Evaluating Average External Costs of Inland Freight Transport in South-Eastern European Countries: Policy Implications

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Summary:

For achieving the goals for sustainable and efficient transport development it is necessary to adopt effective measures for shifting towards environmentally friendly modes of transport as well as for cutting down the fuel consumption, greenhouse gases emissions and noise. These goals could not be reached without accounting for social costs of transport and especially for external costs.

Using transferability approach suggested in IMPACT study (2008) and its updates, an evaluation of average external costs of transport on national level for South-Eastern European countries is suggested in this article in order to help policy makers to prioritize measures and projects envisaged in inland modes of transport on the basis of potential savings for the society, which is not done so far. The article also suggests potential measures with regards to improving transportation activities.

Key words: external costs of transport, internalization of external costs, infrastructure charges.

JEL Classification: R41, R48

1. Introduction

The most important national goals for transport systems development in the South-Eastern European (SEE) countries are related to increasing transport system efficiency and sustainability as well as pushing the competitiveness of national economies. These goals could be reached through a system of measures undertaken after thorough analysis of transport costs. However, this analysis needs application of contemporary costs accounting approaches in transport and up-to-date infrastructure charging principles.

The infrastructure charging system in transport is based on "user is to pay" principle. Besides the internal costs (private costs) calculated in infrastructure charges, there exist other costs which are not reflected in charges but which influence external parties. Hence, it is necessary to differentiate charges in order to account for external costs, as for different modes of transport different external costs are present.

All this issues appear to be of utmost importance when analysing transport activities and the opportunities for funding infrastructure projects in South-Eastern European Countries (ITT 2013) and to achieve the respective transport policy goals.

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2. Methodology

On the European level a plenty of projects and studies were carried out in order to estimate the proper impact of externalities and to translate it into costs for the society. Even though the "transferability of results remains limited" (IMPACT, 2008), a considerable number of different researchers pave the path towards proper valuation. The handbook and its updates give a detailed overview of that is being done in the field of cost estimation.

Table 1. List of studies on external costs

Author, Title, Year of Publication	Base year(s) of results	Countries covered	Cost categories covered[1)]	Transport modes covered	Externality: which part of total accident costs is external?	Outputs, Result differentiation
EU Projects and Programs						
High Level Group on transport Infrastructure charging, 1999c	only Marginal Cost Methodology	European Union	Congestion, accidents, air pollution, noise, climate change	Road, rail	Users own Risk value internalised	marginal costs, cost rates
PETS (Pricing European Transport Systems), 2000	1995/98, pricing scenario 2010	EU-15, Switzerland, Case Studies	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, maritime	Users own Risk value internalised	Marginal social/ external costs
UNITE (Unification of accounts and marginal costs for transport efficiency), 2003 Project coordinator: ITS, Leeds	1998, (1996, 2005)	EU-15, Hungary, Estonia, Switzerland	Congestion, accidents, air pollution, noise, climate change	Road, rail, urban public transport, air, water	Only transport system external costs treated as external costs (risk value internalised), no risk values for relatives and friends considered	total, average for all countries considered, marginal costs for specific countries (case studies)
RECORDIT (Real cost reduction of door-to-door intermodal transport), 2001 Project coordinator: ISIS, Rome	1998	3 selected European corridors	Congestion, accidents, air pollution, noise, climate change	Intermodal freight transport: road, rail, ship	Only transport system external costs treated as external costs (risk value internalised), no risk values for relatives and friends considered	Total and average costs, sector results
HEATCO (Developing Harmonised European Approaches for Transport Costing and Project Assessment), Project coordinator: IER, Stuttgart	2004	EU-25	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water	Project on valuation of changes of accident risks (no differentiation between external and internal) incl. risk values based on WTP studies	Values for casualties avoided for EU 25 (2002 prices)

GRACE (Generalisation of research on accounts and cost estimation), ongoing Project coordinator: ITS, Leeds	2005	EU-25	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water	dep. on case study: Impact Pathway and Top-Down Approach	Marginal costs based on literature survey
Other studies with a European Scope						
INFRAS/IWW, External costs of transport, 2000	1995 Estimate for 2010	EU-15, Norway, Switzerland	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water (inland water transport)	Risk value external	Method and results: Total and average costs, marginal costs
INFRAS/IWW, External costs of transport - update study, 2004a	2000	EU-15, Norway, Switzerland	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water (inland water transport)	Risk value external	Results: Total and average costs, marginal costs
OECD/INFRAS/ Herry), External costs of transport in Central and Eastern Europe, 2003	1995 (2010)	Eastern Europe	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water	Risk value external	Results: total and average costs
CE Delft/ ECORYS, Marginal costs of Infrastructure use - towards a simplified approach, 2004	Unit cost rates for 2002	EU-15	Congestion, accidents, air pollution, noise, climate change	Road, rail, aviation	2. Approaches: marginal costs: Own risk is internalised when entering the transport system average costs: risk value assumed to be external	Marginal and average costs for selected examples
TRL 2001: Cost Matrices Handbook: Estimates of the Marginal Costs of Transport, 2001	1995	EU-15, Norway, Switzerland	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water	Meta-analysis of existing results INFRAS/IWW 2000, PETS, ITS, 2001	Marginal costs for selected countries and modes
Country specific studies						
COWI: External Costs of Transport in Denmark (Hvid 2004)	1999-2001	Denmark	Congestion, accidents, air pollution, noise, climate change	Road, rail	own Risk value internal, Risk values of victims external	Total and average costs

CE Delft, The price of transport - overview of the social costs of transport, 2004 (update of the 1999 study)	2002	The Netherlands	Congestion, accidents, air pollution, noise, climate change	Road, rail, air, water (inland shipping)	Risk value external	Method and results: total costs, variable social costs
ITS, 2001: Surface transport costs and charges – Great Britain 1998, 2001	1998	United Kingdom	Congestion, accidents, air pollution, noise, climate change	Road only	own Risk value internal, risk value of relatives and friends (40% of own risk value) external	Method and results : marginal and average costs
OSD (Federal Office for Spatial Development), Accident costs for road and rail in Switzerland 1998, 2002	1998	Switzerland	Congestion, accidents, air pollution, noise, climate change	Road, rail	2 perspectives: transport user external (risk value partially external), transport system external (risk value internal)	Total and average costs

Source: IMPACT, 2008

As it could be seen from the table there are no projects or studies conducted in South-Eastern Europe (SEE) although the external costs evaluation for some of the counties in this region has been included in OECD report on external costs of transport in Central and Eastern Europe (OECD 2010). Still, most of the countries from SEE are not covered in this study.

IMPACT study represents one of the most possible reference bases for further external costs studies in the South-Eastern European countries. The methodology for the external cost calculation can be widely used since the unit values for input figures are presented in monetary terms related to the specific value, such as Euro per hour, per accident, per unit of emission, per life year lost, etc. The output values are presented in a form which can be translated for the purpose of internalisation. The main unit for the infrastructure pricing is cost per vehicle-kilometres. Similar to other studies of external costs a transfer of cost per passenger or tonne kilometre has been carried out in order to compare different modes and, where relevant or useful, other output unit values are shown. When applying the results to the SEE region it should be taken into consideration that the figures are in general representative only for average Western European countries and not directly applicable to the SEE region. The value transfer approach is also appropriate to apply to the transfer of the data to other countries and can still provide reliable data for policy purposes at lower accuracy levels. The study mostly presents and does not select the most appropriate approach for the cost calculation (CE Delft 2011).

