External Costs in the Transport Sector – A Critical Review of the EC Internalisation Policy

BY HERBERT BAUM, TORSTEN GEIßLER, JUTTA SCHNEIDER AND JAN-ANDRÉ BÜHNE, COLOGNE

Introduction

In the year 2006 the Directive 1999/62/EC (Eurovignette Directive) on road charges was amended by the Directive 2006/38/EC which provided a framework that allowed the EU Member States to charge road users for the use of infrastructure. One constraint of the current Directive is the requirement that revenues may not exceed related infrastructure costs. The European Commission's original plan was to include elements of external costs in the charges. However, the European Parliament insisted in the adoption process of the Directive that further analysis on this subject is necessary. Article 11 required the Commission to present a generally applicable, transparent and comprehensive model for the assessment of all external costs no later than 10 June 2008, to serve the basis for future calculations of infrastructure charges. This model shall be accompanied by an impact analysis of the internalisation of external costs and a strategy for a stepwise implementation of the model for all modes of transport.

In preparation of this task the European Commission has launched a study to develop a model for assessment and to prepare proposals for the internalisation of the external costs. Starting from a discussion paper on "Methodologies for external cost estimates and internalisation scenarios" (March 2007) a consortium under the lead of CE Delft has conducted this research study. The final product, the "Handbook on estimation of external costs in the transport sector" with cost estimates for passenger and goods transport was published in December 2007. In addition, the European Commission organised a public consultation (October-December 2007) and a stakeholder workshop (January 2008) on internalisation of external costs.

Authors' address:
Prof. Dr. Herbert Baum
Dr. Torsten Geißler
Dr. Jutta Schneider
Dipl.-Volksw. Jan-André Bühne
Institute for Transport Economics at the University of Cologne
Universitätsstr. 22
50923 Cologne, Germany
e-mail: h.baum@uni-koeln.de

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In July 2008 the European Commission presented the Greening Transport Package. Besides the Greening Transport Communication and Inventory the package contained the internalisation strategy of the Commission (incl. impact assessment), the proposal for amending the Eurovignette Directive and a communication on rail noise. Obviously, the greatest need for action is identified in road freight transport. The proposal for road sector allows the calculation and variation of tolls according to traffic-based noise and air pollution as well as congestion.

This study was carried out in spring 2008 for ACEA to provide orientation in the process of the Directive amendment. The study was finished in May 2008 before the Greening Transport Package was presented. Therefore, the study does not comment on the proposal which was released in the meantime. Moreover, the study is focused on a critical review of the already identifiable elements of the internalisation policy. Therefore, the study centres on the CE Delft Handbook, which provides the basis for the EC proposal. The requirements for a revision of the Eurovignette Directive are also examined. The intention of the study is a critical discussion of the methods, the cost estimates and the economic consequences of the present materials and the expected proposals of the Commission. Thus the study should provide a foundation for a rational policy for the problem of external costs.

1. The framework of the Handbook

The mandate given to the European Commission by the European Parliament is to present a transparent and comprehensive model for assessment of all external costs. The Handbook was commissioned, "to summarise the existing scientific and practitioner's knowledge. The central aim of the study is to provide a comprehensive overview of approaches for estimation and internalisation of external costs and to recommend a set of methods and default values for estimating external costs."[1]

1.1 Handbook as a meta-study

The Handbook does not carry out the original estimation of the external costs, but it is a meta-study of existing third-party studies. The fact that the Handbook does not carry out its own quantifications is rendered acceptable by the complexity of the problem and the extensive calculations.

However the Handbook must also accept all critique of the third-party studies used in the Handbook. These studies are by no means accepted unreservedly in the economic and academic area. The reported criticism is considerable. The Handbook would have to take this criticism on board and dispute it substantially in order to justify that the estimates can be used as a basis. Because this has not been carried out, the credibility of the Handbook is reduced.

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[1] CE Delft et al., Handbook on estimation of external cost in the transport sector. Produced within the study: Internalisation Measures and Policies for All external Cost of Transport (IMPACT), Delft, 19. December, 2007, p. 1.

1.2 No plausibility test

The Handbook presents the third-party results of the evaluation of the external costs as recommendations for the internalisation strategy. Due to the far-reaching consequences resulting from a significant increase in transport costs and the serious effects on society and the economy, the European Commission would have required not only a compilation of values, but also a plausibility test, with which relevant data could be isolated from implausible data. A commentary on these studies can be found in the annex but it is mostly descriptive and not analytical in nature. As a result recommendations are given, without the option to verify and validate their reliability.

1.3 Uncertainty about the results

The Handbook produces a compilation of extremely different estimations of external costs. It presents a wide range of cost estimates and cost differences and no rationale for the cost divergences. Thus it appears that a significant uncertainty exists concerning the amount of the external costs. A reason for this could be that different estimation methods were used in the studies, which led to over and underestimation of the external costs. No attempt has been made to point out the possible reasons for the differences in the cost estimates or to work out a cost proposal with the highest probability degree. It seems therefore risky to select the presented cost estimates as a basis for an internalisation.[2]

2. Which costs are external?

2.1 Handbook cost categories

The Handbook defines external costs as those costs which are induced by transport users but not borne by them, instead these costs are passed on to third parties and the general public. In the catalogue of externals costs, the following components are considered:

- Congestion costs (time losses, vehicle operating costs),
- Accident costs,
- Air pollution costs,
- Noise costs,
- Costs of climate change,
- Other external costs,
- Costs for nature and landscape,
- Costs for soil and water pollution,

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[2] Schmidtchen, D. et al., The Internalisation of External Costs in Transport: From the Polluter Pays to the Cheapest Cost Avoider Principle, Saarbrücken, October 2007, p. 24.

- Costs of up- and downstream processes,
- Additional costs in urban areas,
- Costs of energy dependency.

The amount of the external costs results from the summation of the individual cost components. Thereby ranges of cost values, which have been taken from third party-studies, are shown in the Handbook. The costs are expressed in €/veh-km relating to the year 2000. With regards to road transport there is a distinction between passenger cars and goods vehicles. A range is denoted for minimum, central and maximum costs. Geographically there is a differentiation according to large, small and medium urban areas and rural areas. Table 1 gives an overview of the basic results of the estimates for the different categories of external costs.

Table 1: External cost proposals of the Handbook

Unit values per cost component in €ct/vehicle-km									
Cost component		**Passenger car**				**Goods vehicle**			
		Urban roads	**Motor-ways**	**Rural roads**	**Weighted average**	**Urban roads**	**Motor-ways**	**Rural roads**	**Weighted average**
Conges-tion[1]	**Peak**	30.0	10.0	5.0	**11.1**	75.0	35.0	13.0	**31.0**
	Off-peak	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
	Weighted average	12.0	4.0	2.0	**4.4**	30.0	14.0	5.2	**12.4**
Accidents[2]		4.2	0.3	1.6	**1.7**	10.7	0.3	2.7	**3.4**
Noise[3]		0.8	0.0	0.0	**0.2**	7.6	0.0	0.1	**1.4**
Air pollution[4]		0.5	0.3	0.3	**0.3**	7.0	5.3	5.8	**5.9**
Climate change[4]		0.7	0.4	0.4	**0.4**	1.8	1.5	1.6	**1.6**
Up- and downstream processes[4]		0.9	0.6	0.6	**0.7**	2.1	1.7	1.9	**1.9**
Nature & landscape[5]		0.0	0.4	0.4	**0.3**	0.0	1.2	1.2	**0.9**
Soil & water pollution[6]		0.1	0.1	0.1	**0.1**	1.0	1.0	1.0	**1.0**
Total	**Peak**	37.2	12.1	8.4	**14.8**	105.2	46.0	27.3	**47.1**
	Off-peak	7.2	2.1	3.4	**3.7**	30.2	11.0	14.3	**16.1**
	Weighted average	**19.2**	**6.1**	**5.4**	**8.1**	**60.2**	**25.0**	**19.5**	**28.5**

Annotation:
1 Congestion urban areas: output values for small and medium urban areas, urban collectors, peak
2 EU-27 plus Norway and Switzerland average values
3 Weighted average of day and night values, goods vehicles: HGV values
4 Passenger car: medium vehicle (1.4 – 2l), EURO-3, 25% diesel and 75% petrol vehicles, goods vehicle: truck (16 – 32t), EURO-3, example Germany values
5 No external costs in urban and built-up areas, motorways and rural roads: long run marginal costs
6 Unit costs for rail and road transport in Switzerland

Source: Own compilation on basis of the Handbook.

On a more critical note, it is questionable whether all cost positions in this estimate actually have external character or if they are already completely or partially internalised. In this case the external costs must be reduced by the already internalised costs.

The cost values are displayed in separate categories:

- The groups 'passenger cars' and 'goods vehicles' are considered. Medium cost unit rates, which are oriented towards the values of the 16-32 t vehicle group, are given in the 'goods vehicles' group in the categories air pollution, climate change and up and downstream processes.
- The road categories are divided into urban roads, motorways and rural roads. Based on these categories and its distribution, a weighted average is determined. In order to determine the mileage distribution, the structure of Germany is taken.[3] The share of vehicle-kilometres is 31.2% for motorways, 18.0% for urban roads and 50.8% for rural roads.
- The congestion costs are divided into peak and off-peak times. The share of peak time is 40%, the share of off-peak time is 60%.
- For all other external cost elements, average values are used (unit: €-ct/veh-km).
- The total external costs are the sum of the various components. They are divided into road categories and into peak and off-peak times. With this information, weighted average values are calculated.

The total cost proposals are 8.1 €-ct/veh-km for passenger cars and 28.5 €-ct/veh-km for goods vehicles as a weighted value over all road categories and over all times. The accordant differentiations are displayed in Table 1.

2.2. Congestion costs – double counting

Congestion costs include increased vehicle operating costs and time losses in road transport due to traffic congestion. Congestion costs have always been counted among external transport costs by the European Commission. This has already been done in the Green Book "Towards Fair and Efficient Pricing in Transport" in 1995.[4]

In actual fact, congestion costs are already internalised and should not be counted as external costs. With increasing traffic density there is a mutual hindrance between motorists. Each motorist contributes the same level of congestion as he or she suffers through other motorists. Thus every motorist constitutes a burden to the collective of other motorists and

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3 Bundesanstalt für Straßenwesen, Traffic and accident data – Germany, Summary statistics, Bergisch Gladbach 2007.

4 European Commission, Towards Fair and Efficient Pricing in Transport. Green Paper. COM (95) 691.

at the same time is burdened by this collective. Additionally, motorists take such congestion into account in their transport decisions and therefore including congestion costs in an external cost analysis is equivalent to a double counting.

It is remarkable that Infras, as co-author of the Handbook, does not explicitly add congestion costs to the external costs of transport in an earlier study commissioned by the International Union of Railways (UIC): "…congestion is a phenomenon within the transport sector. Users mutually disturb each other, but do not impose extra costs on the rest of society. Considering delays in freight or business transport, which entail additional production costs to certain industries, the shippers or the business traveller is assumed to account for these effects and thus they are not external. Therefore, congestion costs must not be added up with classical externalities."[5]

If congestion costs (e.g. for passenger cars on urban roads of 12 ct/veh-km, weighted average) are subtracted from the total external costs, only external costs in the amount of 7.2 ct/veh-km remain, meaning the external costs are reduced by 63%.

2.3 Accident costs – mostly internalised

It is also controversial to what extent accident costs are external. The Handbook expressly stresses that in the case of accident costs, only those costs which are not covered by third-party insurance should be calculated as external costs.[6]

Accident costs include the following categories:

- Direct reproduction costs,
- Indirect reproduction costs (police, insurance, administration),
- Production losses (lost output),
- Humanitarian costs (pain, grief and suffering).

In order to make a statement about the proportion of external costs, it must first be established which cost components are covered by insurances (e.g. liability insurance, health insurance, social security). Thus it has to be taken into account that insurance companies are financially connected by recourse agreements.

Table 2 gives an outline of the internal and external character of the miscellaneous accident cost categories.

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5 Infras, IWW, External Costs of Transport. Update Study, Zürich / Karlsruhe, October 2004, p. 64.

6 Handbook, p. 14.

Table 2: Externality of Accident Costs

direct reproductioncosts	Accident victim is not causer of the accident	*internal*	Internalised by recourse agreements of automobile- and third party liability insurances or the accident causers bear the costs themselves. Therefore internalisation by insurance system or liability law. To the amount of an exceedance and in case of illiquidity of the accident causer external.
direct reproductioncosts	Accident victim is causer of the accident	*partly extermal*	Costs of health insurance, nursing care insurance etc. bear an community of policy holders which is not completely concordant with the collective of traffic participants. Thus external in as much as non-traffic participants have to bear additional costs.
indirect reproductioncosts due to staff replacement	-	*external*	Costs accrue for companies without a claim for recourse
indirect reproductioncosts due to Police, administration of justice, insurance administration	-	*partly external*	Costs are partly beared by insurances. Partly supply of services is independent of demand. No explicit assignation to internal or external costs possible.
Production losses	Accident victim is not causer of the accident	*internal*	Based on the last three months before the accident, an average wage is calculated. The accident victim gains a compensative payment. Therefore internalised by recourse agreements of automobile- and third party liability insurances or the accident causers bear the costs themselves. According to the calculated average wage, differences (also in the future) between average wage and the actual educable income are external.
Production losses	Accident victim is causer of the accident	*intern*	Incomelosses of the accident causers which are beared by themselves are completely internal.
humanitary costs	Accident victim is not causer of the accident	*intern*	Internalised by compensative payment for personal suffering.
humanitary costs	Accident victim is causer of the accident	*intern*	Only accrue to the causer of an accident. Thus completely internalised.

Source: Own compilation.

Whereas the direct reproduction costs can be regarded as completely internalised, the Handbook argues that production losses and humanitarian costs are external.[7]

- Production losses would be losses in gross domestic product, which society would incur. This can thus be distinguished between two cases:
  - The accident victim is causer of the accident: income losses of the accident causer are carried by the accident causer. Therefore they have to be considered as internal costs.
  - The accident victim is not causer of the accident: income losses arise to the victim of the accident, which are compensated by annuity payments or other compensative payments. The compensation is paid by the accident causer's motor vehicle insurance, private liability insurance or directly by the accident causer.

  Accordingly, production losses are covered by insurances and have to be regarded as internalised.
- The main part of the accident cost estimation in the Handbook is the "Value of Statistical Life" (VOSL). The VOSL is the effort to quantify the value of human life. It exceeds the capabilities of a pure economical analysis. The valuation is not derived objectively from the factual damage caused by an accident but is subjectively valued based on interrogations ("willingness to pay"). The factual welfare losses cannot be deduced from a subjective valuation but only from objective costs incurred by society. These costs can be approximated objectively from compensative payments for non-pecuniary damages to the accident victim. Thusly estimated cost rates are considerably lower than the subjectively determined value of statistical life. Compensative payments for non-pecuniary damages are covered by insurances. Hence this accident cost component is also internalised.

The lion's share of accident costs has to be considered as already internalised. The Handbook does not make an explicit empirical statement about this internalised part of the accident costs. However, other studies conclude that between 59 and 76% of accident costs are internalised, which should constitute a lower limit.[8]

2.4 Other external costs

Furthermore, the Handbook contains other costs, which represent a burden for the population and for the economy. It has to be proved, to which degree the other costs have to be added to external costs or if parts of them are already internalised.

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7 Handbook, p. 37.

8 Handbook, p. 42, UNITE D5 and D8.

- The environmental costs (e.g. noise) are fully added to the external costs. Indeed, a part of the environmental costs can be reduced by prevention measures within the transport infrastructure. The infrastructure is funded by the motorists as originator (e.g. by fuel tax). An example of this is noise protection, where measures in the infrastructure (e.g. noise barriers) help to reduce the immissions for the residents. The external noise costs have to be reduced by the financial contribution from the motorists and thus by the subsequent reduction of the immission costs. Moreover, noise is only relevant for urban areas.
- A further part of the noise costs is already internalised as the costs are offset by the benefits of the claimant. People are choosing to live on noisy major streets due to the cheaper rents. The rents are cheaper because of the higher noise level. On the one hand residents suffer from the noise, on the other hand they profit from the reduced rents. The residents' exposure to noise is partly compensated by cheaper rents. It is the owner of the real estate and not the tenant who suffers the disadvantage of the noise exposure. In contrast, increase in value is given due to the development of the real estate with traffic (road respectively public transport). Thus, an appropriation is suggested by literature to halve the noise costs that have to be covered by the motorist.[9]
- Another cost category mentioned in the Handbook is energy dependency of the European economies. This one is especially used by oil producing countries. For the assessment, US-studies are analysed. The dependency and scarcity of oil leads to a higher fuel price, which has to be borne by the motorists. Thus, the dependency of oil is internalised by higher prices for fuel.
- The last considered cost category is the costs of nature and landscape, which emerge in the traffic sector through infrastructure measures. A question arises as to whether there are economical losses due to the disturbance of nature and landscape which would justify this cost category. Indeed, it is a matter of aesthetic intrusions, which are not reflected in a reduction of the gross domestic product and can thus not be considered as external costs. Hence, these costs are labelled as "intangibles", which should be additionally mentioned as a disadvantage in the assessment of the measures, but which is not part of the cost calculation.

