COMPETE

Analysis of the contribution of transport policies to the competitiveness of the EU economy and comparison with the United States

Annex 1

to COMPETE Final Report:

Analysis of operating cost in the EU and the US

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Partners:

INFRAS
INFRAS
Zurich, Switzerland

TIS
Transport, Innovation and Systems
Lisbon, Portugal

EE
Europe Economics
London, United Kingdom

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List of abbreviations

AT	Austria
ATC	Air Traffic Control
ATM	Air Traffic Management
BE	Belgium
bn	billion = 10^9
BTS	Bureau of Transportation Statistics of the US
CH	Switzerland
CHF	Swiss Franc(s)
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estland
ES	Spain
EU	European Union
EUR	Euro
FI	Finland
FR	France
IATA	International Air Traffic Association
ICAO	International Civil Aviation Organisation
IE	Ireland
IT	Italy
GDP	Gross Domestic Product
GPS	Global Positioning System
GR	Greece
HDV	heavy duty vehicle(s) (> 12t gross weight)
HU	Hungary
IOT	Input-output-table
IRU	International Road Transport Union
km	kilometres
LCC	Low Cost Carrier(s)

LDV	light duty vehicle(s) (< 12t gross weight)
LT	Lithuania
LTO	Landing and take-off
LU	Luxembourg
LV	Latvia
m	million = 10^6
MA	Malta
mill	million = 10^6
Mio.	million = 10^6
MTOW	maximum take-off weight
n.d.a.	no data available
NL	Netherlands
NEC	not elsewhere classified
p.a.	per annum = per year
pkm	passenger-kilometres
PL	Poland
PPP	Purchase Power Parity
PT	Portugal
SE	Sweden
SK	Slovakia
SL	Slovenia
SSS	Short Sea Shipping
t	ton(s)
TEU	Twenty-foot-equivalent-unit: volume of a container that is 20 feet long, eight feet wide and 8,5 feet high
tkm	ton-kilometres
train-km	train-kilometres
UIC	International Union of Railways
UK	United Kingdom
US / USA	United States of America
USD	US Dollar
vkm	vehicle-kilometres

Annex 1: Analysis of operating cost in the EU and the US

1 Methodology and procedure

1.1 Procedure for quantitative estimation

Operating costs of different transport modes in different transport countries are depending on many factors, such as

- Transport volumes
- Fleet structure and age
- Market prices and financing conditions of equipment (vehicle market, garage, maintenance equipment, interest rates, insurance etc.): These prices are in addition dependent of the level of liberalisation of the equipment market.
- Energy consumption (depending on average energy use of the fleet)
- Structure of charges and taxes (infrastructure use, road taxes, environmental taxation)
- Taxation structure (transport taxes, others)
- Wage level (usually depending on general economic conditions according to GDP per capita
- Level of competition/liberalisation of the transport sector.

There are two approaches possible to consider these influence factors per country and per transport mode:

- Top down: Transport costs per country based on input-output table information: This approach follows the logic of the production of public/professional provision of transport services. The approach however is too narrow, since private transport and individual passenger road transport is not included. In addition the available information within input-output table is very rough.
- Bottom up: Estimation of specific costs per transport mode and –mean and aggregation according to national transport levels.

Within COMPETE, we will use a harmonised bottom up approach, which starts from typical specific costs for exemplary transport means and countries. These countries cover a representative set all over EU25 and US. Since data sources are however not always consistent (different years, different structure of cost elements etc.), a transfer procedure is necessary, in order to get information for all countries and make specific cost comparable. The use of a transfer mechanism based on selected macroeconomic key indicators such as national fleet structure information, average fuel consumption, GDP per capita purchase power parity adjusted, national interest rates and different levels of liberalisation. For the specific modes, the following procedures were used:

Road transport

The operating costs of road transport have been calculated on the basis of seven cost components: costs for wear and tear, capital costs, personnel costs, fuel (energy) costs, insurance costs, taxes and charges, additional costs (overhead, etc.). For each of this cost components, the costs were calculated on the basis of specific data for each country. In the following table, the method for calculating the operating costs of road transport is described in detail.

Table 1-1: Road transport operating costs (calculation method and sources)

Cost Component	Calculation method	Data sources
Wear and tear	Country specific data: Maintenance cost index for road passenger and freight transport (were available), direct country data or GDP/capita PPP[1] adjusted (where no other data available).	EC (1999), EUROSTAT (2006)
Capital costs (vehicle)	Country specific data: Average purchase prices of new vehicles, average age of vehicles (passenger cars, trucks, buses & coaches), national interest rates.	EUROSTAT (2006), EUROSTAT (2006b), TAXUD (2002), EC (1999), EC (2000)
Personnel costs	Country specific data: Personnel cost index in the road transport sector (passenger transport: buses and coaches, freight transport).	EUROSTAT (2006)
Fuel (energy) cost	Country specific data: Average fuel prices (gasoline, diesel) and average fuel consumption per vehicle-km.	EUROSTAT (2006), TREMOVE (2005), ACEA (2006)
Insurance costs	Country specific data: Insurance cost index for road passenger and freight transport (were available), GDP/capita PPP adjusted (where no other data available).	EUROSTAT (2006), EC (1999), EC (2000)
Taxes and Charges	Country specific data: Taxes and charges for road transport (passenger cars, duty vehicles, buses & coaches): total taxes and charges without fuel taxes (counted in the category 'fuel costs') and vehicle purchase taxes (counted in the category 'capital costs').	TREMOVE (2005), ECMT (2003), ECMT (2005), FACORA (2004), BGL (2006), BGL (2002), EC (1999)
Additional cost	Country specific data: GDP/capita PPP adjusted as an indicator for the additional costs.	EUROSTAT (2006)
Total operating costs	Overall basis: Cost rates of a set of selected countries for which data were available: Germany, UK, France, Spain, Italy, Czech Republic and other European Countries, USA, Switzerland.	ADAC (2006), AA (2004), AAA (2005), TCS (2006), BGL (2005), BGL (2006), RHENUS (2005), RHA (2006), Barnes, Langworthy (2003), Ministerio de Fomento (2006), Herry (2001), CDV (2006), ASTAG (2004), Ufficio Italiano dei Cambi (2004), ECOTRA (2006), ECORYS (2006), VTPI (2006), SFSO (2005), BAG (2004), INFAS/DIW (2004).

[1] PPP. Purchase Power Parity

Rail transport

The rail transport operating costs have been calculated on the basis of six cost categories: capital costs, personnel costs, energy costs, insurance costs, taxes and charges, additional costs (wear and tear, material costs, infrastructure charges, etc.). For most countries, the operation cost data have been calculated directly on the basis of the International Railway Statistics 2004 (UIC 2006). This data base provides detailed information about the costs and revenues of all big European railway companies, as well as detailed traffic data (train-kilometres). On this basis, the specific costs per train-kilometre have been calculated. The UIC database covers almost all European countries with a railway network in use. It does, however, not include data for the United Kingdom and the USA. Therefore, other data sources had to be used for these countries (UK: Smith 2006; USA: Parsons Transportation Group 1999 and DMJM Harris 2002).

Air transport

The calculation of the operation cost of air transport has been based on detailed information of specific airline companies (cost structure, costs per available ton-km, transport volumes, etc.) and international aviation statistics. The operation costs have not been divided into different cost categories. The results are only presented for the overall average operating costs per available ton-km and the total operating costs for the whole air transport sector.

Water transport

The operating costs of water transport have been calculated on the basis of international studies (REVENUE 2005, RECORDIT 2001) as well as specific data of selected countries (Herry 2001, Günthner 2001, Cambridge Systematics 2004, Brooks et al. 2006). For the category of short sea shipping, no data have been calculated for specific countries but only for the total European Union and the USA. For the category of inland waterways, data have been calculated for those selected countries which have a relevant amount of inland waterway transport (Belgium, Germany, France, Netherlands, USA).

2 General input data

2.1 Traffic data

The following two tables show the traffic data, which formed the basis of the calculations of the total operating costs and the average operating costs per passenger-km and ton-km. The transport model TREMOVE (TREMOVE 2005) was the main database for the traffic data. Data for the USA were taken from the Bureau of Transportations Statistics of the US (BTS 2005).

Table 2-1: Traffic data 2005 (vehicle-km) EU25, USA and Switzerland

	Traffic Data 2005 (vehicle-km)							
	Road (in million veh-km)					Rail (in million train-km)		Aviation (in mio. available tkm)
	Passenger Cars	Buses	Coaches	LDV	HDV	Passenger	Freight	Total (pass.+freight)
Belgium	82'454	191	762	3'434	5'164	105	20	4'164
Czech Republic	33'883	69	556	5'838	7'458	118	34	2'648
Denmark	40'952	179	503	3'168	2'753	67	9	2'307
Germany	565'933	1'755	3'662	15'068	46'146	474	253	36'585
Estonia	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	373
Greece	48'210	408	1'167	7'176	3'442	17	2	4'019
Spain	243'847	799	2'316	50'616	24'834	151	49	22'013
France	536'999	1'069	2'408	70'117	39'833	405	138	34'617
Irland	24'148	103	463	1'092	1'874	12	2	3'940
Italia	447'659	1'338	5'663	25'855	26'005	261	102	15'998
Cyprus	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	0	0	1'141
Latvia	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	440
Lithuania	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a.
Luxembourg	4'035	24	35	253	489	6	1	746
Hungary	23'204	144	1'204	2'182	3'153	101	21	1'851
Malta	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	0	0	575
Netherlands	109'544	101	424	83	5'745	175	15	17'381
Austria	46'104	204	855	578	4'101	84	56	4'937
Poland	88'082	291	1'477	10'756	14'811	216	72	2'215
Portugal	63'477	52	491	1'517	2'176	23	12	4'095
Slovenia	6'501	11	90	321	465	11	7	420
Slovakia	8'251	73	611	1'774	2'563	51	14	478
Finland	43'676	166	552	7'940	4'539	31	18	2'465
Sweden	64'947	280	567	4'410	5'016	85	43	2'883
United Kingdom	433'099	1'068	2'584	34'124	24'298	490	68	51'430
USA	3'560'115	3'919	10'681	816'213	364'524	218	861	292'296
Switzerland	56'976	54	224	357	3'164	147	30	8'216

Sources: Europe: TREMOVE (2005), USA: Bureau of Transportation Statistics (BTS 2005). n.d.a.: no data available

Table 2-2: Traffic data 2005 (passenger-km, ton-km) EU25, USA and Switzerland

	Traffic Data 2005 (passenger-km, ton-km)								
	Passenger transport (in million pkm)					Freight transport (in million tkm)			
	Passenger Cars	Buses	Coaches	Rail Passenger	Aviation	LDV	HDV	Rail Freight	Inland Waterways
Belgium	113'548	3'133	10'636	8'109	8'038	673	41'820	7'702	8'392
Czech Republic	73'279	1'107	8'722	7'993	2'852	1'354	49'839	14'918	489
Denmark	60'889	2'556	6'711	5'175	7'478	624	19'241	2'122	0
Germany	903'291	29'115	47'484	66'722	45'455	3'076	363'508	85'582	63'667
Estonia	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a
Greece	89'448	6'264	15'790	1'688	26'073	1'323	23'821	531	0
Spain	353'853	13'281	34'807	20'593	74'098	7'998	168'292	11'403	0
France	760'987	16'206	24'373	71'297	32'731	12'184	297'500	44'577	8'416
Irland	39'314	1'568	4'780	1'265	6'684	188	11'739	335	0
Italia	733'857	19'430	77'223	44'369	32'312	3'537	205'458	20'864	0
Cyprus	n.d.a	n.d.a	n.d.a	0	n.d.a	n.d.a	n.d.a	0	0
Latvia	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a
Lithuania	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a	n.d.a
Luxembourg	5'469	432	493	644	n.d.a	59	2'968	563	0
Hungary	51'834	2'303	15'581	10'698	2'380	496	21'061	8'647	0
Malta	n.d.a	n.d.a	n.d.a	0	n.d.a	n.d.a	n.d.a	0	0
Netherlands	151'142	1'651	5'532	13'828	11'973	11	43'873	4'971	43'092
Austria	73'590	3'413	9'680	8'850	5'757	118	30'686	18'113	2'507
Poland	189'093	4'660	24'635	34'933	2'321	1'776	93'987	47'613	1'138
Portugal	93'854	958	9'065	3'805	10'870	303	15'481	2'677	0
Slovenia	13'002	378	3'157	595	614	54	2'304	2'881	0
Slovakia	18'152	2'564	21'399	4'202	144	299	12'713	13'762	1'468
Finland	59'582	2'580	5'202	3'352	6'929	857	29'498	10'208	0
Sweden	97'524	4'304	5'766	8'366	15'425	806	34'372	20'525	0
United Kingdom	703'035	17'227	28'373	41'803	62'854	5'591	165'195	21'349	0
USA	4'335'367	34'218	226'460	48'797	895'905	204'799	1'829'286	2'580'686	475'691
Switzerland	90'942	893	2'533	18'050	7'093	89	24'090	9'087	0

Sources: Europe: TREMOVE (2005), USA: Bureau of Transportation Statistics (BTS 2005). n.d.a.: no data available

2.2 Economic data

The economic data used can be seen in Table 2-3. All data are official Eurostat data.