In the update study (CE Delft 2011) total average external costs are calculated for the following five core cost categories:

1. Accidents – including medical costs, production losses and loss of human lives.
2. Air pollution – including health/medical costs, crop losses (Bickel, et al. 2003), building damages etc.
3. Climate change – including avoidance costs to reduce risk of climate change and

damage costs of increasing average temperature.

4. Noise – including annoyance and health costs.
5. Congestion – including time and additional operating costs; for scheduled transport: delay costs.

In addition to the core cost categories, five other important cost categories are updated:

6. Costs of up- and downstream processes – including climate change and air pollution costs of energy consumption and GHG emissions of up- and downstream processes[1]. The focus is on fuel and electricity production;
7. Costs for nature and landscape – including cost elements such as repair cost and restoration measures (e.g. unsealing, renaturation, green bridges);
8. Additional costs in urban areas – including time losses of non-motorised traffic in urban areas.
9. Biodiversity losses (due to air pollution) – including damage or restoration costs of air pollutant related biodiversity losses (Preiss, Friedrich and Klotz 2008); and
10. Costs for soil and water pollution – including restoration and repair costs for soil and water pollutant with focus on transport related heavy metal and hydrocarbon emissions.

The value transfer and the adjustments in this study are made following the recommendations of the IMPACT Handbook (2008), the update study External costs of transport (CE DELFT, INFRAS and Fraunhofer ISI, 2011), the update study Update of the Handbook on External Costs of Transport (RICARDO-AEA 2014) and the General instructions for the calculation of external cost in WP 6: ADB and Green Transport - Deliverable 6.1 External costs of transport in ADB area: lessons learnt" (ITT 2013) developed under ADB Multiplatform project[2]. It should be taken into consideration that a value transfer to different EU countries is sensitive to national and local specifications and it is only undertaken because no national studies are available. The respective results represent rough estimates only.

The sequence in applying the transferability approach suggested in IMPACT study for calculation of total external costs per country and mode of transport is as follows:

- Firstly, the updated values (recent) of the average external costs (€/tkm) per cost category (except for congestion) and transport mode are defined.
- Secondly, the updated (recent) data on transport volumes (tkm) for each type of vehicle and for each country are determined;
- Thirdly, the average values (€/tkm) are multiplied with the transport volumes (tkm), in order to calculate the total external cost (€) per each cost category, transport mode and country.

The results per country differ due to many different reasons. Some of the most important reasons for different average costs are differences in (CE Delft 2011): GDP per capita (PPP adjusted); load factors (for all transport modes); vehicle stock (share of efficient, low-emission vehicles); share of diesel and electric trains; electricity mix for rail; population density (mainly for noise and air pollution cost); accident risk etc.

[1] Emissions in up- and downstream processes of transport (life cycle emissions) related to energy production, vehicle and infrastructure production, maintenance and disposal. Upstream costs are paid by producers (transport companies, infrastructure managers, forwarders etc.), and are directly related to the cost of transport services tendering. In contrast, downstream costs are paid by users of these services.

[2] The author prepared the report on Calculation of total external cost for ADB Pilot routes by using marginal and average values within ADB Multiplatform project financed by South-East Transnational Cooperation Programme.

3. Calculation of Total External Costs for Each SEE country by Using Average Values

The calculation of total external costs for each SEE country is based on the reference values of the average external costs (€/1000 tkm) and transport mode provided by the update study External costs of transport (CE DELFT, INFRAS and Fraunhofer ISI, 2011) (table 18, pp. 83) referring to 2008. Adjustment of these values is made by using GDP per capita in PPPs coefficients for 2008 by country and by respective coefficients related to harmonized indices of consumer prices (HICP) for 2012 relative to 2008 (counted to index 2005 =100)[3]. Through this adjustment the reference values have been updated to current economic conditions and they reflect the peculiarities of each SEE country (see table 2 and 3).

Table 2. Adjustment factors for average, marginal and total external costs

Country	GDP per capita in PPPs coefficient	Ratio of HICP /2012-2008
Bulgaria	0,43	1,12
Croatia	0,65	1,10
FYROM	0,34	1,03
Greece	0,93	1,11
Romania	0,49	1,23
Serbia	0,36	0,97
Slovakia	0,72	1,10
Slovenia	0,91	1,08

The next steps in calculation of total external costs are related to the definition of respective volumes of traffic by countries and modes of transport per 2012 and the multiplication of the adjusted values of external costs to traffic volumes. As the traffic data in ton kilometres for road transport refers only to HDV, the calculations

Table 3. Total external costs for each SEE country per year by modes of transport

			Road Freight Transport*				Rail Freight Transport				Inland Waterways Transport				
Country	GDP per capita & PPPs per 2008 coeffici ent	Ratio of HICP / 20122008	Reference value for 2008	Average external costs adjusted for 2012 (€/1000 tkm)	Traffic (1000 mio tkm)	Total external costs (mio €)	Reference value for 2008	Average external costs adjusted for 2012 (€/1000 tkm)	Traffic (1000 mio tkm)	Total external costs (mio €)	Reference value for 2008	Average external costs adjusted for 2012 (€/1000 tkm	Traffic (1000 mio tkm)	Total external costs (mio €)	Total external costs
Bulgaria	0,43	1,12	32,7	36,6	24,4	892,60	16,3	18,3	2,91	53,07	16,2	18,1	5,35	97,05	951,02
Croatia	0,65	1,1	42,2	46,4	8,6	401,49	5,2	5,7	2,33	13,34	7,2	7,9	0,77	6,11	415,60
FYROM	0,34	1,03	23,9	24,6	5,8	142,83	6,4	6,6	0,42	2,79	0,0	0,0	0,00	0,00	145,62
Greece	0,93	1,11	32,1	35,6	20,8	742,51	13,4	14,9	0,28	4,21	0,0	0,0	0,00	0,00	746,72
Romania	0,49	1,23	19,5	24,0	29,7	711,44	13,1	16,1	13,47	217,07	7,2	8,9	12,52	110,88	941,04
Serbia	0,36	0,97	32,7	31,7	2,5	78,47	16,3	15,8	2,77	43,78	16,2	15,7	0,60	9,49	122,86
Slovakia	0,72	1,1	42,5	46,8	29,7	1388,15	14,0	15,4	7,59	116,90	8,7	9,6	0,99	9,44	1506,04
Slovenia	0,91	1,08	23,9	25,8	15,9	410,10	6,4	6,9	3,47	23,98	0,0	0,0	0,00	0,00	434,09
* Only for HDV															

[3] The source of information for calculations of these factors is EUROSTAT database.

Table 4. Traffic forecasts by SEE countries and by modes of transport

Country	Traffic forecast for road transport				Traffic forecast for rail transport				Traffic forecast for IWW transport			
	Value tkm_road 2012	tkm_road forecasts 2015	tkm_road forecasts 2025	tkm_road forecasts 2035	Value tkm_rail 2012	tkm_rail forecasts 2015	tkm_rail forecasts 2025	tkm_rail forecasts 2035	Value tkm_iww 2012	tkm_iww forecasts 2015	tkm_iww forecasts 2025	tkm_iww forecasts 2035
BG	24,40	26,52	40,14	53,75	2,90	1,61	0,56	0,37	5,30	4,10	5,91	7,73
HR	8,60	11,47	14,73	18,00	2,30	3,22	3,96	4,69	0,80	0,69	0,96	1,26
FYROM	5,80	5,92	6,98	8,04	0,40	0,58	0,65	0,73	-	-	-	-
GR	20,80	22,79	14,64	7,98	0,30	0,58	0,65	0,72	-	-	-	-
RO	29,70	45,33	56,82	66,21	13,50	6,88	0,74	0,62	12,50	12,99	18,25	23,51
SR	2,50	3,43	7,28	10,43	2,80	2,24	0,54	0,16	0,60	0,52	0,48	0,36
SK	29,70	36,41	53,30	67,11	7,60	6,50	3,09	0,30	1,00	0,70	0,37	0,10
SL	15,90	20,94	31,29	41,65	3,50	3,45	3,71	3,97	-	-	-	-

are made only for this type of vehicles for each country. The results for each SEE country are presented in table 3 above.