2.5 What remains?

The analysis has shown that a part of the external costs based on the Handbook has to be eliminated. The congestion costs are not to be regarded as external costs. The major part of the accident costs is already internalised by insurances. The costs of nature and landscape do not display an economic loss. The remaining external costs are only air pollution, climate costs, noise, costs of up- and downstream processes and soil and water pollution.

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[9] Michalski, B. Externe Kosten – ein untaugliches Konzept für Umverteilung. Unfertige Methoden, überhöhte Rechnungen, unreflektierte Forderungen, Ministerium für Bauen und Verkehr des Landes Nordrhein-Westfalen, Düsseldorf, Juni 2007, p.29

Only 1.7 ct/veh-km (= 21%) are left over as external costs for passenger cars out of the total external costs of 8.1 ct/veh-km and the remaining external costs for goods vehicles are 11.8 ct/veh-km out of 28.5 ct/veh-km (= 41%). If the fact is considered that the costs for CO2 are internalised by fuel tax most practically, the remaining external costs for passenger cars are only 1.3 ct/veh-km (= 16%) or 10.2 ct/veh-km for goods vehicles (= 36%) of the former total external costs respectively. It is essential to question whether the expenditure of an expensive charging technology (such as electronic road pricing) can be justified for such a low volume of costs. Out of reasons of efficiency, other possibilities should be developed to reduce external costs (e.g. fuel tax, supply-side measures).

3. Methodological critics

3.1 Method-mix in evaluation principles

The aim of the assessment is to express the physical consumption of resources in monetary dimensions and to use this information to deduce the costs. In economic theory, different principles are used for the evaluation of external effects:

- The damage-cost principle deduces the economic assessment directly from the consumption of resources and the damages which are induced by traffic in the economy respectively. Thus this approach is called "resource approach".
- The avoiding-cost principle determines the costs potentially incurred by individuals or society either to avoid damages due to traffic or to reduce the damages to an acceptable level. The costs are borne by the pollutees or by the society who had to suffer the damages.
- The willingness-to-pay principle evaluates the external costs by considering the payments which the polluter is prepared to pay for his harmful action, as well as the payments which the pollutee is prepared to pay to avoid the damage.

The Handbook considers the results of third-party studies for the estimate of the external costs. The Handbook itself does not carry out any original quantification of values. The proposed valuations are due to different evaluation principles, thus, a selective mix of methods are conducted.

In theory, such a mix of methods is not allowed because various contents of costs are measured with each method. These can be damages due to losses of production, the avoidance of certain damages or the willingness-to-pay for certain reductions of damages. The questions and thus the costs differ in each case. The external costs of transport are therefore not established, objective values but they vary according to the employed method of evaluation. The resulting cost is imprecise and finally undetermined due to the different principles of assessment. Instead, it is essential to use only one principle of assessment within each cost estimation. This is the only way to get a coherent and transparent cost result.

The question is which method is best? The aim of cost analysis is to determine the resource consumption due to traffic. To reach this target the methods that contain the consumption of resources should be used. These are the damage-cost and avoiding-cost approaches. In contrast, the willingness-to-pay approach covers issues which have no cost circumstances and are based on subjective valuation.

3.2 Value of statistical life

The Handbook calculates the accident costs from of the value of statistical life as well as direct and indirect economic costs. The accident costs are estimated for fatalities, severe injuries and slight injuries. The main part of the accident costs consists in the value of statistical life. In the EU-25 the VOSL ranges from €250,000 to €2.6 m per fatality. An average value of €1.5 m is estimated. The value of life for severe injuries amounts to 10% of the VOSL value per fatality and the value for slight injuries is 1%.[10]

This approach is the attempt at an economic assessment of the value of human life per se. This is a completely different objective compared to an estimation of costs resulting from resource losses. The cost analysis does not aim to estimate the subjective value of human life but to capture the resource losses of an economy objectively. Hence not an ethical but only an economical criterion can be decisive for a valuation. An estimation of the value of statistical life should therefore be based on the costs of lost output and the humanitarian costs (payments for non-pecuniary damages).

Additionally, for an assessment of the value of statistical life a questionable approach has been used: The willingness–to-pay approach. It is subject to the following criticism:

- Willingness-to-pay analyses are conducted using surveys ("stated preference approach"). The results depend on the way the survey is designed and conducted. The extent to which the methods of evaluation are comparable in different cases is questionable.
- In establishing their "willingness to pay", false estimates may be made by the respondents. Expressing a willingness to pay is one thing, actually having to pay is another. Even on the question of human life it is necessary to be aware of the danger that hypothetical and actual willingness to pay are at variance.
- The willingness-to-pay concept sets out to determine the cost in terms of market price which the road user would be prepared to pay to prevent accidents. In the willingness-to-pay analysis, however, only the evaluation of the demand side sets the price at which the supplier would provide safety services. If the willingness to pay expressed in the surveys is used as a basis for calculating costs, the costs are structurally overestimated. The willingness-to-pay price exceeds the market price level approach as it includes an assessment of consumers' surpluses.

[10] Handbook, p. 42.

Instead of using a willingness-to-pay approach, the accident costs should be determined using a damage-cost approach – including reproduction costs, costs for resource losses and humanitarian costs. A consequence of this would be that the accident costs would be significantly lower. The Handbook conflicts with the European Commission's former evaluation practice, which is based on the damage-cost approach. An accident cost rate of €1 m per fatality results from this former approach. The Handbook exceeds this value by 60%.

3.3 CO_2 emission costs

The evaluation of CO_2 emission costs can also be criticised. In the Handbook, two different evaluation principles are used in parallel, namely the avoiding-cost approach and the damage-cost approach. The avoiding-cost approach is used for the evaluation of CO_2 emission costs in the short-term during the period 2010-2030. Thereby the avoidance aim is the accomplishment of the post-Kyoto targets (20-30% reduction of CO_2 emissions in 2020 compared to 1990). The damage-cost approach is applied for the long-term evaluation from 2030 to 2050. For this case, a CO_2 avoidance target is not defined.

The evaluation of CO_2 emissions has to be criticised in multiple aspects though:

- It is remarkable that within the same CO_2 cost category two fundamentally different evaluation principles are used (avoiding costs and damage costs), which is not justifiable when trying to achieve evaluation consistency. Furthermore, it is also inconsistent that the damage-cost approach is rejected instead of used for other external cost components (e.g. accident costs).
- The decision to use the damage-cost approach for the evaluation of the long-term climate damages in particular must be critically judged. With this approach, damages that refer to crop losses, weather fluctuations, floods, land losses, and serious health problems are to be detected. Especially for the long-term perspective, such climate damages are not assessable. It is not useful to evaluate damages which cannot be sufficiently specified in terms of extent, the time of incidence or the occurrence probability. Hence, the estimation of CO_2 emission costs is afflicted with substantial uncertainties and speculative elements. These uncertainties are also evident through the fact that the fluctuation range is substantially larger for damage costs than for avoiding costs. The choice of the social discount rate has an essential influence here on the amount of climate change costs in particular.[11] In contrast, the avoiding-cost approach has the advantage that no estimate of the damages caused by climate change is necessary and the determination of avoiding costs is associated with fewer uncertainties.
- When based on the avoiding-cost approach, the climate costs turn out to be substantially lower in comparison to the costs identified via a damage-cost approach. Based on

[11] Nordhaus (2006), The "Stern Review" on the Economics of Climate Change, NBER Working Paper Series No. 12741, Cambridge, pp. 6.

an avoiding-cost approach, the Handbook assumes €25 per tonne CO_2. Other estimates show a similar range of €20-25 per tonne CO_2.[12] In contrast to this, the CO_2 costs assessed with the help of a damage-cost approach range between €55 and €85 per tonne. Ideally, a "market price" should be used for the evaluation of CO_2 costs. At the European Energy Exchange in Leipzig, where CO_2 emissions permits are traded, these kind of permits are currently available almost free of charge. This indicates that CO_2 emissions permits are actually abundant due to an oversized cap of the total permitted emissions.

- The Handbook assumes a dramatic increase of the CO_2 costs in the long-term. The premise for this estimate is the assumption that no considerable measures to reduce CO_2 emissions are currently being implemented world-wide and business-as-usual is predominant. Whether this assumption is justified, must be doubted. Notably, European governments are determined to act politically and also the chances of a joint, world-wide CO_2-reduction policy are high after the Bali conference in December 2007. For Europe, it is to be expected that avoidance technologies will be developed by the industry in the near future, which will lead to lower climate damages. Due to expected, long-term technological progress, average avoiding costs will exhibit a decreasing tendency, so that at least external climate costs will not rise.[13] Additionally, the automobile market shows that market penetration of low-emission vehicles is advancing in Europe.
- Furthermore, it is doubtful whether there is a need for internalisation of CO_2 costs at all, since those are already charged through high petrol and diesel taxes. Excise duties on petrol and diesel are generally in the region of €0.40/litre in the EU. In contrast, the external CO_2 costs of €0.08/litre (2020) range clearly below these taxes. Therefore, the argument that external CO_2 costs are already internalised over the fuel price is valid for Europe. The European fuel price policy also decreases CO_2 emissions by providing incentives such as smaller vehicles, higher fuel efficiency, energy-conscious driving behaviour, and fewer vehicle mileage, so an additional price increase is not justified. This question will need to be clarified again, if it is to be considered whether there is still a margin for additional internalisation besides the existing taxation and charging burdens.

3.4. Mix of railway electricity for climate costs

In determining railway climate costs, traction power is assumed as the current constant mix of primary energy. This average consideration might lead to wrong conclusions about the climate costs of the railway sector.

The assumption of a constant energy mix implies that in times of lower energy consumption (e.g. due to optimised propulsion technologies) the energy production from all energy sources, including also renewable, will be equally reduced. This contrasts with environ-

12 Kopp, P. and Prud'homme, R., The internalisation… loc. cit., p. 12; Michalski, B.,"Externe Kosten"…, loc. cit, p. 22.

13 Stern, N., The Economics of Climate Change, The Stern Review, Cambridge et al., 2006, pp. 260-261.

mental goals because energy should generally be produced as environmentally friendly as possible. The actual procedure, however, is different. The production of energy from power plants with high climate impact is dropped first. Hence, the marginal reduction of climate impact is higher than the average reduction. Otherwise, when the rail energy demand becomes higher (which is likely when internalisation measures are applied to the road sector) the marginal climate costs will increase more than the average costs. Summing up the argument, a calculation of climate costs based on marginal costs would be less beneficial for the railways.[14]

Furthermore, when the energy mix also comprises energy from nuclear power plants the risk of nuclear incidents in Europe has to be considered in the calculation of external costs for railways.[15]

3.5 Discrimination of road transport by noise costs

The assessment in the Handbook is based on the willingness-to-pay approach. In contrast, the best approach is the avoiding-cost principle. This covers the consumption of resources which have to be used in order to reduce noise to a tolerable level. Empirical comparisons have shown that the valuation of noise following the willingness-to-pay approach leads to results which differ by the factor 2.3 from the avoiding-cost approach.[16]

An important aim of the internalisation of external costs is to guarantee fairness between all transport modes.[17] But this aim is not reached, as the noise valuation contains a "railway bonus".[18] For a given noise level, the railway has a discount of 5 dB(A) in contrast to other modes. This discriminates the road in contrast to the railway. The justification for this is that railway noise is less intrusive compared to road traffic noise. A discount of 5 dB(A) has extensive effects on noise costs. Such a "railway bonus" cannot be caused factually. In contrast, railway noise is seen as an extensive burden in public discussions. Here, an equal treatment of railway and road traffic shall be provided.

3.6 Dynamic adjustment of cost forecasts

The estimates of the external costs in the Handbook refer to the past and are insofar from an ex post-examination (2000 and/or 2002). Only the CO_2 costs constitute a prospective character. However, for a policy of internalisation a future-oriented evaluation has to be carried out. Thereby, the significance of problems, the need for action and also future cost

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14 Michalski, B., "Externe Kosten"…, loc. cit., p. 18f.

15 Michalski, B., "Externe Kosten"…, loc. cit., p. 19.

16 Planco, Modernisierung von Methoden des Bundesverkehrswegeplans. Gutachten im Auftrag des Bundesministers für Verkehr, Essen 1991, p. 33.

17 Handbook, p. 4.

18 Handbook, p. 65.

changes can be estimated. The political planning is thus set up on a meaningful basis. Without such a cost prognosis, political decisions can be criticised for being based on outdated data.

It has to be assumed that the drivers of and the amount of external costs will change in the future. A dynamic cost estimation has to consider changes in transport demand, changes of behaviour, improvements in transport infrastructure and technological progress. This can also be illustrated by the evolution of the Euro emission standards. As for particulate matters (PM) which currently represent a significant source of air pollution in cities, the reduction from Euro 1 (140 mg/km) to Euro 5 (5 mg/km) amounts to 96%. Even compared to the recent Euro 4 standard (25 mg/km), Euro 5 will reduce PM by almost 80%.[19] Thus, the contribution of PM emissions from diesel engines will diminish in the near future.

In order to get results for the amount and structure of future external costs, cost forecasts have to be conducted, which can serve as a basis for an internalisation strategy. The following elements should be considered in such a cost prognosis:

- Forecast of the transport performance. Increases in goods transport and decreases in passenger transport are expected due to the demographic shift.
- Efficiency progress of the transport organisation (e.g. capacity improvement, optimisation of routes, information),
- Implementation of extension programs of transport infrastructure (road, rail) in order to change the long-term modal split – changes in favour of rail transport,
- Reduction of fuel consumption, emissions and noise because of significant technological progress (vehicles, engines) and improved driver behaviour,
- Enhancement of active and passive safety (e.g. advanced driver assistance systems),
- Promotion of the acceptance, market penetration and retrofitting speed of new road traffic technologies.

In these areas, many developments and innovations are introduced, which show positive results (e.g. declining accident numbers, sinking air pollution, less noise). The tendency goes clearly toward lower damages and thereby a decreasing need for internalisation of external costs.

[19] Regulation (EC) 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger cars and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information.

4. Theoretical defaults – Disregarding the external benefits of transport

4.1 Confrontation of external costs and benefits

The strategy of internalising external costs is justified by the theoretical basis of the marginal social costs.[20] The marginal social costs consist of the marginal private costs (which are incurred by the users of the transport system) and the marginal external costs (which are imposed on others). The welfare optimum for society is reached when the amount of external costs is internalised through charges to the users.

Besides external costs, there are also external benefits which evolve in the process of economic activities. This fact is also acknowledged by the Handbook. It is stated that infrastructure investments are only economically viable when the additional social benefits outweigh the additional social costs.[21] However, external benefits are not considered below this point. The focus of the Handbook is limited to postulate the internalisation of external costs. Narrowing down the debate on external effects only to the internalisation of external costs as it currently takes place in the political arena, represents a case of governmental failure.

According to welfare economics external costs have to be confronted with external benefits. Only the difference between the two figures is applicable for internalisation to users. When both, external benefits and costs, add up to a similar amount, there is no room for internalisation. On the other hand, external benefits which overcompensate for external costs provide an argument for subsidies.[22] By neglecting this fundamental principle, the internalisation policy will not be able to meet the optimal state of welfare.

In fact, road transport generates manifold external benefits – a fact not denied by critics.[23] Generally, the benefits emerge from the following impact chain: transport enables the mobility of persons and goods within a defined geographical area. Specialisation takes place which gives rise to higher productivity. As a result, growth, income and employment are stimulated. An example for this process which can be studied on a global scale is the relocation of production facilities to countries with the lowest wages.

4.2 Empirical Evidence

Because the estimate of external benefits requires complex impact assessment and calculation procedures, the research interest is more focused on external costs. Empirical evidence

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20 European Commission, European Transport Policy for 2010: Time to decide, White Paper, COM (2001) 370, Brussels 12.09.2001; Kopp, P., Prud'homme, R., The internalisation of external costs in the transportation system, Discussion Paper for the 12th ACEA SAG meeting, Brussels 2007.

21 Handbook, p. 11.

22 For a textbook analysis of externalities see Krugman, P., Wells, R., Microeconomics, New York 2005, p. 455-571.

23 Handbook, p. 11.

on external benefits of transport is scarce so far. A detailed estimation of transport benefits was presented for Germany in 1999.[24] This study estimated the economic growth effects of transport between 1965 and 1990 on a statistical base (growth accounting). The study explains the labour productivity as a function of the capital stock, the human capital, the productive efficiency and the transport performance in passenger and goods transport. The main results can be summarised as follows:

- The labour productivity in 1990 would have been 20% lower if transport performance had remained at the 1965 level (= no transport growth).
- Moreover, the gross domestic product (GDP) would have been 25% lower.
- The growth effect is mainly driven by road transport (passenger and goods transport) which accounts for 90% of the total growth effect.

The existence of those benefits is not denied within the research community. However, it is controversial whether and to what extent these benefits are already internalised via markets and prices. If this is already the case, then benefits could not be offset against the external costs.[25] External benefits would thus be limited to the benefits of the general public in emergency transports, user cost savings in public transport with compacted schedule and the pleasure of traffic spotting in general.[26] In this case, no relevant external benefits of transport would remain.

4.3 Are external benefits internalised?

In order to explore the externality of benefits, it is essential to distinguish between technological and pecuniary external benefits:

- A technological external benefit evolves when the transport activity of person A improves the welfare of person B (e.g. income) directly and without a market relation between them. B does not demand this benefit and does not pay for it. There is no market exchange between A and B.
- A pecuniary external benefit evolves when person B benefits from the transport activity of person A and a market relation between A and B does exist. The benefit of the transport activity is external but it will be internalised by the price mechanism on markets. The benefit will thus be passed on via markets to other economic agents.

