Assessment of social and economic impacts of transport policy

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Abstract

In 2011 the EU has launched a new White Paper on Transport, 'Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Europe'. The White Paper was accompanied by an Impact Assessment. The results were model based to a large extent. Social impacts were not included or quantified. This was the base for the ASSIST project. This project had as a goal to provide the EU with advice on the possible social and economic impacts of transport policies that have been applied in the EU, the Member States or in other countries in the past or are planned to be applied in the future. The results of the project are two-fold: 1) a Handbook on the Social and Economic Impacts of Transport Policy and 2) a policy instrument, ASTRA-EC, which helps policy makers to assess different transport policies. In this paper we will elaborate on the results of the ASSIST project and draw some conclusions and make some recommendations.

Keywords: Assessment, social impacts, economic impacts, Europe, transport policy

Résumé

En 2011, l'UE a publié un Livre Blanc intitulé "Feuille de route pour un espace européen unique des transports - Vers un système compétitif et économe en ressources". Ce Livre blanc était accompagné d'une analyse d'impact dont les résultats étaient principalement issus de travaux de modélisation. Ces travaux ne prenaient pas en compte (et par conséquent ne quantifiaient pas) les impacts sociaux. Cette absence a été à l'origine du projet ASSIST dont l'objectif était de conseiller l'UE sur les possibles impacts sociaux et économiques des politiques de transport appliquées (ou susceptibles de l'être dans le futur) dans l'UE, les Etats membres, voire même dans d'autres pays. Les résultats du projet ASSIST sont de deux ordres: 1) un manuel sur les impacts économiques et sociaux des politiques de transports et 2) l'outil ASTRA-CE, destiné à aider les décideurs à évaluer les différentes politiques de transport. Dans cet article, nous présentons les principaux résultats et conclusions du projet ASSIST et proposons certaines recommandations.

*Mots-clé:*Analyse, impacts sociaux, impacts économique, Europe, politique des transports

1. Introduction

In 2009, the European Union (EU) has developed a new policy strategy for the next decades. The European Commission (EC) describes the new strategic objective as "*The exit from the crisis should be the point of entry into a new sustainable social market economy, a smarter, greener economy, where our prosperity will come from innovation and from using resources better, and where the key input will be knowledge*" [EC 2009 COM(2009)647].

In line with the general policy strategy, the EU has launched a new White Paper on Transport, 'Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Europe'**.** The White Paper has several ambitions on the development of the European transport system, which fits in the general strategy. The main goal of the White Paper is to reduce transport GHG emissions by at least 60% until 2050, compared with 1990 (including aviation and excluding maritime transport). The main goal is accompanied by 10 further targets (for more details see EC, 2011c)

The White Paper on Transport was accompanied with an Impact Assessment (EC, 2011c,e). The impact assessment was model based (PRIMES-TREMOVE, Trans-Tools, GEM-E3). The assessment was in principle done for all 131 transport policy measures in the White Paper. However, the assessment was limited concerning the social impacts. Other limitations concern the fact that different impacts are often neglected in assessments, such as second round effects and distributional impacts. These limitations were a motivation to carry out the ASSIST project.

The ASSIST project aims at providing the EU with advice on the possible social and economic impacts of transport policies that have been applied in the EU, the Member States or in other countries in the past or are planned to be applied in the future. Additionally, future challenges for the transport system are taken into consideration.

ASSIST concentrates on the social, economic and environmental impacts[*] of transport policy measures. The social impacts are regarded as impactsthat change the social conditions of an individual (such as choice of travel mode and accessibility) or a society (such as community cohesion and employment). The economic impacts are those that change the economic conditions of an individual (such as time savings and individual costs of mobility) or the society (such as tax revenues for governments and modal share). The environmental impacts (such as pollutants and noise) are considered if they have a relation with social or economic impacts.

This paper describes the main results of the ASSIST project. It reports on the transport policy measures and their impacts, the future challenges that have an impact on the transport system and thus transport policy measures. Also, the results of the ASSIST project will be described. It is a handbook on impacts of selected transport policy measures and the development of ASTRA-EC, an instrument to help policy makers get insights into the impacts of transport policy measures.