As it could be seen from the table 3, the highest are the average external costs for road transport and respectively Slovakia is the country with the highest external costs for road transport due to the highest road traffic. Slovakia has the highest total external costs as well.

With regard to rail transport, Romania has the highest external average costs as this country has the highest rail traffic volume comparing to other SEE countries.

Notwithstanding that the adjusted reference values for average external costs per tkm per 2012 for inland waterways transport in Bulgaria, Serbia and Slovakia are higher than in Romania, the respective external average costs of this mode are the highest in Romania due to the highest traffic volume.

4. Forecast for Total External Costs for Each SEE country

Based on calculations of total average external costs by ADB countries per 2012, a forecast per 2015, 2025 and 2035 is made.

This forecast for the average external costs is worked on the projections for traffic volumes and for HICP (see tables 4 and 5) computed by statistical software SPSS. The data sets used for the computation are from 1990 to 2012.

Table 5. HICP forecast for SEE countries

Country	Value HICP 2012	HICP forecasts 2015	HICP forecasts 2025	HICP forecasts 2035
BG	144,58	163,2	222,4	281,6
HR	122,46	131,1	160,9	190,7
FYROM	18639,6	22479,8	31596,5	40713,2
GR	122,61	131,7	163,2	194,7
RO	147,88	166,2	244,8	323,5
SR	65073,1	70038,2	83837,9	97637,6
SK	121,16	132,6	168,2	203,8
SL	121,35	133,1	167,5	202

As it could be seen from the tables 4 and 5 above the trends are different in different countries. While in **road transport** in Greece the expected increase for 2015 will not be supported further and in 2025 and 2035 decrease in road ton kilometres will be available. In all the other SEE countries the trends are towards an increase in road traffic.

In **railway transport** the situation is much more complicated - a slight increase is expected in Croatia, Greece, FYROM and Slovenia. In the other countries the expectations are towards decrease in rail traffic volumes. Especially significant it will be in Bulgaria and Romania. The projections for 2015, 2025 and 2035 reflect the poor conditions of maintenance and development of railways and slow reforms in these countries in the past decade.

The traffic volumes in **inland waterways transport** are envisaged to increase in the future in almost all SEE countries located along the Danube. The expected trends of IWW traffic are toward decrease in Serbia and Slovakia. They reflect the development of IWW transport in these countries during the recent decades. Provided that the traffic on the river Danube will grow up and the conditions for development of this mode of transport will be improved through wide deployment of river information services (Commission 2012), the prognoses are for growth in the whole region.

The respective values of coefficients, necessary for forecasting the total average external costs by countries, are computed using the forecasts for traffic volumes and estimating the ratio between the respective value per 2015, 2025 and 2035 and the value per 2012. The calculations are presented in the table 6 below and the forecasts for total average external costs by countries and modes of transport per 2015, 2025 and 2035 are presented in table 7.

Table 6. Forecast coefficients per 2015, 2025 and 2035

Country	Value HICP 2012	Forcast factors for HICP			Value tkm_road 2012	Forecats factors for road traffic			Value tkm_rail 2012	Forecats factors for rail traffic			Value tkm_iww 2012	Forecats factors for IWW traffic		
		Ratio of HICP 2015/2012	'Ratio of HICP 2025/2012	'Ratio of HICP 2035/2012		Ratio of tkm_road 2015/2012	Ratio of tkm_road 2025/2012	Ratio of tkm_road 2035/2012		Ratio of tkm_rail 2015/2012	Ratio of tkm_rail 2025/2012	Ratio of tkm_rail 2035/2012		Ratio of tkm_iww 2015/2012	Ratio of tkm_iww 2025/2012	Ratio of tkm_iww 2035/2012
BG	144,58	1,13	1,54	1,95	24,4	1,09	1,65	2,20	2,9	0,56	0,19	0,13	5,3	0,77	1,12	1,46
HR	122,46	1,07	1,31	1,56	8,6	1,33	1,71	2,09	2,3	1,40	1,72	2,04	0,8	0,86	1,20	1,58
FYROM	18639,6	1,21	1,70	2,18	5,8	1,02	1,20	1,39	0,4	1,45	1,63	1,83	-	-	-	-
GR	122,61	1,07	1,33	1,59	20,8	1,10	0,70	0,38	0,3	1,93	2,17	2,40	-	-	-	-
RO	147,88	1,12	1,66	2,19	29,7	1,53	1,91	2,23	13,5	0,51	0,05	0,05	12,5	1,04	1,46	1,88
SR	65073,1	1,08	1,29	1,50	2,5	1,37	2,91	4,17	2,8	0,80	0,19	0,06	0,6	0,87	0,80	0,60
SK	121,16	1,09	1,39	1,68	29,7	1,23	1,79	2,26	7,6	0,86	0,41	0,04	1	0,70	0,37	0,10
SL	121,35	1,10	1,38	1,66	15,9	1,32	1,97	2,62	3,5	0,99	1,06	1,13	-	-	-	-

Table 7. Total external costs forecast by SEE countries and by modes of transport

Country	Total external costs (mio €) per 2012			Total external costs (mio €) forecast per 2015			Total external costs (mio €) forecast per 2025			Total external costs (mio €) forecast per 2035		
	Road freight transport	Rail Freight Transport	Inland Waterways Transport	Road freight transport	Rail Freight Transport	Inland Waterways Transport	Road freight transport	Rail Freight Transport	Inland Waterways Transport	Road freight transport	Rail Freight Transport	Inland Waterways Transport
Bulgaria	892,60	53,07	97,05	1095,10	33,26	84,75	2258,76	15,76	166,47	3829,75	13,19	275,70
Croatia	401,49	13,34	6,11	573,25	19,99	5,65	903,52	30,18	9,64	1308,58	42,36	15,00
FYROM	142,83	2,79	0,00	175,82	4,88	0,00	291,37	7,68	0,00	432,45	11,12	0,00
Greece	742,51	4,21	0,00	873,87	8,74	0,00	695,63	12,14	0,00	452,36	16,04	0,00
Romania	711,44	217,07	110,88	1220,37	124,33	129,50	2253,13	19,70	267,98	3469,54	21,81	456,19
Serbia	78,47	43,78	9,49	115,88	37,70	8,85	294,41	10,88	9,78	491,22	3,75	8,54
Slovakia	1388,15	116,90	9,44	1862,45	109,42	7,23	3458,38	65,98	4,85	5276,08	7,76	1,59
Slovenia	410,10	23,98	0,00	592,39	25,93	0,00	1113,97	35,09	0,00	1788,22	45,29	0,00

The data in the table 7 and the presented graph on figure 1 show that the trends are expected to be toward increase of the total external costs for road transport in overall region of SEE countries. The predicted increase is the slighter in inland waterways transport and very weak in railways transport. So obviously the projections for the future developments are in favour of the IWW and railways as they will provide lower external costs and slighter increase in their values than those in road transport.