Table 2-3: Economic data 2004 (GDP total, GPD per capita) EU25, USA and Switzerland

	Economic data 2004	
	GDP total 2004 (in Mio. €, market prices)	GPD per capita (PPP) 2004 (Index; EU25=100)
Belgium	288'089	118.5
Czech Republic	86'787	70.4
Denmark	196'300	121.3
Germany	2'215'650	108.8
Estonia	9'043	51.3
Greece	167'169	81.5
Spain	837'316	97.7
France	1'648'369	109.4
Irland	148'557	137.2
Italia	1'351'328	103.0
Cyprus	12'533	83.3
Latvia	11'167	42.9
Lithuania	18'083	47.9
Luxembourg	25'664	226.4
Hungary	81'115	60.2
Malta	4'269	69.2
Netherlands	488'642	124.6
Austria	237'039	122.8
Poland	203'711	48.9
Portugal	142'297	72.2
Slovenia	26'146	79.2
Slovakia	33'119	51.9
Finland	149'725	112.4
Sweden	282'014	117.5
United Kingdom	1'716'531	116.4
USA	9'433'475	150.9
Switzerland	288'853	131.5

Sources: EUROSTAT (2006). PPP: Purchase Power Parity.

3 Road transport

3.1 Passenger transport (passenger cars, buses and coaches)

Exemplary costs of different countries

The following tables show exemplarily different average operation costs for certain countries. The costs shown are original data, not fully following the cost structure proposed for this study. The data summarized are only one source of input data among many others for calculating the average operation costs of passenger cars (see more about the main data sources in the following chapter 'input data').

Table 3-1: Passenger cars operating costs for Germany

Cost Component	Costs per vehicle-km (in EUR/vkm)
Depreciation	0.16
Taxes & Insurance	0.06
Parking/garage	0.03
Fuel	0.09
Washing and maintenance	0.02
Repair and tyres	0.03
Additional expenses	0.01
Total	**0.40**

Source: ADAC (2006).

Table 3-2: Passenger cars operating costs for the UK

Cost Component	Costs (in pence/veh-mile)	Costs (in EUR/vkm)
Road Tax	1.10	0.010
Insurance	3.06	0.028
Cost of capital	3.24	0.030
Depreciation	14.82	0.136
Fuel	10.77	0.099
Tyres	1.09	0.010
Servicing labour costs	2.79	0.026
Replacement parts	2.45	0.022
Parking and tolls	1.80	0.016
Additional costs	0.69	0.006
Total	**41.81**	**0.383**

Source: AA (2004). Data for an average petrol car with a purchase price of 13'000-20'000 GBP and 15'000 miles travelled per year.

Table 3-3: Passenger cars operating costs for USA

Cost Component	Costs (in cts/mile)	Costs (in EUR/vkm)
Fuel	8.5	0.042
Maintenance	5.8	0.029
Tyres	0.7	0.003
Insurance	8.0	0.040
Taxes	2.6	0.013
Depreciation	26.7	0.133
Financial charges (interests)	4.9	0.025
Total	**57.2**	**0.286**

Source: AAA (2005).

Input data, data sources

The following tables show some of the most important input data for calculating the operating costs for passenger cars, buses and coaches. The calculations of the operation costs for the road passenger transport are mainly based on specific country information (covering all countries available) about:

- Fuel costs (EUROSTAT 2006)
- Average fuel consumption (TREMOVE 2005, ACEA 2006)
- Price levels for passenger cars, buses and coaches (EUROSTAT 2006b, EC 1999, TAXUD 2002)
- Average age of passenger cars (EUROSTAT 2006)
- Maintenance and insurance costs for passenger cars, buses and coaches (selected countries, EC 1999)
- Taxes and charges (TREMOVE 2005, FACORA 2004, EC 1999)
- Average wage level for bus and coach transport (EUROSTAT 2006)

Table 3-4: Average fuel consumption 2005 (based on average CO2-emissions) for passenger cars, buses and choaches. Index: Belgium = 100

	Average fuel consumption 2005 (Index, Belgium=100)		
	Passenger Cars	Buses	Coaches
Belgium	100	100	100
Czech Republic	86	79	98
Denmark	114	101	110
Germany	115	102	99
Estonia	89	80	99
Greece	108	112	116
Spain	103	107	109
France	103	102	97
Irland	105	108	110
Italia	105	102	113
Cyprus	106	107	115
Latvia	89	80	99
Lithuania	89	80	99
Luxembourg	92	95	97
Hungary	93	80	100
Malta	106	107	115
Netherlands	104	102	106
Austria	108	103	104
Poland	86	82	99
Portugal	108	112	108
Slovenia	89	80	99
Slovakia	89	80	99
Finland	120	102	104
Sweden	118	98	107
United Kingdom	104	99	97
USA	n.d.a.	n.d.a.	n.d.a.
Switzerland	111	91	102

Sources: TREMOVE (2005). n.d.a.: no data available

Table 3-5: Average fuel prices in 2004 (fuel prices incl. fuel taxes)

	Gasoline (€/1000 l)	Diesel (€/1000 l)
Belgium	1'106	815
Czech Republic	868	781
Denmark	1'175	882
Germany	1'178	940
Estonia	694	640
Greece	814	730
Spain	889	753
France	1'082	875
Irland	997	910
Italia	1'147	935
Cyprus	785	709
Latvia	703	635
Lithuania	771	678
Luxembourg	935	676
Hungary	996	891
Malta	852	681
Netherlands	1'287	878
Austria	965	794
Poland	864	697
Portugal	1'052	767
Slovenia	835	730
Slovakia	905	836
Finland	1'173	811
Sweden	1'123	884
United Kingdom	1'207	1'219
USA	434	458

Sources: EUROSTAT (2006).

Table 3-6: Price level and average age of passenger cars, average wages for bus and coach transport (all data for latest year available)

	Aver. price level for new pass. cars 2004 (Index: Belgium=100)	Aver. age of pass. cars 1998 (in years)	Wages for bus & coach transport 2003 (Index: Belgium= 100)
Belgium	100	5.8	100
Czech Republic	48	9.9	23
Denmark	247	7.9	112
Germany	105	6.6	76
Estonia	52	9.9	18
Greece	79	10.4	29
Spain	86	8.7	49
France	103	7.3	97
Irland	150	6.9	67
Italia	99	8.3	92
Cyprus	102	7.4	37
Latvia	43	9.9	12
Lithuania	43	9.9	9
Luxembourg	101	4.3	58
Hungary	57	12.6	24
Malta	83	8.7	48
Netherlands	123	6.8	87
Austria	108	7.1	88
Poland	39	9.6	9
Portugal	102	10.8	49
Slovenia	66	7.4	43
Slovakia	47	9.9	21
Finland	140	9.9	70
Sweden	117	9.5	88
United Kingdom	112	6.3	76
USA	n.d.a.	n.d.a.	51
Switzerland	119	7.1	91

Sources: Price level: EUROSTAT (2006); Age of cars: EUROSTAT (2006b): Statistics in Focus, Economy and Finance 3/2006; Wages: EUROSTAT (2006). n.d.a.: no data available.

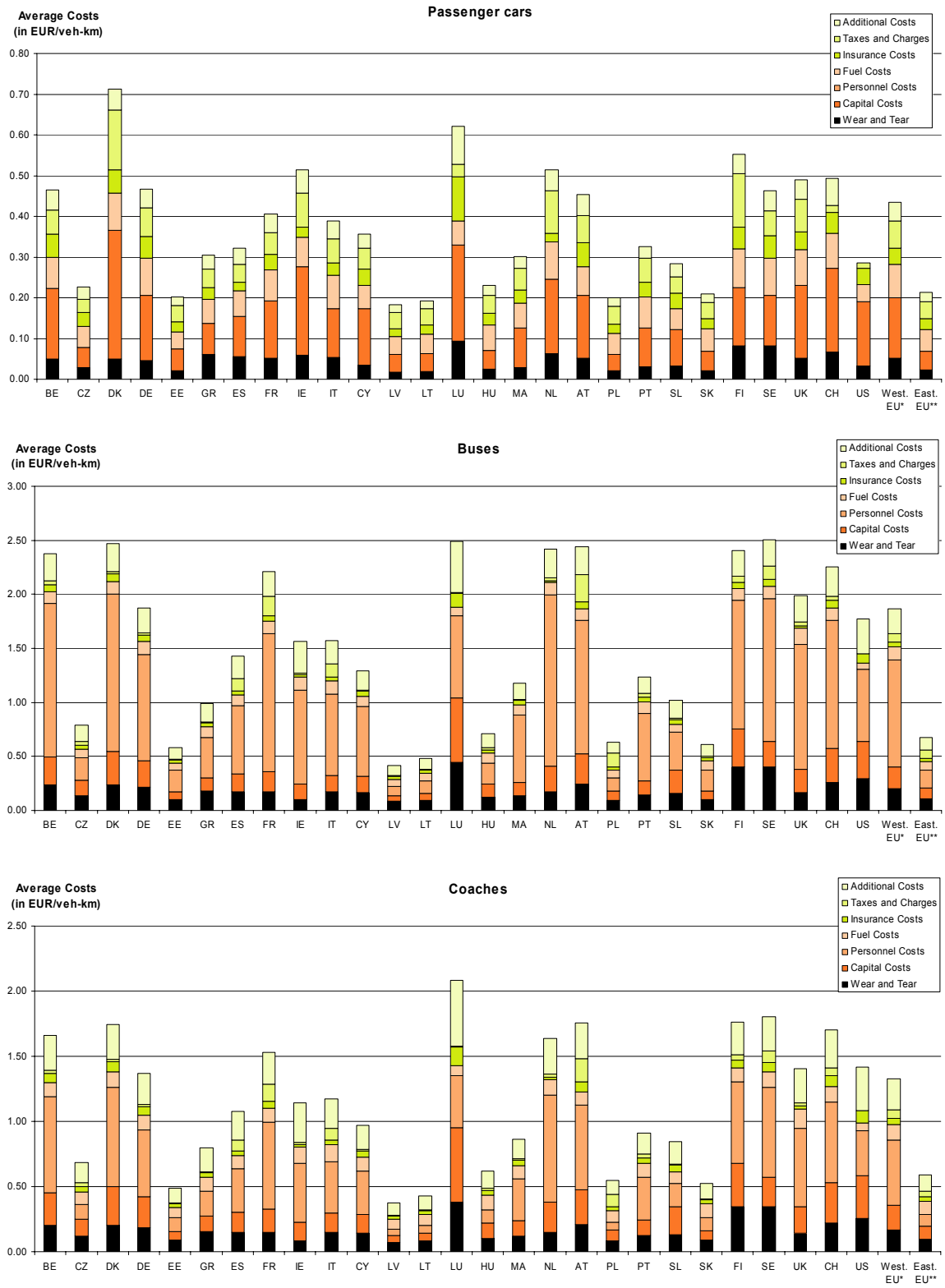
Results per country

The following table shows for each country as well as for the whole EU25 the average costs per vehicle-km, the total costs and the total costs per GDP (for passenger cars, coaches and buses).