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[24] Baum, H. und Kurte, J., Wachstums- und Beschäftigungseffekte des Verkehrs. Deutsches Verkehrsforum, Köln 1999.

[25] Rothengatter, W., Do External Benefits Compensate for External Costs of Transport?, in: Transportation Research, Vol. 28A (1994), p. 321ff.

[26] Ecoplan, Externe Nutzen des Verkehrs, Zürich 1993, p. 51; Bundesamt für Raumentwicklung und Bundesamt für Strassen, Die Nutzen des Verkehrs, Teilprojekt 1: Begriffe, Grundlagen und Messkonzepte, Bern 2006, p. 6.

Technological effects represent "real" external benefits whereas pecuniary effects are already internalised. Beyond this strict duality, cases may also be found in between. That is, when the effect is partly internalised but the other part remains a technological effect. This kind of effect, where the internalisation takes place only in an imperfect way, can be labelled as dimensional externality. The follow-up reasoning focuses on technological external benefits because they are the right ones for confrontation with the external costs of transport.

4.4 Cases of technological external benefits

Many and diverse external benefits are passed on without market relations. Hence, these benefits can be characterised as technological external benefits:[27]

- An export-oriented company pioneers a foreign market. The exporter has to pay costs for market development. The benefit of the market development represents a technological external benefit because export followers benefit from the pioneer without any market involvement and thus do not need to compensate him for his efforts.
- The mobility of employees enables companies to hire more qualified personnel. As a consequence, the efficiency of the companies improves because skills are spread via diverse communication channels ("knowledge spillovers"). Communication also requires transport performance from the newly contracted employees. Hence, the external benefit is partly credited with transport activities.
- Market extensions represent an important source of economies of scale (decreasing average production costs). They can only be realised when the transport system allows markets to expand spatially. This again involves transport performance. External benefits occur when market extensions make new production technologies profitable.
- The agglomeration of business activities leads to technological spillovers. The spatial concentration of business activities is enabled by transport because transport makes markets accessible. The impact of technological externalities can be demonstrated by the spatial distribution of industries. Some industries appear concentrated in regional clusters (e.g. computer industry in the Silicon Valley). Technical progress is triggered by complex interaction between suppliers, users, trade press etc. Beyond informal contact with innovators, the inspiration for new technological solutions is the main source of imitation.[28]
- Welfare and growth essentially depend on the quantity and the availability of knowledge. The formation and distribution of innovations are largely determined by an economy's transport and communication networks. The innovator develops knowledge and skills which are also available for use by other producers free of charge.

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27 Garrisson, W., Souleyrette, R., Transportation, Innovation and Development, Berkeley 1995.

28 See Wolfe, T., The Tinkerings of Robert Noyce, How the Sun rose on the Silicon Valley, in: Esquire Magazine, December 1983, pp. 346-374.

4.5 New growth theory

The examples prove the existence of the technological external benefits of transport. External benefits are included in numerous economic activities such as technology and knowledge spillovers, market developments and cost-decreasing effects. The new growth theory (endogenous growth theory), which was developed around 1990, yields to the result that externalities, which are provided all but free of charge for the overall economy, represent the actual engine of growth and welfare.[29] Because transport as a General Purpose Technology is involved in most of these processes, at least parts of the externalities are attributable to the transport system. This implies for the internalisation strategy that external benefits have to be offset against the external costs and only the difference is applicable for internalisation. This is the clear result of welfare economics and the new growth theory.

5. Conceptual deficiencies

5.1 Who is responsible? – Joint causation and reciprocal nature

The concept of the Handbook consistently applies the polluter-pays principle for the internalisation of the external costs. The polluter causes external costs for the public and should pay for it. The polluter-pays principle is rooted in article 174 of the Treaty establishing the European Community. Thus this principle has a considerable political significance but is not undisputed: in modern institutional economics, this principle was identified as a "naïve" glance at the problem of external costs leading to an incomplete economic way of thinking.[30]

External costs are the result of competing interests regarding the use of scarce resources (in this case: environment). Without such a rivalry, there would be no occurrence of external costs. Therefore, external costs consist of a joint causation (polluter and pollutee) and a reciprocal nature. This theory was developed in 1960 by the British economist, Ronald H. Coase, who received for his work the Nobel Prize in Economics.[31]

The following example shows the basic ideas of his concept: a motorist generates noise exposure in a certain area, which annoys a local resident. Thus, external costs result from the fact that rivalling claims become effective. The motorist asks for his right to a certain degree of mobility and the adjacent resident wants a quiet environment. First of all, driving a car produces noise, which alone does not represent an external cost. The costs result only from the fact that the local resident lives nearby the road and is therefore bothered by the

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29 Romer, P., The Origins of Endogenous Growth, in: Journal of Economic Perspectives, Vol. 8 (1994), No.1, pp. 3-22; Grossman, G., Helpman, E., Endogenous innovation in the theory of growth, Journal of Economic Perspectives, Vol. 8 (1994), No.1, pp. 23-44.

30 Schmidtchen, D. et al., The Internalisation of External Costs, loc. cit., pp. 14.

31 Coase, R., The Problem of Social Cost, in: Journal of Law and Economics, Vol. 3 (1960), pp. 1-44.

noise. If nobody lived next to this road, no external cost would occur. Insofar, joint causation is the reason for external costs: the desire for driving a car and the desire for quietness.

Due to this rivalling use, a "tragic choice" arises.[32] Reducing the harm to one party would inevitably imply harming the other party. Reducing the cost imposed on one party leads to an increase in cost for the other party.

Initially, it is an open question as to which strategy is more efficient in the reduction of external costs. It may be more efficient if the noise polluter pays; in contrast, it can also be efficient if the pollutee pays for noise protection, or even that both share the burden. The welfare reaches its maximum if the person with the lowest costs undertakes the action. By this means, the overall economy is burdened with only the smallest resource consumption. This is the main idea behind the "cheapest cost-avoider principle".[33]

The advantages of the cheapest cost-avoider principle include the following issues:

- Guarantee of efficiency, no wasting of resources, facilitation of growth and employment,
- Fair solution,
- Broader framework of options with innovative solutions.

As a result, different options come into consideration for the reduction of external costs. The polluter-pays concept can thus be a potential alternative. But it might be the case that the polluter-pays principle is the most expensive solution in relation to other alternatives.

In order to find out which abatement measures for external costs have the largest impact on the overall welfare, the alternatives must be evaluated by cost-benefit analyses. Within such analysis, the benefits of a measure are compared with its respective costs in order to identify the measure with the largest surplus of benefits in comparison to the costs. If, for example, an internalisation via charges is analysed, the benefits resulting from reduced environmental damages have to be compared with the costs induced by decreased mobility. The Handbook does not provide such a cost-benefit analysis for the internalisation strategy, therefore its economic profitability cannot be judged.

Since it seems unlikely, that a "market" of property rights for the environment will be spontaneously established, public bodies should take over the negotiations between polluters and pollutees. The implementation of the cheapest cost-avoider principle requires an institutional framework, which consists of five steps:

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32 Schmidtchen, D. et al., The Internalisation…, loc. cit., p. 68.

33 Schmidtchen, D. et al., The Internalisation…, loc. cit, p. 15.

- Identification of the possible actors who can influence the outcome of external costs,
- Identification of the alternative ways in which the external effects can be reduced,
- Calculation of the minimum costs of the various methods,
- Selection of the least cost method and actors,
- Framework for negotiations concerning sharing the financial burden between the actors.

In order to solve externality problems, it is important to be aware that not only internalisation via prices is desired, but also that the entire spectrum of possible measures for the reduction of external costs must be examined. On this basis, the most economical measure can to be selected.

5.2 Supply-side improvements

The Handbook aims at an internalisation of external costs mainly via charges and taxes. The goal is a decrease in transport demand and a change in the modal split towards transport modes, which generate lower external costs. The main focus is on a demand restriction by public-administered prices. Insofar, this solution constitutes a one-sided and interventionist character. In addition, this approach will hardly be capable of managing the foreseeable growth of transport demand up to the year 2030 (passenger transport: 1.2-1.5% p.a., goods transport: 1.1-2.4% p.a.).[34] Demand restrictions will also have negative consequences for the competitiveness of European industries, for growth, income and employment throughout the European Union.

In contrast, a consistent market-based solution for the external cost problem would be given if both sides of the market – demand and supply – were used as instruments to decrease external costs. A market-based approach requires that, in a situation of scarcity, like in the case of external costs, both market variables are used to overcome the scarcity: the demand is reduced and at the same time the supply is improved. This dual character of a market based solution is not incorporated in the Handbook. The options of lowering the external costs by an extension and improvement of the supply side remain completely excluded. The necessity of considering the supply side results imperatively from the cheapest cost-avoider principle.

Supply-side improvements in the transport sector include, among others, the following issues:

- Enlargement of transport infrastructure
- Better utilisation of existing infrastructure capacities

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34 European Commission, European Energy and Transport, Trends to 2030, Update 2007, Luxembourg 2008, p. 97.

- Upgrading of transport systems with additional information systems
- Information and communication technologies for safe and clean mobility
- Development and market implementation of more efficient and less polluting vehicles.

The effect of the supply improvement consists of a decrease in external costs. This option should be examined in a least cost approach framework. The external cost reduction by a supply-side strategy results from several impact channels:

- Supply-side measures (e.g. infrastructure investments) generate a capacity effect. A higher transport volume can be absorbed by the infrastructure without deteriorating the traffic conditions. Or an assumed constant transport volume can lower both internal and external costs (less fuel consumption, CO_2 emissions, air pollution and accidents).
- The present infrastructure can be used more efficiently if regulations permitting longer and heavier vehicles – such as those in place in some European states (European Modular System) – are changed.
- Transport processes are getting more efficient through information and communication technologies. A better transport management reduces external costs by an optimisation of routes, prevention of congestion, and homogenisation of traffic flow.
- Intelligent vehicle safety systems can avoid or mitigate accidents and their consequences. For instance, an electronic stability program has a proven positive effect on the avoidance of skidding accidents and therefore can save accident-related resource losses.
- The specific emissions (g/km) of the different transport modes can be reduced by technological progress. Due to lower emission factors, there is a decline in CO2, air pollution and noise.

The benefits of such a successful supply-side strategy in the reduction of external costs are well documented in numerous impact analyses for countries in the European Union. If policy aims at an internalisation of external costs, the supply side should not be neglected. In this case, a combination of demand and supply measures should take place in order to ensure that a reduction of external costs is tackled by two sides. The policy will thus be relieved because demand restrictions could be assisted or partly substituted by improvements on the supply side.

However, supply-side measures always have a financing problem. This could be reduced by the creation of a circular financial flow. For this purpose, revenues gained through charging and taxation should be earmarked for supply-side improvements. Thus, an integration of allocation and financing issues will be implemented. The question of the disposition of revenues is addressed later in the document (see 6.2).

5.3 Subsidies and external costs

The problem of the external costs is affected by the existence of subsidies in the transport sector. It is a fact that considerable subsidies are paid in the EU for the infrastructure and operation of the different transport modes. The different transport modes therefore feature diverse subsidy rates. This results in distortions in competition between the different modes.

Subsidies are defined as payments made by the state to companies without compensation. They represent costs for the general public, but they are not compensated by the subsidies recipient. Therefore subsidies are added to the external costs. They are quasi the fiscal component of the external costs. This aspect of the external costs is completely disregarded in the Handbook.

An attempt to quantify subsidies in the EU comprehensively was made by the European Environment Agency.[35] Among subsidies, the following are subsumed:

- Provision of infrastructure,
- Other financial transfers that appear in public budgets (e.g. direct support to operators, alleviation of part debts, pension contributions),
- Differences in fuel taxation with part exemption from fuel tax,
- VAT exemptions for certain segments of the transport market.

The approximation of the annual subsidies (last update: 2005) for EU-15 amounts to €269-293 bn. They are allocated as follows:

- Road: €125 bn (€110 bn for infrastructure)
- Rail €73 bn (€37 bn for infrastructure, €33 bn for operating)
- Air €37–35 bn
- Water: €14–30 bn
- Multiple modes: €30 bn

According to this analysis the road would be the biggest subsidies recipient. The reason for this result is that the fiscal revenues from road (€200 bn) are not considered as payment for the use of road infrastructure, but as general contribution to public budgets. This step is not

[35] European Environment Agency, Size, Structure and Distribution of Transport Subsidies in Europe, Technical report, No 3, 2007, Luxembourg 2007. Proof of significant subsidies for rail and urban public transport is confirmed in national subsidy analyses, see also Boss, A., Rosenschon, A., Der Kieler Subventionsbericht: Grundlagen, Ergebnisse, Schlussfolgerungen, Kieler Diskussionsbeiträge Nr. 423, Kiel 2006.

admissible. Here the "principle of equivalence" is essential, which requires that each tax payer should be taxed to the benefits he/she gains from services and goods provided by the state. Thus the paid road taxes have to be credited to the costs of the road infrastructure. The result is that the road transport pays more taxes (€200 bn) than it receives from the infrastructure subsidies (€110 bn).

Regarding rail, the subsidies are not offset by tax revenues.[36] Here the subsidies are the amount – less revenues from infrastructure charges – which the state pays to the rail. The subsidies for the rail amount to a total of €73 bn, thereof €37 bn are for the infrastructure and €33 bn for the operation. Important subsidies are also paid for the infrastructure and operation of urban public transport, which are not regarded in the subsidies analysis. Subsequently there is a subsidies surplus for rail and urban public transport, while the road does not obtain subsidies.

For the calculation of the external costs the subsidies for rail can be handled in an alternative mode: either they are added directly to the external costs of the rail, or the subsidies for the rail are deducted from the external costs of the road. In both cases the end result of the external costs for road comes off better. By not taking subsidies into account in the estimation of the external costs, the competitive position of the road compared with the rail is weakened.

5.4 Modal shift policy

The internalisation of external costs aims superficially to establish cost transparency within the transport sector. However, an increase in the cost of road transport causes a change in the modal split. A hidden effect of this is that the proportion of road transport is reduced and the proportion of rail is increased. It is argued that the railway has lower external costs and thus increases the welfare of the economy. Indeed, there remains no agreement as to whether a change in the modal split could lead to a lower burden of external costs.[37]

– The external cost values in the Handbook are based on the factual transport operations of today in the goods sector, i.e. on the actual modal split of the competing transport modes. The main operational focus of the railway is to carry large rail vehicle combinations with high capacity in terms of weight at low speeds. If road transport is to be replaced by rail, its market profile would have to change. The railway would have to be faster and more flexible the trend would go to smaller wagons and to lighter goods. In this case, the previous advantages of the railway concerning external costs would be reduced and the specific external costs per tonne-kilometre (tkm) would increase. Case studies[38] have shown that the emission of CO_2 per tkm increases by 60% on railway, if

[36] Kopp, P., Prud'homme, R., The internalisation …, loc. cit., p. 10.

[37] See: Kopp, P. and Prud'homme, R., The internalisation… loc. cit., p. 17; Michalski, B., „Externe Kosten"…, loc. cit, p. 36, p. 51.

[38] Öko-Institut e.V., Universität Dortmund, Fraunhofer Institut, Nachhaltige Mobilität durch Innovationen im Güterverkehr, Berlin 2007.

the carried goods are shifted from bulk cargo to volume cargo. Short trains need up to 70% more energy than long trains. Further impairments of energy efficiency are due to the assignment of rapid trains, because energy demand increases strongly as a result of the higher aerodynamic resistance. The attractive cost level of the (current) railway is thus not based on an advantage on principle, but is dependent on the favoured modal split.

- A modal shift to rail also meets its limits in view of the anticipated transport growth. The capacities of all modal transport are required in order to cope with the predicted transport demand alone.[39] This is anchored in the principles of co-modality of transport modes – resolved on by the EU. Thus the room for transfer to rail is restricted by the internalisation of external costs.
- A change in modal split in aid of the railway is only reasonable if certain conditions are met. The railway must be able to carry these additional transports and to carry them on a sufficient level of quality. The transfer of a notable part of the current road goods transport to railway demands comprehensive and cost intensive enlargements of the railway infrastructure. This begs the political question as to whether the investment costs for the change in modal split to rail goods transport are to be accepted, which might eat up the external cost savings, or possibly exceed them entirely. Additional or strengthened goods transport corridors in the railway can be worthwhile for certain geographical transport combination, but they are no "general power" for more goods transport on railways.

Due to the current external costs displayed in the Handbook, there is no reason for a policy leading to a change of the modal split from road to railway. In this case, higher requirements for the railway are necessary in terms of infrastructure and operation which lead to higher external costs for the railway and reduce its advantage in comparison to the road.

6. Financial arrangements for internalisation

6.1 Compensation with existing taxes and charges

The financial burdens caused by the internalisation of external effects must be synchronised with existing taxes and fees in road transport. It is a fact that some duties (fuel tax, vehicle tax, motorway tolls) are charged in road transport.

In the theory of marginal social cost pricing, the internalisation of external costs is seen as an alternative to the existing taxation of road transport. Parallel to a charging, a compensational reduction of taxes should occur, so that the net burden for motorists is not increased. A restructuring of duties with a revenue-neutral effect is planned. The separate instruments for internalisation are to provide more effective incentives to avoid external damages than the previous taxation, which is not precise enough in access.

[39] European Commission, European Energy and Transport, Trends to 2030, Update 2007, Luxembourg 2008.