5. Calculation of Total Average External Costs for Each SEE country per Cost Category

The next step of the calculation of total average external costs **for each SEE country** is to define the reference values of the average external costs (€/1000 tkm) **per cost category** (except for congestion) and transport mode provided by the update study External costs of transport (CE DELFT, INFRAS and Fraunhofer ISI,

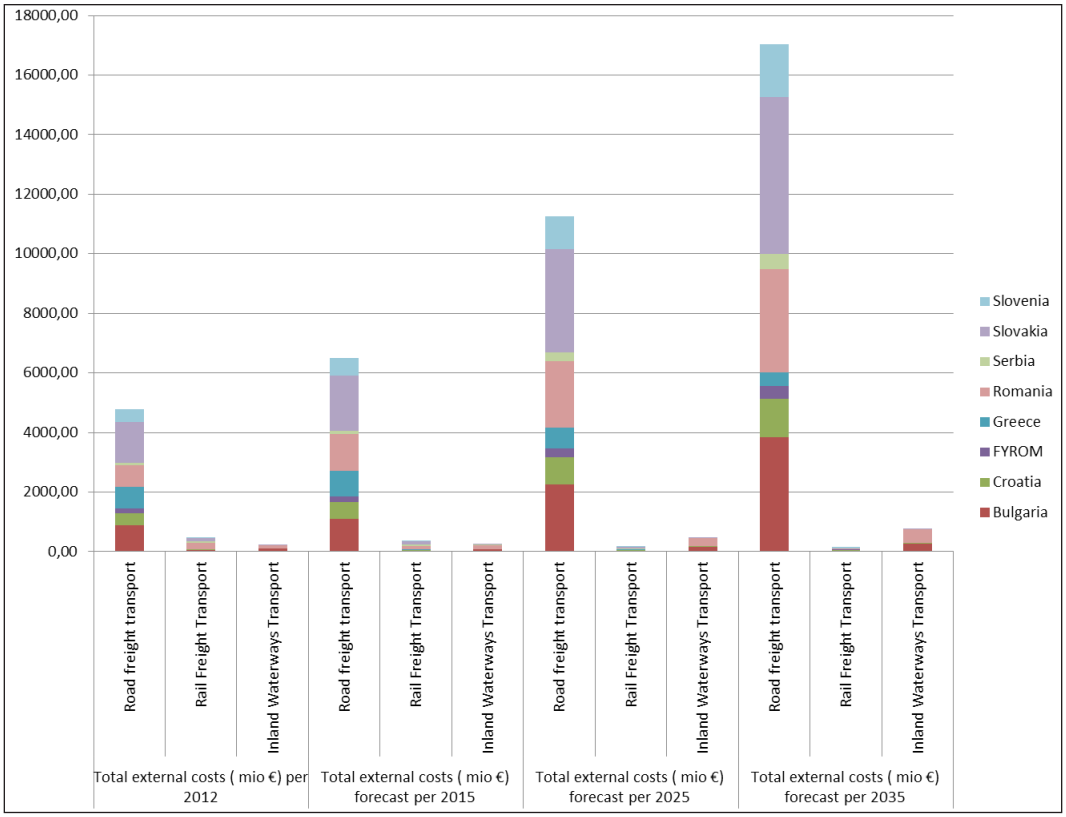

Fig. 1. Total external costs forecast by ADB countries and by modes of transport

Table 8. Adjusted values of average external costs for road transport for each SEE country per 2012 (€/ 1000 tkm)

Cost category	Refferent values per 2008 (€/1000 tkm)	Adjusted values for road transport external costs per 2012 by SEE countries (€/ 1000 tkm)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	10,2	4,91	7,29	3,57	10,53	6,15	3,56	8,08	10,02
Air pollution	6,7	3,23	4,79	2,35	6,92	4,04	2,34	5,31	6,58
Noise	1,8	0,87	1,29	0,63	1,86	1,08	0,63	1,43	1,77
Climate change high scenario	9,8	4,72	7,01	3,43	10,12	5,91	3,42	7,76	9,63
Climate change low scenario	1,7	0,82	1,22	0,60	1,75	1,02	0,59	1,35	1,67
Up- and downstream processes high scenario	3	1,44	2,15	1,05	3,10	1,81	1,05	2,38	2,95
Up- and downstream processes low scenario	1,7	0,82	1,22	0,60	1,75	1,02	0,59	1,35	1,67
Nature and landscape	0,7	0,34	0,50	0,25	0,72	0,42	0,24	0,55	0,69
Biodiversity losses	0,5	0,24	0,36	0,18	0,52	0,30	0,17	0,40	0,49
Soil and water pollution	0,8	0,39	0,57	0,28	0,83	0,48	0,28	0,63	0,79
Urban effects	0,5	0,24	0,36	0,18	0,52	0,30	0,17	0,40	0,49
Total external costs high scenario	**34**	**16,37**	**24,31**	**11,91**	**35,10**	**20,49**	**11,87**	**26,93**	**33,42**
Total external costs low scenario	**24,6**	**11,85**	**17,59**	**8,61**	**25,39**	**14,83**	**8,59**	**19,48**	**24,18**

* The traffic data used for calculation of external costs for road transport by countryes are only for HDV.

2011) referring to 2008. Adjustment of these values is made again by using 'GDP per capita in PPPs' coefficients for 2008 by country and by respective coefficients related

Table 9. Adjusted values of average external costs for railway transport for SEE countries per 2012 (€/1000 tkm)

Cost category	Refferent values per 2008 (€/1000 tkm)	Adjusted values for rail transport external costs per 2012 by SEE countries (€/1000 tkm)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,2	0,10	0,14	0,07	0,21	0,12	0,07	0,16	0,20
Air pollution	1,1	0,53	0,79	0,39	1,14	0,66	0,38	0,87	1,08
Noise	1,0	0,48	0,72	0,35	1,03	0,60	0,35	0,79	0,98
Climate change high scenario	0,9	0,43	0,64	0,32	0,93	0,54	0,31	0,71	0,88
Climate change low scenario	0,2	0,10	0,14	0,07	0,21	0,12	0,07	0,16	0,20
Up- and downstream processes high scenario	4,2	2,02	3,00	1,47	4,34	2,53	1,47	3,33	4,13
Up- and downstream processes low scenario	2,4	1,16	1,72	0,84	2,48	1,45	0,84	1,90	2,36
Nature and landscape	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Biodiversity losses	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Soil and water pollution	0,4	0,19	0,29	0,14	0,41	0,24	0,14	0,32	0,39
Urban effects	0,1	0,05	0,07	0,04	0,10	0,06	0,03	0,08	0,10
Total external costs high scenario	**7,9**	**3,80**	**5,65**	**2,77**	**8,16**	**4,76**	**2,76**	**6,26**	**7,76**
Total external costs low scenario	**5,3**	**2,55**	**3,79**	**1,86**	**5,47**	**3,19**	**1,85**	**4,20**	**5,21**

Table 10. Adjusted values of average external costs for inland waterways transport for each SEE country per 2012 (€/1000 tkm)