As the ASSIST project is not intended to re-invent the existing environmental impact assessment methodology, the focus is clearly on economic and social impacts of transport policies. Main environmental impacts are considered in a qualitative way if they have a social dimension.

This paper is structured as follows: First we will present the social and economic impacts of transport policy. We will take a look at the future challenges and the Handbook that was constructed. Then we will turn to the development of ASTRA-EC. Finally, some conclusions about the work will be drawn.

[*]In ASSIST we use the term '*impact'* to indicate the effects of transport policy measures upon the transport system and the drivers outside the transport system

2. Social and economic impacts of transport policy measures

2.1 Scoping transport policy measures

At first a scoping of the transport policy measures (TPMs) was made. A categorization of TPMs has been developed, which covers different dimensions such as transport modes and geographical level. Different TPMs from selected policy documents and studies were screened in order to compile a list of social, economic and environmental impacts by category. In total the ASSIST project screened more than 300 policies or measures and carried out a detailed ex-post analysis of social and economic impacts of 61 TPM which fit into the eight policy categories as defined by the White Paper.

These categories comprise:

1. Pricing (for example toll)
2. Taxation
3. Infrastructure
4. Internal market
5. Standards and flanking measures
6. Transport planning
7. Research and innovation
8. Others.

With regard to *social impacts***,** the most relevant impacts found in the literature, concern choice of travel mode, accessibility, community cohesion and health. Regarding the *economic impacts*, the impacts on modal share, tax revenues, mitigation of external costs (collective economic impacts) and time savings (individual economic impacts) are highlighted across all TPM categories. For the categories 'Pricing', 'Research and Innovation' and 'Infrastructure' the impacts on individual mobility costs were particularly high. Furthermore, the measures within the 'Research and Innovation', 'Internal Market', and 'Infrastructure' affect sectoral and spatial competitiveness. With respect to *environmental impacts*related to social or economic impacts, the major impacts from TPMs within all categories are climate change, pollutant emissions and noise.

It has to be kept in mind that the impact chains as defined and presented in the ASSIST project are derived from a theoretical concept, supported by well documented real life experiences. In reality, social, environmental and economic impacts are merely caused by various factors among them policies play a major but not the sole role. Thus, it can not be expected that, when implementing TPMs, that the impacts described automatically appear, and in return, it might be possible, that certain impacts occur without having taken any of the TPMs analysed.

2.2 Future challenges

Different trends or future challenges affect the transport system and thus TPMs and their impacts. The most important challenges with an implication for transport policy were addressed. They include *fighting climate change*, *fossil fuel shortage*, *air pollution and noise*, *urban sprawling/urbanisation*, *ageing of the European society*, *migratory pressure*, *unemployment*, *income inequality*, *terrorism and insecurity*, *individualism*, *diffusion of ICT and technological innovation*, *third manufacturing revolution*, *globalisation/outsourcing*, *fragility of European Monetary Union (EMU)*, and *public and private debt*. These challenges were analysed for their implication on the categories of TPMs (see previous section).

Concerning the future challenges the following questions were raised:

1. Which future challenges are relevant for the different TPM categories or individual transport policy measures?
2. Against the background of these challenges, how would each of them affect the social, economic and environmental impacts of the TPM? Are there any new impacts that might have to be taken into consideration?
3. Given the (possible) implication(s) of a trend in the context of a particular TPM, should the existing policy be adapted? Is there a necessity to introduce new policies in order to attenuate the (negative) implications?

Concerning the first question, different reports, policy studies and articles have been studied. Furthermore a number of experts have assessed the implications. The most important future challenges for the transport system and transport policy measures are *shortage of fossil fuels* and d*iffusion of ICT*. It is expected that these two challenges have a high implication for the transport system. Challenges that have a moderate implication are: *climate change*, *ageing of the European society*, *public and private debt*, *globalisation*, *fragility of the EMU* and *urbanisation and sprawling*. These challenges are prominent enough to be taken into account when developing transport policy measures.