Table 3-7: Passenger cars, buses and coaches: Specific costs per vehicle-km, total costs and total costs per GDP (data for 2005)

	Passenger Cars			Buses			Coaches		
	Specific costs (in EUR/veh-km)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)	Specific costs (in EUR/veh-km)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)	Specific costs (in EUR/veh-km)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)
Belgium	0.46	38'288	13.3%	2.37	454	0.16%	1.66	1'263	0.44%
Czech Republic	0.23	7'664	8.8%	0.79	54	0.06%	0.68	380	0.44%
Denmark	0.71	29'175	14.9%	2.47	442	0.22%	1.75	879	0.45%
Germany	0.47	263'753	11.9%	1.87	3'282	0.15%	1.37	5'014	0.23%
Estonia	0.20	n.d.a.	n.d.a.	0.58	n.d.a.	n.d.a.	0.49	n.d.a.	n.d.a.
Greece	0.30	14'652	8.8%	0.99	405	0.24%	0.80	930	0.56%
Spain	0.32	78'684	9.4%	1.43	1'139	0.14%	1.08	2'490	0.30%
France	0.40	217'417	13.2%	2.21	2'362	0.14%	1.53	3'681	0.22%
Irland	0.51	12'424	8.4%	1.56	161	0.11%	1.14	529	0.36%
Italia	0.39	173'700	12.9%	1.57	2'104	0.16%	1.17	6'652	0.49%
Cyprus	0.36	n.d.a.	n.d.a.	1.29	n.d.a.	n.d.a.	0.97	n.d.a.	n.d.a.
Latvia	0.18	n.d.a.	n.d.a.	0.41	n.d.a.	n.d.a.	0.38	n.d.a.	n.d.a.
Lithuania	0.19	n.d.a.	n.d.a.	0.48	n.d.a.	n.d.a.	0.43	n.d.a.	n.d.a.
Luxembourg	0.62	2'506	9.8%	2.49	59	0.23%	2.08	73	0.29%
Hungary	0.23	5'350	6.6%	0.71	102	0.13%	0.62	745	0.92%
Malta	0.30	n.d.a.	n.d.a.	1.17	n.d.a.	n.d.a.	0.86	n.d.a.	n.d.a.
Netherlands	0.51	56'299	11.5%	2.42	244	0.05%	1.64	694	0.14%
Austria	0.45	20'905	8.8%	2.44	499	0.21%	1.76	1'501	0.63%
Poland	0.20	17'540	8.6%	0.63	184	0.09%	0.55	810	0.40%
Portugal	0.33	20'731	14.6%	1.24	65	0.05%	0.91	446	0.31%
Slovenia	0.28	1'844	7.1%	1.02	11	0.04%	0.85	76	0.29%
Slovakia	0.21	1'734	5.2%	0.61	45	0.13%	0.52	319	0.96%
Finland	0.55	24'097	16.1%	2.40	399	0.27%	1.76	974	0.65%
Sweden	0.46	30'081	10.7%	2.51	701	0.25%	1.80	1'021	0.36%
United Kingdom	0.49	212'233	12.4%	1.99	2'124	0.12%	1.40	3'625	0.21%
USA	0.29	1'017'245	10.8%	1.77	6'940	0.07%	1.42	15'148	0.16%
Switzerland	0.49	28'077	9.7%	2.26	121	0.04%	1.70	380	0.13%
EU 25 *	0.42	1'229'077	11.8%	1.78	14'834	0.14%	1.22	32'103	0.31%
Western EU **	0.43	1'194'944	12.1%	1.87	14'438	0.15%	1.33	29'773	0.30%
Eastern EU ***	0.21	34'132	7.9%	0.67	397	0.09%	0.59	2'330	0.54%

** Without Baltic countries, Malta and Cyprus (no traffic data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia. n.d.a.: no data available.*



** Western Europe means here EU15. ** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia.*

Figure 3-1: Passenger cars, buses and coaches: structure of average costs (per vehicle-km) (data for 2005)

Table 3-8: Passenger cars, buses and coaches: Average costs per passenger-km (data for 2005)

	Average costs per pkm (in EUR/pkm)		
	Passenger Cars	Buses	Coaches
Belgium	0.34	0.14	0.12
Czech Republic	0.10	0.05	0.04
Denmark	0.48	0.17	0.13
Germany	0.29	0.11	0.11
Estonia	n.d.a.	n.d.a.	n.d.a.
Greece	0.16	0.06	0.06
Spain	0.22	0.09	0.07
France	0.29	0.15	0.15
Irland	0.32	0.10	0.11
Italia	0.24	0.11	0.09
Cyprus	n.d.a.	n.d.a.	n.d.a.
Latvia	n.d.a.	n.d.a.	n.d.a.
Lithuania	n.d.a.	n.d.a.	n.d.a.
Luxembourg	0.46	0.14	0.15
Hungary	0.10	0.04	0.05
Malta	n.d.a.	n.d.a.	n.d.a.
Netherlands	0.37	0.15	0.13
Austria	0.28	0.15	0.16
Poland	0.09	0.04	0.03
Portugal	0.22	0.07	0.05
Slovenia	0.14	0.03	0.02
Slovakia	0.10	0.02	0.01
Finland	0.40	0.15	0.19
Sweden	0.31	0.16	0.18
United Kingdom	0.30	0.12	0.13
USA	0.23	0.20	0.07
Switzerland	0.31	0.14	0.15
EU 25 *	0.27	0.11	0.09
Western EU **	0.28	0.12	0.10
Eastern EU ***	0.10	0.04	0.03

** Without Baltic countries, Malta and Cyprus (no traffic data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia. n.d.a.: no data available.*

3.2 Freight transport (LDV, HDV)

Exemplary costs of different countries

The following tables show exemplarily different average operation costs for certain countries. The costs shown are original data, not fully following the cost structure proposed for this study. The data summarized are only one source of input data among many others for calculating the average operation costs of LDV and HDV (see more about the main data sources in the following chapter 'input data').

Table 3-9: Truck operating costs for Germany

Cost Component	Trucks, long distance Share of total costs (in %)	Trucks, short distance Share of total costs (in %)	Average costs, HDV (in EUR/vkm)
Personnel (wages, social costs)	38.7%	49.6%	0.486
Depreciation	9.3%	11.4%	0.114
Interests	1.1%	1.3%	0.013
Fuel	21.4%	12.7%	0.188
Maintenance and repair	8.0%	6.7%	0.081
Washing	0.5%	0.6%	0.006
Tyres	1.9%	2.5%	0.024
Taxes & charges	2.2%	1.2%	0.019
Insurance	4.6%	5.2%	0.054
Additional expenses	12.4%	8.8%	0.117
Total	**100%**	**100%**	**1.100**

Sources: BGL (2005). BGL (2006), RHENUS (2005).

Table 3-10: Truck operating costs for the UK

Cost Component	Truck operating costs UK 2006 (32 tonne gross rigid vehicle, tipper)		
	Time related costs (in £/year)	Mileage costs (in £/mile)	Average costs per vkm (in EUR/vkm)
Wages	24'600 £/a		0.29
Depreciation	12'200 £/a		0.15
Licences	1'200 £/a		0.01
Insurance	4'910 £/a		0.06
Interest on capital	2'750 £/a		0.03
Overhead	12'050 £/a		0.14
Fuel		0.428 £/mile	0.27
Tyres		0.044 £/mile	0.03
Repairs and maintenance		0.126 £/mile	0.08
Total	**57'710 £/a**	**0.598 £/mile**	**1.06**

Source: RHA (2006).

Table 3-11: Truck operating costs for the USA

Cost Component	Average costs HDV per mile (in USD/miles)	Average costs HDV per vkm (in EUR/vkm)
Personnel costs	0.50	0.25
Mileage costs (variable)	0.43	0.21
Additional vehicle costs	0.87	0.43
Total	**1.80**	**0.90**

Source: Barnes, Langworthy (2003).

Table 3-12: Truck operating costs for Spain (26-tons truck with 3 axes)

Cost Component	Costs HDV per year (in EUR/year)	Average costs HDV per vkm (in EUR/vkm)
Depreciation	17'647	0.19
Interests	846	0.01
Wages	25'580	0.27
Insurance	4'996	0.05
Taxes	815	0.01
Fuel	23'218	0.24
Tyres	3'059	0.03
Maintenance	1'434	0.02
Repair	1'948	0.02
Total	**79'543**	**0.84**

Source: Ministerio de Fomento (2006).

Table 3-13: Truck operating costs for Eastern Europe (in EUR/vkm)

Cost Component	Czech Republic	Estonia	Latvia	Lithuania	Hungary	Poland	Slovakia	Slovenia
Personnel costs	0.12	0.09	0.10	0.09	0.12	0.12	0.14	0.23
Depreciation	0.15	0.10	0.11	0.10	0.15	0.08	0.15	0.14
Taxes & charges	0.06	0.07	0.07	0.07	0.02	0.04	0.11	0.03
Insurance	0.02	0.01	0.01	0.01	0.02	0.04	0.02	0.02
Interests	0.05	0.04	0.04	0.04	0.08	0.04	0.11	0.06
Fuel	0.18	0.16	0.17	0.15	0.17	0.13	0.14	0.18
Tyres	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.02
Maintenance & repair	0.03	0.02	0.02	0.02	0.02	0.06	0.05	0.04
Other costs	0.05	0.16	0.08	0.07	0.07	0.17	0.00	0.10
Total	**0.68**	**0.68**	**0.63**	**0.58**	**0.68**	**0.72**	**0.75**	**0.81**

Source: Herry (2001). All data in EUR/vkm.

Table 3-14: Truck operating costs for the Czech Republic: Taxes and Costs Structure for freight transport groups (in % of total costs)

Cost Component	Small companies (in %)	Middle companies (in %)	Big companies (in %)
Material & Energy	33.5%	17.4%	16.7%
Services	48.9%	33.3%	54.5%
Personal Costs	1.7%	10.0%	6.8%
Overhead Costs	5.0%	15.9%	5.2%
Depreciations	0.0%	3.7%	1.3%
Excise Tax	9.2%	13.6%	11.5%
Road Tax	0.25%	0.4%	0.38%
Income Tax	0.28%	1.5%	1.05%
Health and Social Insurance	0.9%	3.2%	1.75%
Other Taxes & Fees	0.34%	0.96%	0.7%
Costs Summary	100.0%	100.0%	100.0%

Source: CDV (2006).

