

EXECUTIVE SUMMARY

This expert review assesses the study “Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities” (STICITE). It scrutinises the evidence in detail, including the methodologies, assumptions, data, results and conclusions, presents additional insights and research, and considers alternative approaches. Based on our review, we make recommendations for further study (Annex X).

5

General observations

The STICITE study is comprehensive, well-researched and thorough. It clearly identifies uncertainties in characterising and evaluating external costs, and where limitations to internalisation exist.

The publicly available documentation from the study includes a large amount of detailed data showing the results of analysis and numerical calculations. However, certain critical data and calculations, necessary to understand fully and reproduce the analytical steps, and investigate alternative scenarios, are not available for review. We acknowledge legitimate concerns regarding intellectual property. However, without access to this information, precise sensitivity analysis and full scrutiny of evidence were not possible.

The underlying approach of this review, when determining the nature and magnitude of external costs, is the “individual user perspective”. This perspective is consistent with well-established definitions of external costs, that are generated by people or groups that make decisions, and are imposed on other people or groups. The individual decisions to enter and utilise the transport system using a chosen means has an impact on other parties, that can be evaluated. The “system perspective” can provide additional insights under certain circumstances, for example when considering predictable congestion.

The objectives quoted by STICITE, which are 1: “influencing behaviour” (to reduce external costs), 2: “generating revenues” and 3: “increasing fairness”, are the key boundary conditions in assessing the implications of internalisation. Fairness involves applying the “polluter pays” principle, referring to the party generating the external cost. A strict interpretation of this principle would additionally involve the party bearing the external cost, where this party is identifiable, receiving a payment in compensation for the damage caused. In practice, identifying that party and executing payment can be complex and needs to be investigated for each external cost category.

The STICITE study is not a cost-benefit analysis, but does acknowledge that transport delivers benefits to society. The available literature around the benefits of transport suggests there are indeed a number of direct, indirect and wider economic benefits of transport. These derive from employment and value added within the transport sectors, the contribution of transport to the economic performance of other sectors, increased labour supply, induced property development, dynamic clustering and increased competition. However, the literature indicates that the wider benefits cannot be considered as external.

External and infrastructure cost and revenue: evaluation and internalisation

Our review has assessed STICITE’s evaluation of each external cost category and of infrastructure costs and revenues. The methodologies used by STICITE are appropriate, but the results are subject to uncertainties due to limitations in the best-available data and methods.

External cost categories: the following summarises the conclusions on evaluation of each external cost category and the implications for internalisation.

- Accidents: applying the responsibility approach, consistent with the individual user perspective, allocates costs to the causers of accidents and accounts for risk anticipation by internalising insurance premiums. This results in a value for external accident costs for road 44% lower than reported by STICITE when using the same value of statistical life (VSL). Significant uncertainty in the external accident cost figures exists due to the best-available methods and data for the determination of VSL.
 - Internalisation: contribution to behavioural change and fairness (internalisation objectives 1 and 3) can be achieved by internalisation of accident costs through insurance premiums. This represents full internalisation of the value of life/injury recognised by the insurance, or a partial internalisation if the VSL as reported by STICITE is applied. This highlights the wide range of valuations of VSL according to different assumptions. The impact of road pricing on accidents is highly situation-dependent and it is not clear that pricing would lead to reduction in accidents and their external costs. Addressing accidents through command and control and other measures can provide a comprehensive response to external accident costs, as acknowledged by STICITE.
- Congestion: STICITE's use of delay cost to calculate total external costs is not consistent with its statements that delay cost includes both internal and external components. From our analysis, the deadweight loss, used by STICITE when comparing costs to revenues and calculating cost coverage ratios, is the external congestion cost consistent with the individual user perspective. According to the STICITE figures, deadweight loss is approximately on sixth of delay cost. External congestion costs in non-road modes were addressed in STICITE but comparable figures were not generated. One estimate for average external delay costs of passenger rail indicates they may be similar to deadweight loss external costs in road transport, per pkm.
 - Internalisation: comprehensive application of the individual user perspective would preferentially apply pricing between the parties generating the congestion costs and those bearing the costs, implying mainly system-internal transfers. There are practical and technical challenges in designing effective congestion pricing mechanisms, for example through marginal social cost pricing (MSCP), that in practice inevitably includes an average pricing element. These factors hinder the full achievement of the behavioural and fairness objectives of internalisation through congestion pricing.
- Pollution and climate costs:
 - Pollution: the STICITE methodology appears to be appropriate and the input data are reputable. The individual processing steps in the calculation of impact on human health are not fully available for scrutiny. Also considering the value of life year, derived in a similar way to VSL, some uncertainty in the final values results.
 - Well-to-wheel climate: the key variable in the external cost determination is the cost of carbon. STICITE acknowledges a wide range of possible values.
 - Internalisation: using STICITE values for external costs, for almost all passenger cars and for other road vehicles certified to recent emissions standards, internalisation through fuel duties represents full MSCP of climate costs and approximate MSCP for pollution. For diesel rail in 13 EU28 Member States it represents full MSCP of climate costs and partial MSCP in the other 15.

