INTERNALISING THE SOCIAL COSTS OF TRANSPORT

Chapter 5

Obstacles to the Use of Economic Instruments in Transport Policy

by Werner Rothengatter
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Introduction

In most countries, the transport market is more or less controlled by the public sector. The reason is that the private market is expected to fail in providing the best allocation of transportation resources because of the sub-additivity characteristics of transport infrastructure, and because of the external effects caused by transport activities. But market control by the public sector may itself induce government failures, if it is performed by the wrong measures and induces false incentives (see OECD, 1992). Therefore, the issue arises of finding an optimal mix of public and private control. In general this means that public leadership should continue, but that the instruments of public management should gradually be replaced by private market instruments.

Economic instruments

Market economies are often considered to be superior to centrally-planned systems because of:

- spontaneous signalling of economic scarcity through flexible prices;
- decentralised decision-making and instantaneous adjustment;
- direct feedbacks by profits or losses; and
- stimulation of dynamic efficiency by competition.

In other reports of the OECD, market instruments are identified with pricing policies such as user charges, tradeable emission permits, deposit refund systems, etc. (see OECD, 1991). But pricing policy is only a part of the instruments which are applied in market economies and which contribute to efficient use of resources. And pricing policy per se is not sufficient to provide efficiency, as has been shown in the former socialist countries. It is crucially important that prices reflect the real costs or scarcity of resources. Furthermore, pricing policy should be embedded in the context of investment, operation management and finance policies. Therefore, attempts to bring more market principles into the transport sector by institutional changes should not be neglected.

Focusing the view

There are two basic ways to introduce economic instruments into the transport sector:

- assignment of market segments to private companies (i.e. the institutional solution); and
• application of the private enterprise instruments of planning, pricing and management by public enterprises or agencies (i.e. the operational solution).

In the first case, the public delegates management of a segment of the transport market to private decision-makers. In consequence, incentives, regulations and monitoring schemes have to be defined to make sure that private agents behave according to public objectives or requirements. It is not necessary for the public to know all the details of the technology, or everything about the optimal strategies for the market. The only requirements are that the public agent find the most efficient private agent and develop an effective control scheme to prevent that agent from violating the regulations.

A special case of the institutional solution is the establishment of a "pseudo market" by the emission of pollution permits. While the public sector would fix the total emission volume, the private market could solve the problems of allocating the pollution rights to the users, setting prices and finding the most efficient ways of providing information and services for the trade of pollution rights.

In the second case, the public enterprise or agency would have to know everything about the technology and the demand situation which a private agent would have to know in order to be efficient. Furthermore, the public enterprise would also have to combine elements of profit-maximizing behaviour with elements of social welfare, including both merit goods and equity considerations. The instruments applied for decision-making and business activities can be absolutely private (such as rentability calculations, pricing rules or management techniques), even if the underlying objectives are not specifically oriented to profit maximisation.

Clearly, the management task in the second case is much more complicated, since managers are expected to be as well-versed in private business affairs as in dealing with public bodies and lobby groups. In France, there is a long tradition in the training of management science to public sector managers (beginning with Colbert, the Secretary of Finance of Louis XIV). The Anglo-Saxon tradition is completely different from the French. Its roots contain an intrinsic scepticism of the management capabilities of the public sector, because of insufficient incentive mechanisms (“X-inefficiency” -- Leibenstein, 1966). Therefore, in the Anglo-Saxon scientific literature, the notion of economic instruments in transport is closely linked with the notion of privatisation.

Sequence of the analysis

On the basis of these preliminary remarks, the analysis in this paper is organised as follows: the next section summarises the reasons favouring introduction of market instruments in the transport sector. This is followed by a review of the psychological barriers which may stimulate people to refuse market instruments, as well as the real obstacles which stem from the technology of production in the transport sector, or from equity or fairness problems. Possibilities for removing these psychological and real obstacles are then reviewed. The paper concludes with several policy recommendations.

In this paper, the institutional aspects of employing economic instruments play a dominant role. The reasons for this are twofold: first, it seems improbable that the public sector will be able to implement market strategies, because: i) public agencies tend to suffer from "X-inefficiencies"; and ii) the public is permanently under the pressure of lobby groups and of the press such that the incentive system facing those responsible for managing public agencies work against the market. Second, an institutional change in the responsibility for infrastructure management opens up the possibilities for a flexible demand management approach, which is absolutely consistent with the needs of environmental policy. Flexible pricing strategies according to the elasticities of demand, for instance, help to divert traffic to less congested time periods, routes or modes, and can be enforced by private or mixed private/public infrastructure operators much more easily than by public ones.
To underline this reasoning, it is useful to recall the fact that all the pricing instruments which are
discussed in this volume have a long history and have been described in the literature since Pigou (1920),
Knight (1924), Hotelling (1936), Smeed (1964), or Walters (1966). Therefore, the problem is not so much
one of generating new theoretical approaches as it is of developing an institutional framework for the
introduction of these market instruments.

Why transport economists call for economic instruments

Transport infrastructure as a "club good"

Transport infrastructure is used predominantly for private purposes. Private consumers maximise
their utility by performing consumption activities over space and time, and by using the transport infra-
structure as a bridge between different locations in space. Private producers apply spatial logistic schemes to
reduce their costs through specialisation and work-sharing, or to increase the radius of input demand and
output supply. The additional benefits to society at large by providing basic accessibility and communication
potentials are comparatively small in developed industrialised countries. Existing cost allocation studies for
the transport sector suggest that the share of the public in the benefits of infrastructure are only between 15
and 25 per cent of the total (DIW, 1987; Aberle and Holocher, 1984). Therefore, transport infrastructure is
basically a "club good", which provides most of its benefits to clubs of private users.

Abstracting from distributional problems for the moment, there is little reason for treating this club
good like a public good and for producing or allocating transport services according to public rules. On the
other hand, the transport infrastructure is characterised by a sub-additivity of costs, and its use leads to external
diseconomies. Therefore, a high level of public control is needed to prevent the transport market from
natural monopoly and from distortions by externalities. The conclusion is that public control is necessary,
but that economic market instruments directed at the private sector are often feasible.

Externalities

External effects occur if a resource is used commonly, the property rights of which are not defined.
In this case, the utility or production functions of agents are influenced by factors outside the market, and
upon which they have no control. The decisions which are taken on the basis of such utility or production
functions are consequently inefficient from the social point of view, and overall resource allocation could be
improved if these externalities were internalised.

This could be simply done by a clear definition of property rights. Under the ideal assumption that
there are no transaction costs, no problems of income redistribution, nor of unbalanced political power, it is
not important to whom the property right is assigned to (Coase, 1960). But there are major cases where these
assumptions do not hold (see Rothengatter, 1992):

- Adding unprofitable links to the network. This can happen in less dense areas or in hilly
  regions, where the costs of additional infrastructure are very high. Improving accessibility to
  remote regions may foster regional development and produce interregional multiplier effects.
  Therefore, overall benefits can exceed the costs of investments if the (regionally) underpriced
  use of the infrastructure produces interregional spillovers. This is an example for positive
  external effects of the transport infrastructure which can be generated by an integrated network
  planning of the public.
- Noise emissions and pollution by the use of the transport infrastructure. Defining property
  rights for the environment can be one element of a solution strategy (e.g. pollution emission
  certificates, which could be traded on a special market). But as there are many different sorts
of environmental disturbances caused by transport activities (and many polluters and affected parties), high transaction costs would be associated with the introduction of any complete market mechanism for controlling pollution tradeable certificates. Therefore, other forms of market mechanisms or direct regulations would also have to be discussed to supplement the "pure property rights" strategy.

- **Congestion externalities.** In the context of externalities, the congestion problem is often mentioned as a prototype example, following Pigou (1962). Contrasting the first two examples, these external effects are exchanged between the users of the transportation system only. They are typical interaction effects which occur in overcrowded systems, not only on roads but also in supermarkets or on beaches. A large step towards reduction of such interaction effects consists in introducing simple private rules of pricing and allocation -- for instance, on the basis of average infrastructure costing. But in highly congested areas, this might be insufficient, and special congestion policies would become necessary. In this case, if a congestion charge is introduced, the income from this charge should be used for the benefit of users (redistribution of income or investment in the infrastructure capacity).

Figure 5.1 demonstrates that the external effects which occur in the transportation system are of four basic types:

- depletion of natural and human resources without paying the costs, because these are not transmitted to the polluter by market prices. These effects occur by interactions between the transport sector and the level of nonrenewable resources;
- providing synergy effects by adding links to the transport infrastructure which would not be profitable, if they were evaluated as isolated projects. If the public does not charge the private sector the full costs of such investments, there remain uncompensated external diseconomies. The affected parties in this case are the public sector, the transport sector and the sectors of private production and consumption;
- congestion effects stemming from the simultaneous use of the infrastructure. All parties involved in these interactions are inside the transport sector;

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Figure 5.1. **Interactions causing externalities in the transport sector**

![Diagram of interactions causing externalities in the transport sector](image-url)
• positive effects of transport on consumption and production patterns. These effects are exchanged between the transport sector and the sectors of private production and consumption.