Table 3-15: Total and average costs for different road freight vehicles in France (2006). Data source: ISIS France on the basis of CNR (2006)

	Truck with trailer (combination) max. weight 26 t		Truck with trailer (combination) max. weight 40 t		Van / box wagon 9 t	
Total kilometres per lifetime of a truck : Annual kilometres : Number of days in operation per year : Ratio drivers/vehicle : Average fuel consumption per 100 km : Tank load factor :	744 234 km 124 039 km 237 1,19 30,5 L 45%		736 470 km 122 745 km 231 1,16 37,9 L 53%		364 819 km 38 402 km 235 1,04 20L 95%	
Fuel €/Km	0,263	22,7%	0,326	25,2%	0,169	9,9%
Tyres €/Km	0,033	2,8%	0,047	3,6%	0,023	1,3%
Maintenance & repair €/Km	0,115	9,9%	0,150	11,6%	0,144	8,4%
Tolls €/Km	0,065	5,6%	0,065	5,0%	not concer ned	not concer-ned
Wages and charges €/day	180,52	29,7%	173,67	25,3%	119,22	43,0%
Travel expenses €/day	40,52	6,7%	40,42	5,9%	13,70	4,9%
Insurances €/day	13,79	2,3%	20,89	3,0%	7,42	2,7%
Taxes €/day	2,64	0,4%	3,10	0,5%	1,19	0,4%
Capital costs: depreciation and interests (truck) €/day	41,58	6,9%	52,30	7,6%	23,68	8,5%
Capital costs: depreciation and interests (trailer) €/day	16,21	2,7%	20,27	2,9%	not con-cerned	not con-cerned
Fixed costs (overhead, etc.) €/day	62,37	10,3%	64,68	9,4%	58,20	20,9%
TOTAL COSTS per year (€/year)	**143'843**	**100,0%**	**158'851**	**100,0%**	**65'383**	**100,00%**
TOTAL COSTS per vkm (€/vkm)	**1.16**		**1.29**		**1.70**	

Table 3-16: Total and average costs for different road freight vehicles in France (2006). Data source: ISIS France on the basis of CNR (2006)

	Truck 11 - 13 t (without trailer)		Refrigerated truck 40 t		Tipper 40t	
Total kilometres per lifetime of a truck : Annual kilometres : Number of days in operation per year : Ratio drivers/vehicle : Average fuel consumption per 100 km : Tank load factor :	486 650 km 48 665 km 237 1,04 23 L 78%		732 691 km 136 696 km 243 1,24 36,7 L 86,75%		468 872 km 80 840 km 211 1,01 42,7 L 80%	
Fuel €/Km	0,196	13,2%	0,311	23,7%	0,362	27,9%
Tyres €/Km	0,023	1,6%	0,040	3,1%	0,047	3,7%
Maintenance & repair €/Km	0,108	7,3%	0,130	9,9%	0,141	10,8%
Tolls €/Km	0,024	1,6%	0,051	3,8%	0,010	0,7%
Wages and charges €/day	118,21	38,9%	189,61	25,7%	140,07	28,1%
Travel expenses €/day	16,26	5,4%	46,20	6,3%	11,73	2,4%
Insurances €/day	11,35	3,7%	14,26	1,9%	13,14	2,6%
Taxes €/day	1,41	0,5%	2,47	0,3%	2,56	0,5%
Capital costs: depreciation and interests (truck) €/day	26,85	8,8%	50,61	6,9%	44,72	9,0%
Capital costs: depreciation and interests (trailer) €/day	not concer ned	not concer-ned	14,51	2,0%	16,71	3,4%
Fixed costs (overhead, etc.) €/day	57,71	19,0%	81,56	11,0%	54,33	10,9%
TOTAL COSTS per year (€/year)	**71'985**	**100,0%**	**179'408**	**100,0%**	**105'009**	**100,00%**
TOTAL COSTS per vkm (€/vkm)	**1.48**		**1.31**		**1.30**	
			Of which costs of refrigeration			
			39,74 €/year	5,4%		

Input data, data sources

The following tables show some of the most important input data for calculating the operating costs for light duty vehicles (LDV) and heavy duty vehicles (HDV). The calculations of the operation costs for the road freight transport are mainly based on specific country information (covering all countries available) about:

- Fuel costs (EUROSTAT 2006) → see Table 3-5 in chapter (road) passenger transport
- Average fuel consumption (TREMOVE 2005)
- Price levels for duty vehicles (EC 1999, EUROSTAT 2006)
- Average age of duty vehicles (EUROSTAT 2006)
- Maintenance and insurance costs for road freight transport (selected countries, EC 1999)
- Taxes and charges (TREMOVE 2005, ECMT 2003, FACORA 2004, BGL 2006, EC 1999)
- Average wage level for road freight transport (EUROSTAT 2006)

Table 3-17: Average fuel consumption 2005 (based on average CO2-emissions) for light and heavy duty vehicles. Index: Belgium = 100

	Average fuel consumption 2005 (Index, Belgium=100)	
	LDV	HDV
Belgium	100	100
Czech Republic	96	91
Denmark	125	99
Germany	105	103
Estonia	99	92
Greece	140	105
Spain	115	103
France	107	102
Irland	113	101
Italia	112	102
Cyprus	126	104
Latvia	99	92
Lithuania	99	92
Luxembourg	122	92
Hungary	100	96
Malta	126	104
Netherlands	130	105
Austria	106	103
Poland	100	90
Portugal	111	107
Slovenia	99	92
Slovakia	99	92
Finland	110	106
Sweden	114	103
United Kingdom	113	100
USA	n.d.a.	n.d.a.
Switzerland	109	101

Sources: TREMOVE (2005). n.d.a.: no data available

Table 3-18: Price level, average age and average wages for road freight transport (all data for latest year available)

	Aver. price level for new duty vehicles 2000 (Index: Belgium=100)	Aver. age of duty vehicles 2002 (in years)	Wages for road freight transport 2003
Belgium	100	7.8	145
Czech Republic	59	8.7	21
Denmark	102	6.7	148
Germany	92	7.6	100
Estonia	43	12.0	20
Greece	73	12.0	38
Spain	73	9.0	65
France	73	8.0	130
Irland	42	5.7	88
Italia	73	9.7	77
Cyprus	70	9.5	66
Latvia	36	13.3	9
Lithuania	40	13.3	12
Luxembourg	191	6.5	77
Hungary	51	8.4	20
Malta	58	9.6	64
Netherlands	73	6.1	161
Austria	104	7.5	126
Poland	41	9.7	12
Portugal	61	9.5	64
Slovenia	67	6.2	35
Slovakia	44	11.7	20
Finland	172	10.0	122
Sweden	99	8.6	135
United Kingdom	71	6.7	118
USA	127	n.d.a.	68
Switzerland	111	8.2	121

Sources: Price level: EUROSTAT (2006) and EC (1999); Age of duty vehicles: EUROSTAT (2006); Wages: EUROSTAT (2006). n.d.a.: no data available.

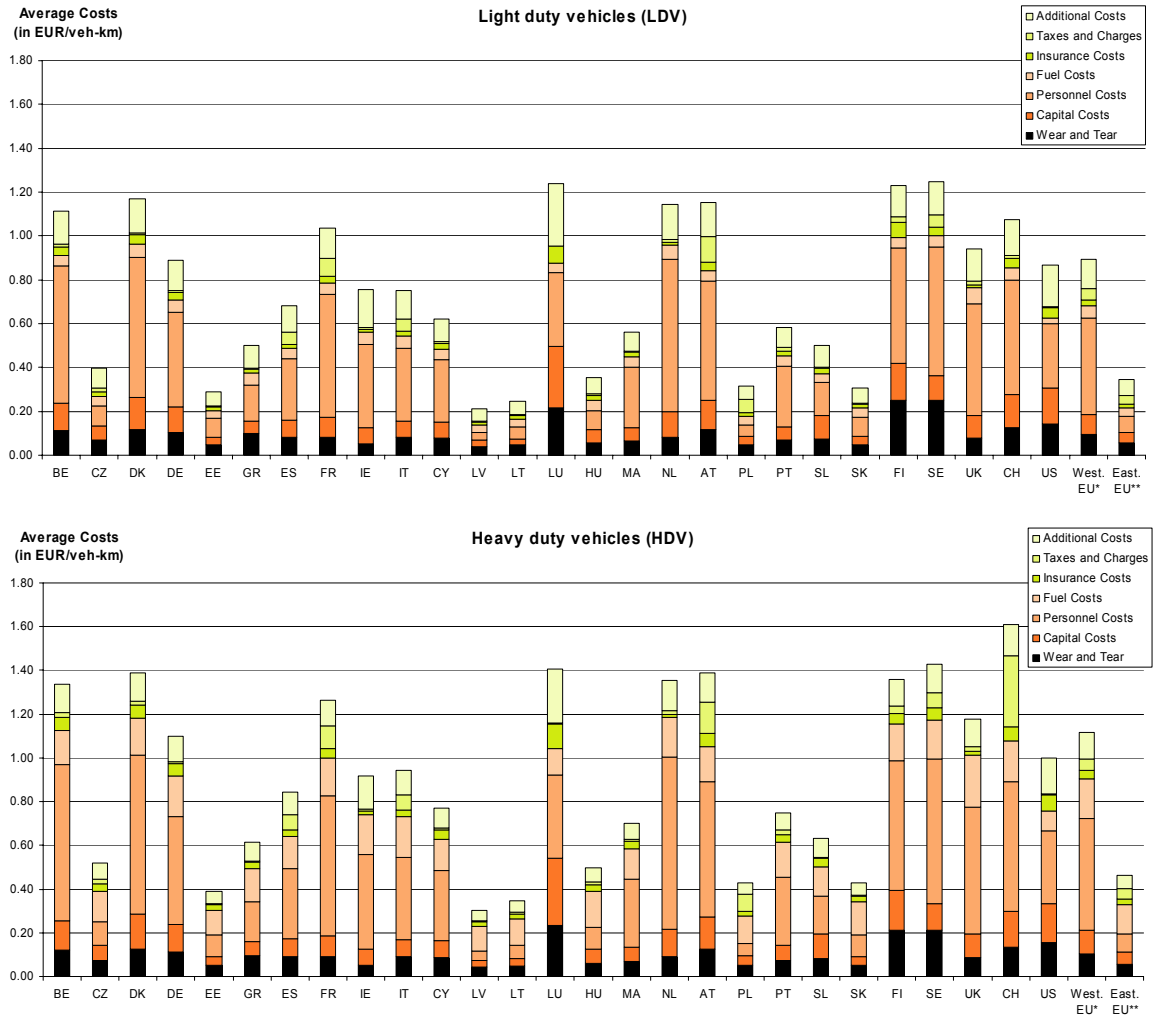
Results per country

The following table shows for each country as well as for the whole EU25 the average costs per vehicle-km, the total costs and the total costs per GDP (for light duty vehicles LDV and heavy duty vehicles HDV).

Table 3-19: Light duty vehicles (LDV) and heavy duty vehicles (HDV): Specific costs per vehicle-km, total costs and total costs per GDP (data for 2005)

	LDV			HDV		
	Specific costs (in EUR/veh-km)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)	Specific costs (in EUR/veh-km)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)
Belgium	1.11	3'824	1.33%	1.34	6'896	2.39%
Czech Republic	0.40	2'307	2.66%	0.52	3'882	4.47%
Denmark	1.17	3'703	1.89%	1.39	3'826	1.95%
Germany	0.89	13'374	0.60%	1.10	50'784	2.29%
Estonia	0.29	n.d.a.	n.d.a.	0.39	n.d.a.	n.d.a.
Greece	0.50	3'601	2.15%	0.62	2'120	1.27%
Spain	0.68	34'621	4.13%	0.84	20'966	2.50%
France	1.04	72'708	4.41%	1.26	50'388	3.06%
Irland	0.75	824	0.55%	0.92	1'716	1.16%
Italia	0.75	19'448	1.44%	0.94	24'556	1.82%
Cyprus	0.62	n.d.a.	n.d.a.	0.77	n.d.a.	n.d.a.
Latvia	0.21	n.d.a.	n.d.a.	0.30	n.d.a.	n.d.a.
Lithuania	0.24	n.d.a.	n.d.a.	0.34	n.d.a.	n.d.a.
Luxembourg	1.24	314	1.22%	1.40	686	2.67%
Hungary	0.36	776	0.96%	0.50	1'567	1.93%
Malta	0.56	n.d.a.	n.d.a.	0.70	n.d.a.	n.d.a.
Netherlands	1.14	95	0.02%	1.35	7'773	1.59%
Austria	1.15	667	0.28%	1.39	5'693	2.40%
Poland	0.32	3'404	1.67%	0.43	6'366	3.12%
Portugal	0.58	887	0.62%	0.75	1'630	1.15%
Slovenia	0.50	161	0.62%	0.63	293	1.12%
Slovakia	0.30	540	1.63%	0.43	1'101	3.32%
Finland	1.23	9'757	6.52%	1.36	6'175	4.12%
Sweden	1.25	5'498	1.95%	1.43	7'162	2.54%
United Kingdom	0.94	32'113	1.87%	1.18	28'596	1.67%
USA	0.87	707'797	7.50%	1.00	363'936	3.86%
Switzerland	1.07	383	0.13%	1.61	5'092	1.76%
EU 25 *	0.85	208'622	2.01%	1.03	232'176	2.24%
Western EU **	0.89	201'433	2.04%	1.11	218'966	2.21%
Eastern EU ***	0.34	7'190	1.67%	0.46	13'209	3.07%

