transport and traffic volume. These effects are summarised as modal split changes in figure 4-6 below.

Figure 4-6: Change in modal split, unconstrained social marginal cost pricing



The changes do not only depend on the price changes of table 4-5 but also on two further points:

- A part of transalpine freight transport is long-distance transport. Thus, the impacts on transport volume also depend on the pricing strategy outside the transalpine crossings. The case study assumes that in the "rest of Europe" social marginal cost pricing is introduced too. The result is that infrastructure usage charges should be lowered if the low

marginal cost estimates are assumed (-36.8%), and increased (doubled!) if the high values are used.

- Social marginal cost pricing affects also the rail freight transport prices. Only in the case of the low cost estimate infrastructure usage charges would decrease compared to the base case.

The main findings of the analysis of a change to SMCP in transalpine freight transport found in the PETS case study can be summarised as follows:

- The current pricing schemes in transalpine freight transport do not reflect short-run marginal social costs, neither in road nor in rail transport. In the case of road freight, the need for action is a priority at the European level (i.e. outside the Alpine area) and for the transalpine corridors with low existing charges and tolls.
- The marginal cost pricing scenario does not lead to a substantial increase in rail transport. The cost estimates derived from the literature and additional calculations within PETS are not high enough to change the prices in a way that induces road transport to switch extensively to rail transport.
- Switzerland cannot hold its high share of rail transport if SMCP is introduced. In the case of the low cost estimates, the road transport volume on the Swiss corridors almost doubles whereas it decreases on the French and Austrian corridors. First of all traffic from the Brenner and the Mont Blanc divert back to the Gotthard if Switzerland gives up its rail-friendly transport pricing policy.
- The results calculated suggest that pricing based on economic efficiency objectives alone will not save rail - if it starts from the price-relevant cost rates assessed in PETS. Substantially higher productivity gains than assumed in the case study are needed if rail wants to increase its market share under a social marginal cost pricing scheme.
  This finding is confirmed by the EU research project STEMM[30] where the potential impacts of different policy instruments on modal split has been estimated for transalpine freight transport (see Ecoplan and MDStransmodal, 1998). A successful liberalisation of the rail freight market and more appropriate pricing schemes in road freight transport proved to be the most effective instruments to make freight switch from road to rail.
  Such improvements are especially needed if - as suggested by representatives of the alternative pricing approach - rail should bear its total infrastructure costs in the long term. Calculations within PETS suggest that rail freight transport would largely cease to exist if it had to achieve total cost recovery.
- Further scenarios calculated within the PETS case study show that with additional pricing measures in favour of rail a change in the modal split in favour of rail can be achieved.

[30] STEMM, Strategic European Multimodal Modelling, http://www.cordis.lu/transport/src/stemm.htm

There might be reasons for such additional measures:

– In the case of plausible capacity constraints in the road network it might be cheaper to increase the rail share of total transalpine freight transport than to extend the road infrastructure.[31]

– The external cost estimates underestimate the real external costs of transport because a range of Alpine-specific cost factors (e.g. impact on bio-diversity, impact on the shelter function of Alpine forests) had to be neglected in the assessment due to the limited knowledge and data availability.

– The predicted, compared to the current situation, may entail significantly higher road transport volumes in the case of marginal cost pricing than the public are prepared to tolerate, given the sensitive Alpine environment and sustainability considerations. Or to say it the other way around: If the Alps as sensitive area should be preserved as intact living space and habitat, a pricing scheme should rather be oriented at certain politically defined sustainability objectives than on SMCP where Alpine-specific issues are not treated adequately.

4.2 The welfare impacts of changes in transport pricing

According to section 3-2 above, efficiency or welfare gains are the central theoretical arguments in favour of a change to social marginal cost pricing in transport. The open question is how large these welfare gains might be. Within the UNITE project, comprehensive General Equilibrium Analysis have been carried out with Computable General Equilibrium models (CGE modes) to assess the welfare, distributional and economic impacts of different pricing scenarios for Belgium (see Mayeres et al., 2002a) and Switzerland (see Wickart et al., 2002).

In an Alpine context, especially the results for Switzerland are of interest. In the case study, the effects of the pricing scenarios containing elements of both pricing approaches of chapter 3 are analysed. The scenarios and sub-scenarios can be summarised as follows:

- **MC-PURE-scenarios**: A change to a “pure” SMCP regime. Because revenues from social marginal cost pricing do not cover total costs - one of the basic objections of the alternative pricing approach against SMCP - increases in the VAT rate (scenario MC-PUREa) and in the percentage rate of social security contributions (MC-PUREb) generate the additional funds needed to cover total costs of transport. The marginal cost rates used as price basis have been derived from results produced within the UNITE project. They are rather low compared to existing official Swiss figures.