The fourth category of externalities is especially emphasised by the road lobby groups. The scientific positions here are highly divergent. Some scientists argue that it can be shown from theoretical reasoning that such positive externalities do not exist at all (Rothengatter, 1992); others demonstrate that some positive externalities exist, but that they are negligible (ECOPLAN, 1992); and a third group tries to show that these effects are significant and might offset the negative externalities of transport (Willeke, 1992; Aberle and Engel, 1992).

**Pricing versus regulation**

In a world of sustainable economic development, transport prices should reflect the true scarcity of resources. The problem which has to be solved by transport policy is that actual transport prices do not comprise the true depletion of environmental and human resources. As a result, transport prices are set too low and induce high excess demands for transport activities. A first solution has traditionally consisted of rationing transport demand by regulatory policies.

Examples are:

• zonal entry prohibitions for cars and trucks;
• enforcement of rail transport by regulation dependent on good categories and transport distances;
• control of market entry by concessions (trucks, buses, taxis, etc.);
• assignment of slots at the airport according to non-economic principles (e.g. "grandfathering of rights");
• introduction of technical environmental standards and control of vehicle licensing; or
• assignment of parking rights to residents in congested areas.

The problems of a purely regulatory policy have been discussed at length in the literature. For example, the transport policy of the European Union (EU) is oriented to reducing regulations because:

• Regulations impose rigid barriers to the behaviour of people, such that they cannot react flexibly according to their preferences.
• Regulation encourages people to find ways of circumventing the rules and directs private intelligence into the wrong directions.
• Regulation can be used as a national policy to protect the home markets from foreign competition.
• Regulation does not create enough incentives to promote innovation and dynamic efficiency.

The reasoning of economists is that prices are best suited to transmit the scarcity of resources into the decision planning of individuals and as such, prices regulate the market through so-called "soft constraints". "Soft constraining" individual decisions means that individuals are not prevented from certain transport activities, but that budget constraints operate to ensure that people decide according to their marginal utility per monetary unit. Contrasted with a "pure" regulation policy, individuals are therefore free to respond to higher transport prices by:

• choosing other spatial patterns for production, consumption and housing;
• changing logistics for input supply, distribution and sales of intermediary and final products;
• changing vehicles categories;
• adjusting the number and spatial distribution of trips;
• changing the choice of mode; and
• changing the route.

The striking advantages of price versus regulation policies are:

• All elements of the decision hierarchy of users can be influenced.
• The form of the response is left to the user. The individual can decide on the change of behaviour such that the de-central intelligence of millions of decision units is stimulated to find best solutions to save energy or pollution.

In short, pricing policies can introduce market-conforming reactions into the transport sector, which help to reduce external diseconomies without jeopardising the working efficiency of the market economy. In theory, the environmental side could also be internalised into the market economy as has been done with the social side in order to establish a socially sustainable market economy -- note that this does not mean that the social problems of the industrialised countries have been solved satisfactorily up to date, but it means that the solution of social problems is much more advanced than the solution of environmental problems. This is partly due to the fact that voters react much more sensitively to changes in their social situation than to changes of the global environmental quality (e.g. warming of the atmosphere, increases in the size of the ozone hole, etc.).

Private organisation, management and finance

The institutional side plays a key role in discussions about introducing economic instruments. Even in countries which show a high degree of confidence in public economic performance, it has been realised that it is necessary to change the form of organisation and to assign transport management from purely public bodies to institutions outside the normal public sector budget (such as funds or public enterprises. The essential properties of such institutions are:

• independence from short term political business (the public acting as a principal, not as an agent);
• organisation according to private business principles;
• "ear-marking" of revenues to combine investment planning and costing schemes;
• incentive-compatible rules for paying salaries and for promoting managerial careers; and
• clear rules for the payment of public or merit public services (Commissioner-Pays Principle).

Against the background of these principles, it is also necessary to define the range of acceptable activities of these private or mixed public/private institutions. In the context of private financing of transport infrastructure, the "build-operate-transfer" model has been developed to orient to the question to the single objective of finance and operation. Such an object can relate to a tunnel (Channel Tunnel), a bridge, a highway link, or a single asset (such as a new airport). But usually such objects are also integral parts of a broader network. Consequently, the cost, market, and political risks will be highly influenced by activities outside the object.

Take, for example, the case of private financing and operation of a MAGLEV-link between Berlin and Hamburg (IWW, 1992). The cost risks depend on the behaviour of regional public transit companies and the Deutsche Bundesbahn (which will provide interface between the systems). The market risk is dependent on the reaction of the Deutsche Bundesbahn (complementary or competitive behaviour, which leads to different time tables and production schedules by the Deutsche Bundesbahn). The political risk is influenced by government policy towards competing transport modes, such as car or air travel. The time span for approval and the legislative processes is also an uncertain factor. In any case, a private or mixed
private/public company running a transport facility separately from complementary network elements cannot make use of the associated synergy effects, and will therefore probably respond in a sub-optimal manner.

The essential challenge of institutional policy in transport management is therefore not so much to decide on privatisation per se, but on the scope of activities which a private or public enterprise is allowed to perform and on the interface between that firm and neighbouring economic sectors. For example, if strong interrelationships between different companies remain, it will be necessary to develop agreements on sharing joint costs or common revenues, and the implementation of transfer schemes between high- and low-income companies, if the latter have contributed to the profits of the former.

**Technical possibilities**

The Smeed Report (1964) on road-pricing and its economic and technical feasibilities has already come out with the conclusion that technology is not a major obstacle for economic instruments in the transport sector. In the meantime, the technical instruments have been developed even further, although one should add that this is not the result of intensive research for implementing user charges, but a side outcome of the DRIVE-project of the EU. When developing a system for traffic guidance and control, it was discovered that the technology can also be applied to implement a pricing system. Thus the road-pricing technology became a (very small) part of DRIVE.

The results of DRIVE and other research activities (e.g. on road-pricing for London or Edinburgh) confirm the Smeed Committee’s view that the technical problems are solvable. A first technological option would use automatic vehicle identification (AVI), which centrally records the charges for each vehicle. A second technology would not identify individual vehicles, but would deduct the cost of using roads from a stored value medium (similar to the current use of telephone cards), where the proprietor of the system is not able to establish who is actually using the facility (see Button, 1993). This latter approach can be extended to the use of smart cards, similar to those of credit cards, which automatically debit the costs of trips directly from bank accounts or charges them into a credit card account. Because of practical difficulties which occurred with the AVI-system in Hong Kong (essentially problems with privacy and with the perception of car drivers), the smart card system is now favoured for most applications.

While very simple toll systems have already been installed in some European countries to collect user charges (expressways in Italy, France, Spain; tunnels and expressways in Austria), a breakthrough on road-pricing is only conceivable with the use of sophisticated electronic systems. In Germany, the Autobahnen system is so densely interconnected with primary and state roads that simple turnpike toll systems cannot work. This is the main reason why a vignette system for trucks and cars on German Autobahnen has been discussed by the Ministry of Transport. The EU Council of Ministers of Transport has also decided (June 1993) to introduce a "Euro-Vignette" system in some countries of the EU (Benelux-countries, Denmark and Germany). This charging system is restricted to trucks and to motorways. It is obvious that such systems suffer from many deficiencies, such as independence from mileage and congestion (wrong incentive effects), or high transaction costs, and little efficiency of control. Nevertheless, it is probable that the vignette system will eventually be completely substituted by electronic road-pricing. (According to the decision of EU Transport Ministers in June 1993, an electronic road pricing system can be introduced in 1998.)

**Why people refuse economic instruments -- psychological obstacles**

**Free rider problems**

Public opinion is generally biased against higher user charges. "It is never popular to increase petrol taxes, etc. Trade and industry are opposing air pollution charges, as well as area licensing for urban
road traffic.” (Hansson, 1992). The reason for the heavy resistance of people against flexible pricing systems is often assumed to lie in the unfair distributional effects generated by such instruments. In the case of road-pricing, this argument is very popular and can be transformed easily to influence political decision makers. The case of the poor commuter who has to travel 100 kms per day for the journey to work, and cannot afford the user charges because he has to feed a large family on a low-income, is the standard paradigm of anti-road pricing campaigns.

However, it is easy to show that this argument does not hold on the average. The rich run a higher mileage than the poor, so they will have to pay more if user charges are introduced, based on mileage travelled. Therefore, it is not surprising that higher-income groups expect negative redistributive effects (in terms of direct losses of income), and therefore tend to reject flexible user charges (Staehelin-Witt et al., 1992). In the empirical study of Small (1983, cited in Sims, 1992), the progressive income taxation effects of congestion tolls have been confirmed. Therefore, when pressure groups complain about the negative distributive effects of pricing policies to the poor, they are often trying to preserve their own high-income positions. Thus, the main reason for this resistance is the fear that perceived gains from free-ridership will be lost to the higher-income classes. This free-ridership can occur on two levels:

- insufficient payments to recover the costs of transport infrastructure; and
- using environmental and human resources without any charge.

On the first level, allocation problems occur:

- between the group of users and the group of non-users; and
- totally within the group of users, but among the different user classes.