The Handbook does not declare the precondition of a compensational tax reduction and unmodified net burden as a requirement. It is only mentioned, "that new charges covering external costs have to consider the existing tax structure".[40] In the Handbook there is no explanation as to the meaning of this statement.

It is announced in CE Delft's "Methodology Paper" from March 15 2007 that "because of considerations of fairness, existing taxes or charges may be lowered or abolished in order to limit the total tax burden of transport users".[41] However, there is a visible tendency that the internalisation of external costs is combined with an increase of the financial burden (see scenarios 3-5).

Irrespective of this, it is claimed that the existing taxes and charges must be considered in the internalisation of external costs.[42] The existing taxes and charges serve primarily to cover the infrastructure costs. If more revenue is generated than infrastructure costs then the surplus must be regarded as compensation for the external costs.

- For the EU it is true that taxes and charges in road transport represent an overpayment of the infrastructure costs, while taxes and charges in railways present an underpayment. This is indicated in a subsidies analysis for the EU-15 for 2005, in which the infrastructure costs of €110 bn for the road are offset by €200 bn in revenues from taxes and charges in the year 2000.[43] According to the calculations of the German Institute for Economic Research, the coverage degree of infrastructural costs in Germany is about 218% for passenger cars, 75% for heavy goods vehicles (before toll charging) and 55% for rail transport.[44] The cost coverage of road transport by fuel and motor vehicle taxes, as well as tolls for heavy goods vehicles, exceed the assignable infrastructural costs.
- The overpayment of infrastructure in road transport from existing taxes and charges must be credited to the cover of external costs. The average rate of fuel tax is about €0,40/litre Europe-wide.[45] Because of cost coverage analyses it can be assumed that, for passenger cars, the fuel tax covers 200% of the infrastructure costs, whilst for heavy goods vehicles, the fuel tax covers 100% of the infrastructure costs.
- For passenger cars this would mean that €0,20/litre must be credited against the external costs. It is therefore assumed that the congestion and accident costs are already internalised and the rest of the external costs would be covered from this overpayment. The ex-

40 Handbook, p.12.

41 CE Delft, et al., Methodologies for external cost estimates and internalisation scenarios. Discussion paper, Delft, March 2007, p. 1.

42 Kopp, P. and Prud'homme, R., The internalisation… loc. cit., p. 17.

43 European Environment Agency, Size…, loc. cit., pp.6.

44 Deutsches Institut für Wirtschaftsforschung, Wegekosten und Wegekostendeckung des Straßen- und Schienenverkehrs in Deutschland im Jahr 1997, Berlin 2000.

45 Handbook, p. 83.

ternal climate costs for passenger cars amount to about €0,10/litre,[46]4 so that €0,10/litre can be used to cover the external costs of air pollution and noise.

– In contrast, no scope would remain for the coverage of external costs for CO_2 emissions, air pollution and noise for heavy goods vehicles due to the current fiscal burdens. Here, an internalisation of external costs would have to mean an increase in the financial burden.

The Handbook only shows the absolute external costs that are to be charged to road transport. The taxes and charges, which are paid from road transport, must be deducted in order to calculate the net burden. The amount left over after the payment of infrastructure costs must be deducted. Considering that the congestion costs and accident costs are already internalised and are deducted from the external costs, the residual external costs (CO_2 emissions, air pollution and noise) of passenger cars are covered by the current taxes and charges. In contrast, however, there is an additional burden for heavy goods vehicles caused by the internalisation of external costs.

6.2 Earmarking of revenues

Supporters of an internalisation of external costs in the road transport sector argue that this can open up new financial revenues for the financing of transport infrastructure and to develop measures for the reduction of external damages. Obviously, the use of these revenues is to remain a political decision, which is up for debate.

The Handbook does not contain information about the disposal of the revenues. In contrast, an earlier discussion paper from CE Delft displays a wide range of disposition alternatives:[47] extension of the transport infrastructure, mitigation measures for external damages, intermodal funds for cross-subsidisation of rail and urban public transport, lowering of labour costs, financing of the general public budget.

A recent Eurobarometer survey reveals that there is a clear majority (76% of the respondents) in favour of earmarking the revenues. Only 17% are in favour of the allocation to the general public budget (7% did not know). The group of earmarking supporters are almost equally divided on the proposals to use the revenues for road infrastructure improvements (36%) or investment in other transport modes (40%).[48]

A fairly similar picture appears from the Public Consultation on the internalisation of external costs carried out by the EU Commission (29.10.07-31.12.07), 36% of the respon-

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46 Handbook, p. 83.

47 CE Delft, Methodologies for external cost estimates and internalisation scenarios, Discussion paper for the workshop on internalisation on March 15, 2007, Delft, p. 53/54.

48 European Commission, Attitudes on issues related to EU transport policy, Analytical report, Flash Eurobarometer No. 206B, Brussels 2007.

dents argued for a use of the revenues in the transport sector in general, 31% for the use within the mode of transport that has been charged or taxed, 20% for an increase of the general public budget and 4% had no opinion.[49]

From the theoretical point of view of public finance, the "equivalent principle" is valid ("pay as you use"), which postulates an earmarking of revenues for the mode of transport that has been charged or taxed. This would mean that the revenues gained from the road transport sector also have to be spent in this sector. Such an earmarking has a crucial advantage in comparison to the past taxation, which has so far not provided an earmarking and has used the revenues for the general public budget. By earmarking the revenues for road infrastructure, financing can be decoupled from eventualities and risks provoked by public budget fluctuations. This therefore provides a more stable financing basis in relation to the today's situation and the financing of road infrastructure does not have to compete year by year with other state purposes. In addition, an earmarking is important for a high public acceptance of the internalisation policy.

However, it seems unlikely that such an earmarking will be implemented. In Germany, the revenues from the electronic toll collection system installed in 2005 for heavy goods vehicles are still not earmarked for road transport but are used to finance the whole transport sector. In 2005, the transport finance organisation AFITF (Agence de financement infrastructures de transport de France) were created in France. It is financed 100% with revenues from the privatisation of the motorway companies and toll revenues from the road transport sector. But three quarters of the gained revenues are expenditures intended for railway projects.[50] The realistic expectation that an earmarking of the revenues will not be implemented goes against theoretical financing principles, goes against fairness between the transport modes, reduces public acceptance and takes away a crucial argument for an endorsement of an internalisation strategy.

6.4 Barriers for PPP-financing

Up to now, road infrastructure has been predominantly governmental property and is funded by public funds. It is political will to setup a stronger private participation in infrastructure financing in the future. The aim is to tap additional private funds alongside public funds to accelerate the expansion of the infrastructure. The private-public-partnership (PPP) provides an appropriate concept that can be formed in different ways. It consists of public start-up financing and continuous revenues either from private charging or from state allocation, which for example is funded by fuel tax. The European Commission is also

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[49] European Commission, Internalisation of external costs, Results of the public consultation (29.10.07-31.12.07), Brussels, p. 17.

[50] Longuet, G., Des avantages de la privatisation. Le débat autour de la vente d´une partie du réseau des autoroutes francaises, in : Le Figaro, 30./31.7.2005, S. 11.

an advocate of PPP-models and recommends them to member states. The question remains as to how the internalisation of external costs in road transport fits into this concept.

On the one hand, the internalisation of external costs through electronic charging could create synergy effects, while the charging technology is used both for charging the private toll and also for charging the external costs. The shared utilisation would decrease the cost of the charging system. This would be one benefit of the internalisation strategy.

On the other hand, the charging of external costs could induce disincentives for PPP-models. The internalisation tends to increase financial burdens in road transport. An effect of this is a decrease in transport demand and a modal shift to other transport modes. In both cases the traffic volume on the road decreases. This in turn leads to a decrease in turnover for private operators, who bear the market risk. A crowding-out effect occurs, in which higher external costs lead to lower private charging revenues. The willingness for a private capital engagement requires a certain minimum turnover. Overall, private investors will have a lower propensity to enter the market. In order for private shareholders to be able to plan, the long-term path for external costs which are to internalised must be negotiated with private operators in order to guarantee their profitability.

A crowding out-effect also occurs when road infrastructure is publicly owned. The charging of external costs leads to lower vehicle-kilometres in road transport, which means that revenues from fuel tax decrease. More charges are crowded out because of fewer fuel taxes, so that a conflict arises between the state's allocating goals and financial aims. This must be considered in the state's revenue planning. The state must decide whether it can cope with the reduction in tax revenues due to more charging revenues.

7. Instruments for internalising external costs

7.1 Road Pricing as basis instrument

The Eurovignette Directive (1999/62/EC) stipulates in article 11 the preparation of a strategy for a stepwise implementation. This means that the instruments for an internalisation also have to be critically assessed and validated concerning their applicability. This task has not been fulfilled by the Handbook. Instruments have not been validated.

We therefore have to resort to the "Methodological Paper", published in March 2007, in which instruments are specified for different scenarios without discussing their pros and cons.[51] The paper makes the following suggestions to reduce the external costs in road traffic:

[51] CE Delft, Methodologies…, loc. cit., Tab. 17, 18.

- Climate costs: CO_2 taxation (fuel tax), differentiated vehicle purchase tax, standards for CO_2 emissions, ETS,
- Air pollution: charge per km, differentiated to Euro standards,
- Noise: charge per km, differentiated to noise standards,
- Accident costs: charge per accident for insurance companies,
- Congestion costs: congestion charge.

Basically, the suggested instruments result in the use of charges and taxes supplemented by standards and, in the long-term, ETS. Because a differentiation is to be accomplished on a km-basis this would require an electronic, EU-wide road pricing system. It is debatable whether the benefits of such a system will exceed its costs.

7.2 Implementation costs

Up to now there have been no cost estimates for EU-wide electronic road pricing. For this reason we have to make a projection on the base of a case-study. For this approach, detailed data for a charging system in the UK is available for the year 2004, which includes passenger cars as well as goods vehicles (costs are for the year 2004).[52]

- The costs for the on-board-units (OBU) are estimated as €150 per OBU. These costs seem to be realistic. For 30 m vehicles in the UK, the investment sum for equipping all vehicles reaches €4.5 bn.
- The annual operating costs are estimated between €3-4.5 bn. They add up to about 25% of the expected charging revenues of €12 bn. They are composed as follows:
  - Costs for administration (e.g. call centres, data handling) €750 m,
  - Costs for communication €1,500 m,
  - Costs for charging system €1,300 m,
  - Costs for monitoring € 400 m.

Using the cost structure of the UK-study for EU-27 and adjusting the estimate to the vehicle stock in EU-27, the following costs result:

- Costs for investment in the EU-27 are €33 bn (€150 per on-board-unit and the vehicle stock is about 220 m vehicles).

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52 Department for Transport, Feasibility study of road pricing in the UK. A report to the Secretary of State for Transport, London 2004, p. 173.

- The operating costs are €22 bn based on the data for UK. The operating costs for the UK are estimated for a comprehensive tolling system as at least €3 bn for 30 m vehicles. This value is extrapolated to 220 m vehicles in EU-27.
- Besides these there are costs for administration (e.g. penalty for users without paying, handling of complaints and court costs.

As a rule, a charging system causes high operational and administrative costs. As shown in the following chapter (London Congestion Charging), these costs can amount to up to 40% of the total revenue. The Eurovignette Directive 2006/38/EC prescribes that an enlargement of the charging system from heavy commercial vehicles to other vehicle categories can be omitted, if the additional operational and administrative costs amount to more than 30% of the additional charging revenues. Moreover, it must be recognised that, in a first step, the implementation costs only occur for a technology which makes no substantial improvement to the infrastructure.

7.3 Congestion charging

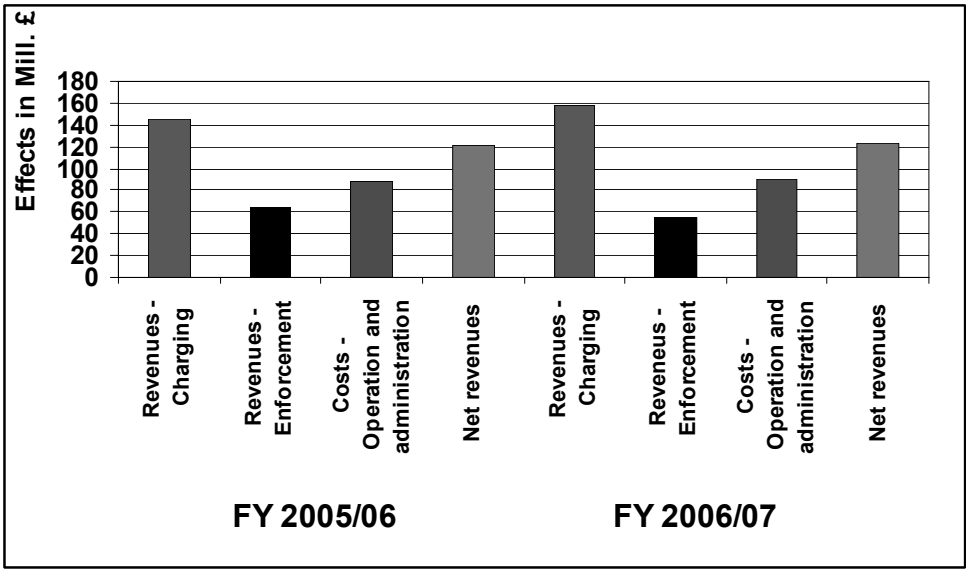
For an internalisation of external costs in large urban areas, the Handbook proposes congestion charging – comparable to London and Stockholm.

Congestion charging shows considerable disadvantages:

- Urban development is characterised by a trend to sub-urbanisation. This development is undesired because it leads to increasing vehicle-kilometres and consequently to rising external costs outside of the city centre. Congestion charging promotes the sub-urbanisation, as road users try to avoid the charge. In this manner, other areas outside the town centre gain in attractiveness (e.g. shopping and recreational traffic).
- Congestion charging is only appropriate for large urban areas with a central downtown area (such as London), which is mainly accessible over a few arterial roads, because only that way the charging control is likely to work. Many European congestion areas are split into several sub-centres.
- Due to congestion charging there is a local and temporal shift in congestion situations. An increase in traffic on the margins of the high-priced time interval – thus at the beginning and end of the peak-load-time - must be anticipated. Likewise, areal shifts take place, namely from the high charge zone to the low charge zone or to bypass roads.
- The traffic streams in urban areas do not show the necessary flexibility, so that the required clearance for a reduction of external costs is not granted. Commuter and educational traffic have to be handled within a certain core time. Similarly, the transport of goods is appointed to fixed delivery periods. For a shift to other transport modes (rail, urban public transport) there is a lack of the necessary capacities during the peak hours.

The London Congestion Charge is widely accepted as a success story in reducing congestion and improving air quality in metropolitan areas. However, these impacts arrive at substantial costs. The revenues from charging amount to around £150 m. In addition, revenues from enforcement are taken in the amount of around £60 m. Both add up to about £210 m with a recent trend to higher charging and lower enforcement revenues (because of scheme changes). On the other hand, the costs of scheme operation and administration add up to £90 m. This means that more than 40% of the total revenues (or put alternatively, 60% of the charging revenues) are spent for operation and administration. This means that a substantial part of the revenues is already consumed before the public transport supply (e.g. additional busses) can be improved.

Figure 1: Scheme revenues and costs of the London Congestion Charge



Source: Transport for London, Central London Congestion Charging, Impacts Monitoring, Fourth and Fifth Annual Report, London 2006 and 2007

7.4 Value added services of the road charging system

The requirement for an internalisation of external costs with differentiated charges, which are dependent on the mileage, is a Europe-wide application of an electronic tolling system. As shown, this is associated with high costs for the systems and their operation. These costs thus oppose the market introduction of electronic charging. Supporters of the internalisation strategy argue that this system (on-board-units, Galileo satellite system) could be used for value added services in the transport industry. Thus, the transaction costs would be

reduced. The services could be offered cheaper and customer benefits would be generated out of other services. Hence, the benefits of the tolling system would be extended to other applications for transport users. It would be a waste to use the electronic system only for charging external costs and not to use other options to improve the efficiency.

Indeed, various possibilities exist in using the system technology. This is especially true for road goods transport. The following services are of interest to the carriers:[53]

- Innovative navigation services with route recommendation,
- Tracking and tracing,
- Fleet management,
- Registry of driver information and its transmission to the carrier's control station,
- Management of goods parking spaces near motorways based on telematics,
- Enhancement of road safety through intelligent vehicle systems.

On the other hand, it has to be recognised that the benefits of value added services do not accrue automatically. Providers, who develop such services and offer them on the market, are essential. The users have to pay for these services. It is doubtful whether the prices for using the application are justified and whether the transport business has a corresponding willingness-to-pay. It is certainly true that a potential value added from a charging system increases the acceptability of the transport business. However, the success depends on the attractiveness of the services, on the generated benefits, and on the willingness-to-pay. This will be proved in the concrete application of possible services. The system providers have to develop business models, the operators have to present the costs for the use of the interfaces, and the politicians have to compose the legal framework for the supply of additional services.

8. Wider economic impacts

8.1 Methodological approach

The internalisation of external costs increases the costs of the passenger and goods transport.[54] The economic and social consequences of the internalisation must be analysed in an

[53] It has to be considered that the value added services have to be provided in a way which does not affect competition between vehicle manufacturers, system providers and service providers, refer also to Directive 2004/52/EC of the European Parliament and of the Council of 29 April 2004 on the interoperability of electronic road toll systems in the Community.