[31] In this context it should be noted that the PETS case study did not take into account congestion. However, one can assume that the results would not change dramatically because congestion is first of all an issue for passengers transport (peak loads on a limited number of days, e.g. Eastern or at the beginning of school holidays) or connected with extraordinary events (e.g. closure of the Gotthard and Montblanc tunnel).

- **MC-TCR-scenarios**: A change to a SMCP regime combined with the budget constraint total cost recovery in the transport sector. Total cost recovery is ensured by a two-part tariff type of pricing (combination of a distance-dependent tax with a fixed annual tax). The differences between the three sub-scenarios refer solely to the way the different modes contribute to the budget constraint, i.e. whether there is cross-subsidisation or not:
  - MC-TCRa: No cross-subsidisation, each mode has to cover its financial costs.
  - MC-TCRb: Cross-subsidisation only between passengers and freight transport of the same mode, thus no cross-subsidisation between road and rail
  - MC-TCRC: Cross-subsidisation between the modes and between passengers and freight transport
- **MC-REV-scenarios**: A change to a more SMCP oriented pricing approach with the less strict constraint that the pricing reform should not lead to a need for additional funds from the public treasury compared to the situation before the pricing reform. The pricing and the budget rules differ between the modes. In the case of MC-REVa, both modes experience the same pricing reform (SMCP), but only road transport has to cover its total costs. MC-REVb is a "first mover-scenario": Only for private road transport, a pricing reform oriented at SMCP is introduced. There are no changes for public transport.
- **AC-scenarios**: A change to an average cost pricing regime in transport: Whereas the scenario AC-SOC contains an internalisation of external costs too, this is not the case for the scenario AC-FIN.

In table 4-7 we show the welfare implications of selected scenarios. In the case of the scenarios with budget constraints - or revenue requirements - the welfare implications strongly depend on the way non-Swiss users of the Swiss road network are integrated in the pricing and financing scheme. Therefore table 4-7 distinguishes between the two cases:

- "Standard case": Same pricing scheme for foreign and domestic road users.
- "Domestic only": Only the domestic road users contribute to the budget constraint, the foreign users are priced at marginal social costs.

The results presented in table 4-7 suggest the following evidence:

- The simulations for Switzerland predict a limited increase of total welfare for SMCP in transport (+0.17% and +0.18% for the two "pure" SMCP scenarios). These limited welfare gains should be kept in mind when an implementation of SMCP is considered: The analysis here assumed "perfect instruments" (i.e. no transaction costs). Section 3.2 above has made clear that sophisticated instruments being able to set differentiated price signals have high transaction costs.
- In general, urban households are negatively affected by the scenarios (max. € 350 per household), non-urban households positively (max. € 230 per household) if the revenues from the pricing schemes are redistributed with a reduction of a general tax like the VAT or social security contributions. These distributional effects would certainly influence the acceptance of an implementation of new transport pricing schemes. Other, spatially

differentiated redistribution schemes would change the distributional outcome of new pricing schemes.

Table 4-7: Welfare implications of the UNITE pricing scenarios: Hicksian equivalent variation in income, in % change versus the base case[32]

Standard case	MC-PUREa	MC-PUREb	MC-TCRa	MC-TCRc	MC-REVb	AC-FIN
Urban HH	-0.17%	-0.13%	-0.42%	0.07%	-0.02%	-0.29%
Non-urban HH	0.23%	0.24%	0.03%	0.25%	0.11%	0.03%
Welfare	0.17%	0.18%	-0.04%	0.22%	0.09%	-0.02%
Domestic only	MC-PUREa	MC-PUREb	MC-TCRa	MC-TCRc	MC-REVb	AC-FIN
Urban HH	-0.17%	-0.13%	-0.42%	-0.20%	-0.12%	-0.34%
Non-urban HH	0.23%	0.24%	0.02%	0.23%	0.10%	-0.07%
Welfare	0.17%	0.18%	-0.04%	0.17%	0.07%	-0.11%

- The comparison between the total cost recovery scenarios MC-TCRa and MC-TCRc makes clear that the more flexible the budget constraint is implemented, the higher is the welfare level. Thus, cross-subsidisation between modes can increase the efficiency of a pricing strategy containing revenue requirements. In the standard case, the CGE model simulations suggest for the scenario MC-TCRc that it is exclusively road passengers transport which contributes to the budget constraint for the transport sector as a whole. In the case "domestic only", it is road freight transport.
- The result for scenario MC-REVb shows that a solution
  - where marginal social cost pricing - and thus an internalisation of external costs - is implemented first or even solely in road transport and
  - where the situation for rail transport remains unchanged

  slightly increases welfare. There seems to be case for a "first mover solution" as supported in section 3.4 above.
- The high welfare implications of the treatment of foreign traffic can be seen from scenario MC-TCRc which is the best scenario in the standard case. The reason is that the reduction of the VAT which is possible because transport now covers its total costs, is partly financed by foreign users of the Swiss transport networks.