In the "high transport tax" countries, (e.g. U.K. or Germany), there is no global free-ridership, in the sense that road users as a whole cover the total monetary costs of transport. But in Germany, for instance, there is a heavy internal cross-subsidisation between groups of users because:

- the fixed vehicle taxes disadvantage users with low mileage;
- the heavy loads only pay about 70% of their real infrastructure costs; and
- foreign users contribute little to the costs for which they are responsible (in the case of heavy loads, only about 10 per cent).

Furthermore, free-rider advantages occur to infrastructure users because they do not pay for the external costs of accidents, for environmental damages, and for the over-exploitation of human resources. As long as individuals profit from inefficient social cost allocations, there will be no incentives to change this allocation. In democracies, this leads to the dilemma of political truth-telling. Since people are concerned about environmental conditions, a politician cannot win an election without an environmental program. But, since people respond negatively to higher financial burdens to their budget, a politician might lose the next election if he/she actually tries to implement the environmental program. Therefore, price systems in transport tend to be incomplete, if they are decided upon by political bodies.

*Private misunderstanding about public infrastructure*

Although transport infrastructure is supplied by the public sector, it is actually a "club good" (see earlier discussion). If the public sector allocates this good according to public rules, it stimulates agents to seek additional rents by free-riding. As a consequence, excess demands for infrastructure capacity are generated. *Private* agents (based on their view that infrastructure is a public good) will respond according to the *public* good pattern. In other words, they will call for more capacity and put pressure on politicians to react, without revealing their true willingness to pay for the good.
This institutional "game" has established fixed behavioural patterns in many societies, so that agents stress traditional rent-seeking activities, instead of accepting more efficient alternatives. One result is that the private sector loses billions of ECU per year through congestion costs. Even though it is obvious that the public sector is not able to invest at will in transport infrastructure extensions to meet these demands (because of their empty treasuries and the resistance of people against investment plans), the acceptance of market instruments has not increased. This is somewhat surprising, since road-pricing has been proven to provide higher private benefits than costs, even at the individual level. Remember, a business traveller who pays 25 ECU to save 1 hour gains an expected profit of 25 ECU if his value of his time is 50 ECU/hour.

Unfortunately, misunderstandings about the character of transport infrastructure lead to inefficient responses by private agents, because they do not realise the potential improvements stemming from private forms of management and finance.

Public misunderstanding about private transport

The transport system generates many production and consumption benefits overall in the economy. These benefits are complementary inputs or outputs of many activities. Some of these benefits are external in the sense that the advantaged party does not pay the full costs of the transport system. Willeke (1992), for instance, mentions such external benefits as:

- development of remote regions;
- creation of new consumption patterns;
- new patterns of industrial and residential location;
- growth and structural effects; and
- industrial innovations linked to services of the transport system.

Based on this reasoning, the conclusion could be drawn that transport activities produce significant external benefits. This seems to be general thinking in transport policy and is supported by some scientists (e.g. Willeke, 1992; Simons, 1992; Aberle and Engel, 1992). The policy consequence which follows from the existence of positive externalities is that these externalities should be compensated for in the design of tax reliefs or subsidies. The Deutsche Straßenliga (1992), for instance, has concluded that the positive externalities almost equal the external costs, so that it is not justified to increase the total tax burden on road transport. This result was derived from interim reports of a study for the IRU on the European scale.

However, this conclusion is wrong. As has been shown in both theoretical and empirical studies (ECOPLAN, 1992; Rothengatter, 1992), the supposed positive externalities stem from infrastructure supply, but not from its use. There are no relevant external benefits of road transport which could justify monetary compensation in the form of reduced road user charges or fees to cover environmental costs. In most cases, the source of the misunderstanding is that the externality generated by the public sector through the building of infrastructure (see Figure 5.1) is assumed to be produced by the users of this infrastructure. Although the correct result can be derived by simple theoretical deductions, it does not correspond to the intuitive thinking of some transport experts and many politicians. Many of them falsely believe that transport is a inherently special sector of the economy, and should to be treated differently from other sectors with respect to subsidisation. This misconception seems to be an important reason for public and private business resistance against the internalisation of external costs.

Historical experience

Turnpikes and tolls on roads, bridges or tunnels are not inventions of modern transport management. They have a long history. These instruments were applied in ancient Rome to tax foreign
traders, and were absolutely normal in the Middle Ages to charge the users of trade paths. In the U.K. in the 18th century, about 90 per cent of long distance trunk roads were toll roads. On the continent, very different experiences with toll systems have occurred. Some were legally-based and implemented according to common principles (such as the bridge tolls introduced under Karl I in the 11th century). But in countries with weak central governments and strong territorial principalities, un-coordinated toll systems developed which became, in extreme cases, similar to street robberies.

It is this bad historical experience which makes people distrust both pricing systems and the decentralisation of responsibilities for transport infrastructure. In particular, in the case of private infrastructure companies, people are afraid of adverse mechanisms because private profit maximisation could destroy synergy in and between the networks such that the efficiency gains of privatisation would be overcompensated by losses of synergy. Cross-subsidisation (which is usual in public networks, since expensive roads in hilly regions are not priced higher than in flat regions) would have to be reduced in a world of decentralised private network organisation and management. Furthermore, there is not much confidence in the advices of transport economists, because most of their results are derived from abstract or partial models, and there is a strong feeling among both practitioners and politicians that the concept of rational economic management in the transport sector is good for nice theoretical games, but is not an appropriate strategy for the real world. There is a clear signal here not to jeopardise the overall working efficacy of the transport system by implementing immature theoretical ideas (especially, those of transport economists!)

**Enforcement of psychological barriers by lobbyists**

Changes in the allocation of costs are always associated with a different pattern of payments by the groups concerned. As previously discussed, road-pricing and the internalisation of social costs affect high-income groups more than those with low incomes. Naturally, higher-income groups are quite capable of forming lobby groups to put pressure on the decision-makers. The most powerful of these lobbies are:

- automobilists clubs; in Germany, about 12 million car owners are organised in a general club of automobilists (ADAC). All German club members are voters;
- national and international road unions; although small with respect to membership and economic power, they are very influential because of their professional attitudes and the political over-rating of the importance of transport companies; and
- lobby groups of industrialists; these groups become very active if the public sector plans to increase tax burdens for industry as a whole, or for individual components of industry.

Summing up, there is a powerful political bias of lobby groups against economic instruments. Because of their solid financial basis, lobby groups can afford to hire highly qualified specialists to analyze the weaknesses of economically-based concepts and to develop populist counter-arguments and media campaigns. A striking example of this process was provided in the journal "Motorwelt" of the ADAC in Germany, where the club responded to an estimation of the external diseconomics of car traffic, with the calculation that external benefits of car travel exceed external costs by 5-10 times (ADAC-Motorwelt, 1992).

**Real obstacles to implementing economic instruments**

The reasons for objecting to economic instruments are not only psychological. There are several hard problems associated with the technology in the transport sector and with fairness/equity concepts, which will have to be solved before introducing the market into the transport sector to any great extent.

At this stage, we should recall that economic instruments concern investment and production planning, price-setting, organisation and management, as well as finance. In principle, each of these parts
has to be analyzed separately for individual modes of passengers and goods transport. Since it is not intended to discuss all segments in detail here, emphasis is given to some general problems which are shown using examples from different transport modes, without being complete.

**Synergy in networks**

Physical networks are natural monopolies, both because their cost functions are sub-additive and because capacity decisions are not reversible, in the sense that fixed costs are "sunk". An incumbent of a given network component is able to protect his domain against entry by competitors, such that any effort to privatise would result in general in a technological monopoly. Whether or not this technological monopoly leads to a complete market monopoly depends on the degree of control by the private monopolist of the market for substitutes (Baumol, Panzar and Willig, 1982). Therefore, privatisation of wide parts of a network generates problems of monopoly power, while the privatisation of small parts (e.g. a link, a tunnel or a bridge might destroy the synergy in the network). Some possibilities include:

- **a)** privatisation of a link, organisation as a build-operate-transfer scheme;
- **b)** road-pricing on a regional expressway network;
- **c)** zonal road-pricing; or
- **d)** privatisation of regional public transit.

In case **a**, two situations are possible: In the left-hand illustration of Figure 5.2, the considered link is combining two distinct parts I and II of the network. In this case, the private operator is able to generate viable estimates of his expected income, because he is able to control the demand, assuming he has a reliable forecast of the demand side. This situation is promising for the private operator, but not as much for society as a whole, because it is probable that the private firm will be able to apply monopolistic pricing. Prototypes for this situation are the Channel Tunnel and the Alpe tunnels.
In the right-hand illustration, the considered link is part of a closely-knit network. Now, the firm operating the link is influenced by the behaviour of the (public) firms which are operating the rest of the network. We see here that these relationships can be either complementary or substitutional. If the other firms act competitively, the private firm has no control on prices and cannot behave monopolistically. This situation seems advantageous for society, but only from the aspect of pricing on competing routes. The load pattern on the network can only be optimised if the firms cooperate, which means that the other firms do not apply strategic prices to prevent travellers from choosing the route via AB. Formulating this situation as a cooperative game, we would realize that a compensation scheme is necessary to form a grand coalition which can provide maximal cost efficiency.