[54] This holds true for the internalisation of external costs by fiscal means. However, there are also other approaches which contribute to a reduction of external costs such as enlargement of transport infrastructure, better utilisation of existing infrastructure capacities (e.g. European modular system) etc. These measures could be part of a more balanced strategy to reduce external costs in the transport sector.

impact assessment. The Commission was appointed by the European Parliament to conduct an impact analysis and to include the results within the proposal. The impact assessment has not yet been published but it is expected in June 2008, together with the proposal. The question is whether the proposed internalisation measures are compatible with the EU's economic and social aims. According to the Lisbon strategy, the European Union is to become "the most competitive and dynamic knowledge-based economy in the world by 2010".[55] This involves sustainable economic growth, more and better jobs, greater social cohesion and respect for the environment. More recently, the European Council launched the second three-year cycle of the renewed Lisbon strategy for growth and jobs (2008-2010).[56] It reconfirmed the four priority areas of investing more in knowledge and innovation, creating a more dynamic business environment by unlocking the business potential (especially of SME's), investing in people and greening up the economy.

In the following, an attempt is made at conducting an empirical assessment of the most important economic and social impacts. The following aspects are analysed:

- Inflation impulses,
- Employment effects,
- Social fairness,
- Europe-wide cohesion.

The goal is to demonstrate the impacts of the internalisation of external costs. The results refer only to road transport and not to other modes. Passenger car transport is distinguished from goods transport. To show the range of possible internalisation strategies, two scenarios are considered:

- Internalisation according to the Handbook proposal: All external costs which are considered in the handbook – irrespective of their current relevance for internalisation – are internalised. In this case, the charges would be the highest and the risks for price stability, employment etc. would be very pronounced.
- Internalisation according to the modified proposal: This scenario considers only those external costs for internalisation which represent valid externalities. Therefore, congestion costs, the share of the internalised accident costs and the costs for nature and landscape are not considered. Only the costs for air pollution, CO2 emissions, noise and up and downstream processes are charged. In terms of impacts, this scenario would exhibit more moderate but still distinct impacts.

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55 Council of the European Union, Presidency Conclusions, Lisbon European Council, 23. and 24. March 2000.

56 Council of the European Union, Brussels European Council 13/14 March 2008, Presidency Conclusions.

The impact assessment for the two scenarios does not consider external benefits. As argued earlier, external costs have to be offset against the external benefits. Only the difference is applicable for internalisation. However, because of the so far scarce empirical evidence on external benefits, an offset scenario is not considered in the following.

The cost basis for the internalisation is represented in Table 3. The calculations are implemented with the weighted average costs for all road categories (urban roads, motorways and rural roads) and for the average of peak- and off-peak costs.

Table 3: External cost components as considered in the impact assessment

External cost components (in €-ct per km)	Handbook proposal		Modified proposal	
	Passenger cars	Goods vehicles	Passenger cars	Goods vehicles
Congestion	4.4	12.4	---	---
Accidents	1.7	3.4	0.5	1.1
Noise	0.2	1.4	0.2	1.4
Air pollution	0.3	5.9	0.3	5.9
Climate change	0.4	1.6	0.4	1.6
Up- and downstream processes	0.7	1.9	0.7	1.9
Nature and landscape	0,3	0.9	---	---
Soil and water pollution	0.1	1.0	---	---
Total	**8.1**	**28.5**	**2.1**	**11.9**

Source: Own calculations.

8.2 Inflation impulses

The internalisation of external costs increases the costs of mobility in both passenger and goods transport. Generally, mobility expenses are part of the price level of the overall economy. Hence, higher mobility costs are also reflected in the economies' general price level, represented by the Consumer Price Index (CPI). The following calculations will be carried out exemplarily for Germany.

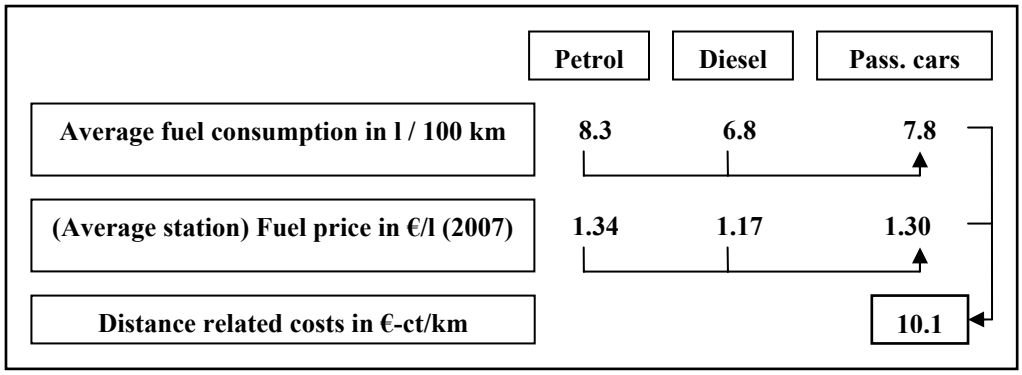
The internalisation of external costs will lead to km-based user charges. Currently, there is no corresponding position in the CPI weighting scheme. However, distance based charges can be treated as an increase in km-based mobility costs. This interpretation makes it possible to explore the impact of the internalisation on the Consumer Price Index.

The model calculation involves the following preparatory steps (see also Figures 2+3):

– Data on fuel consumption and fuel prices (2007 station prices in €/l) are used to find out the distance-related costs of transport (in €-ct per km). The analysis considers different vehicle types (passenger cars and goods vehicles). On the input data level, the car fleet

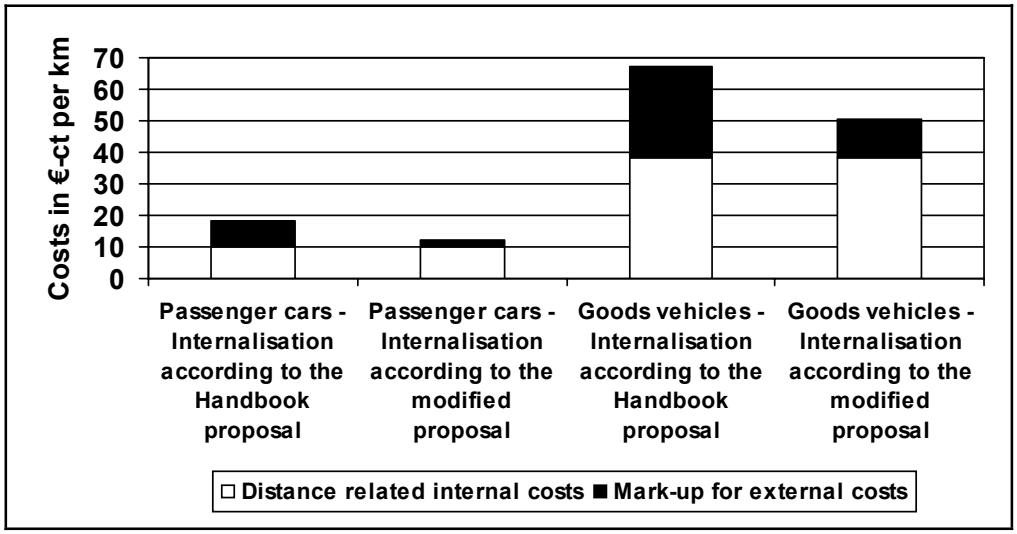
is also distinguished between petrol and diesel cars. As a result, the distance-related costs amount to 10.1 €-ct/km in passenger cars and 38.6 €-ct/km in goods vehicles.

Figure 2: Distance related costs – example: passenger cars



Source: BMVBS (Ed.), Verkehr in Zahlen 2007/08, Berlin 2008; own calculations.

Figure 3: Mark-ups to distance related costs



Source: Own calculations.

– The internalisation scenarios (Handbook proposal / modified proposal) lead to different mark-ups to the distance-related costs. The mark-ups are calculated as weighted average (applying vehicle-kilometre on different road types as weighting factors). In the inter-

nalisation scenario according to the Handbook proposal, the mark-ups amount to 8.1 €-ct/km in passenger cars and 28.5 €-ct/km in goods vehicles. The internalisation scenario according to the modified proposal leads to mark-ups of 2.1 €-ct/km in passenger cars and 11.9 €-ct/km in goods vehicles. Compared to the basis of distance-related costs, the mark-ups differ between 21% and 80% (the lower value applies to the internalisation scenario according to the modified proposal) for passenger cars and between 31% and 74% for goods vehicles.

The increase of distance-related costs is considered as an increase in fuel prices which is equivalent to the internalised external costs on km-basis. This holds true assuming conditions of constant transport demand. This assumption will be modified subsequently.

The process of the model calculation is represented in Figure 4. It shows that the internalisation of external costs impacts the CPI via both channels – passenger and goods transport. The impact is determined by several factors:

- Weighting share of fuel prices (COICOP [Classification of Individual Consumption by Purpose] 0722): They amount to 35.37‰ within the CPI.[57]
- Demand reaction: Congruent to the latest evidence on national and European level[58] the price elasticity of demand (reaction of vehicle-kilometre on price modifications) is assumed as -0.3 to reflect short-term reactions in the segment of passenger cars and -0.2 for goods vehicles. In a more long-term perspective, demand may react more elastic. Hence, the elasticity is assumed as -0.6 for passenger cars and -0.5 for goods vehicles.
- Share of transport costs: Transport represents a typical auxiliary service to the industry. The average input to other industries amounts to 2.5%.[59] This share is applied to all industries and CPI index groups (01-12) respectively.
- Share of (goods) transport input relevance to index groups: In some index groups – such as "01-Food and (Non-Alcoholic) Beverages" – inputs for the transport sector are relevant for all positions whereas in some other groups – such as "11-Hotel and Restaurant Services" – inputs from goods transport are not necessary. A third characteristic considers that – such as in "04 Housing, Water, Electricity…" – transport sector inputs are only partly relevant. For instance, index group 04 contains the rent for flats (041) which make up the largest part (203.30‰) of the index group 04 weight (308.00‰). The "relevance factor" is then calculated to 1 - 203.30‰ / 308.00‰ = 0.34. This procedure is applied to all index groups.

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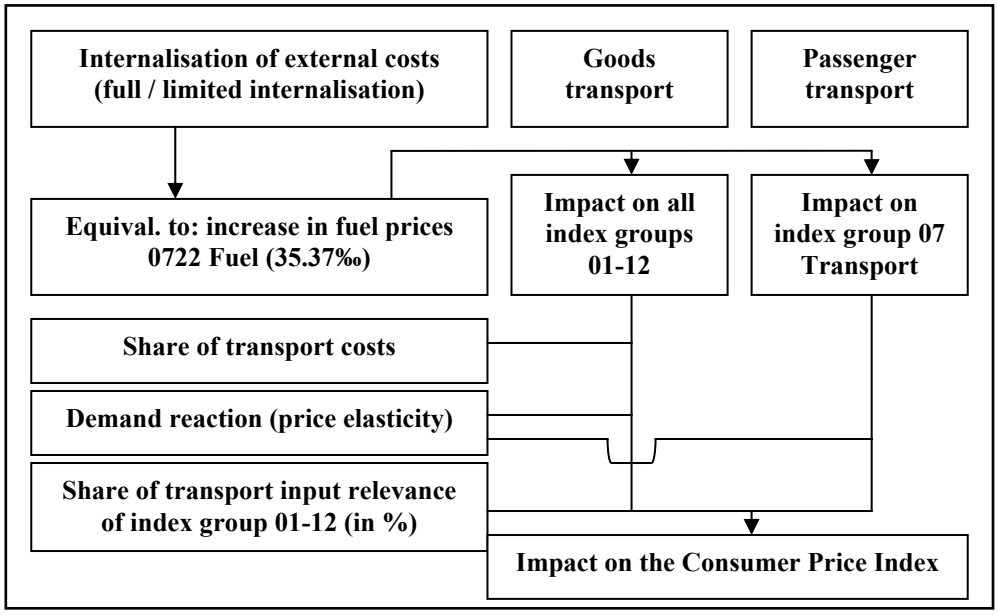
57 Statistisches Bundesamt, Verbraucherpreisindex auf Basis 2005, Wiesbaden 2008.

58 CE Delft, Handbook…, loc. Cit, p. 27; Hautzinger, H. et al., Analyse von Änderungen des Mobilitätsverhaltens – insbesondere der Pkw-Fahrleistung – als Reaktion auf geänderte Kraftstoffpreise, Heilbronn 2004.

59 Wuppertal Institut, Bedeutung stark steigender Öl- und Gaspreise für den privaten und gewerblichen Verkehr in NRW, Enquête-Kommission des Landtags NRW, Endbericht, Wuppertal 2007, p. 83.

Figure 4: Process of the model calculation of the inflation impulse



Source: Own representation.

The results of the model calculation are represented in Table 4. They show that the internalisation of external costs will lead to substantial inflation impulses:

- For the internalisation scenario according to the Handbook proposal (short-term reaction) the increase of the Consumer Price Index adds up to 3.0%-points. The majority of this effect contributes the passenger transport with 2.2%-points because consumers are directly impaired by the internalisation measures. The impact on goods transport amounts to 0.8%-points. The effect is lower than in passenger transport. Consumers are impaired indirectly because the increase of transport costs is spread all over the economy.
- A stronger demand reaction – as reflected by higher price elasticity – will dampen the inflation impulse in a more long-term perspective. The total CPI increase adds up to 2.0%-points. The goods transport contributes to a quarter of the total effect.
- The internalisation scenario according to the modified proposal produces generally more moderate results. In the short-term perspective the inflation impulse will amount to about 1.0%-point, whereof passenger transport contributes 0.7%-points and goods transport 0.3%-points.
- Exact results may vary for slightly different conditions in other EU member states. However, the dimension of the inflation effect will remain valid.

– In addition, it has to be kept in mind that the inflation impulse represents an add-on to the current inflation rate. This means that the impulse of e.g. 1.0%-point becomes additional to the socket inflation. Under the current economic conditions – involving high oil prices, a robust business cycle and increasing food and raw material prices – the internalisation strategies represent a considerable risk for price stability in the European Union.

Table 4: Inflation impulse of the internalisation of external costs

Inflation impulse (CPI increase in %-points)	Handbook proposal		Modified proposal	
	Short-term reaction	Long-term reaction	Short-term reaction	Long-term reaction
Passenger transport	2.2	1.5	0.7	0.7
Goods transport	0.8	0.5	0.3	0.2
Total	**3.0**	**2.0**	**1.0**	**0.9**

Source: Own calculations.

For validation purposes, the results are compared with the results of a macroeconomic simulation study, which assesses the impacts of pricing measures in the transport sector for Germany on the basis of the PANTA-RHEI model. Model outputs are figures for sectoral and macroeconomic variables such as transport prices, transport performance, general price level, employment etc:[60]

– In passenger transport the study investigates the impact of a continuous raise of the eco-tax on fuels (as it was practised in annual steps from 1999 to 2003). A five-year raise, each by 3.07 €-ct/year, would result in an inflation impulse on the Consumer Price Index by 0.5%-points or 0.1%-points respectively per step.[61] This corresponds well with the result of the internalisation scenario according to the modified proposal, where an amount of 2 €-ct/km (this would imply eight annual raises of the eco-tax, therefore 0.8%-points) leads to a CPI rise of 0.7%-points.

– In goods transport our results can be compared to the increased "Lkw-Maut" (distance-based tolling for heavy goods vehicles). The two assessed scenarios (doubling of "Lkw-Maut" and "Swiss scenario") assume add-on charges of 12.5 €-ct/km and about 40 €-ct/km. The charged amount thus corresponds quite well to the assumptions made hereunder for the internalisation scenarios according to the modified proposal and according to the Handbook proposal (short-term reaction). The inflation impulses to the CPI amount to 0.2%-points for the doubling charges scenario and 0.7%-points for the Swiss scenario.[62] Again, the results indicate changes which are comparable to the own model calculations.

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60 Distelkamp, M., Lutz, Chr., Meyer, B., Wolter, M.I., Schätzung der Wirkung umweltpolitischer Maßnahmen im Verkehrssektor unter Nutzung der Datenbasis des Statistischen Bundesamtes, GWS Discussion Paper 2004/5, Osnabrück 2004.

61 Distelkamp, M., Lutz, Chr., Meyer, B., Wolter, M.I., Schätzung der Wirkung…, loc. Cit. p. 91.

62 Distelkamp, M., Lutz, Chr., Meyer, B., Wolter, M.I., Schätzung der Wirkung…, loc. Cit. p. 99-102.

8.3 Employment effects in the automotive industry

The automotive industry represents a key industry for Europe. Solely 2.3 m employees are directly dependent on the motor vehicle production in Europe.[63]

The internalisation of external costs by means of distance-based user charges will also influence the renewal of the vehicle stock. As a consequence, employment in the automobile industry will also be influenced. Conceptually, the employment effects in the automotive industry can result from the following technical and economic considerations:

- The demand reaction due to the charging leads to lower annual vehicle-km. Under the condition of a constant technical lifecycle output (e.g. 150,000 km/veh), the renewal of the vehicle will be delayed.
- In terms of household budget, it can be argued that the internalisation absorbs parts of the planned mobility budget. Several reactions have to be considered. When the household plans a fixed mobility budget (e.g. 15% of its monthly income) in order to cover expenses for fuel, vehicle insurance, maintenance etc., the charging absorbs parts of the budget which were initially dedicated to the renewal reserve. On aggregated level, the renewal of the vehicle stock will be delayed. A delay in fleet renewal would not be consistent with a strategy for the reduction of CO_2 emissions.[64]

The delay would also impair employment in the automobile industry. Otherwise, it is also possible that the households cut their expenses for other, less urgent purposes. Employment effects can then spread over the whole economy. The possible reactions and their implication for the employment effects are represented in Figure 5.