Concerning the second question, the future challenges affect the transport system and the TPMs in different ways, and thus the further impacts on society, economy and environment. Although it is possible to isolate challenges, TPMs or impacts, the analysis becomes complex as soon as interdependencies occur between the different aspects. For example, the challenge 'ageing' has interdependencies with 'migration', 'diffusion of ICT' and 'Third Manufacturing Revolution'. Sometimes the challenge reinforces the TPM and its impacts. In other cases the challenge has a negative implication for the TPM and its impacts. Due to the interdependencies between the challenges, different implications may occur. For this purpose, the application of the ASTRA-EC model is built (see next chapter).

It is obvious that changes in the transport system itself as well as in the output of the transport system can cause changes for society, economy and environment. By connecting the different challenges to the transport system some further impacts could be identified. But again, things start becoming complex when interdependencies between the challenges are taken into account. Concerning the impacts on society, economy and environment, the analysis showed that economic and environmental impacts can be quantified to a certain extent. The impacts on society need a more qualitative approach when analysed and taken into account in drafting policy responses.

The answer to the third question is diffuse. In some instances, the TPM (category) is good for now and needs only little extra attention, like promotion of the Telework incentive. On the other hand, some TPMs need to be reviewed in the light of some challenges. For example, the European Road Safety Action Programme (ERSAP) should be reviewed in order to see whether it takes the challenge of 'Ageing' sufficiently into account. Also the Energy Taxation Directive does not include air and maritime shipping. Hence, this may need some extra attention as well.

2.3 Social and economic impacts of transport policy measures

The findings of ASSIST resulting from the impact assessment elaborated within our "Assessment of the Social and Economic Impacts of Transport Policy Measures" are presented in the following overview. In general, social impacts on the society as a whole or on groups have been defined in the context of economic and environmental impact assessments:

- It is obvious, that the qualitative and quantitative extent of impacts of individual TPMs strongly depends on the geographical area of implementation (scale), the individual design (e.g. measures within the same TPM category do not necessarily have the same design) and how the measure is supported (financially, politically etc.) by the implementing authority.
- The overall assessment of the TPM clearly shows that, if any social groups are affected, these are mostly income groups.

Economic impacts

- Regarding economic impacts (in the sense of being influenced), the most frequently affected segments are transport operators, who are clearly positively influenced by the majority of policy measures, especially by 'E-Freight' and 'End-to-End' security certificates. In comparison, other segments such as passengers, society, the economy etc. are less frequently affected by economic impacts.
- All TPMs belonging to 'Internal Markets' and 'Infrastructure' generate no negative impacts.
- Pricing and taxation measures challenge transport operators, users and the economy as a whole. As pricing and taxation measures influence transport costs directly, their efficiency depends on the economic framework and the preconditions of their implementation.
- Transport costs, competitiveness and revenues in the transport sector are the economic impact fields most frequently addressed by the selected TPMs.

- ‘End-to-end security certificates’, ‘E-freight and ‘Elimination of TEN-T bottlenecks’ are assumed to have the most positive economic impacts on transport costs, revenues, spatial and sector competitiveness and insurance costs.

Social impacts

- Positive impacts in social terms are mostly expected for residents, the society, the economy, employees and public bodies. Especially measures like the introduction of ‘SESAR’, ‘End-to-End security certificates’, ‘low emission zones’ as well as the ‘European Rail Traffic Management System (ERTMS)’ have undisputable benefits for these groups.
- Many TPMs contribute to improve safety and health; by far the most (positively) affected social impact fields.
- There is no transport policy measure which affects the cultural heritage or culture in general.
- The overall assessment of the TPM clearly shows that, if any social groups are affected, these are mostly income groups. 25 of all TPM have impacts on income groups, out of which the ratio of positive and negative impacts is balanced. The second most common, but only sparsely affected social group by transport policy measures concerns the age, respectively younger or elderly people.

Environmental impacts

- Although as mentioned above, the social impact analysis showed many positive results, the environmental effects of transport policies are even more beneficial. Almost 95% of all impacts are environmentally positive.
- The TPMs investigated will help significantly to reduce air pollutants and noise emissions, which also has a direct positive impact on the society.
- Measures allocated to ‘transport planning’ (‘Influencing demand for sustainable transport – promotion of cycling within urban / suburban areas’, ‘City logistics’) and ‘infrastructure’ (‘Reduction of TEN-T missing links’, ‘Green transport corridors’, ‘Deployment of roadside-based ITS infrastructure for information services‘) have the most frequent environmental impacts.
- The TPMs ‘Noise emissions restrictions’ and ‘Park and ride systems’ are the measures with the most positive impacts on the environment. In contrast, the visual quality of the landscape and the land use are least affected by transport policy measures.