A prototype for this situation is the MAGLEV-link between Hamburg and Berlin. A private operator of the MAGLEV could (under extremely positive assumptions) make a profit, if the railway company (Deutsche Bundesbahn) does not react, even though it will be losing a major part of its market in the corridor. If the Deutsche Bundesbahn reacts by lowering prices for the Inter-City-train, it can improve its own cash balances, but the MAGLEV operator will run a loss. This shows that it is very difficult -- sometimes impossible -- to construct a market according to the classical ideal, because the market structure is in most cases monopolistic or oligopolistic.

Case b represents a road-pricing scheme which is applied only on roads of the highest quality category (AB and CD in Figure 5.2). This measure could be introduced using the argument that expressways are very expensive and that the income is needed to extend the high level network. Such an argument will probably be accepted by the users, because they are used to the “good service -- high price” argument from their experiences in other markets. But what will happen with the load pattern on the network after introducing the tolls? Inevitably, the price-sensitive part of the demand will partly shift to the (lower quality) rest of the network and will produce more accidents, air pollution and noise than before. This means that a partial analysis of the shifts in demand is not sufficient to determine the probable outcome. A complete analysis and assessment of the network-wide effects may show that partial applications of road-pricing schemes are counterproductive. One prototype is the French LASER-project (a plan for an orbital tunnel around Paris), where the planned underground tunnel is regarded as a “first class service” which justifies the

![Figure 5.3. Road pricing on an urban expressway network](image)
"first class price" (Papon, 1991). A second example is the German Autobahn system, for which an electronic road-pricing is being considered. Early studies of this possibility support the hypothesis that some traffic will be diverted to roads of lower grades, for which accident rates and congestion problems are likely to be higher. This holds, in particular, for agglomeration areas, where a major part of traffic on Autobahnen is short distance travel.

Case c denotes a situation where the road manager tries to control traffic in congested areas by differentiated zonal user charges (Figure 5.3). The problem which arises from sharp differentiation of zonal prices is again that traffic can shift to other routes, therefore circumventing high density areas, on roads of lower quality, which once more produces higher accident rates and pollution externalities. Second, such a scheme would create incentives to change travel patterns such that short trips to the centre would be substituted by longer trips to sub-centres (Steierwald et al., 1992).

Figure 5.4 Zonal road pricing system for Stuttgart

Finally, case d is related to the often-discussed issue of privatising public transit. The British example has shown that privatisation of single lines by tender cannot provide a satisfactory solution. The attractiveness of public transit is highly dependent on coordinated services, time-tables and tariffs. To preserve synergy effects in the public transit network after privatisation, it is necessary either to form larger units or to control the private firms by using "coordination authorities". What can be learned from the British lesson is that line concessions should be substituted by network concessions, and that the interface between the private networks needs strict coordination and monitoring by public authorities.
Transaction costs

The introduction of economic instruments may be associated with high transaction costs such as:

- preparation, planning and legal foundations;
- physical equipment needed for charging systems;
- information and advertisement;
- information failure and other activities designed to evade the charges; and
- monitoring and control of private operators.

Preparation and planning of a private infrastructure project can be more expensive than for a public project. For instance, a public road project can be separated into single sections and the construction in the first section can be started today, even though the property rights for section \( n \) are not yet owned by the public. In the case of privatisation, the property right of the whole link has to be assigned to the private consortium, and the project cannot be started unless the property rights for all sections are transferred. Furthermore, the privatisation of individual links is only possible if there is agreement on all problems concerning interfaces, common costs (or benefits) and risk sharing (i.e. cost, market, and political risks). Preparing the contracts for private infrastructure facilities can be extremely costly for both private agents and for the public. After a initial period of euphoria about private financing for transport infrastructure projects, banks eventually begin to react reluctantly and insist on major public involvement in the project, in order to control this type of a risk.

The costs of implementing charging systems depend strongly on the technology used. Although most turnpike systems on freeways indicate cost figures which are about 20-30 per cent of income, modern electronic-pricing by smart card systems is said to be much more cost-efficient, so that only 15 per cent of the income needs to be spent for equipment control and administration (Janson, Nemoto and Patterson, 1990). Nevertheless, this is still a significant cost compared with an increase in fuel taxes, which can be achieved at almost zero incremental cost. But the big disadvantage of a fuel tax is that it cannot be differentiated according to economic or environmental characteristics in specific regions, because people would avoid filling their tanks at gas stations located in high-price regions.

Incurring information costs is a necessary element of increasing rational economic behaviour, which is the main reason for using market instruments in the first place. This information should help travellers choose the best time, the best mode or the best route for their planned trips. Studies in the context of the DRIVE-project have shown that it is possible to considerably increase information levels in transport at relatively low costs, but that generating complete information on network conditions, and providing a continuous on-line service on route and mode choice will be very costly.

Although improved information will lead to better economic choices, one also has to consider that any remaining information failures may cause unexpected responses and often frictional losses. For example, a considerable percentage of road users does not follow recommendations on route-orientation because they have some previous experience that indicates that these recommendations are sometimes inaccurate. Even a bigger problem is that of unplanned user reactions to pricing schemes. In trying to escape from newly priced transport links or zones, people might move longer distances or choose sub-optimal routes. It is also possible that zonal road-pricing stimulates people to choose other destinations, e.g. to change the shopping centres that they visit (Steierwald et al., 1992).

If the public sector tries to introduce more market efficiency into the transport sector by choosing the privatisation route, it has to consider that the private firm will maximise private profits and will not automatically fulfil public expectations. This means that regulating the private firm might be necessary,
which will, in turn, impose monitoring and control costs. Therefore, the reduction of X-inefficiency may simultaneously induce an increase of Y-inefficiency (higher external diseconomies by private operations), if there is no insufficient public sector control. As Sappington and Stiglitz (1987) have shown, the efficiency advantages of private operations have to be compared with the additional costs of public interventions, monitoring, and control, before taking a decision concerning the desirability of privatisation.

Classification problems

It is well known that classification problems occur in private markets and may induce inefficient allocations in a world of uncertainty (for the case of the market for lemons, see Akerlof, 1970). If private market instruments are introduced into the transport market, some of these types of problem can also emerge. These can consist of both economically-based and politically-based classification problems.

In the first category, examples of segmentation problems include:

- defining user classes;
- separating zones; and
- separating time ranges

for both a road-pricing system, and for the allocation of environmental costs. The classification problem arises if users are assigned to classes according to mean or expected values of their behaviour. Take, for example, the case of heavy load lorries which may be assigned to the user classes 20-30 tonnes and 30-40 tonnes, according to their total weight. If these user classes have to pay very different charges, motivated by different road track costs, contribution to congestion and traffic noise, based on the mean values of costs (25 or 35 tonnes), then road haulage firms will be stimulated to operate trucks of 29 and 40 tonnes total weight only. As this does not correspond with economic efficiency such a classification would lead to a sub-optimal allocation.

There is also a political risk which occurs when classifying users with special rates:

- residential/non-residential users;
- emergency services (fire police, community services);
- special user groups (young, old, handicapped);
- income classes; or
- classes of advantaged/disadvantaged groups.

As a rule, classification problems are much more difficult to solve for public agencies than for private firms. This means that trying to introduce market instruments by letting public institutions act as private firms can provoke bitter resistance among people, because economic principles of classification can conflict with feelings of social justice and equity. For instance, the introduction of "Stockholm type" entry permits for cars, coupled with the purchase of public transit-tickets (they were planned, but not introduced, in Stockholm), failed in the Stuttgart region because the States' Ministry of Transport tried to classify users according to their estimated accessibility to PT-stations. So it could happen that a road was defined on the borderline between accessibility regions, such that residents living on two sides of the road had to pay different charges. People ultimately rejected this proposal because they thought the system was unfair. Political problems of this type will usually occur with zonal price systems. But price differentiation according to the time of the day, or the level of congestion, may also hit captive low-income groups, and will therefore induce similar equity problems.
Principal agent problems

"Principal agent" problems are well-known in private business, when the owners of capital assign management responsibilities to professionals. The principal agent problem can be roughly defined as the process of establishing a system of payments, information flows and control mechanisms to ensure that the professional managers fulfil the objectives of the capital owners, while still making a profit for themselves. Privatisation of public sector transportation activities leads to quite similar relationships. The public (being the principal) may assign management responsibility (e.g. for operating a railway service) to a private company, which is assumed to know more about their required technology, and which can produce the service more efficiently. The private agent is forced by contractual arrangements to observe the objectives of the principal (i.e. the public sector).

The big difference between private/private and public/private "principal agent" relationships is that, in private markets, all participants have the same concept of the overall efficiency of a firm (i.e. monetary profits). But if the principal is the public sector, objectives other than profit-maximising will prevail (e.g. minimising environmental externalities or adverse distributional impacts). Until now, the theoretical research has not succeeded in providing clear answers concerning whether mixed public/private principal agent relationships are workable (Bös, 1991).