Cost category	Refferent values per 2008 (€/1000 tkm)	Adjusted values for IWW transport external costs per 2012 by SEE countries (€/1000 tkm)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,0	0,00	0,00	n.a.	n.a.	0,00	0,00	0,00	n.a.
Air pollution	5,4	2,60	3,86	n.a.	n.a.	3,25	1,89	4,28	n.a.
Noise	0,0	0,00	0,00	n.a.	n.a.	0,00	0,00	0,00	n.a.
Climate change high scenario	3,6	1,73	2,57	n.a.	n.a.	2,17	1,26	2,85	n.a.
Climate change low scenario	0,6	0,29	0,43	n.a.	n.a.	0,36	0,21	0,48	n.a.
Up- and downstream processes high scenario	1,3	0,63	0,93	n.a.	n.a.	0,78	0,45	1,03	n.a.
Up- and downstream processes low scenario	0,8	0,39	0,57	n.a.	n.a.	0,48	0,28	0,63	n.a.
Nature and landscape	0,4	0,19	0,29	n.a.	n.a.	0,24	0,14	0,32	n.a.
Biodiversity losses	0,5	0,24	0,36	n.a.	n.a.	0,30	0,17	0,40	n.a.
Soil and water pollution	0,0	0,00	0,00	n.a.	n.a.	0,00	0,00	0,00	n.a.
Urban effects	0,0	0,00	0,00	n.a.	n.a.	0,00	0,00	0,00	n.a.
Total external costs high scenario	**11,2**	**5,39**	**8,01**	**n.a.**	**n.a.**	**6,75**	**3,91**	**8,87**	**n.a.**
Total external costs low scenario	**7,7**	**3,71**	**5,51**	**n.a.**	**n.a.**	**4,64**	**2,69**	**6,10**	**n.a.**

to the harmonized indices of consumer prices for 2012 relative to 2008 (counted to index 2005 =100)[4]. Through this adjustment the reference values for each cost category are updated to the current economic conditions and they reflect the peculiarities of every SEE country. The adjusted values for each country and for different modes of transport are presented in table 8, table 9 and table 10 below.

[4] The source of information for calculations of these factors is EUROSTAT database.

Based on the adjusted values for different average external cost categories and using the traffic data by country further calculations of different cost categories and total average annual external costs by countries are made. The results of the calculations are presented in table 11, 12 and 13.

As it could be seen from the table 11 above the highest values of external costs for road transport are those for accidents in Slovakia and Greece. Other important costs are those for climate change for high

Table 11. Average external costs for road transport for SEE countries per 2012 (mio €)

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for road transport - forecast per 2015 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	10,2	146,88	90,06	25,51	258,24	312,79	13,01	321,83	230,07
Air pollution	6,7	96,48	59,16	16,76	169,63	205,46	8,55	211,40	151,12
Noise	1,8	25,92	15,89	4,50	45,57	55,20	2,30	56,79	40,60
Climate change high scenario	9,8	141,12	86,53	24,51	248,11	300,52	12,50	309,21	221,04
Climate change low scenario	1,7	24,48	15,01	4,25	43,04	52,13	2,17	53,64	38,34
Up- and downstream processes high scenario	3	43,20	26,49	7,50	75,95	92,00	3,83	94,66	67,67
Up- and downstream processes low scenario	1,7	24,48	15,01	4,25	43,04	52,13	2,17	53,64	38,34
Nature and landscape	0,7	10,08	6,18	1,75	17,72	21,47	0,89	22,09	15,79
Biodiversity losses	0,5	7,20	4,41	1,25	12,66	15,33	0,64	15,78	11,28
Soil and water pollution	0,8	11,52	7,06	2,00	20,25	24,53	1,02	25,24	18,04
Urban effects	0,5	7,20	4,41	1,25	12,66	15,33	0,64	15,78	11,28
Total external costs high scenario	**34**	**489,61**	**300,21**	**85,04**	**860,80**	**1042,63**	**43,38**	**1072,77**	**766,89**
Total external costs low scenario	**24,6**	**354,25**	**217,21**	**61,53**	**622,81**	**754,38**	**31,38**	**776,18**	**554,86**

* The traffic data used for calculation of external costs for road transport by countryes are only for HDV.

scenario[5]. They are again the highest in Slovakia and in Greece and the lowest in Serbia and in Former Yugoslavian Republic of Macedonia (FYROM). The reasons for the respective low results could be derived from the lower traffic volumes in these countries on one hand, but on another, their adjusted values for the respective cost categories are lower as well due to lower GDP per capita in PPP's compared to the other countries.

With regard to the average external costs for air pollution, the lowest are the costs in Serbia and in FIROM. Respectively, the highest are the costs for air pollution in Slovakia and Greece. Again, the reasons are the highest level of volume of road traffic and higher adjusted values in the respective SEEC and the lower in the others.

The same is the situation regarding the noise costs.

As far as the costs for up and downstream processes are concerned, in Slovakia and Greece they are higher than in the other countries and in Serbia and FYROM they are lowest.

With respect to the average external costs for nature and landscape, costs for soil and water pollution the shares are the same as for other costs.

The lower average external costs for SEEC are those for biodiversity losses and urban effects in Serbia and FYROM and theses are actually, the lowest costs in the overall comparison.

Regarding the **railway transport**, the results of calculations presented in table 12 show that the highest average external costs are those for up and downstream processes in Romania and Slovakia. The reasons for this are the respectively higher volume of traffic and higher adjustment factors (coefficients) for these countries. The lowest average external costs are those for urban effects in FYROM because of very low traffic volume there.

[5] Low scenario is based on the lower cost estimate accounting for the avoidance cost estimates for meeting the EU GHG reduction target for 2020. These are estimated to be at least € 25 per ton of CO2.

High scenario accounts for the higher climate cost estimate and it is based on the cost for meeting the long-term target for keeping CO2 eq. level in the atmosphere below 450 ppm in order to keep global temperature rise below 2 Centigrade. Extrapolating the cost values for 2025 from Kuik (2009) back to 2008, results in values of € 42 (low), € 78 (medium) and € 146 (high) per ton of CO2 (applying a discount rate of 3%). Based on this, a value of € 146 per ton of CO2 as high value for 2008 is used. (CE Delft 2011).

Table 12. Average external costs for rail transport for SEE countries per 2012 (mio €)

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for rail transport per 2012 per SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,2	0,28	0,33	0,03	0,06	1,62	0,19	1,20	0,68
Air pollution	1,1	1,54	1,83	0,16	0,32	8,93	1,06	6,61	3,75
Noise	1,0	1,40	1,67	0,15	0,29	8,12	0,97	6,01	3,41
Climate change high scenario	0,9	1,26	1,50	0,13	0,26	7,31	0,87	5,41	3,07
Climate change low scenario	0,2	0,28	0,33	0,03	0,06	1,62	0,19	1,20	0,68
Up- and downstream processes high scenario	4,2	5,88	7,00	0,62	1,23	34,10	4,06	25,25	14,32
Up- and downstream processes low scenario	2,4	3,36	4,00	0,36	0,70	19,49	2,32	14,43	8,18
Nature and landscape	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Biodiversity losses	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Soil and water pollution	0,4	0,56	0,67	0,06	0,12	3,25	0,39	2,40	1,36
Urban effects	0,1	0,14	0,17	0,01	0,03	0,81	0,10	0,60	0,34
Total external costs high scenario	**7,9**	**11,06**	**13,17**	**1,17**	**2,31**	**64,14**	**7,64**	**47,50**	**26,94**
Total external costs low scenario	**5,3**	**7,42**	**8,84**	**0,79**	**1,55**	**43,03**	**5,12**	**31,86**	**18,07**

With regard to other average external costs for rail transport, they are much lower comparing to the costs for up and downstream processes. Even the costs for biodiversity losses and for soil and water pollution are equal to zero as their reference values are zeros. Again the respective average external costs are higher in Romania and in Slovakia than in the other countries due the reasons mentioned above.