The project website www.assist-project.eu contains for some 60 directives and regulations a qualitative assessment. As an example, the figure below shows a screenshot of the social impacts of the introduction of flexible working hours (EC DG EMPL, 2009).

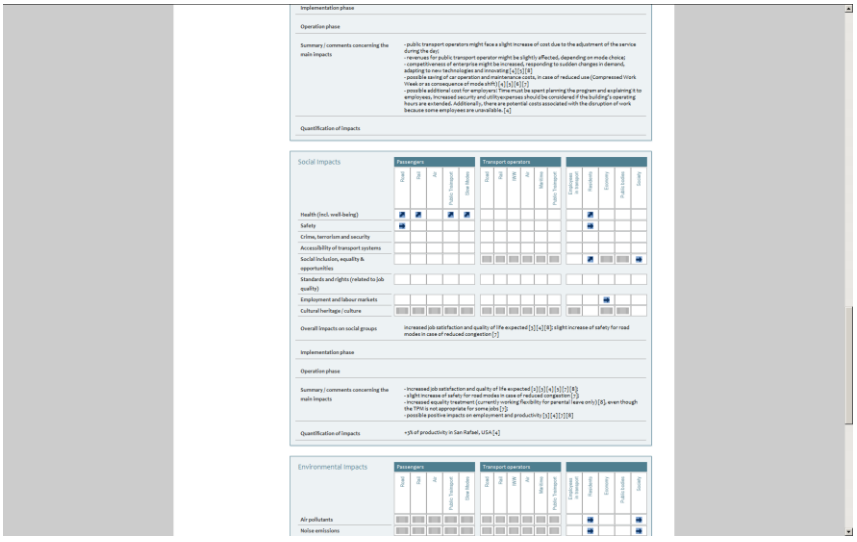

Fig. 1. Screenshot of the ASSIST factsheet for flexible working hours

3. Modelling social and economic impacts

3.1. The ASTRA-EC model

The ASTRA-EC model has been developed within the ASSIST project with the aim of modelling the social and economic impacts of transport policy measures, providing the European Commission with a powerful tool for strategic assessment in the medium and longer period (up to the year 2050). Geographically, ASTRA-EC covers all EU27 member states plus Norway and Switzerland.

ASTRA-EC is a model based on the principles of system dynamics, simulating the evolution of systems based on the relationship between causes and resulting effects: in other words, the model variables change dynamically over time as an effect of the interaction of positive or negative feedback loops.

ASTRA-EC consists of different modules, each related to one specific aspect: the transport system (e.g. estimating the number of trips, tonnes moved, mode split), the vehicle fleet (in terms of composition and evolution of technologies), the demographic system (population segmented by attributes), the economic system (e.g. consumption, investment, taxation, trade), the environmental system (energy consumption, emissions), the social system (employment, accidents). A key feature of ASTRA-EC as an integrated assessment model is that the modules are linked together. Changes in one system are thus transmitted to other systems and can feed-back to the original source of variation. For instance, changes in the economic system immediately feed into changes of the transport behaviour and alter origins, destinations and volumes of European transport flows. In turn, via some micro-macro bridges (see below), the changes in the transport system feed back into the economic system e.g. adapting the consumption behaviour of households or the sectoral inter-change of intermediate goods and services.
Thanks to its multidimensional structure, ASTRA-EC is capable to simulate a wide range of impacts stemming from the application of a transport policy measure: the model can address direct impacts as well as second-level and third-level impacts of transport policy measures.

The focus of ASSIST is on economic and social impacts. ASTRA-EC can cover economic impacts thanks to a detailed representation of the linkages between the transport sector at the microeconomic level and the macroeconomic level. The main micro-macro bridges modeled in ASTRA-EC concern:

- Passenger transport and sectoral consumption
- Transport and sectoral investment
- Transport and sectoral employment
- Freight transport and total factor productivity
- Transport and intermediate inputs of input-output tables
- Transport and exports.