We can therefore assume that privatisation can proceed on the basis of sound economic theory, so long as the public objectives do not differ significantly from private ones. This means that overall efficiency has to be measured in terms of financial income or loss by both partners. In the light of this partial efficiency concept, the privatisation of the public bus companies in Britain can be seen as a success, because these measures contributed to the resolution of financial problems. But if there are other public objectives which are negatively affected by shrinking modal shares of public transport in Britain, then the evaluation of these measures may change. The example of the response of US-railway companies with respect to the passenger transport regulation before the Stagger's Act is helpful for illustrating the point that forcing the principal's objectives into the decision environment of the agent (generally by regulations), will lower overall efficiency of the management and will produce counter-productive incentives for the agents. Before the Stagger's Rail Act in 1980, U.S. private rail companies had to provide passenger transport service if there was demand. As passenger transport was not profitable, the companies minimised the quality of this service, and succeeded in most cases in reducing the demand so much that the service could eventually be cancelled anyway (see Boyer, 1990).

Impacts on land use

Strong voices are often heard on the road-pricing issue from the retail trade (see Jansson et al., 1990). Retail traders are usually concerned that road-pricing schemes might reduce trips for shopping purposes. Flexible environmental charges, related to congestion, could have similar effects. These voices are supported by planning experts who apply partial models of spatial distribution which are calibrated by accessibility measures.

Experience which has been gained so far with restrictive policies towards cars in downtown districts does not support these arguments. Traffic restraint effects can create attractive spaces for shopping and other activities in the central districts. As road-pricing is a very flexible instrument it could help to substitute "hard" by "soft" restrictions, such that the attractiveness of downtown shopping could actually be increased. The structural effects which have been observed are a diversion of "low value/high transport needs" commodities from the centres to the suburbs, while "high value/low transport needs" commodities have been diverted from the suburbs to the centres.
The question whether road-pricing and environmental charges lead to more or less commuting activities cannot clearly be answered. As car travel in urban agglomerations becomes more expensive, the reaction of people could be to choose residential locations outside the agglomeration. On the other hand, prices for car driving would also increase in less congested areas such that a balance between the higher costs per km inside and the higher distances travelled outside the agglomerations could be achieved. Furthermore, the quality of public transport can play a decisive role. People can avoid the costs of car travel in agglomerations much better by choosing public transport than in areas of low population density. In any event, a policy of increasing centralisation of land use in the suburbs to improve the chances of public transport would be supported by road-pricing and environmental charges.

Privacy

An efficient pricing system cannot be based on charging tolls at turnpikes on the road or on the sale of coloured stickers in different cities or countries. Turnpike toll systems, as they have been introduced in some European countries on highways, tunnels or bridges, lead to high transaction costs and time losses for customers. These disadvantages outweigh the economic advantages if there are many interfaces between the toll roads (e.g. motorways) and the toll-free roads. In these cases, electronic road-pricing is necessary. Electronic road-pricing works either by external registration and direct charging to individual driver accounts, or by "smart card" readers inside the car. The "external registration" approach leads to problems of privacy and personal integrity, because data on the spatial movement of individuals would be recorded which theoretically could also be used to monitor private behaviour (fear of "Orwell's 1984"). When the charging is performed inside the car from smart cards, there is no problem about privacy concerning individual car drivers, but there is still the problem of control.

If control is carried out by video registration or electronic license plates, problems of privacy might arise once again. In this case, it will be necessary to restrict registration to those cars which are not equipped with active card readers and which therefore cannot be charged by the system. Car drivers may be afraid of tight electronic controls on driver behaviour (speed, distance, etc). Together with a general distrust that people have concerning the operation of electronic systems, the feeling of one's personal integrity being threatened by tight control systems is the main reason for the intrinsic reluctance of people to accept this type of control system. The present state of technological development continues to give experts representing opposing groups an opportunity to doubt the absolute reliability or legal security of electronic pricing systems.

Redistribution of income and equity

It was pointed out earlier that the distributional effects of road-pricing are not necessarily regressive, as argued by many interest groups. Since the distributive argument plays an important role, it is elaborated in more detail below. Small (1983), as cited in Sims (1992), has studied the effects of a road-pricing scheme on three income classes: low, medium, and high-income groups. The results of his analysis are summarised in Table 5.1. The main conclusions of this research are:

- The question of whether congestion charges have regressive or progressive effects has no unique answer. It cannot be answered by theoretical modelling, but only by empirical testing. And it depends on the particular effects which are included in the analysis.
- The absolute welfare-impacts of the toll are highest for the high-income groups and lowest for the low-income groups. But relating these welfare losses to income produces the reverse ranking. Therefore, absolute welfare impacts are progressive, while relative welfare impacts are regressive.
• If the toll revenues are redistributed uniformly to each consumer, the result is a net transfer from the rich to the poor. This means that the negative impacts on income distribution can be compensated for by a lump sum redistribution.
• If we ignore the redistribution of toll revenues and evaluate only the welfare effects of the imposition of the toll, and the resultant time savings, the result is clearly adverse to low-income commuters (Sims, 1991).
• The same holds if the revenues are distributed uniformly. The low-income group has the lowest net welfare gain.

### Table 5.1 The incidence of congestion tolls

<table>
<thead>
<tr>
<th>Effects</th>
<th>Income class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare effects of price increase</td>
<td>1 (low) 2 (medium) 3 (high)</td>
</tr>
<tr>
<td></td>
<td>-17.1 -20.2 -22.4</td>
</tr>
<tr>
<td>Uniform redistribution of toll revenues</td>
<td>19.7 19.7 19.7</td>
</tr>
<tr>
<td>Net welfare effect (excluding savings)</td>
<td>+2.6 -0.5 -2.7</td>
</tr>
<tr>
<td>Welfare effects of price increase and time savings</td>
<td>-9.9 -6.3 -0.5</td>
</tr>
<tr>
<td>Net welfare effect (including time savings)</td>
<td>+9.8 +13.3 +19.2</td>
</tr>
</tbody>
</table>

Cents/workday/commuter


Therefore, the question is whether the equity effects are measured on the basis of net welfare effects, including or excluding the benefits from time-savings. Clearly, the rich benefit more because the value of their time is higher. From a microeconomic perspective, this higher value of time can be justified on the basis that higher-income people would produce a higher value added in the time saved. Therefore, the inclusion of the time-saving element can be interpreted as the productivity potential of time savings, which should in turn, be excluded from equity considerations. Following this reasoning, the net welfare effects (excluding time savings) is the appropriate measure of equity impacts. This measure has a positive sign for low-income commuters. This example clearly shows that the pricing system will only produce neutral equity results if compensation payments are made to correct for the relative welfare losses of the poor.

**Impacts on international relationships and trade**

The introduction of private market rules by infrastructure and environmental charges provides a better allocation of produced and natural resources. This statement, which is also in the spirit of the White Paper of the European Commission (1992) on a global concept for sustainable mobility in the European Union, is generally agreed on by the EU countries. But there are very different opinions concerning the implementation of this issue in the freight transport market. Although a proposal of the British presidency in December 1992 to introduce road user charges on the base of infrastructure costs (leaving the possibility to add a CO₂-charge to the fuel tax) was supported by six countries (U.K, France, Italy, Germany, Spain, Portugal) and could be accepted under certain conditions by three other countries (Greece, Belgium, Luxembourg), it was heavily opposed by the Netherlands, Denmark and Ireland. The latter fear a national
way of fixing the charges, in particular in Germany, which is the largest transport market of the Union (about one third of the total freight transport volume of the EU countries is generated in Germany).

User charges, environmental fees and stricter traffic regulations in Germany based on the "territoriality principle" could have impacts on the market positions of the competing road haulage industries of the countries. German truckers would profit, while Dutch and Danish truckers would lose. Therefore, these countries strongly advocate a fixing of user charges on the EU level, i.e. by a "Euro-Vignette". Of course, a Euro-Vignette cannot be derived from optimal allocation calculus, it can only be derived from fairness considerations. The Dutch fairness arguments are twofold. First, it is pointed out that the importance of the road haulage industry is much higher in the Netherlands than in Germany, where other industries are also strongly protected by the public sector -- e.g. not regarding their environmental impacts on other countries (e.g. steel industry). And second, the Dutch argue that the environmental impacts of Dutch trucks in Germany are offset by the export of water pollution from Germany to The Netherlands through the river Rhine.

Because the German government has developed its position concerning cost allocation and environmental protection in transport only in the recent years, while it had previously agreed on establishing a European legacy in the transport sector where the principle of non-discrimination (and not the costs for the environment) played the dominant role, it will be hard to gain acceptance of the latter position. The European Law Court, for instance did not accept the environmental argument when it stopped the first German attempt to introduce a user charge for heavy load trucks in 1991.

This example shows that there is not only a problem of equity with respect to social groups which arises from introducing market instruments, but also a serious problem of international fairness for competing industries. In any case, the boundaries for "environmental arbitrage" have to be fixed in a new way in the EU, as well as for new competitors from central European countries (Poland, Bulgaria). For instance, a recent study of The Netherlands Institute of Economic Analysis (cited in DVZ, 1993, on the impacts on strict speed regulations in Europe) has shown that this measure would disadvantage the Dutch road haulage industry because of a labour cost increase of 10 per cent and a similar increase of time costs, which cannot be offset by a reduction of the costs of fuel consumption by 8 per cent. At this point, the argument of non-discrimination seems to be over-stressed, since it is directly posed against improving safety and environmental standards or the market position of the railways.