The assessment of the employment effects in the car sector is based on the following statistical dates and model assumptions:

- The stock of passenger cars in Germany (2007) amounts to 46.6 m cars. 67% of the stock belongs to inland makes, 33% to foreign makes (e.g. French, Italian, US-American, Japanese, South Korean cars).[65]
- The average vehicle-kilometre per car driven amount to 12,000 km/year. Congruent to the assessment methodology of the Federal Transport Infrastructure Investment Plan (BVWP), the average vehicle lifetime is assumed as 12 years.[66]

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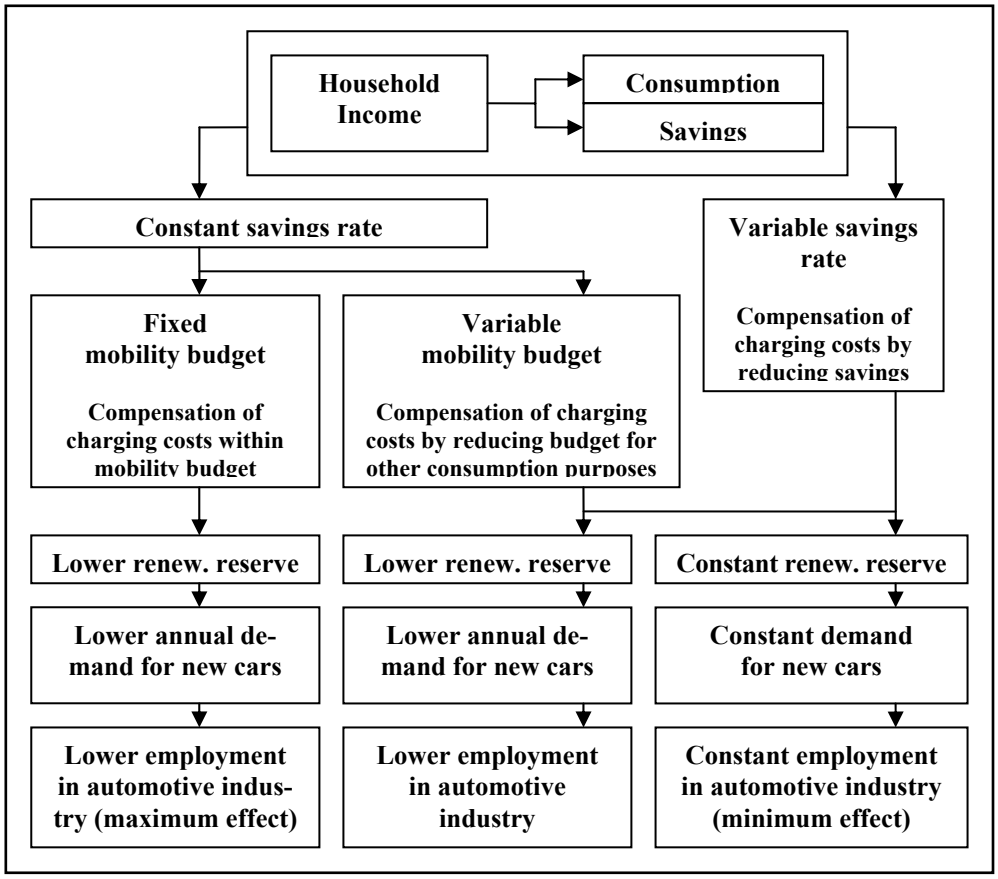
63 ACEA, The Engine of Europe, www.acea.be.

64 European Commission, Proposal for a regulation of the Parliament and of the council on Setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles, COM (2007) 856, Brussels 19.12.2007.

65 Kraftfahrt-Bundesamt, Statistische Mitteilungen Fahrzeugzulassungen, Bestand und Marken am 1.1.2007, Flensburg 2007.

Figure 5: Consumer Reactions to charging and their implication for employment in the automotive industry



Source: Own representation.

– The investment costs are calculated for a representative vehicle (VW Golf V). The investment costs amount to about €18,000.[67] The discount rate is in line with BVWP assumed as 3%.

66 Planco Consulting GmbH, Numerische Aktualisierung interner und externer Beförderungskosten für die Bundesverkehrswegeplanung (BVWP) auf den Preisstand des Jahres 1998, Schlussbericht für das Bundesministerium für Verkehr, Bau- und Wohnungswesen, Essen 2000, p. 25.

67 ADAC, ADAC Autokosten 2008, Sonderdruck, Stand 4/2008, München 2008, S. 17.

- The turnover of the German automotive industry (vehicle production, production of vehicle parts and accessories) amounts to €278 bn (2007). The average annual employment amounts to 705,000 employees.[68] The employment coefficient can be calculated to 2.54 employees per m € turnover.
- According to the internalisation scenario based on the modified proposal, the external costs are charged with 2 €-ct/km to passenger cars on the total road network.
- In order to show the range of employment effects, a fixed mobility budget is assumed. Since this assumption leads to maximum employment losses in the automotive industry, the results have to be interpreted as "up to x persons or up to y%".

In the calculation process, the statistical base data are combined with the model assumptions. Interim results are stated and commented below:[69]

- The amount of money which has to be appropriated for buying a new car after 12 years equals €1,270/year (investment costs [€18,000] ∗ annuity factor [0.81] / vehicle lifetime [12 years]). The internalisation absorbs financial means of €240/year (internalisation charge [2 €-ct/km] ∗ veh-km [12,000 km/year]). Hence, the disposable renewal reserve per year declines from €1,270 to €1,030. As a consequence, the savings period will last longer and the renewal of the car will be delayed by up to 27 months, i.e. 2 years and 3 months.
- Because the renewal of the car stock needs more than 14 years instead of 12 years, the annual demand for new cars will decrease from 3.881 m cars to 3.266 m cars.
- The demand reduction amounts to 615,000 cars/year (calculation process: [46.6 m/12 years] – [46.6 m/14.26 years]). 67% of the reduction, i.e. 412,400 cars/year, applies to inland makes.
- The demand reduction represents a production value of €7.4 bn (412,400 cars ∗ €18,000/car). Applying the employment coefficient of 2.54 employees per m € turnover, the associated employment reduction adds up to a maximum of 18,800 employees per year.

The results can be summarised and interpreted as follows:

- The internalisation of external costs according to the modified proposal reduces employment in the automotive industry. This effect can be quantified with up to 18,800 employees per year in Germany. This equals an employment reduction of up to 2.67%.
- The employment reduction is caused by lower demand for new cars because the renewal of the car stock is temporally stretched from 12 years to more than 14 years.

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68 VDA-Statistik, www.vda.de.

69 Slight differences due to rounding of figures can appear.

- Scaling up the results to European level can be done roughly on the basis of the car stock in the EU-27 compared to Germany. The share of Germany on the EU-27 car stock (235 m vehicles, 2007) amounts to about 20%. Therefore, the employment reduction on European level can be estimated to up to 100,000 employees.
- In the framework of the model calculation, the figure of 100,000 has to be regarded as maximum value. Depending on the assumption of the mobility budget (see above) the employment reduction may be substantially lower. On the other hand, it has to be considered that other European economies may produce cars more labour intensively. Depending on this, the maximum employment reduction may even surmount the number of 100,000 employees.

The employment perspectives for the manufacturers of goods vehicles look quite different. Investment decisions in the road haulage sector are to a large extent driven by economic considerations (incl. tax depreciation), thus leaving room for incentives – even for a faster fleet renewal. Such a one-time effect can appear when fleet owners try to recover the fiscal burden of the internalisation with lower operating costs (i.e. buying of cleaner and more fuel efficient vehicles). This reaction pattern is suggested by a macroeconomic simulation study (PANTA RHEI model) of pricing measures for Germany. The results (referring to the "Swiss scenario" which is comparable to the internalisation scenario according to the Handbook proposal in this study) are briefly summarised below:[70]

- The employment effect for the overall economy is negative. The employment loss cumulates to about 75,000 jobs per year in Germany. This loss is foremost driven by losses in the road haulage, logistic services industry and vehicle manufacturing industry.
- From a temporal perspective, the employment effects in the vehicle manufacturing industry are slightly more positive (up to 3,000 employees) in the first year after the implementation, representing the faster fleet renewal. Afterwards (two to three years after implementation of the measure), the employment effect also becomes negative. Based on the mentioned study, this effect can be explained with shifts to other modes after contracting periods have run out.

8.4 Social fairness

The internalisation of external costs must comply with the principle of social fairness. This is measured with the additional financial burden of the different income groups in society. A "regressive" effect to the income distribution is politically undesirable. The regressive effect is when the recipients of lower income are relatively higher burdened than the recipients of higher income. It remains an open question as to whether the internalisation policy complies with the requirement of distributional justice.

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70 Distelkamp, M., Lutz, Chr., Meyer, B., Wolter, M.I., Schätzung der Wirkung…, loc. Cit. p. 97-102.

In the following, an empirical distribution analysis ("incidence analysis") is conducted for the income situation exemplifying Germany. The analysis is carried out for passenger car transport. The object of the analysis is how the internalisation of external costs affects to the income distribution.

- Two charging scenarios are considered: an internalisation according to the Handbook proposal of all external costs (8.1 €-ct/km) and an internalisation according to the modified proposal (2.1 €-ct/km) (only accident costs, CO2 costs, air pollution and noise costs) for the whole road network in Germany.
- The essential base data is the sample survey of household income and expenditure (EVS) 2003 of the Federal Statistical Office.[71] This is a sample survey, where 0.2% of all private households are interviewed about their income and expenditure.
- The basis for the calculation of the distribution effects are the vehicle-kilometres on roads made by households in the different income classes. The quota of vehicle-kilometres for the household income classes is determined by the expenditures of the households for fuel (EVS 2003). The fuel expenditures for the households are dependent on their road performance: the fuel expenditures rise with increasing vehicle-kilometres and are directly interrelated with their road performances.
- The calculation of the cost share of vehicle-kilometres for the household income groups, which are based on the fuel expenditures of the respective EVS household group, is conducted using the average fuel consumption. For the calculation an average consumption of 7.8 l/100 km is supposed.
- The toll on road traffic is in addition to the present duties (fuel tax, vehicle tax et cetera). It is an additional fiscal burden for those households which use a vehicle, and is not compensated by a tax reduction elsewhere.
- The extent of the decrease in transport demand is determined from the income level of a household class in case of an increase in charges. It is assumed that there would be a higher reduction of vehicle-kilometres in households with lower income than in households with higher income. This relation is considered in price elasticities depending on income.[72] The price elasticities of transport demand for three different household types are demonstrated in the following table.

The elasticities should be used for the following calculation. The income classes for the 3 household types are adapted for the analysis of the distribution effects for the household income classes in the EVS 2003.

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71 Federal Statistical Office, Sample survey of household income and expenditure 2003, booklet 4, Wiesbaden 2005.

72 Baum, H. et al., Economic benefits of car traffic, Cologne 1998, pp. 62ff.

Table 5: Elasticity of fuel prices for veh-km (for different types of households)

	Elasticity of fuel prices for vehicle kilometres
Type of household 1: 2-people-household; rents and welfare recipients with lower income (less than 1,000 €)	-0,36
Type of household 2: 4-people-household of clerks and workers with middle income (1,500 to 2,500 €)	-0,28
Type of household 3: 4-people-household of civil servants and employees with higher income (more than 2,500 €)	-0,20

Source: Baum, H et al., Economic benefits…, loc cit., p. 63

The elasticities should be used for the following calculation. The income classes for the 3 household types are adapted for the analysis of the distribution effects for the household income classes in the EVS 2003.

Using this data it is possible to calculate the distribution effects on the households resulting from the toll. The road vehicle-kilometres for the various household income groups are calculated from the fuel expenditure.

With the aid of these price elasticities, the fall in demand is quantified for the different income groups (and therefore also the decline of fuel expenditure). Finally the toll is added as a cost factor to the remaining vehicle-kilometres. Thereby the fuel expenditure for each household rises.

The financial burden effect for several household income groups (relating to their net income) could be identified from the increase in expenditure due to the toll charges. The findings are shown in Table 6 (internalisation according to the Handbook proposal) and 7 (internalisation according to the modified proposal).

It turns out that the household groups are burdened in a different way by the charging of a toll. In the case of internalisation according to the Handbook proposal, the middle income groups (<2,000 to <5,000 EUR) are more burdened. In this case, the additional costs are 2% and 3% of the household net income and so they demonstrate a substantial income absorption. The financial situation for the multiple person households is thus tightened. In case of single households and those in the higher income groups, the burden is significantly lower. Here, the toll involves additional costs, which are at most 1.6% of the household net income.

Table 6: Additional costs for different groups of households resulting from a road charge (Handbook proposal)

Group of income	Size of house-hold	Number of house-holds	Number of persons	Net income per house-hold	Net income per house-hold	Net income per group of households	Total income share of house-holds' group	Expenses for fuels per household	Expenses for fuels per house-holds' group	Total expenses share of house-holds' group
(Euro)	(Per-sons)	(1.000)	(1.000)	(Euro/ month)	(Euro/year)	(Million Euro/ year)	(%)	(Euro/mon th)	(Million Euro/ month)	(%)
<900	1	2833	2833	706,29	8.475,48	24.011,04	2,32%	17,80	50,42	2,1%
<900	2	150	300	770,98	9.251,76	1.387,76	0,13%	34,00	5,10	0,2%
<1.300	1	3518	3518	1.104,36	13.252,29	46.621,56	4,51%	27,47	96,66	4,0%
<1.300	2	867	1734	1.125,76	13.509,11	11.712,40	1,13%	41,38	35,88	1,5%
<1.300	3	113	339	1.164,69	13.976,28	1.579,32	0,15%	40,35	4,56	0,2%
<1.500	1	1531	1531	1.397,79	16.773,50	25.680,23	2,49%	42,31	64,78	2,7%
<1.500	2	545	1090	1.404,36	16.852,34	9.184,52	0,89%	52,02	28,35	1,2%
<1.500	3	108	324	1.408,07	16.896,89	1.824,86	0,18%	44,70	4,83	0,2%
<2.000	1	2717	2717	1.724,02	20.688,28	56.210,05	5,44%	48,02	130,47	5,4%
<2.000	2	1705	3410	1.761,85	21.142,24	36.047,52	3,49%	66,88	114,03	4,7%
<2.000	3	348	1044	1.764,61	21.175,31	7.369,01	0,71%	78,78	27,41	1,1%
<2.000	4	112	448	1.797,00	21.564,00	2.415,17	0,23%	79,00	8,85	0,4%
<2.600	1	1610	1610	2.269,90	27.238,79	43.854,46	4,25%	59,52	95,82	3,9%
<2.600	2	2495	4990	2.300,15	27.601,78	68.866,44	6,67%	76,79	191,59	7,9%
<2.600	3	502	1506	2.307,67	27.692,08	13.901,42	1,35%	102,45	51,43	2,1%
<2.600	4	315	1260	2.331,00	27.972,00	8.811,18	0,85%	110,00	34,65	1,4%
<2.600	5	74	370	2.310,00	27.720,00	2.051,28	0,20%	114,00	8,44	0,3%
<3.600	1	1097	1097	2.994,66	35.935,95	39.421,74	3,82%	67,79	74,37	3,1%
<3.600	2	3014	6028	3.042,76	36.513,11	110.050,51	10,65%	97,46	293,74	12,1%
<3.600	3	891	2673	3.082,40	36.988,84	32.957,05	3,19%	119,70	106,65	4,4%
<3.600	4	904	3616	3.120,00	37.440,00	33.845,76	3,28%	123,00	111,19	4,6%
<3.600	5	232	1160	3.179,00	38.148,00	8.850,34	0,86%	125,00	29,00	1,2%
<5.000	1	484	484	4.184,52	50.214,27	24.303,71	2,35%	75,15	36,37	1,5%
<5.000	2	1882	3764	4.183,47	50.201,64	94.479,48	9,15%	115,86	218,05	9,0%
<5.000	3	611	1833	4.175,40	50.104,79	30.614,03	2,96%	127,49	77,90	3,2%
<5.000	4	910	3640	4.197,00	50.364,00	45.831,24	4,44%	131,00	119,21	4,9%
<5.000	5	257	1285	4.245,00	50.940,00	13.091,58	1,27%	135,00	34,70	1,4%
<18.000	1	263	263	7.295,91	87.550,95	23.025,90	2,23%	87,09	22,90	0,9%
<18.000	2	1418	2836	6.875,03	82.500,36	116.985,52	11,32%	128,00	181,50	7,5%
<18.000	3	351	1053	6.725,00	80.700,00	28.325,70	2,74%	143,00	50,19	2,1%
<18.000	4	615	2460	6.731,00	80.772,00	49.674,78	4,81%	138,00	84,87	3,5%
<18.000	5	238	1190	6.852,00	82.224,00	19.569,31	1,89%	139,00	33,08	1,4%
Sum		32.730	62.506			1.032.989,03	100,00%		2.426,98	100,0%

Source: Statistisches Bundesamt, EVS 2003, own calculations.