Interpreting the results from the calculation of average external costs for SEEC countries per 2012 for **inland waterways transport** one should note that FYROM, Greece and Slovenia are not Danubian countries so their external costs are 0. For the remaining countries the calculations show that the highest average external costs are those for air pollution and for high scenario of climate change in Romania owing to the highest traffic volume of IWW transport in this country. The lowest external costs are those for nature and landscape and the respective lowest level of these costs is observed in Serbia in which the volume of traffic is the lowest as well (see table 13).

Table 13. Average external costs for inland waterways transport for SEE countries per 2012

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for IWW transport per 2012 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Air pollution	5,4	13,91	2,98	0,00	0,00	40,75	1,14	4,22	0,00
Noise	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Climate change high scenario	3,6	9,27	1,99	0,00	0,00	27,16	0,76	2,81	0,00
Climate change low scenario	0,6	1,55	0,33	0,00	0,00	4,53	0,13	0,47	0,00
Up- and downstream processes high scenario	1,3	3,35	0,72	0,00	0,00	9,81	0,27	1,02	0,00
Up- and downstream processes low scenario	0,8	2,06	0,44	0,00	0,00	6,04	0,17	0,62	0,00
Nature and landscape	0,4	1,03	0,22	0,00	0,00	3,02	0,08	0,31	0,00
Biodiversity losses	0,5	1,29	0,28	0,00	0,00	3,77	0,11	0,39	0,00
Soil and water pollution	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Urban effects	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total external costs high scenario	**11,2**	**28,85**	**6,18**	**0,00**	**0,00**	**84,51**	**2,36**	**8,75**	**0,00**
Total external costs low scenario	**7,7**	**19,84**	**4,25**	**0,00**	**0,00**	**58,10**	**1,62**	**6,01**	**0,00**

The comparison between the results for different modes of transport shows that the average total external costs for inland waterways transport in SEE countries for 2012 are the lowest and those for road transport are the highest.

6. Forecasts for Total External Costs in Seec per Cost Category

Using the results of calculations for average external costs per cost categories by countries and modes of transport, forecasts per 2015, 2025 and 2035 are made. The forecast factors for HICP and traffic volumes by modes, presented in tables 4 and 5 are applied in order to compute the respective values (see tables 13 to 21).

Following the trends in the traffic volumes, the expected average external costs for **road transport** will fall in Greece. As the trend in road traffic is towards increase in all the other SEE countries, obviously this will lead to an increase in average external costs by countries as well (see tables 14 - 16).

The average external costs for **railway transport** by country in SEE region are envisaged to increase slightly in most of the countries. Owing to the decrease in rail traffic volumes foreseen in Bulgaria and Romania, the average external costs are expected to fall down in these countries as well (see tables 17 -19).

The trends in the external costs for **inland waterways transport** follow the

Table 14. Average external costs for road transport for SEE countries - forecast per 2015

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for road transport per 2012 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	10,2	119,72	63,08	20,72	219,42	182,35	8,81	239,87	159,27
Air pollution	6,7	78,64	41,43	13,61	144,13	119,78	5,79	157,56	104,62
Noise	1,8	21,13	11,13	3,66	38,72	32,18	1,56	42,33	28,11
Climate change high scenario	9,8	115,03	60,60	19,91	210,82	175,20	8,47	230,47	153,02
Climate change low scenario	1,7	19,95	10,51	3,45	36,57	30,39	1,47	39,98	26,55
Up- and downstream processes high scenario	3	35,21	18,55	6,10	64,54	53,63	2,59	70,55	46,84
Up- and downstream processes low scenario	1,7	19,95	10,51	3,45	36,57	30,39	1,47	39,98	26,55
Nature and landscape	0,7	8,22	4,33	1,42	15,06	12,51	0,60	16,46	10,93
Biodiversity losses	0,5	5,87	3,09	1,02	10,76	8,94	0,43	11,76	7,81
Soil and water pollution	0,8	9,39	4,95	1,63	17,21	14,30	0,69	18,81	12,49
Urban effects	0,5	5,87	3,09	1,02	10,76	8,94	0,43	11,76	7,81
Total external costs high scenario	**34**	**399,08**	**210,26**	**69,08**	**731,41**	**607,83**	**29,37**	**799,57**	**530,90**
Total external costs low scenario	**24,6**	**288,74**	**152,13**	**49,98**	**529,20**	**439,78**	**21,25**	**578,51**	**384,12**

* The traffic data used for calculation of external costs for road transport by countryes are only for HDV.

Table 15. Average external costs for road transport for SEE countries - forecast per 2025

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for road transport - forecast per 2025 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	10,2	302,96	141,95	42,28	205,57	577,50	33,06	597,61	432,63
Air pollution	6,7	199,01	93,24	27,77	135,03	379,34	21,72	392,55	284,18
Noise	1,8	53,46	25,05	7,46	36,28	101,91	5,83	105,46	76,35
Climate change high scenario	9,8	291,08	136,38	40,62	197,51	554,85	31,76	574,17	415,67
Climate change low scenario	1,7	50,49	23,66	7,05	34,26	96,25	5,51	99,60	72,11
Up- and downstream processes high scenario	3	89,11	41,75	12,43	60,46	169,85	9,72	175,77	127,24
Up- and downstream processes low scenario	1,7	50,49	23,66	7,05	34,26	96,25	5,51	99,60	72,11
Nature and landscape	0,7	20,79	9,74	2,90	14,11	39,63	2,27	41,01	29,69
Biodiversity losses	0,5	14,85	6,96	2,07	10,08	28,31	1,62	29,29	21,21
Soil and water pollution	0,8	23,76	11,13	3,32	16,12	45,29	2,59	46,87	33,93
Urban effects	0,5	14,85	6,96	2,07	10,08	28,31	1,62	29,29	21,21
Total external costs high scenario	**34**	**1009,88**	**473,17**	**140,93**	**685,23**	**1924,98**	**110,20**	**1992,03**	**1442,10**
Total external costs low scenario	**24,6**	**730,68**	**342,35**	**101,97**	**495,78**	**1392,78**	**79,73**	**1441,29**	**1043,41**

* The traffic data used for calculation of external costs for road transport by countryes are only for HDV.

Table 16. Average external costs for road transport for SEE countries - forecast per 2035

Cost category	Refferent values per 2008 (€ /1000 tkm)	Average external costs for road transport - forecast per 2035 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	10,2	513,68	205,59	62,75	133,68	889,27	55,16	911,71	694,49
Air pollution	6,7	337,42	135,04	41,22	87,81	584,13	36,23	598,87	456,18
Noise	1,8	90,65	36,28	4,50	23,59	156,93	9,73	160,89	122,56
Climate change high scenario	9,8	493,53	197,53	24,51	128,44	854,40	53,00	875,95	667,25
Climate change low scenario	1,7	85,61	34,27	4,25	22,28	148,21	9,19	151,95	115,75
Up- and downstream processes high scenario	3	151,08	60,47	7,50	39,32	261,55	16,22	268,15	204,26
Up- and downstream processes low scenario	1,7	85,61	34,27	4,25	22,28	148,21	9,19	151,95	115,75
Nature and landscape	0,7	35,25	14,11	1,75	9,17	61,03	3,79	62,57	47,66
Biodiversity losses	0,5	25,18	10,08	1,25	6,55	43,59	2,70	44,69	34,04
Soil and water pollution	0,8	40,29	16,12	2,00	10,48	69,75	4,33	71,51	54,47
Urban effects	0,5	25,18	10,08	1,25	6,55	43,59	2,70	44,69	34,04
Total external costs high scenario	**34**	**1712,26**	**685,30**	**85,04**	**445,60**	**2964,23**	**183,87**	**3039,02**	**2314,96**
Total external costs low scenario	**24,6**	**1238,87**	**495,84**	**61,53**	**322,40**	**2144,71**	**133,04**	**2198,82**	**1674,94**
* The traffic data used for calculation of external costs for road transport by countryes are only for HDV.									