**Government failures**

Public policy tools have been developed in the past without paying much emphasis to environmental issues. The tax system for instance is often counterproductive in that it does not generate enough incentives to save environmental resources. But many controls and regulations which have been established in the past also have no environmental background. The OECD has issued a volume on this problem recently (OECD, 1992) the main results of which are summarised later.

An important consequence of government failures is inertia against introducing the market instruments that would be necessary for an optimal control of transport demand and supply. The public sector in general is a bad manager because the incentives for public servants are counterproductive (e.g. there is no correlation between economic efficiency and salaries), and because public agencies are exposed to the influence of lobby groups and of the press. Although several management and appraisal techniques have been developed in the public sector which could help to make public sector management more flexible and efficient, the deficiencies with respect to economic incentives are so grave that, in most countries, the introduction of market instruments would hardly generate major changes, unless it were also combined with significant institutional changes.
For reasons given earlier, there are also doubts that the public sector would be able to implement an optimal environmental charging/taxation policy. This can only change if the voters respond positively to environmental policy actions which put restrictions on their behaviour. This means that information on the state of the environment has to be improved, which should result in a change of values and more general acceptance of sustainability issues. Referring to the present discussion of an energy/CO\textsubscript{2} tax in Europe, it seems that much work still remains to be done in this direction.

Again, this weakness of the political decision mechanism could partly be overcome by institutional changes. Instead of charging people directly for polluting activities, the public could establish an "Eco-Bank", which could control the issuance of pollution permits, as well as the subsequent trade in these permits. The weak point of this type of system would be that a public authority would still have to decide on the national (or EU-wide) pollution limits. After some period of introduction, the lobby forces would probably concentrate on the public decision process of fixing the limit values. Therefore, the comparative advantages of tradeable permits approaches from the institutional point of view might vanish if there is not broad acceptance of the underlying environmental policy in general.

**Summary of major obstacles to road-pricing from the viewpoint of involved parties**

*The concept*

Economically-based user charges are necessary elements of a market concept for the transport sector. But this approach is so heavily opposed that it is worthwhile to analyze the reasons for the objections in the framework of institutional economics. This framework starts with defining the involved parties, i.e., the players in the societal game, their interests, and their viewpoints. In a study of the Swedish VTI-Institute on road-pricing Jansson *et al.* (1990) categorise the parties in the following way (Table 5.2):

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-category</th>
<th>Interest/viewpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road user</td>
<td>Private</td>
<td>Less out-of-pocket cost</td>
</tr>
<tr>
<td></td>
<td>Commercial</td>
<td>More net trip benefit</td>
</tr>
<tr>
<td>Public transport user</td>
<td></td>
<td>Service quality of the public transport system</td>
</tr>
<tr>
<td>Resident</td>
<td></td>
<td>Relief from environmental problems</td>
</tr>
<tr>
<td>Retailer</td>
<td></td>
<td>Brisk business</td>
</tr>
<tr>
<td>Expert</td>
<td>Economist</td>
<td>Economic efficiency based on marginal social cost</td>
</tr>
<tr>
<td></td>
<td>Engineer</td>
<td>Technical reliability and simplicity</td>
</tr>
<tr>
<td>Politician</td>
<td></td>
<td>More supporters for him/her</td>
</tr>
</tbody>
</table>

The political controversy can be represented on the basis of these categories. Obviously, the power of players may be different in different countries or in different periods of time. Nevertheless, this general framework is useful for characterising the difficulties in generating social consensus on road-pricing schemes.
Conclusions relating to the major viewpoints of the "players" in the transport policy "game" were then summarised by Jansson et al. (1990), and are illustrated in Table 5.3.

<table>
<thead>
<tr>
<th>Player</th>
<th>Viewpoint</th>
<th>Position</th>
<th>Concern</th>
<th>City observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Discrimination against the poor</td>
<td>N</td>
<td>rp</td>
<td>Ac</td>
</tr>
<tr>
<td>Private &amp; Commercial</td>
<td>Tangible charge and vague benefit</td>
<td>N</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>Invasion of privacy by plate checking and videotaping</td>
<td>N</td>
<td>rp</td>
<td>HK</td>
</tr>
<tr>
<td></td>
<td>A reasonable way of raising revenue for new road construction</td>
<td>Y</td>
<td>so</td>
<td>Be, Os</td>
</tr>
<tr>
<td></td>
<td>Unnecessary, due to relatively moderate congestion in case study cities</td>
<td>N</td>
<td>so</td>
<td>Ac</td>
</tr>
<tr>
<td></td>
<td>Interferes with right to travel</td>
<td>N</td>
<td>rp</td>
<td>Ac</td>
</tr>
<tr>
<td></td>
<td>Relocation of traffic problems</td>
<td>N</td>
<td>rp</td>
<td>Ac</td>
</tr>
<tr>
<td></td>
<td>Difficulty in enforcement</td>
<td>N</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>Study report prepared by the government is not credible</td>
<td>N</td>
<td>so</td>
<td>HK</td>
</tr>
<tr>
<td>Public transport user</td>
<td>Probable improvement of public transport system in long-term</td>
<td>Y</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>Infeasible capacity expansion to cope with demand transferred from car</td>
<td>N</td>
<td>so</td>
<td>Ac</td>
</tr>
<tr>
<td>Resident</td>
<td>Easy movement of pedestrians and cyclists</td>
<td>Y</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>Necessary to tackle severe environmental problems</td>
<td>Y</td>
<td>so</td>
<td>St, To</td>
</tr>
<tr>
<td>Retailer</td>
<td>Harmful to vitality of business</td>
<td>N</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>No insurance to compensate the adverse effects by road-pricing</td>
<td>N</td>
<td>so</td>
<td>Ac</td>
</tr>
<tr>
<td>Economist</td>
<td>Road-pricing's advantage on peak hours traffic reduction only</td>
<td>Y</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>Empirical simulation models producing results favourable to road-pricing</td>
<td>Y</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td>Engineer</td>
<td>Electronic Road-pricing's technical feasibility proved by HK experiments</td>
<td>Y</td>
<td>rp</td>
<td>Co</td>
</tr>
<tr>
<td></td>
<td>Uncertainty of being able to cope with foreign cars without the coded plate after 1997</td>
<td>N</td>
<td>so</td>
<td>HK</td>
</tr>
<tr>
<td>Politician</td>
<td>Importance of strong political leadership</td>
<td>Y</td>
<td>so</td>
<td>Si</td>
</tr>
<tr>
<td></td>
<td>Legal barrier of prohibitive tolls on federally aided roads</td>
<td>N</td>
<td>so</td>
<td>Ac</td>
</tr>
</tbody>
</table>

**Legend:**
- Concern: so: each city’s particular socio-economic features without direct relation to road-pricing;
  rp: advantages and disadvantages concerning inherent characteristics of road-pricing.
- City observed: Si: Singapore; HK: Hong Kong; Be: Bergen; Os: Oslo; St: Stockholm; Ac: American cities; To: Tokyo; Co: several cities.

Source: Jansson et al. (1990).
Without going through all the steps of modelling the decision-making process, we can derive some essential conclusions from this research (and from an institutional point of view):

- Imposing a pricing scheme is only acceptable if it can be associated with positive consequences by all of the major actors involved. For example, this probably means that user-charge revenues will have to actually be used to finance transport investments or to reduce other taxes. The argument that user charges help to increase welfare by reducing congestion is generally too abstract for many groups.
- Negative impacts on the distribution of income are simply not acceptable. Therefore, introduction of a pricing system must be combined with lump-sum redistributions to correct for regressive income effects.
- Road-pricing and environmental-charging systems have to be discussed with all groups involved, and the ground has to be prepared by a thorough communication process. This is because the politicians who decide on road-pricing systems are intrinsically interested in being re-elected, and they will not adopt such a system in the face of resistance from major lobby groups. Therefore, a dynamic process will have two important properties. First, there will be no policy solution without exercising some threatening power, e.g. by linking the road-pricing system to an investment program. Second, it will not be possible to introduce the optimal system (from the economist's point of view) all at once. It can only be done in a "step-by-step" process.

Possibilities for removing real and psychological obstacles

Real obstacles

Synergy in networks

To preserve synergy in networks, two approaches are possible. First, powerful regional- or network-wide coordination agencies could be established. In this case, the operations services could be auctioned in small pieces to private companies which can themselves be small, e.g. operating only one line. Second, contracts could be established with large companies for the provision of regional- or network-wide services.

In this case, it would be not possible to give free entry to small companies, because they could not guarantee a coordinated regional- or network-wide service. The development of public transport clearly shows that it is necessary to combine intra-city and intra-regional transport to supply an integrated service for cities and their environment. The examples of Karlsruhe and Manchester demonstrate that integration of networks is a most important step for improving the quality of public transport in the cities mentioned. These cities have either already realised (Karlsruhe) or planned (Manchester) combined urban and regional transport using network facilities of the national railway companies for building up an integrated urban/regional light rail system.