- Noise and habitat costs:

Noise: the STICITE methodology is reasonable, but the analytical steps and data sources introduce uncertainties that, when aggregated, diminish the robustness of the figures.

Habitat: the STICITE analysis is less well-developed than other cost categories. The scaling up from a single country study to EU level introduces a high level of uncertainty.

→ Internalisation: for external noise costs, there are significant barriers to achieving the objectives of internalisation through pricing. For external habitat costs, the objectives of internalisation can be partially achieved through fixed or variable revenues.

- Other: STICITE identified additional external cost categories, with only qualitative description of the potential impacts. Additionally, embedded vehicle emissions increase well-to-wheel climate costs by up to 15% for some vehicle types (a 2-3% increase in their total external costs).
- General comments on cost evaluation: STICITE has advanced the state of knowledge in evaluation of external costs. However, for each cost category there are significant inherent uncertainties in one or more of methodology, source data and parameters, in addition to lack of access to some of the detailed calculations. The resulting figures should be seen as one possible estimate for external costs, under the stated assumptions and conditions.
- MSCP: for climate and pollution costs, MSCP through proportional revenues from fuel duties can contribute effectively to meeting the objectives of internalisation. Due to the difficulties of devising practicable pricing schemes, MSCP for congestion and noise can contribute to the objectives to a limited extent. Marginal external habitat costs are zero and MSCP does not apply. The impact of pricing on accident costs is unclear and MSCP does not appear to be an option that meets the objectives.

Alternatives to pricing: In some cases, regulation may be a more suitable method for reducing external costs than pricing. Total or near elimination of externalities will inevitably require regulation and innovation in addition to pricing. This is to a certain extent addressed in STICITE.

Government funding: non-infrastructure subsidies and public service obligations can be considered as additional costs, that support a functioning transport system. Our estimate indicates that these amount to approximately €30bn per year for rail.

Infrastructure costs: the methodologies appear to be robust although the allocation to vehicle types is dependent on assessments of road damage due to load factors. Different assumptions could affect infrastructure cost allocation to some road vehicle types by up to 25%.

Revenues: the values appear to be generally robust but in contrast to the treatment by STICITE, vehicle registration and circulation charges can be considered as partly variable.

Sensitivity analysis

Acknowledging the uncertainties, we have applied the above assessments in a sensitivity analysis to test the impact of alternative assumptions. Due to the different values for external accident and embedded emissions costs, the total external costs for passenger cars, buses/coaches, HGVs and LCVs are lower by up to 20% compared to the STICITE values. For motorcycles they are lower by about 45%. As with the STICITE results, each can be considered as one possible value for external costs, under the stated assumptions.

Applying the above-mentioned changes to accident costs and embedded emissions, as well as the deadweight loss instead of delay cost for congestion, results in a value for total external costs of transport of €652bn, compared to the figure reported by STICITE of €987bn. Of this, €448bn represents those external cost categories whose costs are borne mainly outside the transport system, for which pricing through taxes and charges can be considered most relevant. The remainder (accidents and congestion) are borne mainly inside the system, for which pricing that comprehensively meets the objectives would preferentially involve transactions between those parties inside the system. Again, these are possible values for external costs, under the stated assumptions and conditions.