Table 17. Average external costs for railway transport for SEE countries - forecast per 2015

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for rail transport - forecast per 2015 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,2	0,18	0,50	0,05	0,12	0,93	0,17	1,13	0,74
Air pollution	1,1	0,97	2,75	0,28	0,67	5,12	0,92	6,19	4,06
Noise	1,0	0,88	2,50	0,26	0,61	4,65	0,83	5,63	3,69
Climate change high scenario	0,9	0,79	2,25	0,23	0,55	4,19	0,75	5,06	3,32
Climate change low scenario	0,2	0,18	0,50	0,05	0,12	0,93	0,17	1,13	0,74
Up- and downstream processes high scenario	4,2	3,68	10,50	1,09	2,55	19,53	3,50	23,64	15,49
Up- and downstream processes low scenario	2,4	2,11	6,00	0,62	1,46	11,16	2,00	13,51	8,85
Nature and landscape	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Biodiversity losses	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Soil and water pollution	0,4	0,35	1,00	0,10	0,24	1,86	0,33	2,25	1,47
Urban effects	0,1	0,09	0,25	0,03	0,06	0,47	0,08	0,56	0,37
Total external costs high scenario	**7,9**	**6,93**	**19,74**	**2,05**	**4,79**	**36,74**	**6,58**	**44,46**	**29,13**
Total external costs low scenario	**5,3**	**4,65**	**13,24**	**1,37**	**3,22**	**24,65**	**4,41**	**29,83**	**19,54**

Table 18. Average external costs for railway transport for SEE countries - forecast per 2025

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for rail transport - forecast per 2025 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,2	0,08	0,75	0,08	0,17	0,15	0,05	0,68	1,00
Air pollution	1,1	0,46	4,15	0,45	0,93	0,81	0,26	3,73	5,49
Noise	1,0	0,42	3,77	0,41	0,84	0,74	0,24	3,39	4,99
Climate change high scenario	0,9	0,37	3,39	0,37	0,76	0,66	0,22	3,05	4,49
Climate change low scenario	0,2	0,08	0,75	0,08	0,17	0,15	0,05	0,68	1,00
Up- and downstream processes high scenario	4,2	1,75	15,84	1,71	3,54	3,09	1,01	14,25	20,96
Up- and downstream processes low scenario	2,4	1,00	9,05	0,98	2,02	1,77	0,58	8,14	11,98
Nature and landscape	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Biodiversity losses	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Soil and water pollution	0,4	0,17	1,51	0,16	0,34	0,29	0,10	1,36	2,00
Urban effects	0,1	0,04	0,38	0,04	0,08	0,07	0,02	0,34	0,50
Total external costs high scenario	**7,9**	**3,29**	**29,80**	**3,22**	**6,66**	**5,82**	**1,90**	**26,81**	**39,42**
Total external costs low scenario	**5,3**	**2,20**	**19,99**	**2,16**	**4,47**	**3,90**	**1,27**	**17,99**	**26,45**

Table 19. Average external costs for railway transport for SEE countries - forecast per 2035

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for rail transport - forecast per 2035 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,2	0,07	1,06	0,12	0,22	0,16	0,02	0,08	1,29
Air pollution	1,1	0,38	5,82	0,65	1,22	0,90	0,09	0,44	7,08
Noise	1,0	0,35	5,29	0,59	1,11	0,82	0,08	0,40	6,44
Climate change high scenario	0,9	0,31	4,77	0,53	1,00	0,73	0,07	0,36	5,80
Climate change low scenario	0,2	0,07	1,06	0,12	0,22	0,16	0,02	0,08	1,29
Up- and downstream processes high scenario	4,2	1,46	22,24	2,48	4,68	3,43	0,35	1,68	27,04
Up- and downstream processes low scenario	2,4	0,83	12,71	1,42	2,67	1,96	0,20	0,96	15,45
Nature and landscape	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Biodiversity losses	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Soil and water pollution	0,4	0,14	2,12	0,24	0,45	0,33	0,03	0,16	2,58
Urban effects	0,1	0,03	0,53	0,06	0,11	0,08	0,01	0,04	0,64
Total external costs high scenario	**7,9**	**2,75**	**41,83**	**4,66**	**8,80**	**6,44**	**0,65**	**3,15**	**50,87**
Total external costs low scenario	**5,3**	**1,84**	**28,06**	**3,13**	**5,90**	**4,32**	**0,44**	**2,12**	**34,13**

trends in traffic volumes. In almost all the countries (excluding Slovakia), in which the IWW transport is developed, the level of average external costs is foreseen to increase slightly due to expected growth in the traffic volumes (see tables 19 - 21). However, the total external costs by cost categories will remain the lowest comparing to the other two modes put in the analysis.

Finally, it should be noted that the forecasts made and the future trends of transport developments in inland modes in some SEE countries show that there is a need for urgent measures in order to balance the modal split and to leave no avenue unexplored for reversing negative trends in railway and inland waterways transport performance. This means to find a proper management and policy strategies for minimising the external costs of inland modes of transport.

The analysis made shows that the external costs for road transport will encrease in almost all the counties in South-Eastern Europer although a higher ecologic standarts and regulative measures are undertaken in most of them. The main reason is the expected growth in road transport services demand and respective traffic volumes. Simultaneously, the external costs for rail and inland waterways transport will encrease slightly in almost all the countries remaining out and away under those of road transport.

Table 20. Average external costs for inland waterways transport for SEE countries - forecast per 2015

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for IWW transport per 2035 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Air pollution	5,4	39,52	7,31	0,00	0,00	167,65	1,03	0,71	0,00
Noise	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Climate change high scenario	3,6	26,34	4,87	0,00	0,00	111,77	0,68	0,47	0,00
Climate change low scenario	0,6	4,39	0,81	0,00	0,00	18,63	0,11	0,08	0,00
Up- and downstream processes high scenario	1,3	9,51	1,76	0,00	0,00	40,36	0,25	0,17	0,00
Up- and downstream processes low scenario	0,8	5,85	1,08	0,00	0,00	24,84	0,15	0,11	0,00
Nature and landscape	0,4	2,93	0,54	0,00	0,00	12,42	0,08	0,05	0,00
Biodiversity losses	0,5	3,66	0,68	0,00	0,00	15,52	0,09	0,07	0,00
Soil and water pollution	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Urban effects	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total external costs high scenario	**11,2**	**81,96**	**15,16**	**0,00**	**0,00**	**347,72**	**2,13**	**1,47**	**0,00**
Total external costs low scenario	**7,7**	**56,35**	**10,42**	**0,00**	**0,00**	**239,06**	**1,46**	**1,01**	**0,00**

Table 21. Average external costs for inland waterways transport for SEE countries - forecast per 2025