It is slightly easier to operate parts of road networks through private companies than it is for railway networks. This is because it is not necessary to coordinate time-tables, tariffs or information systems, and because the operation of cars and trucks works in a totally decentralized manner. However, since there is not much practical experience with regional- or network-wide private road network operating companies, a first step could be to establish private firms with public ownership.

In this case, it would be easier to work out appropriate arrangements for network interfaces, tariffs and income sharing. In a second step, a share of the capital (e.g. 49 per cent) could be assigned to private capital owners. On the other hand, a 100 per cent privatisation is possible for parking facilities, airports,
airlines and value added services on networks (e.g. freight shuttle train operators on particular OD-pairs), without disturbing network synergy. In other cases (single links or network parts with private monopolies), the influence of the public remains very important to avoid synergy losses (occurring for instance by non-coordinated pricing strategies) or private monopoly failures.

Transaction costs

Of course, one of the important general issues is to minimise transaction costs stemming from privatisation, or from applying private enterprise instruments to the planning, pricing and management of transport by public enterprises or agencies. There are a number of instruments available here, of which the most important are the application of modern telecommunication systems and a proper segmentation of the supply sector.

It is not unrealistic to anticipate that, in some cases, transaction costs will be too high, even if modern techniques are applied. For instance, the costs of introducing an electronic road-pricing system on German Autobahnen are estimated at between 6 and 18 Billion DM, depending on the actual performance of such a system. Therefore, the economic requirements for an optimal level of control have to be adjusted to the financial possibilities.

Classification problems

If different zones or time ranges must be defined for a flexible pricing system, it is useful to define smooth transitions between zones and/or times. Experience from telephone price differentiation shows that too sharp a price differential causes unexpected demand responses, which can generate other problems (e.g. more congestion along the boundaries of zones).

The same holds for the definition of user classes and privileged groups, if these cannot be unambiguously defined (for instance, by technical characteristics). To solve these "acceptance problems", as well as to reduce the propensity to cheat, screening systems must be simple and intuitively understandable. In general, people object to public agencies more than to private enterprises, when they are confronted with discriminatory prices. For instance, in the case of mandatory accident or life insurance, people will accept discriminatory rules, even though these rules have consequences for the distribution of income. The same holds for time-dependent parking prices charged by private operators. As a rule, therefore, discriminatory strategies which affect equity should be implemented by private institutions. The public sector can then correct for equity problems, not by subsidising transport activities, but by lump-sum payments to affected groups.

"Principal agent" problems

Experience with regulated private companies offers us some clear advice: minimise regulations which are directly counterproductive to private profit-maximisation. This guideline concerns at least the following activities:

• pricing policy;
• quantity of production;
• use of technology; and
• obligatory unprofitable service (imposed by regulation -- see earlier discussion).

This means that the market segments for private agents have to be defined in such a way that the firms can act as profit-maximising units. For instance, the separation of infrastructure from operations management in the railway sector is a step towards this goal. Infrastructure is a natural monopoly, which
needs public control, while operation of the network can be organised by private agents without the need for strong restrictions on their profit-maximizing behaviour.

If such a separation is not possible, and operators have to remain subject to tight public control or intervention, then some public form of the enterprise (possibly even including public ownership) is to be preferred. This is because, in this situation the costs of X-inefficiency are expected to be lower than the costs of monitoring/control, plus the costs of violating public regulations (Y-inefficiency).

**Impacts on land use**

As pointed out earlier, land use is generally not influenced negatively by applying economic instruments in transport. But it is necessary to anticipate the potential impacts by a systems analysis, if the market instruments are only applied to parts of a region or of the network.

**Privacy**

Although personal integrity and privacy previously seemed to be a significant barrier to the use of electronic-pricing methods in the transport sector, the newly developed "smart card" systems have contributed somewhat to overcoming this risk. Only if the smart card reader does not work at a given control point must the data of the car be registered, and the personal data of the car holder identified.

One reason that the smart card might not work could be that the card itself is no longer valid. In this case, the fault would lie with the user. The recording of user data would be legal in this situation, but regular follow-up would be required. A second reason could be a technical failure inside or outside the car. This could provoke serious problems and, in a "worst case" scenario, the electronic-pricing system could be stopped by the law courts, if the technology is not absolutely reliable.

**Redistribution of income**

If politically necessary, compensation to low-income groups for equity distortions caused by economic instruments may be appropriate. If so, this compensation should be made in lump-sum payments, and should be independent from transport activities. The volume of the payments should be oriented to the expected net income losses of the affected groups. Alternatively, a "tax deductions" approach could be used. But the disadvantage of a taxation approach is that it is hard to directly target low-income groups with these deductions. Low-income groups do not usually profit from tax deductions, because their incomes are generally taxed at low levels, if at all.

However, the essential problem here is not so much to identify the best compensation strategy, but to identify the groups concerned, and to prevent others from adopting rent-seeking strategies. For example, in Germany, it has been found that the social groups which would be most disadvantaged by road-user charges are single parents with children and families with many children. If compensation were to be given in the form of tax relief, high-income families with children would receive higher compensations than low-income families. Therefore, lump-sum payments related to the number of children of a family would be a better solution to these equity problems. In the case of Germany, this could easily be implemented by increasing the existing children’s allowance.

In the case of tradeable emission permits, one could look to a "fair" initial distribution of the emission permits to solve the equity problem: for example, every individual could receive a permit to emit a given quantity of CO₂. Individuals who produce less CO₂ than they are allowed could sell a part of their property rights to others who produce more emissions and are willing to pay extra for this right. This solution may be perceived as being fair because everybody starts from the same endowment.
Problems of international impacts

Facing the different national regulations of the transport markets of its member countries, the EU has decided to establish a new market structure based on economic principles. Liberalisation of the transport market is an element of the Treaty of Rome (Article 74) and will therefore be introduced step-by-step, ending with free cabotage on January 1, 1997. The common environmental policy of the Union has a much younger history. Article 130r of the Maastricht Treaty of 1990 defines the commitment of the EU countries to include the aspects of the environment into the common policy.

The liberalisation process in the transport market has been realised in a short time, as it basically started in 1985 after the judgement of the European Law Court. Therefore, it seems possible that the same speed might be realisable in environmental policy, such that medium term targets would be set and the countries could adjust to them gradually, in order to avoid losses for their industry.

Government failures

The major intervention failures, their effects and potential policy responses are summarised in Table 5.4.

Table 5.4. Major intervention failures and policy response

<table>
<thead>
<tr>
<th>Nature of Intervention Failure</th>
<th>Features of Failures</th>
<th>Policy Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Intervention Failures.</td>
<td>• Relative costs of using modes distorted.</td>
<td>• Full costing of environmental effects.</td>
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<tr>
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<td>• Overall cost of transport too low.</td>
<td>• Full marginal cost pricing.</td>
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<td>• Lack of long term incentive to adopt cleaner technology.</td>
<td>• Charges directly related to the use of infrastructure.</td>
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<td>• Excessive use of transport in sensitive areas.</td>
<td>• Fiscal transparency.</td>
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<td>• Appropriate up-dating of charges.</td>
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<td></td>
<td></td>
<td>• Improving environmental evaluation techniques.</td>
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<td></td>
<td></td>
<td>• Full environmental costing in investment appraisal.</td>
</tr>
<tr>
<td>Command and Control Failures.</td>
<td>• Inertia in changing standards.</td>
<td>• Greater flexibility in operation.</td>
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<td></td>
<td>• Lack of incentive to improve on standard.</td>
<td>• More self-correcting systems of control.</td>
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<td>• Problems of policy outside of zones of control.</td>
<td>• Coupling standards with financial incentives.</td>
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<td></td>
<td>• Sub-optimal method of attaining target improvements.</td>
<td>• Careful tiering of zones.</td>
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<tr>
<td>Administrative Failures.</td>
<td>• Poor enforcement of existing laws.</td>
<td>• Greater horizontal coordination of Agencies at local, regional, national and international levels.</td>
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<td></td>
<td>• Confusion over who is responsible.</td>
<td>• Greater vertical coordination between levels of Administration.</td>
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<td></td>
<td>• Development of conflicting policies.</td>
<td>• More emphasis on enforcement of existing policies.</td>
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<td></td>
<td>• Inertia in policy-making.</td>
<td>• Greater integration of environment into transport policy.</td>
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<td>• Improved training with regard to the environment.</td>
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</tbody>
</table>

Psychological barriers

Psychological barriers to the use of economic instruments can be identified in the following areas:

- fear of being exploited by a public or private monopolist, who tries to maximise the tax on income or profits;
- resistance against the loss of benefits stemming from the present cost allocation;
- a general feeling that transport networks are public facilities, which should be equally-available to all customers;
- distrust of decentralized territorial economic structures in the transport sector because of negative historical experiences, with road turnpikes or private institutions (e.g. private railway companies in Europe); and
- "missing fantasy" (e.g. in the case of markets for pollution permits, many people fail to imagine that this could work like trading shares at the bourse).

The basic ways in which these psychological barriers can be removed are:

- increased information;
- more risk-taking by experts in promoting the use of market instruments at the political level;
- using a piece-meal approach to ensure controllable outcomes;
- providing continuity in the policy debate and in political activities; and
- stressing positive aspects (e.g. profitability of environmental protection), instead of negative arguments (e.g. penalties for social costs).