Anticipated future technology, driven by known and expected regulations, is likely to reduce the external costs of all transport modes and vehicle categories substantially by 2030 and potentially towards zero by 2050.

The changes in the external cost values from the sensitivity analysis influence the cost coverage ratios. The variable cost coverage ratio is the key indicator as it provides an approximate measure of the extent of internalisation of marginal costs. For example, the marginal cost coverage ratio for passenger cars increases from 48% to 71%. Accounting for government subsidies as an additional cost, the variable cost coverage ratio for rail decreases, for example for high-speed rail from 208% to 91% and for electric passenger rail from 70% to 46%.

Risks of internalisation

An assessment of the risks of internalisation is a defined element of this review. Potential risks of internalisation include the following:

- Whilst in theory MSCP of congestion can contribute to meeting the objectives of internalisation, the average charging element of congestion pricing in practice and the variability of traffic flows diminish its effectiveness.
- The low price elasticity of transport can limit the effectiveness of pricing measures in reducing externalities.
- The distributional effects of pricing require further consideration, as under some circumstances pricing could also result in adverse outcomes for those on low incomes.
- The uncertainties inherent in the evaluation of external costs can create a risk of inaccurate price signals of internalisation, impairing the achievement of the objectives of internalisation.

Alongside the risks, from our analysis the main potential opportunity to contribute to the objectives of internalisation would be full MSCP of climate and pollution costs. These are the categories in which internalisation by proportional revenues can accurately apply MSCP in practice.

Assessment of STICITE conclusions

Based on our sensitivity analysis and the resulting cost coverage ratios as well as our assessment of MSCP, we make the following inferences on the three general conclusions reached in the STICITE Study Summary:

- The conclusion that “*External and infrastructure costs are only partly internalised by current taxes and charges*” is consistent with our findings, also after our revaluation of the external cost values. This finding is valid for all modes and vehicle categories, with partial internalisation achieved to different extents for each, as evidenced by the values for the total cost coverage ratio.

- Partly in contrast to the STICITE conclusion, the evidence indicates that MSCP is applied in a number of cases. STICITE's marginal cost coverage ratios indicate that MSCP is fully applied to cost categories excluding congestion for passenger cars and high-speed rail and partially to other modes and vehicle types. Our complementary analysis of the characteristics of individual cost categories indicates that MSCP is applied where it can effectively contribute in practice to meeting the objectives of internalisation: climate and pollution. MSCP fully applies to external well-to-wheel climate costs in road transport and, in 13 of the EU28 Member States, to diesel rail, due to full internalisation by fuel duties. For the majority of passenger cars and for other road vehicle types certified to the most recent emission standards, MSCP applies approximately to external pollution costs. In total, MSCP applies in this way fully or approximately to about 80% of the total well-to-wheel climate and pollution costs across all modes.
- Cost coverage ratio 4 compares infrastructure income to infrastructure costs. Evidenced by its low values (between 3% and 35%) except for aviation and maritime, "*Limited use of the 'user-pays' principle in the EU28*" appears to be valid for most vehicle types, to differing extents. However, variable infrastructure cost coverage is above 100% for most modes and vehicle types.

STICITE also presents options for further internalisation for all modes, proposing distance-based charges differentiated by vehicle characteristics, covering marginal climate, pollution, noise and congestion costs. The MSCP already applied to climate and pollution costs, as described above, suggests that the marginal benefits of further application of MSCP for these cost categories are limited. Due to the difficulties in achieving a fully differentiated pricing scheme in practice for congestion and noise, the proposal would introduce quasi-average charging for these categories. It could contribute to the behavioural objectives of internalisation to a limited extent. For congestion, however, a strict interpretation of the polluter-pays principle would require the pricing to generate transactions between users inside the transport system. For noise, it would require a mechanism for those affected by the costs to be compensated by the pricing revenues.

STICITE makes a number of recommendations for further assessment that would enhance knowledge of external costs and internalisation. In addition, we recommend the following:

- Further detailed investigation of the nature and extent of external congestion costs and the impacts of internalisation
- Including urban transport fully in the scope of future study
- Comprehensive evaluation of transport subsidies and their relevance to internalisation