** Without Baltic countries, Malta and Cyprus (no traffic data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia. n.d.a.: no data available.*



** Western Europe means here EU15. ** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia.*

Figure 3-2: Light duty vehicles (LDV) and heavy duty vehicles (HDV): structure of average costs (per vehicle-km) (data for 2005)

Table 3-20: Light duty vehicles (LDV) and heavy duty vehicles (HDV): Average costs per ton-km (data for 2005)

	Average costs per ton-km (in EUR/tkm)	
	LDV	HDV
Belgium	5.68	0.16
Czech Republic	1.70	0.08
Denmark	5.93	0.20
Germany	4.35	0.14
Estonia	n.d.a.	n.d.a.
Greece	2.72	0.09
Spain	4.33	0.12
France	5.97	0.17
Irland	4.39	0.15
Italia	5.50	0.12
Cyprus	n.d.a.	n.d.a.
Latvia	n.d.a.	n.d.a.
Lithuania	n.d.a.	n.d.a.
Luxembourg	5.28	0.23
Hungary	1.57	0.07
Malta	n.d.a.	n.d.a.
Netherlands	8.34	0.18
Austria	5.67	0.19
Poland	1.92	0.07
Portugal	2.93	0.11
Slovenia	2.98	0.13
Slovakia	1.81	0.09
Finland	11.39	0.21
Sweden	6.82	0.21
United Kingdom	5.74	0.17
USA	3.46	0.20
Switzerland	4.33	0.21
EU 25 *	5.05	0.14
Western EU **	5.39	0.15
Eastern EU ***	1.81	0.07

** Without Baltic countries, Malta and Cyprus (no traffic data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia. n.d.a.: no data available.*

4 Rail transport

Input data, data sources

For the calculation of the rail transport data, the main data base was the International Railway Statistics 2004 (UIC 2006). This data base provides detailed information about the costs and revenues of all big European railway companies, as well as detailed traffic data (train-kilometres). On this basis, the specific costs per train-kilometre can be calculated. The UIC database covers almost all European countries with a railway network in use. It does, however, not include data for the United Kingdom and the USA. Therefore, other data sources had to be used for these countries (UK: Smith 2006; USA: Parsons Transportation Group 1999 and DMJM Harris 2002).

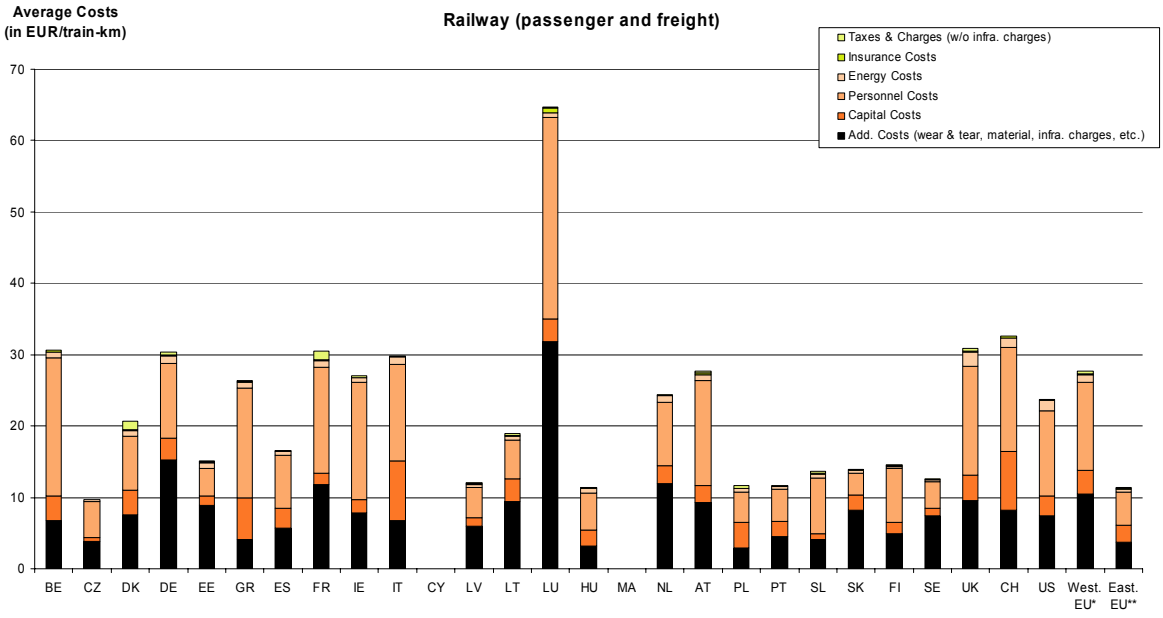
Results per country

The following table shows for each country as well as for the whole EU25 the average costs per train-km, the total costs and the total costs per GDP (for passenger and freight rail).

Table 4-1: Railways (passenger and freight): Specific costs per train-km, total costs and total costs per GDP (data for 2005)

	Rail total			Rail passenger		Rail freight	
	Specific costs (in EUR/train-km)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)
Belgium	30.7	3'833	1.33%	2'877	1.00%	956	0.33%
Czech Republic	9.7	1'481	1.71%	344	0.40%	1'137	1.31%
Denmark	20.6	1'568	0.80%	821	0.42%	746	0.38%
Germany	30.4	22'074	1.00%	10'836	0.49%	11'238	0.51%
Estonia	15.1	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.
Greece	26.3	500	0.30%	366	0.22%	134	0.08%
Spain	16.6	3'323	0.40%	2'532	0.30%	792	0.09%
France	30.5	16'586	1.01%	13'948	0.85%	2'637	0.16%
Irland	27.0	378	0.25%	281	0.19%	97	0.07%
Italia	29.9	10'845	0.80%	8'740	0.65%	2'105	0.16%
Cyprus °	–	0	0.0%	0	0.0%	0	0.0%
Latvia	12.1	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.
Lithuania	18.9	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.	n.d.a.
Luxembourg	64.7	453	1.76%	249	0.97%	204	0.79%
Hungary	11.4	1'391	1.71%	449	0.55%	942	1.16%
Malta °	–	0	0.0%	0	0.0%	0	0.0%
Netherlands	24.3	4'626	0.95%	3'472	0.71%	1'154	0.24%
Austria	27.8	3'885	1.64%	2'025	0.85%	1'860	0.78%
Poland	11.6	3'344	1.64%	888	0.44%	2'456	1.21%
Portugal	11.7	408	0.29%	291	0.20%	117	0.08%
Slovenia	13.7	254	0.97%	50	0.19%	204	0.78%
Slovakia	13.9	897	2.71%	134	0.40%	763	2.30%
Finland	14.5	712	0.48%	332	0.22%	380	0.25%
Sweden	12.6	1'612	0.57%	751	0.27%	861	0.31%
United Kingdom	30.9	17'253	1.01%	10'352	0.60%	6'901	0.40%
USA	23.8	25'628	0.27%	5'171	0.05%	20'457	0.22%
Switzerland	32.6	5'797	2.01%	3'741	1.30%	2'056	0.71%
EU 25 *	25.0	95'423	0.92%	59'737	0.58%	35'686	0.34%
Western EU **	27.7	88'056	0.89%	57'873	0.58%	30'183	0.31%
Eastern EU ***	11.4	7'367	1.71%	1'864	0.43%	5'502	1.28%

** Without Baltic countries, Malta and Cyprus (no traffic data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia. ° There are no railways on Cyprus and Malta. n.d.a.: no data available.*



** Western Europe means here EU15. ** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia.*

Figure 4-1: Railways: structure of average costs (per train-km) (data for 2005)

Table 4-2: Railways: Average costs per passenger-km (rail passenger) and ton-km (rail freight) (data for 2005)

	Rail: Average costs per pkm and tkm	
	Rail passenger (in EUR/pkm)	Rail freight (in EUR/tkm)
Belgium	0.35	0.12
Czech Republic	0.04	0.08
Denmark	0.16	0.35
Germany	0.16	0.13
Estonia	n.d.a.	n.d.a.
Greece	0.22	0.25
Spain	0.12	0.07
France	0.20	0.06
Irland	0.22	0.29
Italia	0.20	0.10
Cyprus °	–	–
Latvia	n.d.a.	n.d.a.
Lithuania	n.d.a.	n.d.a.
Luxembourg	0.39	0.36
Hungary	0.04	0.11
Malta °	–	–
Netherlands	0.25	0.23
Austria	0.23	0.10
Poland	0.03	0.05
Portugal	0.08	0.04
Slovenia	0.08	0.07
Slovakia	0.03	0.06
Finland	0.10	0.04
Sweden	0.09	0.04
United Kingdom	0.25	0.32
USA	0.11	0.01
Switzerland	0.21	0.23
EU 25 *	0.17	0.11
Western EU **	0.19	0.12
Eastern EU ***	0.03	0.06

** Without Baltic countries, Malta and Cyprus (no traffic data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia. ° There are no railways on Cyprus and Malta. n.d.a.: no data available.*

5 Air transport

5.1 Transport Volume

Table 5-1 gives an overview on the performance of selected airlines in Europe and North America. Due to the geographical differences in North America flight distances are roughly 30% longer than in Europe. Another difference is apparent, if the available tons per plane are derived from the below data: In Europe the size of the planes is considerably bigger than in the USA. While in Europe a plane has on average 31 available tons, this indicator only amounts to 22 tons in the US. However, this does not give indication on the usage of the capacities and thus on the profit the companies make.

Table 5-1: Transport indicators of main airlines in Europe and America

EUROPE					North America			
Airline	**Avail. Ton-Km**	**Departures**	**Average Stage Length**		**Airline**	**Avail. Ton-Km**	**Departures**	**Average Stage Length**
	Million tkm		km			Million tkm		km
Air France	16,517	402,394	1,393		Air Canada	7,846	217,359	1,534
Alitalia	7,309	277,009	1,076		American Airlines	34,460	791,825	1,920
Austrian	1,420	42,969	1,499		Canadian	5,461	97,059	2,135
British Airways	23,305	325,455	1,822		Continental	13,146	459,376	1,663
British Midlands	569	93,938	498		Delta	29,655	962,695	1,324
Finnair	2,338	116,236	884		Northwest	21,207	538,948	1,446
Iberia	6,239	227,222	1,077		TWA	6,997	279,442	1,352
KLM	12,745	156,694	1,911		United Airlines	38,530	801,879	1,794
Lufthansa	19,653	499,681	1,168		USAir	11,262	707,108	961
Olympic	1,819	90,710	734					
SAS	4,490	334,871	759					
Swissair	6,889	163,128	1,332					
TAP	1,830	53,291	1,463					
Source: Unite, D6, Annex								

Table 5-2 gives an overview on the transport volume in Europe and in the USA. In order to avoid double counting, only the numbers of departures are listed below. Unfortunately, in the European transport statistics EUROSTAT does not supply data on flight distances and flight kilometres. These can be roughly estimated, if the above distances of the airlines are used as national averages in Europe for freight and passengers. In the USA much more reliable data supplied by the Bureau of Transport Statistics and listed in Table 5-3 can be used. The number of departures in the USA comprises double the amount than in Europe. This is mainly caused by larger amount of freight and a larger number of passengers transported. Due to shorter distances in freight, the amount of flight kilometres is in the same magnitude.