Table 6: Additional costs … (Handbook proposal) - continued

Vehicle kilometres per households' group	Price elasticity of demand	Vehicle kilometres of households' group (regarding the decrease in demand)	Expenses for fuels per households' group (without road charge, regarding the decrease in demand)	Expenses for fuels per households' group (with road charge)	Additional costs for road charge (full internalisation of external costs, compared to fuel expenses without road charge, regarding the decrease in demand)	**Additional costs in percent of households' income (full internalisation of external costs)**
(Million km/ month)		(Million km/ month)	(Million Euro/month)	(Million Euro/month)	(Million Euro/year)	**(%)**
509,99		326,39	32,27	58,72	317,34	**1,32%**
51,58		33,01	3,26	5,94	32,10	**2,31%**
977,59		625,66	61,86	112,55	608,31	**1,30%**
362,86	-0,36	232,23	22,96	41,78	225,79	**1,93%**
46,11		29,51	2,92	5,31	28,69	**1,82%**
655,15		419,30	41,46	75,43	407,67	**1,59%**
286,73		183,50	18,14	33,01	178,41	**1,94%**
48,83		31,25	3,09	5,62	30,39	**1,67%**
1319,61		950,12	93,94	170,92	923,77	**1,64%**
1153,35		830,41	82,10	149,39	807,38	**2,24%**
277,27		199,63	19,74	35,91	194,10	**2,63%**
89,49		64,43	6,37	11,59	62,65	**2,59%**
969,14	-0,28	697,78	68,99	125,53	678,42	**1,55%**
1937,74		1395,17	137,94	250,98	1356,47	**1,97%**
520,17		374,52	37,03	67,37	364,13	**2,62%**
350,46		252,33	24,95	45,39	245,33	**2,78%**
85,32		61,43	6,07	11,05	59,73	**2,91%**
752,14		601,71	59,49	108,24	585,02	**1,48%**
2970,93		2376,74	234,99	427,56	2310,82	**2,10%**
1078,71		862,97	85,32	155,24	839,04	**2,55%**
1124,61		899,69	88,95	161,85	874,74	**2,58%**
293,31		234,65	23,20	42,21	228,14	**2,58%**
367,88		294,31	29,10	52,94	286,14	**1,18%**
2205,37		1764,30	174,44	317,39	1715,36	**1,82%**
787,84	-0,20	630,27	62,32	113,38	612,79	**2,00%**
1205,71		964,57	95,37	173,52	937,81	**2,05%**
350,91		280,73	27,76	50,50	272,94	**2,08%**
231,65		185,32	18,32	33,34	180,18	**0,78%**
1835,76		1468,61	145,20	264,19	1427,87	**1,22%**
507,66		406,13	40,15	73,06	394,86	**1,39%**
858,39		686,71	67,90	123,53	667,66	**1,34%**
334,60		267,68	26,47	48,15	260,25	**1,33%**
24.546,85		18.631,06	1.842,08	3.351,60	18.114,29	

Table 7: Additional costs for different groups of households resulting from a road charge (Modified proposal)

Group of income	Size of house-hold	Number of house-holds	Number of persons	Net income per household	Net income per house-hold	Net income per group of households	Total income share of house-holds' group	Ex-penses for fuels per house-hold	Expenses for fuels per house-holds' group	Total expenses share of house-holds' group
(Euro)	(Per-sons)	(1.000)	(1.000)	(Euro/mon th)	(Euro/year)	(Million Euro/ year)	(%)	(Euro/m onth)	(Million Euro/ month)	(%)
<900	1	2833	2833	706,29	8.475,48	24.011,04	2,32%	17,80	50,42	2,1%
<900	2	150	300	770,98	9.251,76	1.387,76	0,13%	34,00	5,10	0,2%
<1.300	1	3518	3518	1.104,36	13.252,29	46.621,56	4,51%	27,47	96,66	4,0%
<1.300	2	867	1734	1.125,76	13.509,11	11.712,40	1,13%	41,38	35,88	1,5%
<1.300	3	113	339	1.164,69	13.976,28	1.579,32	0,15%	40,35	4,56	0,2%
<1.500	1	1531	1531	1.397,79	16.773,50	25.680,23	2,49%	42,31	64,78	2,7%
<1.500	2	545	1090	1.404,36	16.852,34	9.184,52	0,89%	52,02	28,35	1,2%
<1.500	3	108	324	1.408,07	16.896,89	1.824,86	0,18%	44,70	4,83	0,2%
<2.000	1	2717	2717	1.724,02	20.688,28	56.210,05	5,44%	48,02	130,47	5,4%
<2.000	2	1705	3410	1.761,85	21.142,24	36.047,52	3,49%	66,88	114,03	4,7%
<2.000	3	348	1044	1.764,61	21.175,31	7.369,01	0,71%	78,78	27,41	1,1%
<2.000	4	112	448	1.797,00	21.564,00	2.415,17	0,23%	79,00	8,85	0,4%
<2.600	1	1610	1610	2.269,90	27.238,79	43.854,46	4,25%	59,52	95,82	3,9%
<2.600	2	2495	4990	2.300,15	27.601,78	68.866,44	6,67%	76,79	191,59	7,9%
<2.600	3	502	1506	2.307,67	27.692,08	13.901,42	1,35%	102,45	51,43	2,1%
<2.600	4	315	1260	2.331,00	27.972,00	8.811,18	0,85%	110,00	34,65	1,4%
<2.600	5	74	370	2.310,00	27.720,00	2.051,28	0,20%	114,00	8,44	0,3%
<3.600	1	1097	1097	2.994,66	35.935,95	39.421,74	3,82%	67,79	74,37	3,1%
<3.600	2	3014	6028	3.042,76	36.513,11	110.050,51	10,65%	97,46	293,74	12,1%
<3.600	3	891	2673	3.082,40	36.988,84	32.957,05	3,19%	119,70	106,65	4,4%
<3.600	4	904	3616	3.120,00	37.440,00	33.845,76	3,28%	123,00	111,19	4,6%
<3.600	5	232	1160	3.179,00	38.148,00	8.850,34	0,86%	125,00	29,00	1,2%
<5.000	1	484	484	4.184,52	50.214,27	24.303,71	2,35%	75,15	36,37	1,5%
<5.000	2	1882	3764	4.183,47	50.201,64	94.479,48	9,15%	115,86	218,05	9,0%
<5.000	3	611	1833	4.175,40	50.104,79	30.614,03	2,96%	127,49	77,90	3,2%
<5.000	4	910	3640	4.197,00	50.364,00	45.831,24	4,44%	131,00	119,21	4,9%
<5.000	5	257	1285	4.245,00	50.940,00	13.091,58	1,27%	135,00	34,70	1,4%
<18.000	1	263	263	7.295,91	87.550,95	23.025,90	2,23%	87,09	22,90	0,9%
<18.000	2	1418	2836	6.875,03	82.500,36	116.985,52	11,32%	128,00	181,50	7,5%
<18.000	3	351	1053	6.725,00	80.700,00	28.325,70	2,74%	143,00	50,19	2,1%
<18.000	4	615	2460	6.731,00	80.772,00	49.674,78	4,81%	138,00	84,87	3,5%
<18.000	5	238	1190	6.852,00	82.224,00	19.569,31	1,89%	139,00	33,08	1,4%
Sum		32.730	62.506			1.032.989,03	100,00%		2.426,98	100,0%

Source: Statistisches Bundesamt, EVS 2003, own calculations.

Table 7: Additional costs … (Modified proposal) - continued

Vehicle kilometres per households' group	Price elasticity of demand	Vehicle kilometres of households' group (regarding the decrease in demand)	Expenses for fuels per households' group (without road charge, regarding the decrease in demand)	Expenses for fuels per households' group (with road charge)	Additional costs for road charge (limited internalisation of external costs, compared to fuel expenses without road charge, regarding the decrease in demand)	**Additional costs in percent of households' income (limited internalisation of external costs)**
(Million km/ month)		(Million km/ month)	(Million Euro/month)	(Million Euro/month)	(Million Euro/year)	**(%)**
509,99		326,39	32,27	39,21	83,24	**0,35%**
51,58		33,01	3,26	3,97	8,42	**0,61%**
977,59		625,66	61,86	75,16	159,57	**0,34%**
362,86	-0,36	232,23	22,96	27,90	59,23	**0,51%**
46,11		29,51	2,92	3,54	7,53	**0,48%**
655,15		419,30	41,46	50,37	106,94	**0,42%**
286,73		183,50	18,14	22,04	46,80	**0,51%**
48,83		31,25	3,09	3,75	7,97	**0,44%**
1319,61		950,12	93,94	114,13	242,32	**0,43%**
1153,35		830,41	82,10	99,75	211,79	**0,59%**
277,27		199,63	19,74	23,98	50,91	**0,69%**
89,49		64,43	6,37	7,74	16,43	**0,68%**
969,14	-0,28	697,78	68,99	83,82	177,96	**0,41%**
1937,74		1395,17	137,94	167,59	355,82	**0,52%**
520,17		374,52	37,03	44,99	95,52	**0,69%**
350,46		252,33	24,95	30,31	64,35	**0,73%**
85,32		61,43	6,07	7,38	15,67	**0,76%**
752,14		601,71	59,49	72,28	153,46	**0,39%**
2970,93		2376,74	234,99	285,51	606,16	**0,55%**
1078,71		862,97	85,32	103,66	220,09	**0,67%**
1124,61		899,69	88,95	108,07	229,46	**0,68%**
293,31		234,65	23,20	28,19	59,84	**0,68%**
367,88		294,31	29,10	35,35	75,06	**0,31%**
2205,37		1764,30	174,44	211,94	449,96	**0,48%**
787,84	-0,20	630,27	62,32	75,71	160,74	**0,53%**
1205,71		964,57	95,37	115,87	246,00	**0,54%**
350,91		280,73	27,76	33,72	71,60	**0,55%**
231,65		185,32	18,32	22,26	47,26	**0,21%**
1835,76		1468,61	145,20	176,42	374,55	**0,32%**
507,66		406,13	40,15	48,79	103,58	**0,37%**
858,39		686,71	67,90	82,49	175,14	**0,35%**
334,60		267,68	26,47	32,15	68,27	**0,35%**
24.546,85		18.631,06	1.842,08	2.238,05	4.751,63	

Such a result could be down to the fact that the households with middle incomes have high road vehicle-kilometres. They are therefore affected by the price increase disproportionnately high.

In the case of an internalisation according to the modified proposal, the relative burden of the income recipients is lower. Here, the middle income groups in particular (and again the multiple person households) are affected by the price increase of road transport. The additional financial burden is between 0.5% and 0.8%. The recipients of higher income, as well as single households, are simply charged up to 0.43% of their net income.

The calculations suggest that the internalisation of external costs causes unintended distribution effects on society. The middle income groups and the multiple person households are charged more intensively, while the recipients of higher income are only charged subproportionately. Insofar the charging is full of social conflict, which will reduce political acceptance among the people.

8.5 European Cohesion

Economic and social cohesion represents another important aspect which has to be regarded when the economic implications of the internalisation policy are explored. Cohesion highlights the spatial distribution of the income and employment growth in the EU. As such, cohesion (policy) should ensure that the winners and losers within the Single European Market are balanced in a way that strengthens the economic and social ties in the EU as a whole. Politically, cohesion represents one of the EU goals established in the Treaty on the European Union (Art. 2). Also on a theoretical basis, the last fifteen years involved an increasing interest in refocusing on the spatial dimension of economics (New Economic Geography).[73] Obviously, transport costs are essential in this context. Transport costs are usually modelled following the concept of iceberg transport costs (i.e. a fraction of goods does not arrive at the destination when goods are shipped between regions). As internalisation will take place, transport costs will rise. Regions will be impacted differently by higher transport costs because the distance to the market is not uniform. Hence, it is important to pay attention to the implications of the internalisation policy on cohesion.

In economic theory, cohesion effects are considered based on these arguments:

- Referring to neoclassical growth theory, EU member states with lower than average GDP per capita (initially those at the periphery of the EU) will, in the long run, catch up to the core because of higher annual growth rates.
- The catch-up process, however, does not take place automatically. According to the new economic geography, a better accessibility of peripheral regions can contribute to a

[73] Krugman, P., Geography and Trade, Leuven 1991; Brakman, S., Garretsen, H., van Marrewijk, C., An introduction to geographical economics, Cambridge 2001.

sustainable regional development. However, this depends largely on the equipment of a region with potential factors, such as location and regional accessibility, skilled workers, industry structure and infrastructure equipment. This implies that cohesion policy (e.g. infrastructure investments) to stimulate regional catch-up processes is not successful in any case. There are examples of persistent intra-national income disparities in Italy as well as in Germany (Mezzogiorno effect).

Empirical evidence on European cohesion involves the following findings:[74]

- The GDP per capita of member states with below average GDP per capita grows faster than in the member states with above average GDP per capita. In so far, relative growth rate differences will produce a narrowing of the income disparities over time.
- The development on member state level – even among countries with fairly similar initial conditions (first generation of cohesion countries. Ireland, Spain, Portugal, Greece) – is quite different. Whereas Ireland enjoyed robust economic growth for more than a decade and Spain managed to catch up, Portugal failed to improve its economic situation. In terms of GDP per capita, Portugal was overtaken by new member states such as Slovenia and the Czech Republic.
- Whilst the disparities between member states become narrower over time, they can even become larger within a member state when rather remote regions (e.g. West Wales, Galicia, Apulia, Western Greece) cannot develop as dynamically as the country average.
- The cohesion policy, including infrastructure investment, contributes significantly to the territorial cohesion because of the enabling character of transport infrastructure (impact chain: better accessibility, lower transport costs, improved competitiveness) for regional growth.

Therefore, it is important to pay attention to the implications of the internalisation strategies for economic and social cohesion. The internalisation of external costs will increase transport costs. The rising of the iceberg-like transport costs appear to be a barrier to regional accessibility. This contradicts with the European regional development policies of making peripheral areas more accessible (for example by means of infrastructure investment). Hence, the internalisation strategy will impair the competitiveness of industries in peripheral regions. In the long run, this may also involve the relocation of activities to more central places in the European Union. In order to compensate for this centripetal force, it is important to ensure that high level transport infrastructure (e.g. motorways) in peripheral regions can be used at a reduced km-based charge. The EU proposal for internalisation should include this possibility.

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[74] European Commission, Growing regions, growing Europe, Fourth Report on economic and social cohesion, Brussels 2007; Carrington, A., A Divided Europe? – Regional convergence and neighbourhood spillover effects, in: Kyklos, Vol. 56 (2003), pp. 381-394; ANFAC, La logística como factor clave de competitividad en el Sector del Automóvil, Febrero de 2007.

9. Acceptance by public opinion

The political enforceability of the plans for the internalisation of external costs depends decisively on its acceptance by society and therefore by the political voters. The European Commission put the question up for discussion in a public consultation (in 2007).[75] The European Commission sees a wide majority of people who are pro internalisation of external costs. Citizens of the EU (70%) and organisations (30%) were involved in the public consultation.

- 81% of the respondents are pro internalisation of external costs, about 15% are against it.
- 80% are of the opinion that the EU should do something in the field of internalisation costs in general, 15 % were against it.
- 64% were in favour of using electronic road pricing as an instrument for the internalisation of external costs in road transport and 12% were against it.

Based on this public consultation a conclusion regarding general acceptance can not be made. The survey is in no way representative (only 469 answers for EU-27). Moreover, it can be assumed that the respondents had their own motivation and used their answers to promote their own interests. In fact, respondents were asked about the possible risks of an internalisation, to which they listed competitiveness, economic growth, loss of jobs and social conflicts. However, there was no weighting between the disadvantages and the acceptance, thus it is not easy to estimate the significance of these risks. In addition, the survey did not test the approval of additional financial expenses for motorists.

In contrast to the public consultation, representatively and statistically sound surveys regarding the acceptance or rejection of the European Commission's plans to conduct an internalisation of external costs are available from the Eurobarometer.[76] The survey results for EU-27 lead to the following conclusions:

- A majority of 60% is against the proposal that all road users should pay for congestion and environmental damage through road tolls. Only 35% agreed that these costs should be requested from every road user.
- With a majority of two thirds, the rejection of the proposal is even stronger in the large member states (Germany, France, Italy, United Kingdom).
- Only in a few – mostly new – member states (Czech Republic, Latvia, Lithuania, Greece) there is a small majority (reaching support of 54% maximum) for road pricing for all road users.

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75 European Commission, Public Consultation, loc. cit.

76 European Commission, Attitudes on issues related to EU transport policy, Analytical report, Flash Eurobarometer No. 206B, Brussels 2007.

Similar conclusions can be drawn from the wider public discussion regarding the charging of passenger cars for motorways, which was discussed in recent years in Germany. The similarity of the survey is due to the fact that the charges for passenger cars are an integral part of the European Commission's internalisation plans and therefore acceptance can be tested.

The following description represents Germany:[77] 73% of motorists are against and 26% are pro a charging of motorways according to an ADAC-survey. The "Spiegel" survey showed a 60% rejection rate of passenger car charging and an acceptance of 26 %. Society mistrusts all political claims that additional financial burdens are compensated through tax reduction elsewhere. The majority does not believe that government will compensate the motorway charge by eliminating vehicle tax. Only 22% of society believes this, 70% have definitive doubts.