Cost category	Refferent values per 2008 (€ /1000 tkm)	Average external costs for IWW transport per 2015 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Air pollution	5,4	12,15	2,75	0,00	0,00	47,59	1,06	3,23	0,00
Noise	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Climate change high scenario	3,6	8,10	1,83	0,00	0,00	31,73	0,71	2,15	0,00
Climate change low scenario	0,6	1,35	0,31	0,00	0,00	5,29	0,12	0,36	0,00
Up- and downstream processes high scenario	1,3	2,92	0,66	0,00	0,00	11,46	0,26	0,78	0,00
Up- and downstream processes low scenario	0,8	1,80	0,41	0,00	0,00	7,05	0,16	0,48	0,00
Nature and landscape	0,4	0,90	0,20	0,00	0,00	3,53	0,08	0,24	0,00
Biodiversity losses	0,5	1,12	0,25	0,00	0,00	4,41	0,10	0,30	0,00
Soil and water pollution	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Urban effects	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total external costs high scenario	**11,2**	**25,19**	**5,71**	**0,00**	**0,00**	**98,71**	**2,20**	**6,70**	**0,00**
Total external costs low scenario	**7,7**	**17,32**	**3,92**	**0,00**	**0,00**	**67,86**	**1,51**	**4,61**	**0,00**

Table 22. Average external costs for inland waterways transport for SEE countries - forecast per 2035

Cost category	Refferent values per 2008 (€/1000 tkm)	Average external costs for IWW transport per 2025 by SEE countries (mio €)							
		Bulgaria	Croatia	Macedonia	Greece	Romania	Serbia	Slovakia	Slovenia
Accidents	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Air pollution	5,4	23,86	4,70	0,00	0,00	98,48	1,17	2,17	0,00
Noise	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Climate change high scenario	3,6	15,91	3,13	0,00	0,00	65,65	0,78	1,44	0,00
Climate change low scenario	0,6	2,65	0,52	0,00	0,00	10,94	0,13	0,24	0,00
Up- and downstream processes high scenario	1,3	5,74	1,13	0,00	0,00	23,71	0,28	0,52	0,00
Up- and downstream processes low scenario	0,8	3,53	0,70	0,00	0,00	14,59	0,17	0,32	0,00
Nature and landscape	0,4	1,77	0,35	0,00	0,00	7,29	0,09	0,16	0,00
Biodiversity losses	0,5	2,21	0,44	0,00	0,00	9,12	0,11	0,20	0,00
Soil and water pollution	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Urban effects	0,0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total external costs high scenario	**11,2**	**49,49**	**9,75**	**0,00**	**0,00**	**204,26**	**2,43**	**4,49**	**0,00**
Total external costs low scenario	**7,7**	**34,02**	**6,70**	**0,00**	**0,00**	**140,43**	**1,67**	**3,09**	**0,00**

7. Policy Implications

The results of the analysis made under this study can be used for various purposes. The total and average cost estimates by SEE countries provide a strong basis for comparing the environmental burden of various inland transport modes. They could also be used for general policy development.

First of all, **improving the system of infrastructure charges through internalisation of external costs** will provide a more accurate basis for comparison of returns of investment in transport and will improve the conditions for private investment and usage of infrastructure. With the introduction of direct infrastructure charges reflecting external costs, each transport service could be assessed according to the costs and benefits that are triggered as all costs will be taken into account. On the other hand, the internalisation of the environmental costs will increase the eco-efficiency, i.e. the charges will reflect the cost of eliminating harmful emissions, and the level of these emissions will be reduced to the point where the cost of the reduction will be equal to the benefits of this measure. Thus, from the standpoint of social efficiency, internalisation will maximize the welfare of societies and not the volumes of traffic. From financial perspective, more efficient use of the transport systems will reduce the needs for governments' spending on infrastructure, health and environmental protection. The net effect

in the commercial sectors will be positive and direct effect of higher transportation charges will be offset by reducing the costs of congestion and accidents, and any possible reduction of taxes provided by the governments. So obviously, the results of the study can be used as a basis for pricing strategies. For specific pricing instruments more detailed or specific estimates might be considered (CEC, 1998). As a result, the increase in consumer prices by internalising the external costs, while offering alternatives to road transport, can change users' behaviour substantially – and this may be the cheapest option (Becker, Becker, & Gerlach, 2012) for balancing modal split.

The study could also suggest actions and effects of application in different modes. The primary long term goal of applying a uniform approach to measuring externalities in inland transport modes is **to increase the efficiency in using national transport infrastructure**. Options to achieve this goal can be determined by analysing the impacts and implications of the approach in terms of the infrastructure of transport modes. Besides the internalisation of external costs, **strong investments priorities in government programs towards rail and inland waterways transport developments** should be implemented with the purpose of shifting freight to these modes. The priority tasks are related to *conducting structural reforms in railways, reconstructing rail and port infrastructures and financing modernisation of rolling stocks and fleets*. All these measures could be implemented by **using external average costs estimations for cost benefit analysis** (CBA). This could be very useful for transport infrastructure projects assessment but also for other types of projects for which a CBA is needed. The cost-benefit analysis including average external costs estimations could be used as an economic tool for supporting policy decisions on financing the infrastructure projects in rail and inland waterways transport in SEE countries.

On the other hand, despite that the main focus of internalisation of external costs is on the environmental issues, the analysis results show that the highest external average costs of freight inland transport in SEE countries are accident costs of road transport. With regard to this **possible safety improvements should be addressed** and necessary technical and regulative measures for decreasing the number of accidents, number of fatalities, as well as of severe and slight injuries should be undertaken. Furthermore improvements in existing insurance system, especially applying internalisation of external accident costs when calculating the civil liabilities insurances premiums will improve the road safety situation (OECD 2010). From a pricing point of view, the increase civil liability premiums and their differentiation according to individual risk performance of drivers could be an effective measure to lessen the external costs for accidents.

Conclusion

When analysing the transport activities and deciding on necessary measures for achieving the policy goals, the governments of the SEE countries must take into account the environmental impacts, accidents and congestions as well. In contrast to the benefits of transport, the costs of these effects are generally not borne by the transport users. Without policy interventions, these costs are not recognised by the transport users when they take a transport decisions (ITT 2013). The internalisation of external costs, the last stage in the evaluation of external costs calculation methodology, means making such effects part of the decision making process of transport users. According to the welfare theory approach, the internalisation of external costs by market-based instruments may lead to a more efficient use of transport infrastructure; reduce the negative external effects of transport activity and ensuring transport users equity (CE Delft 2011).

Improving the infrastructure charging systems through internalisation of external costs in South-Eastern European countries will provide a more accurate basis for comparison of investment returns in inland modes of transport and it will improve the conditions for private investment and infrastructure use. With the introduction of direct infrastructure charges including external costs elements, each transport service will be assessed

according to the costs and benefits that are triggered as all costs will be taken into account. On the other hand, the internalisation of the environmental costs will increase the eco-efficiency, i.e. the charges will reflect the cost of eliminating harmful emissions, and the level of these emissions will be reduced to the point where the cost of the reduction will be equal to the benefits of this measures. Thus, from the standpoint of social efficiency, internalisation will maximize the welfare of the societies in SEEC and not the volumes of traffic. From financial perspective, better efficiency in infrastructures' usage in these countries will reduce the needs for government spending on infrastructure, health and environmental protection. The net effect in the commercial sectors will be positive and direct effects of higher transportation charges will be offset by reducing the costs of congestion and accidents, and any possible reduction of taxes provided by the governments.

Range of uncertainty

As it has been noted above it should be taken into consideration that a value transfer of external average costs estimations to different EU countries is sensitive to national and local specifications and it is only undertaken because no national studies are available. The respective results represent rough estimates only and they are produced in order to give a notion on the external costs of inland freight transport in SEE countries and their possible usage as a base for policy measures recommendations.

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