Table 5-2: Air transport volume in Europe and USA

	Departures	**Passengers**	**Freight**	**Flight-km***
	In 1'000	In 1'000	In 1'000 tons	In mill veh km
Belgium	110	8,859	343	132
Czech Republic	70	5,074	27	84
Denmark	172	11,356	6	131
Germany	930	80,017	1,534	1,086
Estonia	10	504	2	12
Greece	200	17,527	52	147
Spain	802	82,581	309	863
France	843	64,384	842	1,175
Irland	104	10,968	34	125
Italia	606	53,371	485	652
Cyprus	30	3,466	17	36
Latvia	12	535	1	14
Luxembourg	20	758	290	24
Hungary	49	3,254	21	59
Malta	15	1,380	8	18
Netherlands	214	22,605	708	408
Austria	149	9,739	79	174
Poland	59	3,062	15	70
Portugal	119	10,773	71	174
Slovenia	11	523	3	13
Slovakia	13	601	3	15
Finland	123	7,340	62	108
Sweden	215	14,001	81	163
United Kingdom	1,034	108,033	1,214	1,883
Switzerland	195	13,777	187	259
Total Europe	**6,105**	**534,489**	**6,395**	**7,830**
USA	**11,817**	**747,088**	**179,373****	**8,242**

* own estimates using average distance from UNITE D6 (2003)

** own calculation on basis of BTS

Source: Eurostat 2006, BTS (www.bts.gov)

In contrast to Europe, US transport statistics are quite comprehensive and give a good overview on the main parameters of air transport as resumed in Table 5-3 The share of non-scheduled flight comprises only 0.4% of all aircraft kilometres. The capacity utilisation amounts to 77% in passenger transport and 59% in goods transport.

Table 5-3: Air transport performance in the USA

	Scheduled	Non-Scheduled	Total
Passenger Enplanements (1000)	738,587	8,501	747,088
Passenger km (mill)	1,253,407	25,826	1,279,234
Available Seat km (mill)	1,614,244	41,643	1,655,887
Passenger Load Factor (%)	77.65	62.02	77.25
Freight tkm (mill)	39,177	15,712	54,890
Total Tonne km (mill)	154,630	18,738	173,367
Available Tkm (mill)	261,252	31,044	292,296
Ton km Load Factor (%)	59.19	60.36	59.31
Departures Performed (000)	11,502	315	11,817
Aircraft km Flown (mill)	7,914	328	8,242
Source: www.bts.gov			

5.2 Operating costs

Operating costs are best compared by using the unit "Costs per available tonne-km". This unit describes the average costs to carry one tonne of freight or passengers over a distance of one kilometre. Available ton km are used as the best measure of output, taking account of the mix of aircraft sizes. Table 5-4 gives an overview on the operating costs in Switzerland 2003. The average, which is weighted by the number of flights undertaken with the respective planes in Switzerland, amounts to roughly 1 Euro per available tkm.

Table 5-4: Total costs per available ton-km in Switzerland 2003

Airplane	€/available ton-km
Airbus 319	0.90
Airbus 320	0.76
Airbus 321	0.63
Airbus 330	0.25
Airbus 330C	0.24
Airbus 343	0.34
Avro AR100	1.25
Avro AR85	1.41
Embraer 145	1.77
Weighted Average	**1.07**
Source: Infras 2003	

A comprehensive research of the operating costs was done by the EU project UNITE and published in Deliverable D6 (UNITE 2003). A group of 13 airlines was selected for the analysis, which was observed during nine consecutive years from 1990 to 1998. Annual cost information was sourced from ICAO Financial Data. Airline operating statistics were collected from

IATA's World Air Transport Statistics (WATS), which is also published on an annual basis. Since this latter data set did not include detailed statistics on airline personnel and wages, additional information was obtained from ICAO's Fleet and Personnel publication.

Table 5-5 lists the PPP adjusted operating costs of airlines in Europe and North America. The above-mentioned Swiss data are comparable with these data, even if they range in the upper cost bracket. Remarkably, the average operating costs in America are 44% lower than in Europe. This has to be judged against the background, that the data stem from 1998 and in the meantime a fierce competition has taken place in the European Air market, which - most probable - had its impacts on the operating costs as well.

Table 5-5: Average costs per available ton-km 1998

EUROPE				North America		
Airline	**Cost per hour**	**Cost per 1000 Avail. Ton-Km**		**Airline**	**Cost per hour**	**Cost per 1000 Avail. Ton-Km**
	Euro/hour	Euro/av. tkm			Euro/hour	Euro/av. tkm
Air France	14543	579		Air Canada	6551	430
Alitalia	10707	743		American Airlines	6103	446
Austrian	9625	1057		Canadian	7175	441
British Airways	13392	597		Continental	5539	442
British Midlands	7073	1383		Delta	6313	478
Finnair	7801	566		Northwest	6543	398
Iberia	11593	739		TWA	6148	468
KLM	13482	481		United Airlines	7380	465
Lufthansa	13359	740		USAir	5988	629
Olympic	11566	840				
SAS	10191	1158				
Swissair	14689	842				
TAP	14217	992				
European Average	**11278**	**838**		**North American Average**	**6393**	**469**

Cost figures are PPP adjusted

Source: Unite, D6, Annex

Table 5-6 compares the cost components of operating costs. Generally, as mentioned above, the operating costs in the USA are lower. This holds especially true for costs related to administration, which are remarkable 62% lower than in Europe. Differences are lowest for infrastructure related costs, which differ by only 28%.

Table 5-6: Cost components in Europe and North America

	Vehicle related	Service related	Infrastructure related	Administr./ commercial related	TOTAL
	295	109	180	254	**838**
Europe	35%	13%	22%	30%	
	184	58	130	98	**469**
North Amercia	39%	12%	28%	21%	
Source: Source: UNITE 2003, D6, Annex, own calculations					

The table above does not give an indication on the share of fuel cost on total operating costs. This is done in Table 5-7 for two examples. While on the short range between Brussels and Paris the amount comprises only 6% of operating costs, this share doubles on the longer flight to Vienna.

Table 5-7: Fuel cost compared to total cost

		Paris - Brussels		Paris - Vienna	
Distance	km	300		1300	
Net Fuel Cost	€/aircraft km	1.35	6%	1.35	12%
Other operating Costs	€/aircraft km	20	94%	10	88%
Total operating Costs	€/aircraft km	21.35		11.35	
Total operating Costs	Euro	6,405		14,755	

5.3 Fees and Charges

An overview of the air charges in Europe is given in below in chapter 5.3.1. Table 5-8 lists some examples of airport charges in Europe. If these costs are added to the operating cost given in Table 5-7, the costs for a flight from Brussels to Paris increase by considerable 74%. The question arises how much cheaper a train would be for short distances. For the longer flight to Vienna the costs only increase by 18%.

Table 5-8: Examples for airport and air control charges in Europe (in Euro/flight)

	Airport Charges	Air Traffic Control
Paris CDG	1106	500
Brussels	770	2376
Vienna	1080	
Facora, 2004, p. 123ff		

5.3.1 Examples for airport charging in Europe

Source: REVENUE 2005 D3, p 142ff

Netherlands

All Airports are state-owned. Scheduled passenger and cargo flights take place in Amsterdam Schiphol (AMS), Rotterdam (RTM), Groningen (GRQ), Enschede (ENS), Eindhoven (EIN) and Maastricht (MST), all of which have paved runways.

Amsterdam Schiphol Airport is the largest airport of the Netherlands. Aeronautical charges are split between airport charges and governmental levies. The airport tax is based on the type of flight (pax/cargo/instruction), maximum Take-Off Weight (MTOW) and noise emission level. The governmental charges are ATC levies (varying according to MTOW), security and noise levies (fixed amounts per flight), and can be considered second-best Aircraft fuel is exempted from taxes and levies by the Chicago convention (in case of international flights), but for domestic flights there is fuel taxation since 1 January 2005 (up to €159,72 per 1000L). Domestic flights in the Netherlands form only a tiny fraction of total traffic, however.

Portugal

There are three international airports on the mainland and four on the islands of Madeira and the Azores. Until late 90's, ANA SA, was in charge for the investment programmes in all airport infrastructure (air traffic control, aviation and non aviation), but currently NAV EP, a new public company, is responsible for air traffic control. With the exclusion of air traffic control, all the remaining charges are classified in four groups:

- Traffic charges (take-off and landing, parking, hangar use and passenger service - also considered a traffic charge by law);
- Handling;
- Commercial areas;
- Other commercial charges.

The main criterion for pricing differentiation of traffic charges is the maximum take-off weight (MTOW) of the aircraft. Environmental criteria are not used for price differentiation in the Portuguese airports. The law clearly defines the relation between the amounts paid and the services provided. The charges are revised every year, after the approval of the ANA proposal by INAC (the State authority for the economic regulation of all airport activities, including air traffic control143). The main objective of the pricing scheme is full cost recovery. Marginal cost calculation is neither required nor suggested by INAC or carried out by ANA. Kerosene is exempted from taxes and levies.

Spain

AENA, the Spanish Aviation Authority in charge of the main airports, charges airlines on an MTOW basis. Airports are divided in three categories in terms of importance (they can switch categories between summer/winter though). Kerosene is exempted from taxes and levies.

Sweden

The National Civil Aviation collects charges from traffic including for example landing fees For professional air transportation there is not energy related taxes and freight transportation of airplane petrol does not have tax liability. For freight transportation VAT in Sweden is 25 %. Passenger transportation services have a tax rate of 6 %. Passenger transports in and out of Sweden do not have value added tax liability.

Switzerland

There are six international airports in Switzerland (the EuroAirport Basel-Mulhouse-Freiburg is a bi-national airport). In Zurich, which is the largest airport of Switzerland, the following charges and taxes are levied:

- Landing charge
- Fleet charge
- Emission tax
- Cargo charge
- Baggage sorting charge
- Passenger charge (including security)
- Noise charge (per aircraft and per passenger)

A differentiated emission tax which was introduced in 1997 in Zurich, and since then in all major Swiss airports as well. Depending on the emission category of an airplane's engines, the emission tax ranges from 0 to 40% of the landing charge. The passenger charge is 21 CHF for local and 8 CHF for transfer passengers. The security charge amounts to 10 CHF for local passengers and 7 CHF for transfer passengers. The noise charge is 5 CHF per passenger for all passengers. The level of charges is determined such that infrastructure costs can be covered without government subsidies. Hence, average cost pricing is applied. Noise charges and particularly the differentiated emission tax show a tendency towards social marginal cost pricing.

United Kingdom

Pricing at airports is governed by a series of international and national obligations and regulations. Pricing is also part of the regulatory review of airports in the UK. British Airports Authority is regulated both by the Civil Aviation Authority and the Competition Commission. Kerosene is exempted from taxes and levies.

5.4 Results per country (operating costs)

The following table shows for each country (incl. USA) as well as for the whole EU25 the average operating costs per available ton-km, the total costs and the total costs per GDP (for passenger and freight rail).

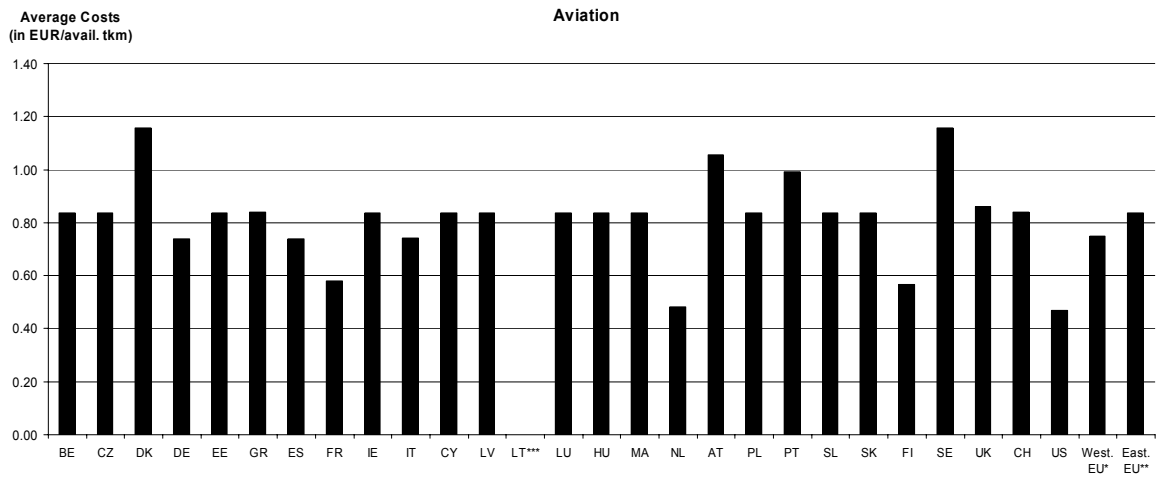
The available ton-km (see also Table 2-1) were estimated for Europe according to average distances covered by the airlines given in Table 5-1. The US data stem from the Bureau of

Transport Statistics. Costs are derived as well from the same Table 5-1. Even though transport volume (available ton-km) is 29 % higher in the USA, transport costs only amount to 80% of Europe's level, due to the above mentioned cost differences. Both effects nearly net out and result in a similar level compared to GDP.