The analysis carried out with the CGE model for Switzerland shows further impacts of the different pricing strategies (e.g. economic effects, impacts on transport volumes) which are not contained in table 4-7:

- For road transport an increase in traffic volume is predicted, for rail a decrease. These impacts are not in line with the official goals of the Swiss transport policy confirmed in

[32] The welfare or efficiency effects of the pricing scenarios are measured in terms of the equivalent variation in income of the households (HEV). A HEV decrease of 1%, for example, corresponds to a loss of income for the households by 1% compared to the base case. In the analysis, an urban and a non-urban household is distinguished. The total welfare effect is the sum of the welfare implications for the two households.

several public votes: Neither a reduction of the adverse environmental impacts of transport would result, nor an increase of the share of rail transport on modal split.

- The impacts on the Swiss economy - measured as changes in GDP induced by the pricing schemes - are more or less neutral (MC-PURE-scenarios) or negative (AC-scenarios, MC-TCRa). Thus, we don't find economic arguments advocating a change of the existing charging and taxation scheme in the direction of the transport pricing scenarios described in this modelling case study. The effects of the pricing scenarios on the different sectors of the Swiss economy are limited too. Only in a small number of sectors the impact on the gross production value (or "turnover") exceeds +/-1%.
- The analysis shows no relevant adverse effects on the Swiss economy and - as seen above - on welfare if social marginal cost pricing and thus an internalisation of external costs is first or even solely introduced for road transport.

Again, we stress that these conclusions are valid for the analysis carried out in this case study for Switzerland. They strongly depend on the assumptions made in the modelling work and especially on the cost bases chosen to define the transport prices. Simple generalisation is not possible as a comparison with the results of a similar analysis for Belgium shows (see Mayeres and Proost, 2002): The higher congestion level in Belgium compared to Switzerland and other marginal cost estimates as pricing basis result in higher welfare gains of SMCP.[33]

The analysis for Belgium furthermore confirms the strong and certainly policy-relevant distributional impacts of changes in transport pricing schemes. The five income groups distinguished are very differently affected. The income effects do not only depend on the pricing side, but also strongly on the way the surplus from social marginal cost pricing is redistributed (other than in the case of Switzerland the revenues from SMCP exceed total transport infrastructure costs in Belgium).

The last statement is in line within findings in AFFORD suggesting "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" (Milne et al. (2001), p. ii). With 200 - 400 € per capita and annum, the efficiency gains assessed in AFFORD for three urban areas (Edinburgh, Helsinki and Oslo) are in the same order of magnitude as the results for Belgium.

Our main conclusion from the CGE modelling exercises refers not that much to efficiency implications whose level is strongly influenced by assumptions concerning the social marginal cost rates used as price basis and by the reference case (e.g. congestion situation in a country). In our view, the studies especially disclose politically highly relevant distributional effects of changes in the existing pricing schemes.

[33] A partial equilibrium analysis carried out for several urban areas in Germany and England are - as expected with regard to the relevance of congestion - more in line with the results for Belgium than for Switzerland (see Mayeres et al, 2002).

5 Conclusions

The recent discussion about pricing in transport has been dominated by a re-emergence of the microeconomic pricing principle of short run social marginal cost pricing. As long as the discussion concentrated on theory, the simplicity of the approach was a strong argument. However, the "splendour of simplicity" is more and more replaced by complexity and critics, as implementation issues become the focus of attention:

- The strong focus on short run efficiency and welfare gains set by economists is just one viewpoint in transport policy and among politicians not the most important one. So far, fairness or equity considerations (who covers deficits, who gets surpluses?) and financial constraints (cost recovery, the need for private sector involvement) have played a more important role. It is difficult to see plausible reasons why politics should adopt the strong economic point of view.
- Though a large number of studies has come up with the proof that the basis for SMCP, i.e. social marginal costs can be estimated, the available set of cost estimates is neither complete (all modes, all relevant cost types) nor robust enough (large uncertainties) to claim that the welfare optimising prices are known. But because "a price has to be an exact quantity, not a range" (Goodwin (2001), p. 29), the definition of this exact quantity will be the result of a political decision process. This process will first of all be governed by genuine and controversial interests and only very partly by evidence from research. Therefore, even a further narrowing of the range of plausible cost estimates will not lead to political consensus on price levels.
- The analysis of critics and advocates of SMCP has shown a number of actual barriers for implementation of SMCP. They refer to technical, organisational and institutional issues.
- Finally, public concerns about the environmental impacts of transport will only decrease if a policy proves to be effective and not solely efficient. In the case of transalpine freight transport, for example, the inhabitants would hardly accept a solution where the modal split changes in favour of road transport - even if they were told that this solution is efficient (see chapter 4).