Social impacts are addressed by ASTRA-EC in two manners. On the one hand, the model provides some indicators related to the social dimensions such as safety (number of accident, fatalities), accessibility and employment. On the other hand, some results in the transport and economic domain are segmented by income groups.

In fact, income distribution itself is modelled in ASTRA-EC, simulating the complex coherences with socio-economic trends on the basis of the age structure of society, educational skills, the dynamics in household structure, employment per sector and the development of demand and supply side of economies. This differentiation is an important input to simulate passenger transport, as confirmed by the analysis of personal mobility trend showing that income distribution has a visible impact on transport mobility habits. Therefore, in the model several variables reflecting mobility and consumer patterns in the field of transport are segmented by social groups, differentiating people according to their income, age, gender and household type. This enables to differentiate the reactions of social groups and analyse the social impacts of transport policy, e.g. in terms of transport expenditure by income group as well as mode split or average distance travelled. Using these indicators, it is possible to assess whether policy measures affect social dimensions and whether an income group is more or less affected than another one.

3.2. Simulating social and economic impacts

The following figure provides an example of how the impulse generated by a change of transport cost (e.g. due to road pricing for passenger vehicles) modifies the transport system, propagates to other domains like the economy and the environment and also feedbacks again to transport.

In the example of Figure 1 passengers transport costs are represented in the model at a "micro" level for each transport mode. Within the transport system, changes of some components of the transport costs (e.g. passenger road pricing) influences modal split via elasticity parameters. Different social groups are affected in a different way, according to their elasticity and their specific mobility patterns. In addition, the distribution of trips is influenced as well (e.g. longer distance trips could be discouraged if transport cost increases).

Another consequence of different transport costs is that transport expenditure of households changes, which in macroeconomic terms means different aggregate consumption, which in turn has effects on GDP. Disposable income influences also car fleet composition: therefore the change on the economic side is fed back in the transport module affecting again passenger transport cost.

At the same time, government revenues may also change in case of charging or fuel taxation. Additional revenues can contribute positively to public budget or can be considered as resources available for re-investments (e.g. for new infrastructures) or can also compensate a reduction of other types of taxes (e.g. income taxes).

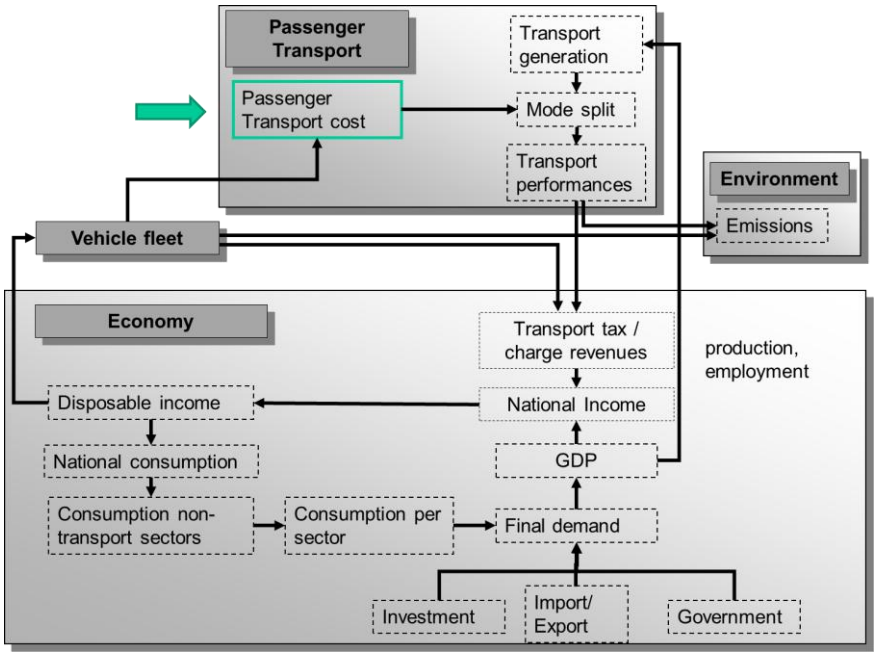

Fig. 2. Main feedback loops generated from passenger transport cost variations in ASTRA-EC.