Table 5-9: Aviation: Specific costs per available ton-km, total costs and total costs per GDP (data for 2005)

	Aviation total		
	Specific costs (in EUR/avail. tkm)	Total operating costs (in Mio. EUR/a)	Operating costs in relation to GPD (in %)
Belgium	0.84	3'489	1.21%
Czech Republic	0.84	2'219	2.56%
Denmark	1.16	2'672	1.36%
Germany	0.74	27'088	1.22%
Estonia	0.84	313	3.46%
Greece	0.84	3'377	2.02%
Spain	0.74	16'276	1.94%
France	0.58	20'054	1.22%
Irland	0.84	3'301	2.22%
Italia	0.74	11'890	0.88%
Cyprus	0.84	956	7.63%
Latvia	0.84	369	3.30%
Lithuania	n.d.a	n.d.a.	n.d.a.
Luxembourg	0.84	625	2.44%
Hungary	0.84	1'551	1.91%
Malta	0.84	482	11.29%
Netherlands	0.48	8'367	1.71%
Austria	1.06	5'217	2.20%
Poland	0.84	1'856	0.91%
Portugal	0.99	4'061	2.85%
Slovenia	0.84	352	1.35%
Slovakia	0.84	400	1.21%
Finland	0.57	1'395	0.93%
Sweden	1.16	3'338	1.18%
United Kingdom	0.86	44'195	2.57%
USA	0.47	136'999	1.45%
Switzerland	0.84	6'914	2.39%
EU 25 *	0.75	163'844	1.58%
Western EU **	0.75	155'346	1.57%
Eastern EU ***	0.84	8'498	1.75%

** Without Lithuania (no data available). ** Western Europe means here EU15. *** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia, Slovakia, Estonia, Latvia, Cyprus and Malta. n.d.a.: no data available.*



** Western Europe means here EU15. ** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia, Slovakia, Estonia, Latvia, Cyprus and Malta.*
**** no data available for Lithuania.*

Figure 5-1: Aviation: Average costs per available ton-km (passenger and freight) (data for 2005)

6 Water transport

6.1 Inland waterways

Main features of Inland Waterway Transport in Europe

The European network of waterways comprises 27,500 km, of which 78% are navigable rivers and lakes and the remaining 22% canals. However, Table 6-1 only reflects the length of the waterways and does not give a true picture of the transport activities. Total transport volume in Europe amounted to 128 bn tkm in 2004. Figure 6-1 shows European inland waterway transport is dominated by the Germany (50%), the Netherlands (34%), France and Belgium (each 7%). The remaining countries transport less than 4% of commercial transport volume and thus shall be neglected henceforth. E.g. in the UK the relative extensive network is mostly used by leisure boats. Nevertheless, commercial water transport has a modal share of 7% of total freight transport in the European Union.

Table 6-1: Length of inland waterways in Europe 2003 (in kilometers)

Country	Total	Canals	Navigable rivers and lakes
Belgium	0	0	0
Czech Republic	664	39	625
Germany	6636	1620	5089
Estonia	0	0	0
France	5384	3715	1669
Italy	0	0	0
Latvia	0	0	0
Lithuania	290	1	289
Luxembourg	0	0	0
Hungary	1440	121	1319
Netherlands	0	0	0
Austria	351	0	351
Poland	3643	331	3312
Slovakia	172	39	134
Finland	7884	125	7759
United Kingdom	1065	155	910
Switzerland	0	0	0
Total	**27529**	**6146**	**21457**
Source: Eurostat 2006			

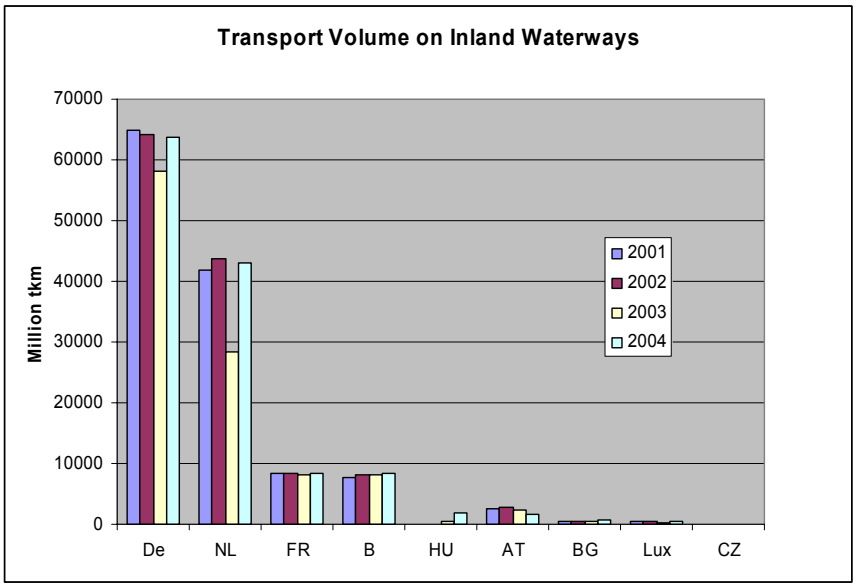


Figure 6-1: Transport volume on inland waterways 2000-2004

Main features of Inland Waterway Transport in the USA

Inland waterway transport in the USA is mainly confined to the East of the country. Source: http://www.worldcanals.com/english/nthameast.html

Figure 6-2 shows a map with the main inland water transport in the East. The US modern waterway network amounts to nearly 42,000 km of high-capacity waterways maintained and operated by the US Army Corps of Engineers. Thus the network of waterways is much larger than the European network. The big geographical difference between USA and Europe regarding inland waterway transport is the fact that in the northern part of the States large lakes, around which numerous industrial towns are located, provide opportunities for water transport. Transport on these lakes comprises a share of 8% (tonne-km) of domestic water transport and 15% of all inland water transport. The main navigable rivers are the Ohio, the Mississippi and the Red River (Table 6-2). In 2003 total transport volume on inland waterways amounted to 476 bn tkm, which is nearly double the amount of Europe.

Source: http://www.worldcanals.com/english/nthameast.html

Figure 6-2: Main US waterways in the East

Table 6-2: Main navigable rivers in the USA

River	Share of ton-miles
Kanawha	5.0%
Ohio	43.2%
Mississippi	39.3%
Atchafalaya	0.4%
Red River	12.1%
TOTAL	100.0%
Source: TR News July/August 2002 (TRB 2002)	

Table 6-3: Top 10 US Inland Waterway Ports 2003

Inland Ports	million metric tons per year
Huntington – Tristate	71
St. Louis, MO and IL	30
Pittsburgh, PA	48
Memphis, TN	16
Cincinnati, OH	12
St. Paul, MN	5
Louisville, KY	8
Mount Vernon, IN	3
Tulsa, Port of Catoosa, OK	2
Guntersville, AL	2
Source: BTS 2006, WCSC, 2006	

Transport operating costs in Europe

Overall data on the transport operating cost in Europe do not exist. Therefore, a number of examples, derived from various research projects in Europe have been compiled in order to assess the spread of transport operation costs.

France

Herry (2001) analysed the transport operating costs for inland water transport in France as shown in Table 6-4. He distinguishes between Class III vessels carrying 650 t and large class IV vessels with 1250 t. In France the costs per tkm are around 10% cheaper for the large vessels. However, considerable cost differences occur according to the distance travelled: If only 100km are covered, the costs per tkm are double compared to a journey of 500 km.

Table 6-4: Operation costs for inland water transport in France (in Euro)

Euro	Class III Euro (650 t)	Class IV Euro (1250 t)
Fixed costs p.a.	117,081	214,648
Fixed costs per working day	407	745
Variable costs p.a.	29,270	53,662
Variable costs per working day	133	244
Total costs p.a.	146,351	268,310
Variable costs per km	1.85	3.05
Fixed costs per working day	406.58	745.32
Euro cent per tkm (100km voyage)	3.3	3.0
Euro cent per tkm (500km voyage)	1.6	1.4
Source: Max Herry 2001		

Table 6-5 composes some cost figures for inland water transport per tkm in different European Countries. The table show large variations of transport operating costs, which are mainly determined by labour costs and the efficiency of the transport. For the latter, determining factors are the size of the vessel, the speed of the boat and of the running water, the number of locks to pass, etc. Therefore, the variation can be considered as quite high.

Table 6-5: Operating costs for inland water transport per tkm

Country	Euro cent/tkm
Hungary	1.2
Austria	1.5
France	0.75 - 3.9
Source: Max Herry 2001	

Unfortunately, no data on operating costs in the USA could be retrieved. Therefore, only a comparison of the revenues from inland water transport can be done.

Comparison of transport revenues

Table 6-6 lists the prices for selected transport links in Germany. The values are derived from the Frachtenspiegel 2000 (ZfB 2000) and the prices per tkm are own calculations. The table gives examples of links on the Rhine, the Neckar, the Main, the Mosel, the Mittelland Kanal to Berlin and the Elbe to Hamburg. The following results can be derived from the calculations:

- Transport on the Rhine is the cheapest: downstream a minimum 0.34 cent/tkm is charged; upstream the price may reach 0,83 cents/tkm.
- The rivers Main, Neckar and Mosel are more expensive than the Rhine, but cheaper than transport on the canals.
- Navigation on the canals to Berlin is more costly and the short trip from Berlin to Hamburg is the most expensive transport route with 1.61 cent/tkm.

Table 6-6: Selected transport prices for dry goods in Germany 2000

Origin	Destination	Distance	Euro per ton				Cent per tkm			
			Downstream		Upstream		Downstream		Upstream	
		km	Min	Max	Min	Max	Min	Max	Min	Max
Oberrhein	Rhein/Ruhr/ Channel	677	2.30	4.35	3.45	5.62	0.34	0.64	0.51	0.83
Neckar	Mannheim	601	3.07	4.09	3.83	5.37	0.51	0.68	0.64	0.89
Main	Mannheim	457	2.30	3.58	2.05	3.83	0.50	0.78	0.45	0.84
Mosel	Mannheim	410	3.58	4.35	3.07	3.58	0.87	1.06	0.75	0.87
Rhein/Ruhr/ Channel	Berlin	616	5.11	5.62	5.62	6.14	0.83	0.91	0.91	1.00
Berlin	Hamburg	350	3.58	4.09	4.60	5.62	1.02	1.17	1.31	1.61
Source: Herry 2001, Frachtenspiegel 2000 (ZfB 2000), own calculations										

In the USA the Bureau of Transportation Statistics BTS gives a comprehensive overview on transport figures and revenues, which is - unfortunately- not available in this format in Europe. Derived from both, the revenues per tkm can be calculated. Table 6-7 gives an overview on inland water transport in the USA: The annual variation of the figures is smaller, if only values in US$ are compared. The exchange rates cause a larger fluctuation. The revenues in the USA range between 0.60 and 0.51 cents/tkm. Surprisingly, the lake transport is not generally cheaper than transport on the rivers and canals.