Against this background, there are merely any advocates of SMCP that do not conclude that "pure marginal social cost pricing has to be modified to take all these issues into account" (Nash and Matthews (2001), p. 8). Modification means that second-best issues become the centre of research interest.

The question then is where advocates and opponents of SMCP ("alternative pricing approach") would not meet if second-best was understood in a broad sense. A number of similar concerns can easily be identified, others can only be suggested:

- More differentiation, appropriate incentives: Both approaches accept that transaction costs will limit the possibilities of differentiation. The assessment of external costs as carried out in the context of the SMCP-discussion provide important inputs to determine which differentiations should have priority. A number of studies and real-world

experiences have shown that pricing is a powerful mean to induce changes in traffic behaviour.

- Territoriality principle: Both approaches are in favour of less charges and taxes based on the country-of-origin principle and more infrastructure usage related charges.
- Inclusion of external costs into the charging and taxation scheme: At first sight, there is a substantial difference because advocates of SMCP propose to include these costs in infrastructure charging schemes whereas representatives of the alternative approach suggest a strict separation of infrastructure user charges and taxes for the internalisation of external effects. However, because of imperfect pricing instruments advocates of SMCP will have to select which cost components should be reflected in a infrastructure usage charges and which in other instruments. With regard to the discussion in chapter 3.2, they will not chose
  - noise (no effectiveness of SMCP based kilometre-chages along noisy transport infrastructures)
  - accidents (a case for the insurance sector because other influence factors are more important than transport volume)
  - climate change (fuel tax more appropriate)

  Thus, the discrepancy will most probably be limited to the costs of air pollution.
- Cost recovery issues: Advocates of SMCP have recognised the high importance of financial constraints: Second-best approaches should address exactly this issue (multi-part tariffs, Ramsey pricing).
  An important point to be addressed in further research should be for which units (sub sectors, parts of a network) cost recovery ratios should be defined in a second-best world. In this context, the question should also be discussed whether cost recovery requirements should - as proposed by representatives of the alternative pricing approach - be defined mode-specifically or whether a joint view could be more appropriate under certain circumstances (e.g. in the sense of a "least-cost-planning-approach" for a defined transport corridor). The issue of cross-financing would then again become relevant.
- Need for packaging: The alternative pricing approach emphasises this need because different goals cannot be achieved with one instrument (effectiveness): The SMCP approach sees a case for a packaging of second-best instruments in order to "replicate the full set of incentives given by hypothetical first-best pricing as closely as possible" (Verhoef (2001), p. 13). A pragmatic interpretation of this theoretical statement may bring the two approaches quite closely together.
- Optimal use of the existing infrastructure: This key concern of SMCP especially for urban areas (congestion pricing) is recognised by representatives of the alternative pricing approach. Peak load pricing is seen as one possibility. Land-use planning instruments and improvements in alternative transport modes help to prevent undesirable effects on land-use caused by urban road pricing schemes. For urban areas, where infrastructure extensions are often strongly limited, SMCP may remain the dominant approach. In an inter-urban context, where infrastructure improvements and extensions are a major issue, this will most probably not be the case (see next point).

- Infrastructure extension and private sector involvement: It is one of the policy goals of the European Commission (see European Commission (2001), p. 59) and many European governments to make the private sector participating in the extension and improvement of transport infrastructure. In this context, the alternative pricing approach seems to be more appropriate. A pricing scheme too strongly oriented at SMCP leading to decreases in the infrastructure user charges if infrastructure is improved (deeper renewal costs) or extended (less congestion) is not in line with the interests of private agents making investments into transport infrastructure. Most advocates of SMCP do not deny that smoothing of charges is appropriate in this context. This again reduces the actual differences between the two pricing approaches.
- Treatment of sensitive areas: The appropriateness of the SMCP approach is limited because the impact-pathway-approach used to derive marginal cost estimates can't be applied due to knowledge and data gaps (e.g. impacts on bio-diversity, monetarisation of these impacts). As long as this is the case - a change is not within sight - pricing should be used as a mean to achieve politically defined sustainability goals. One can't imagine that advocates of SMCP would propose to simply neglect impacts of transport that are a major concern of the public but can't be expressed in monetary terms.

Our final conclusion is that its time to merge both pricing approaches because a political decision favouring exclusively one approach is unlikely. In our view, further research efforts should put an emphasis on implementation issues. Many of the barriers mentioned in the context of SMCP are also valid for more strongly differentiated pricing regimes taking into account requirements of both approaches.

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