In terms of environmental effects, transport energy consumption and emissions will change as well while on the social side the impact on the expenditure of different income groups will be different depending on the initial expenditure for transport and the relative use of transport modes (e.g. share of trips made by car), taking also into account that absolute changes can of different relevance of relative changes (e.g. figure 2).

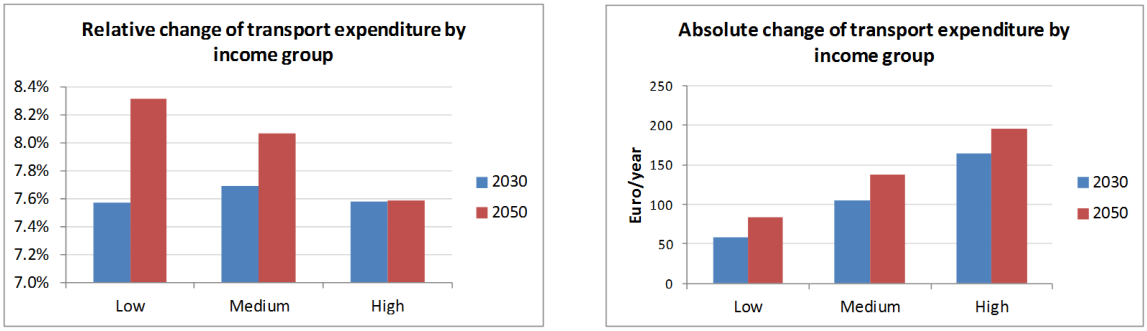

Fig. 3. (a) relative change of transport expenditure by income group; (b) absolute change of transport expenditure by income group.

4. Conclusions and recommendations

This paper elaborates on European transport policy measures focussing on their social and economic impacts. In the context of the EC FP7 project ASSIST, a handbook on social, environmental and economic impacts of transport policy measures and an integrated assessment model, ASTRA-EC, have been developed. They are both instruments to support decision makers by improving the knowledge about likely impacts of transport policy measures. Both tools improved the state-of-the-art in terms of assessing and modellingeconomic and social impacts of transport policies.

The ex-post analysis of TPMs selectedwith reference to the Transport White Paper of 2011 developed a compendiumof existing knowledge on economic and social impacts differentiated into impact ontransport modes, spatial impact and impacts on certain population groups. The analysisrevealed that the TPMs (existing transport policy and the future policy options) as analysed at a general level do not generate negative social impacts at all. However, social impacts are often multifold in their direction especially at local or project level. There they may influence a heterogenous society in different ways. Or spoken in other words, there are always “winners” and “losers”.

ASSIST also revealed that a proven transport policy could generate in the future other impacts than nowadays. This difference emerges because(some) of the future challenges becoming reality and thus changing the framework conditions of transport policies. Obvious examples of these challenges would beageing societies, with different age groups having different vehicle ownership and mobility patterns,or strongly increasing crude oil prices.

A suitable tool to consider these changing framework conditions seems to be theASTRA model approach, as it enables to assess the impacts of various scenarios over time, i.e. scenarioswith changing trends of oil prices, population structure, technology features, etc. Thenewly developed ASTRA-EC model is conceived to quantify economic and social impacts. Considering the fact that ASTRA-EC is a macro-level model simulating most social and economic indicators on country-level it must clearly be said, that micro-level impacts can still notbe provided. Indeed, the capabilities to quantify economic impacts (e.g. in terms ofgross domestic product, valued added or employment) can better be tackled by theASTRA-EC model than the social impacts, for which distributionaleffects on different income groups and age cohorts could be reflected.In that sense, the ASSIST project made progress to assess the social and economicimpacts of past and future sustainable transport policy in Europe, but it still leaves roomfor development and improvement of the quantitative assessment tools as well as for qualitative approachesto describe and consider, in particular the social impacts in European transportpolicy-making.

Acknowledgements

The ASSIST project has been funded under the FP7 framework by the European Commission. Further results of the project can be found on www.assist-project.eu.

References

In the ASSIST project hundredths of reports, directives, regulation, articles and papers have been screened and used. We refer to the deliverables that can be found on the project website for further details. Below you will find a selection of important references that have been used in the project.

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