The results of some representative surveys in Germany concerning motorway charging show that an obvious majority rejects these plans. This result can be applied analogously for the question regarding internalisation of external costs in road transport.

10. Requirements for the revision of the Eurovignette Directive

10.1 Agenda for Eurovignette III

In the beginning of 2008 and as a follow up to the Handbook discussion, the European Commission expressed its position on the further implementation of the internalisation of external costs. The European Commission has emphasised that the internalisation will not follow the recommendations of the Handbook entirely. The Commission favours a stepwise proceeding. They will propose an amendment of the Eurovignette Directive (III) for goods vehicles. Hence, passenger cars are not covered in the first set of proposed measures.

- Goods transport is planned to be charged with its external costs according to the "polluter-pays principle", because the problem is estimated as being particularly urgent and of a major extent.
- The previous regulation that the charges may only cover the costs of infrastructure is going to be suspended so that external costs may also be charged. This means an implementation of goods vehicle charges all over Europe.
- The field of application for charging external costs is the entire road network. The subsidiarity principle is generally applied.
- A differentiation of charges for goods vehicles according to environmental characteristics (e.g. emission classes ("EURO"-classification)), time of day, level of service (peak, off-peak hours) is planned. This may open up a wide range of charges and provides the member states with a lot of flexibility in designing charging systems.

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77 Bundesbürger skeptisch gegenüber Auto-Maut, in: Medien-Info, January 2005.

- There are also plans to earmark revenues for the transport sector. A full earmarking of charges for the road sector, however, is rather unlikely.

The assessment of the identifiable elements of an amendment to the Eurovignette Directive can be based on the arguments of the evaluation in the Handbook. A large part of the comments on the Handbook also hold true for the planned amendment of the Directive. Furthermore, for goods transport additional arguments are relevant. Consequently the following evaluation of the requirements is a combination of arguments from the Handbook and further specific aspects for goods transport. This assessment is of particular political importance because the European Commission has announced its intentions for proceedings in this field.

10.2 Basic principles

For the revision of the Eurovignette Directive certain generally accepted principles for political decisions should be applied. These principles are: compliance in objectives, efficiency, administrative feasibility and acceptance. The general criteria have to be adapted and formulated for the problem of an internalisation of external costs. There should be a consensus about the criteria between the actors in the political decision making process (EC, manufacturers, customers). For a revision of the Eurovignette Directive the following principles can be deduced:

- Transparency: The proposals for a revision should be comprehensible, the various estimates should be weighed and the choice should be substantiated. It should also be disclosed which external costs may be avoided by this approach.
- Fairness of cost allocation: Only those costs, which are of unequivocal external character and are not already internalised, should be relevant for a charging of external costs.
- Intermodal fairness: Charging the external costs of transport should be carried out in a way that grants fairness between different transport modes. All transport modes should be charged by a unified calculation method. Fiscal competitive restraints for certain transport modes have to be avoided.
- Externality efficiency: For the reduction of external costs, the measure which is associated with the lowest costs whilst still ensuring the same level of efficiency, should be adopted. This leads to a maximization of economic welfare.
- Dynamic incentives: The internalization should be undertaken with such instruments promoting innovations and technical progress in the road transport sector. Incentives for an implementation and market penetration of innovative vehicle technologies should be given. However, dynamic incentives can have a negative impact on the fiscal sustainability due to a lower overall revenue level. A decrease in road transport demand leads automatically to a shrinking public budget.

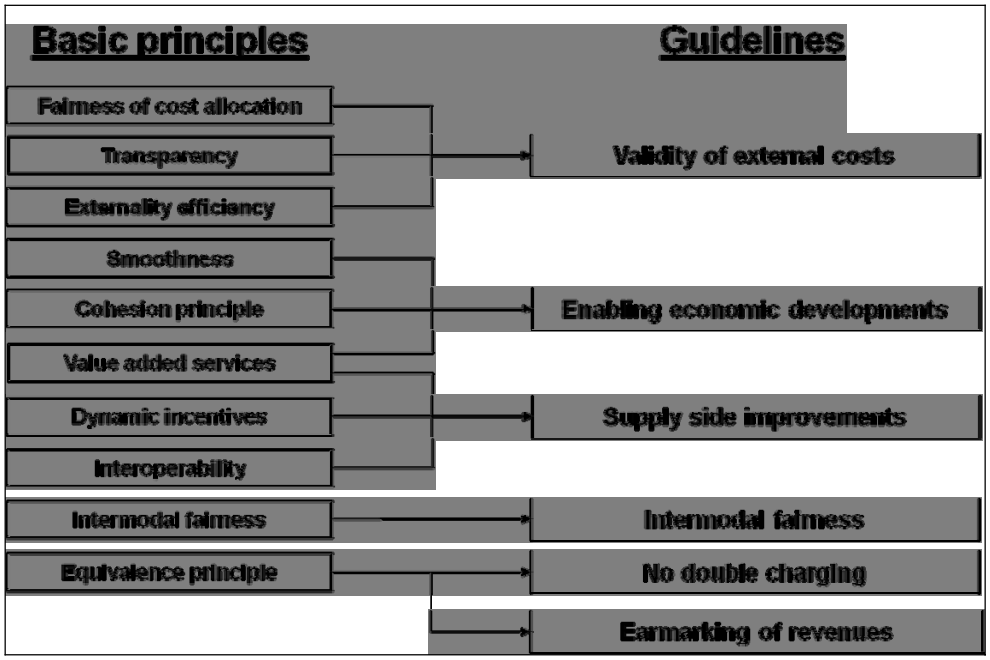
- Value added services: The instruments of the Eurovignette should be constructed in a way that enables value added services for the transport sector. This results in an electronic road pricing for goods vehicles within the EU. With such modern IT-Systems, transport processes in companies can be optimised. Additionally, potential, business opportunities and logistical effect can be achieved in the transport sector.
- Interoperability: Charging instruments should preserve interoperability in international road traffic.[78] As a result, cross-border road transport should be facilitated and barriers for the international exchange of goods can be prevented. It is important that the functioning of the single common market will not be impaired.
- Legal conformity: This especially involves data security regarding the data acquired by the charging systems. There must be a guarantee that no data will be misused by public authorities.
- Smoothness: The charging system should be configured in a way that preserves competitiveness and the ability to develop the economy. Abrupt price shocks through charging must be avoided. There should be a continuous adjustment of charges with moderate increases to the fiscal burden. External costs should not be charged directly in the full amount but rather by a stepwise adjustment over time.
- Equivalence principle: According to the "pay-as-you-use" principle, the revenues of the internalization should be earmarked for the transport mode that has been charged or taxed. Thus a reduction of external damages can be achieved through both a restriction of demand and supply side improvements financed by the charges.
- Cohesion principle: A charging of the external costs should be implemented in a way that enforces the cohesion within the European Union. This means that core and peripheral member states may not be discriminated against through financial charging. This requires exceptions and special considerations for specific EU-Countries. On the other hand, the implementation of charging should not lead to a distortion in competition between the member states.

10.3 Guidelines for an amendment

The basic principles form the basis for a development of guidelines for the revision of the Eurovignette Directive. These provide the framework for the economic, environmental and social sustainability, which must also be considered through an internalisation policy. In figure 6 the interrelation between the principles and the guidelines is represented. This figure also shows which principles feed into which guidelines. In the following text the interrelations are subsequently addressed.

[78] Directive 2004/52/EC of the European Parliament and of the Council of 29 April 2004 on the interoperability of electronic road toll systems in the Community.

Figure 6: The link between basic principles and guidelines for the Eurovignette amendment



Source: Own representation

10.3.1 Validity of external costs

The first question concerning an amendment of the Eurovignette Directive is which components of the external costs have to be included in the internalisation. The political discussion emphasises the congestion costs, accident costs, air pollution, CO2 emission costs and noise costs. These cost components are an integral part of the Handbook.

Weighted average costs for goods vehicles (see table 1) add up to different amounts: for urban roads (60 cents/km), for motorways (25 cents/km) and for rural roads (20 cents/km). These cost estimates should be checked against the following issues and possibly corrected:

– The congestion costs have to be eliminated from the external cost because they are already internalised. Every motorist contributes just as much to the congestion he or she sustains by the other road users. These potential congestion costs are considered in the decision making process (e.g. additional buffer time for drivers, higher staff costs). Consequently, approx. 12 cents/km of the 28.5 cents/km of the average external costs are not applicable, which means that only 56% of the external costs remain.

- For the accident costs, the analysis of the Handbook concludes that the major part of the accident costs is already internalised by insurances. If one assumes 2/3 of the accident costs are internalised, only 1.1 cents/km of the 3.4 cents/km for goods vehicles remain.
- The costs of climate change for goods vehicles amount to 1.6 cents/km. It can be assumed that this is an overestimate because avoiding costs are significantly lower compared to the damage costs.
- The costs of nature and landscape (0.9 cents/km) should not be considered, because these effects do not diminish the economic added value.

The Handbook estimates the external costs for goods vehicles at 28.5 cents/km (weighted average). After correction only 12 cents/km (= 42%) remain. Consequently the charged costs have to be adjusted downwards.

10.3.2 Intermodal fairness

The internalisation of external costs should happen in a way that grants fairness between different transport modes. All transport modes should be charged by a unified calculation method. Fiscal competitive restraints for certain transport modes have to be avoided.

- The European Commission's proposal goes against the principle of intermodal fairness because there are only plans to conduct a charging of the external costs for goods transport on roads. A fiscal burden for railways is not envisioned. Instead, the noise pollution from rail shall be reduced through technical measures, the funding for which still remains undecided. The competitive position of road declines substantially as a result of this unequal treatment of the transport modes.
- There is further discrimination against road transport due to a considerable subsidisation of infrastructure and service operation in rail and urban public transport within the member states. In contrast road transport gains no subsidies. Public expenditures for road infrastructure are offset by revenues from taxes and charges which can be regarded as a payment for the use of road infrastructure. In order to calculate external costs, the subsidies for rail can be dealt with differently: either they are added directly to the external costs of rail transport or the external costs of road transport are reduced in the amount of the rail subsidies. In either instance the balance concerning external costs for goods transport on roads turns out more favourably.
- An unequal treatment to the disadvantage of road transport also takes place due to differing valuation principles. In an evaluation of traffic noise the rail is in a better position thanks to a "rail bonus". For a given noise level, a 5 dB(A) deduction is applied for rail in contrast to other transport modes. This deduction is not to justified.

10.3.3 Supply-side improvements

For goods transport on roads the European Commission is aiming for a fiscal solution through a reduction and shift of transport demand. In contrast, a noise reduction for rail shall be achieved through technical measures. In order to avoid unequal treatment, supply improvements are also to be carried out for road transport. The purpose is to find the measures associated to the least-avoiding costs and thus minimise the financial burden for the economy. It might be that an internalisation of external costs by fiscal means is not the most cost efficient measure.

An integrated approach of supply-side improvements (involving road transport infrastructure, intelligent vehicle technologies for the reduction of accident risk, an upgrading of traffic information systems, development of fuel and emission-efficient vehicles and enhancing the market penetration by regulations and standards) would represent a more balanced approach to tackle externalities. Thanks to the EURO standards, there have been drastic reductions in air pollution caused by goods vehicles. These reductions are an example of the success of supply-side improvements.

Instead of solely relying on a decrease in traffic demand, transport policy should reconsider whether a combination of demand and supply policy is more practical. Thus a reduction of external costs could be accomplished from both sides of the market – supply and demand. Thereby supply-side measures could be co-financed from the returns of financial measures, which would require an earmarking of revenues.

10.3.4 No double charging

In an internalisation of external costs, paid taxes and charges have to be taken into consideration and may be interpreted as coverage of the external costs. The goods transport on roads has to pay vehicle taxes, diesel taxes and (partly) motorway charges for goods vehicles. These fiscal duties exceed the costs of infrastructure for motorways. For example, the infrastructure costs for motorways in Germany are covered by motorway charges from goods vehicles. A considerable part of the diesel tax and the vehicle tax are assigned to the general budget. This over-coverage of infrastructure costs has to be considered in the charging of external costs, because a part of these costs has to be regarded as already covered by the overpayment of infrastructure costs. To justify an additional fiscal burden for the goods transport on roads, it would be necessary for the EU to make the cost structure more transparent. Infrastructure costs, fiscal duties, the coverage degree of infrastructure costs and the remaining free financial resources which cover external costs should be carefully considered in a financial calculation. A reduction in external costs through the overpayment of infrastructure costs would mean that revenues from taxes would have to cover the external costs. Thus the diesel tax could be regarded as coverage of the climate costs.

10.3.5 Earmarking of revenues

On the part of the European Commission, there is a discussion regarding the appropriate earmarking of revenues arising from the charging of external costs. Considered options are used for the transport sector in general – for the mode of transport that has been charged or taxed or for the general budget. The Commission favours the use of the revenues for transport in general, i.e. also for a cross-financing of other transport modes.

From the viewpoint of fiscal theory, charges have the character of "fees" (earmarked revenues) and not of "taxes" (revenues for the general public budget). Consequently, an earmarking for road transport is intended. This can be concluded from the application of the "equivalence principle" ("pay as you use").

A cross-subsidisation for railways and waterways may only be taken into account if a perceptible benefit for road transport arises due to the measures for other transport modes (e.g. reduction of traffic volume on roads in trans-alpine traffic).

10.3.6 Enabling economic development

The revision of the Eurovignette Directive has to consider macroeconomic consequences. The internalisation of external costs in the charges increases the prices for goods transport and thereby affects the economy.

Inflation impacts

Effects arise from the inflation rate. The higher transport costs due to the charging of external costs are largely passed on by transport prices. Depending on the proportion of transport costs, this leads to increasing prices for goods. If demand is altogether inelastic, demand does not significantly decrease with increasing prices for goods. Higher prices for goods result in a rise of the consumer price index, the inflation rate increases.

If higher charges cannot be passed on by an increase in transport prices, the external costs are charged at the expense of transport companies. Transport companies would have to accept a curtailment of their profit margins and would eventually be forced out of the market. For this segment of the transport market, no price effects arise. Instead, production and employment would decline in the transport industry.

The Commission announces within the discussion that it intends to charge congestion, air pollution and noise costs for road goods transport. This would lead to an average charge of 9 cents/km for all road categories. This would result in a rise in the consumer price index by 0.25%-points.

Employment impacts

The second important macroeconomic impact of an internalisation policy is the decrease in the total employment. This contractive effect emerges in several impact channels:

- Increased transport costs which are imposed on goods prices reduce the demand and consequently the mileage in road transport. Subsequently, turnovers of the road haulage industry decline. As a result, the financial scope for fleet renewal of the goods vehicles diminishes. This implies a slower renewal process, also involving higher operating times for the vehicle and a production decline in the vehicle manufacturing industry.
- When increases in transport cost cannot be passed on through goods prices, the profitability of transport companies declines, sometimes losses have to be accepted. Companies which are not able to recover their costs, have to exit the market. The demand for new commercial vehicles diminishes and employment decreases in the vehicle manufacturing industry.
- In the case of a modal shift from road to rail and inland waterways, employment increases for these transport modes. Due to their inferior quality profile compared to road, this would result in a slow-down of productivity, income and employment.
- On the other hand, positive employment effects are possible. These depend on the structure of the charging system. The differentiation of charges through incentives for low-emission and fuel-efficient vehicles would provide incentives for the procurement and production of more eco-friendly vehicles. However, this is a mere momentary effect when the demand stimulus diminishes after the fleet adaptation. Hence, it is important to keep the incentives regularly updated and in line with technical progress.
- Positive effects for employment arise from potential value added services which are enabled by the charging technology. Such services are bought by transport companies in order to increase the efficiency of their transport processes. The provision of services stimulates employment.
- Additional revenues from the charges are generated for public bodies. Spending these financial resources for public investment may result in further stimulation of employment.

The effects on employment include positive as well as negative effects due to different impact channels. For a quantification of effects on employment, complex calculations which would go beyond the scope of this study are necessary. However a proximate estimation of the magnitude of these effects is possible on the basis of research literature.

For this purpose we use a macroeconomic simulation model for Germany[79], which has been developed for the German Federal Environment Agency. The model evaluates the effects

[79] Distelkamp, M., Lutz, Chr., Meyer, B., Wolter, M.I., Schätzung der Wirkung…, a.a.O., p. 97-102.

on employment through different charging scenarios in the road goods transport sector. The calculations refer to the charging of goods vehicles on motorways in Germany up to the year 2020.

For the charging of congestion, air pollution and noise costs, an average charge of 9 cents/km for all road categories arises for the road goods transport sector. As a result, a loss of jobs for the whole economy is expected and up to 24,000 job losses a year in Germany alone.

Abstract

This paper provides a critical review of the European Commission policy towards the internalisation of external costs. The review carried out in spring 2008 is based on the preparatory documents for the EC Green Transport Package (July 2008), most prominently the CE Delft-led "Handbook on estimation of external costs in the transport sector" from December 2007. The starting point of the review is marked by the question which costs are truly external. Moreover, the paper reviews critically the assessment methodology of external costs, the underlying theoretical basis and conceptual issues. Main points of criticism are that external benefits are disregarded by the Handbook and that evaluation principles are mixed. The review includes an assessment of the wider economic impacts of the internalisation in the road sector. The impact assessment reveals that the internalisation would lead to substantial inflation impulses and would threaten employment in the automotive industry and the overall economy. Based on this analysis, principles and guidelines for the amendment of the Eurovignette Directive are worked out.

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