The first rule is to provide better information about the effects of economic instruments. It is essential to convince high-income groups that they will profit (in terms of welfare gains) from a more efficient transport system.

The second rule says that experts can help in this process by transforming economic reasoning into more understandable terms. This means first that abstract arguments have to be made clear by using prototype examples. And second, it is necessary for expert judgements to incorporate not only synopses of the pros and cons of policy options, but also a weighting of these options, coupled with the clear recommendations in favour of more use of market instruments in transport. This also implies that the experts must take part of the political on risk themselves, and not let the politicians stand alone against the aggregate political power of lobby groups and the press.

Concepts are much easier to implement in aggregate if one can show that they work in the disaggregate (third point above). It seems to be impossible to introduce an optimal concept in its entirety at one time. The political "game" is a dynamic one, and new ideas have to prove their validity over time. Therefore, a road-pricing concept would stand a larger chance of success if it were started for selected parts of the network, with initially low prices, designed to adjust the demand behaviour smoothly, instead of producing "shocks".

Political recommendations

General conclusions

Some of the obstacles against economic instruments can be explained by normative deductions which show negative welfare impacts resulting of the imposition of these instruments in the transport sector.
These negative impacts include such things as:

- The "synergetic entity" of networks might be disturbed.
- Transaction costs and other costs of adjustment may occur which exceed the benefits of using economic instruments.
- Economic treatment of different segments of customers implies screening problems which are more delicate in the public sector than they are in the private sector.
- If the management and operation of networks is assigned to private companies, problems of information, monitoring and control may occur.
- The outcome of applying market instruments may disadvantage low-income classes, and thereby conflict with the goal of social equity.
- Instruments designed to collect revenues or to control law-abiding may also disturb personal privacy.

Although these problems can often be resolved, and generally only constitute only a reason to amend the type or application of economic measures (i.e. rather than to reject the measures entirely, they are often reinforced by psychological feelings and by specific campaigns of lobbyists. These "psychological obstacles" include:

- People fear having to pay not only for infrastructure use, but also for monopoly profits or subsidies to other public sectors.
- Users accustomed to free-riding reject payment systems, even though they might actually realise welfare gains from pricing.
- Public sector managers fear losing responsibility for tasks which form the basis for their reputations.
- The history of road-pricing in the late Middle Ages, and of private railways since then, provides a number of illustrative negative examples which strengthen psychological barriers.
- Many car owners are organised in automobile clubs, and make up their mind against economic instruments on the basis of negative statements made by club management and by the press.

This gives rise to the need for work on both the reduction of real obstacles and on the removal of psychological barriers.

**Recommendations for introducing economic instruments in transport policy**

Specific recommendations for reducing obstacles to the introduction of economic instruments in transport policy are summarized in Table 5.5. The individual obstacles and their major causes are illustrated in the first two columns. The third and fourth columns contains recommendations for the cases of both private and public organisations considering the application of market instruments. Obviously, there are several policy measures which could help to remove more than one obstacle. However, to avoid undue complexity in Table 5.5, the policy measures have been assigned to the particular obstacles which are likely to be most affected.
Table 5.5. Policy recommendations related to individual obstacles

<table>
<thead>
<tr>
<th>Obstacles</th>
<th>Major cause</th>
<th>Recommendations</th>
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<tbody>
<tr>
<td></td>
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<td>Case of application by private agents</td>
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<tr>
<td>Need to retain “network synergy”.</td>
<td>Joint cost and production functions in networks; sub-additivity of infrastructure costs for a monopolistic supplier.</td>
<td>(1) Privatisation of joint network segments under public monopoly control.</td>
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<td>(2) Privatisation of single objectives under a strong regime of public coordination.</td>
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<td>(3) Establishment of public coordination agencies to define areas of private competition; organising the auctioning of concessions to the private sector.</td>
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<tr>
<td>Classification problems.</td>
<td>Economic reasons in the case of user classes, zones, times, distances; and public reasons in the case of privileged users (emergency, fire, police, residents, etc.).</td>
<td>(1) Privileged groups (e.g. emergency cars, fire, police, residents in downtown areas) should not be treated differently by the private operator; it is up to the public sector to reimburse their costs, according to public policy objectives.</td>
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<td>(2) Minimise conflicts with social goals when prices are discriminatory.</td>
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<td>(3) Differentiated charges should be fixed and known in advance.</td>
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<td>(4) Clear and simple rules for price differentiation; smooth transitions between zones are required (also for public enterprises).</td>
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<tr>
<td>High transaction and management costs.</td>
<td>Differentiated charging regimes (with tolls varying in time, distance, and space); need for a highly efficient system of registration, for AVI-technology, and for enforcement.</td>
<td>(1) Clear segmentation of the supply side, in order to reduce complexity.</td>
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<td>(2) Preference for the use of build-operate-transfer models for separate objects (e.g. Channel Tunnel).</td>
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<td>(3) Intercity transport (expressways, major railway links) are more easily privileged than urban network segments, because of their high levels of interaction with other parts.</td>
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<tr>
<td>Obstacles</td>
<td>Major cause</td>
<td>Recommendations</td>
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</tr>
<tr>
<td><strong>&quot;Principal agent&quot; problems.</strong></td>
<td>Assignment of management from public decision-makers to professional managers causes problems in setting payment schedules, in defining information flows, and in monitoring and control.</td>
<td>1) Define the supply segment in such a way that the private agent can still act as a profit maximiser.</td>
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<td>1) Introduce private forms of efficiency-enhancing tools in public enterprises.</td>
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<td>2) Do not introduce regulations which conflict directly with profit-maximising objectives.</td>
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<td>2) Give managers of public enterprises an opportunity to serve on the Boards of private companies, and thereby to eventually construct mixed public/private networks.</td>
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<td>3) Give private agents the opportunity to combine their transport business with other value-adding services.</td>
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<td>3) Do not allow political parties to influence the careers of managers in public enterprises.</td>
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<td>4) Define clear criteria for cross-subsidisation between various segments of the supply side (from road users to public transport).</td>
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<tr>
<td>Impacts on land use.</td>
<td>Change of land use induced by changing relative transport prices in space.</td>
<td>1) Avoid sharp distinctions between zones (i.e. by using &quot;pure&quot; pricing strategies).</td>
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<td>2) Suppress undesirable attributes of economic instruments by using complementary strategies (e.g. by introducing prices on access roads to shopping centres in the outskirts of cities at the same time as tolls are introduced on major highways).</td>
</tr>
<tr>
<td>Need for redistribution of income (equity issues).</td>
<td>Low-income groups are often disadvantaged by private market mechanisms.</td>
<td>1) Private enterprises should be free of any redistributive burdens; this is clearly a matter for public policy.</td>
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<td>2) Pricing strategies should be coordinated with the responsible public coordinating agencies, in order to define appropriate public compensation schemes.</td>
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<td>1) Construct &quot;packages&quot; that involve pricing, investments, and cross-transfers; avoid discussion about the isolated (partial) effects of road-pricing itself.</td>
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<td>2) If disadvantaged low-income groups can be identified, construct a system of redistribution to compensate these groups (e.g. allowances for families with children).</td>
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<td></td>
<td>3) If the equity argument is strong but a clear identification of disadvantaged groups is impossible, a lump sum redistribution of excess income to all households is recommended.</td>
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<tr>
<td>Obstacles</td>
<td>Major cause</td>
<td>Recommendations</td>
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<tr>
<td>Need for privacy.</td>
<td>Modern technologies might be seen as an invasion of privacy.</td>
<td>(1) Apply AVI technologies with anonymous charging.</td>
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<td>(2) Restrict information flows to those who do not require personal data or license identification.</td>
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<td>(3) Establish a control system in which the participation of the police is minimised. Clarify the</td>
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<td>legal requirements for private control and define the interface between private and public</td>
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<td>control activities (i.e. traffic regulations, cash control, etc.).</td>
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<tr>
<td>Problem of international impacts.</td>
<td>Introduction of market instruments may change the competitive situation of companies which operate internationally.</td>
<td>(1) In the case of relatively small projects (tunnels, bridges), there will generally be no international problem.</td>
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<td>(2) In the case of large network companies, the situation is similar to that of public agents.</td>
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<tr>
<td>Government failures.</td>
<td>Inertia in setting or changing standards (e.g. for the emission of pollution certificates) creates a risk that excessively low standards will be set, resulting in too-low prices being established for transport services.</td>
<td>(1) Establish an &quot;eco-bank&quot; to control the issuance of pollution certificates and trading at the bourse.</td>
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<td>(2) Assign the task of defining standards to a public agency for the environment.</td>
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<tr>
<td>Psychological barriers.</td>
<td>People are not accustomed to market instruments; consequently, the real problems associated with economic approaches tend to be reinforced by their intrinsic reluctance to accept these tools.</td>
<td>(1) Avoid the impression that user-charging is being done only to maximise profits.</td>
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<tr>
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<td>(2) Start with low prices and appropriate testing of new technologies.</td>
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</tbody>
</table>
REFERENCES