Table 6-7: Revenues from inland water transport in the USA 1990- 2002

Revenues per tkm (Euro cent/tkm)	1990	1994	1995	1996	1997	1998	1999	2000	2001	2002
Internal	0.54	0.53	0.51	0.56	0.57	0.52	0.50	0.59	0.60	
Lakewise	0.54	0.55	0.52	0.57	0.57	0.52	0.52	0.58	0.58	
Sources: BTS 2006, Data for 2002: TR News, July August 2002 (TRB 2002)										

A comparison with the European figures given in Table 6-6 shows, that average prices in the USA are comparable to the most favourable conditions in Germany, e.g. minimum prices downstream on rivers. Thus, inland water transport seems to be significantly cheaper in the USA compared to Europe. The following reasons might contribute to these findings:

- Geographical features (large lakes, big streams, less locks) might enable the operation of larger entities (large vessels, towed trains) and higher speeds.
- Overall productivity may be higher due to a higher efficiency of operation
- Lower wages might contribute to smaller costs.

The reasons are more or less speculative and have to be verified in a separate research.

Charges for the use of inland waterways

In the EU there is no unified system of charging for the use of waterways. In the **Netherlands**, the most important country regarding inland shipping, one does not have to pay for the use of the inland waterways owned by the central government. Charges are levied for using ports and locks that are owned by local governments. It is estimated that the charges results in around € 0,24 per vessel-km that is currently paid for using the inland waterways in The Netherlands. Compared to the operating cost figures given above, this amount can be neglected.

In **Belgium** the Flemish inland navigation administration has decided to decrease the so called 'Scheepvaartrechten' (shipping rights) when using inland waterways owned by the government. For freight vessels these rights amount to 0.025 cent per ton kilometre. This amount can be neglected.

The average charging fee for **German** waterways depends on the value of the transported goods, which is settled by the federal ministry of transport. However, no charging mechanism exists for the "international rivers" namely Elbe, Danube, Rhine and Oder.

On the Mosel, the pricing mechanisms are decided in agreement among France, Germany and Luxembourg. Charges differ according to the type of goods loaded between 0,27 cent/tkm and 0.64 cent/tkm. For a container 2.5 € are charged per TEU and km. On a total distance of 269 kilometres 15 locks have to be passed. The charges for locks amount from 3 € for boats occupying less than 400 m2 lock space up to 6 € for ships with more than 600m2. They can be neglected compared to the distance charges.

Significant charges a levied on the Rhine-Main-Danube channel. Here the charges (Günthner 2001) amount to significant levels compared to operating costs:

- Container: 2.5 cent/ TEU and km
- Cereals: 0.29 cent/tkm
- Iron Ore: 0.48 cent/tkm

In the **USA** fuel taxes are charged on a network of 10,700-mile of navigable river systems. The charge amounts to 24.4 US cents per gallon (4.4 Euro cent/litre) on diesel fuel for vessels that do not draft more than 12 feet. Towing operators pay the tax to the U.S. Treasury. Given a fuel consumption of 1.3 litres per 100 tkm (www.wsv.de) the fee (0.06 cent/tkm) can be neglected regarding the other operating costs.

Transshipment costs and harbour fees

Transshipment fees and harbour costs are not regulated uniformly within Europe. The fees are dependent on the following

- Communal rates of the port
- Duration of the stop over
- Operator of the facilities
- Type of load transhipped
- Storage facilities needed
- Mode of transport
- etc.

Since no comprehensive study on this issue has been done and a generalisation of single fees is not possible, only examples of transshipment costs and harbour fees can be given within this study. However, a general overview on charges in is attached in Table 6-10.

In Germany the states are responsible for the tariff policies in the ports. The fees are harbour fees are gaining importance if a vessel remains moored for a longer period. However, that is not relevant for the issue of this research. More relevant are the fees charged for loading and unloading (pierage). Table 6-8 lists the pierage fees of the most important inland port in Germany. The costs are retrieved from Duisburg's Web Site and comprise the cost for loading/unloading between land and water. Unloading containers from a full large vessel carrying 144 containers would amount to € 950. In other German ports the fees amount to 0.25 to 0.35 Euro/ton.

Table 6-8: Pierage fees 2006 in Duisburg, Germany

Load	Fee	Unit
Full Container	6,60	€/TEU
Empty Container	0,90	€/TEU
Freight class 1+2	0,40	€/ton
Freight class 3+4	0,29	€/ton
Freight class 5	0,20	€/ton
Freight class 6	0,17	€/ton
Source: http://www.duisport.de/de/logistik_transport/transport_segmente/binnenschifffahrt/hafenentgelte/index.php		

Additionally to these fees, other costs, such as crane usage and harbour railways etc. have to be added to the pierage costs. Table 6-9 gives a picture of various transshipment costs in selected European Ports. The table shows as well that the costs in Europe vary so much that averaging costs is not possible.

Table 6-9: Selected transshipment fees for European inland ports

Country	Dues	Unit	Remarks
Denmark	123.65	Euro/ TEU	
Netherlands	1.26	Euro/ TEU	
Switzerland	0.86	Euro/ TEU	51 Euro/ crane hour, assumption: 60 TEU/hour
UK	18.04	Euro/ TEU	
Austria	25.00	Euro/ TEU	
Italy	0.66	Euro/Ton	
Austria	2.0	Euro/Ton	bulk commodities
Austria	7.0	Euro/Ton	general cargo
Germany	2.0	Euro/Ton	
Recordit D5, 2001, S. 38; Max Herry 2001			

Table 6-10: Inland Port and waterway charges in Europe

	Type of Charges	Ports
A	There are no user fees for ships on the Donau. Harbour charges are levied by the port authorities.	Most harbours are owned and operated by the municipalities. An exception is the Donau harbour in Krems, which is run by a private company (Mierka Donauhafen Krems).
B	There is a registration tax for vessels. Freight vessels have to pay canal charges.	Belgian ports are autonomous organisations owned by the State or public authorities. The Antwerp Port Authority, for example, is owned by the City of Antwerp, but operates as an independent company.
FIN	Ships travelling in the lake Saimaa do not need to pay fairway charges. A special Saimaa Channel for accessing the Baltic Sea from there is charged according to the tonnage capacity of the ships.	Ports are municipally owned enterprises or private industrial ports.
F	In France there are about 8.500 km of channels and navigable rivers in France, 6.700 km of them are managed by the Voies Navigables de France (VNF), a public body depending on the central government. Most of the remaining is managed by the local authorities. By concession of the central government and under convention with VNF, some other companies can maintain and operate certain networks. The pricing of the inland waterways is not covering operating and maintenance costs. The essential resources of VNF come from the state and hydroelectric tax (hydrant and water rejection). The debt is very low (21 million Francs in 2000) because VNF does not take out loans to finance its investment and moreover the initial loan during the creation of VNF is refunded gradually. VNF's own resources come to 112 million euros, broken down as follows111: – The hydraulic tax (hydrant and water rejection), 70% – Fees for use of the public waterways (management of public waterways), 12% – Goods tolls, 6% – Leasure boat tolls, 3% –	VNF is a public corporation answerable to the Ministry for Infrastructure, Housing, Transport, Tourism and the Sea and in that way VNF acts in close cooperation with institutional partners and waterway users.
G	Commercial shipping, their auxiliary activities and professional fishing are exempted from the mineral oil tax.115 The use of some segments of channelled waterways and channels is charged, non-channelled waterways and the river Rhine are free of charge. Infrastructure charges cover only about	

	Type of Charges	Ports
	12 percent of total costs.	
GR	Some tolls are payable for using the Corinthian channel.	
I	The importance of inland waterways transport in Italy is very limited.	Inland waterways in Italy are managed by the regional authorities.
NL	There are 5046 km of navigable inland waterways in the Netherlands. The main waterways (definition: more than 5m tonnes of international freight passing each year – 2200km of network) are maintained and managed by DGG, the Freight Transport Department of the Ministry of Traffic. The smaller waterways are under the jurisdiction of regional and local authorities.	Decisions regarding maintenance are taken by the relevant authorities (national/regional/local), decisions regarding water quality and other environmental concerns are taken by the Ministry of Traffic and Public works, although the local water authorities may have some influence on this as well.
P	In Portugal there are nine inland waterway operators, mostly in passenger transport.144 41,6 million passengers used this mode in national and international traffic (INE, 2001)145. The major operator (Transtejo) is a stock holding company owned by the State also owning the correspondent infrastructure. This company usually receives compensatory subsidies from the State, which are related to the provision of public services. Pricing regulation determines that tariffs of inland transport services, with significant traffic density, should be approved by the government. Although tariffs are not based on marginal costs estimates, the recurrent subsidisation suggests that equity aspects are taken into account in the determination of prices. Therefore, in general, the inland waterways pricing principle could be classified as target-oriented. Charges are the pricing instrument used in this mode.	Investment decisions are taken by the Government. The coordination of the construction of the Cais Sodre intermodal station, which is also used by users of the Transtejo service, was carried out by the Metro of Lisbon.
SP	There are 1045 km of navigable waterways in Spain. Their economic importance is negligible though. No pricing scheme was observed.	Inland waterways usually fall under the regional authorities.
CH	In the freight harbour of Basle, the following charges are levied by the port authorities: – Harbour charge (on goods arriving on waterways, rail and road) – Further charges for harbour operation	

	Type of Charges	Ports
	and navigation – Calibration charges Charges appear to be target-oriented (coverage of average costs).	
UK	The Department for Transport has overall policy responsibility for navigable inland waterways, coastal ports and for international shipping. The Department does not develop a national ports strategy in the same way that it develops a national air transport strategy. Port development is left entirely to the private sector and is not funded by government. Ports, like airports are expected to contribute to the funding of new infrastructure requirements that are necessary to service them. Ports are also entirely responsible for financing their infrastructure development.	Ports in the UK are operated as private sector concerns. The government publishes broad policy aims for ports. The development of individual ports is left to the market. The Department, through the Maritime and Coastguard Agency, regulates the safety of the sector.
Source: Revenue D3, 2005, Annex.		

Comparison of transport operating costs in Europe and USA

Since in Europe four countries DE, NL, FR and B carry 96% of the inland water transport volume (measured in tkm), only these countries will be taken into account. The following methodology was used to assess the outcomes of Table 6-11:

- In Germany and the USA only revenues per tkm are given in Table 6-6 and Table 6-7. In order to derive the operating cost, 5% return on sales is deducted.
- Cost estimates for France are derived from Herry 2001, given in Table 6-4.
- Netherlands and Belgium are dominated by transport on the Rhine: Thus similar operating cost as on the German Rhine are assumed. Staff costs are adjusted according to the country wage level for the private transport sector.
- In Europe and the USA most of the main waterways are free of charge. Only on smaller rivers and canals charges are levied. These will be neglected in the cost analysis below
- Due to the complexity of transshipment costs and harbour fees described above, no indication of the share of total costs can be given within this study.

Table 6-11: Comparison of operating costs of inland water transport in Europe and USA

	Specific Costs	**Transport Volume**	**Total Costs**	**Operating cost in relation to GDP**
	Cent/tkm	Mill tkm	Mill Euro	%
Belgium	0.70	8392	59	0.020%
Germany	0.79	63667	502	0.023%
France	1.50	8416	126	0.008%
Netherlands	0.70	43092	301	0.062%
Average Europe	**0.80**	**128291**	**1027**	**0.010%**
USA	**0.56**	**475691**	**2675**	**0.028%**

Table 6-11 produces the results of the comparison. Due to the above described comparative advantages and the higher transport efficiency, operating costs in the USA are significantly (30%) lower than in the EU. If single countries are compared, the cost difference is even higher. As indicated above, the cause might be geographical features as well as higher labour productivity of the sector. A definite answer to this question cannot be given within this framework.

Compared to Europe, in the US 3.7 fold the volume is transported on inland waterways. However, due to the lower prices the total transport costs only amount to 2.6 bn Euro, compared to roughly 1 bn in Europe. If these amounts are set in relation to GDP, the costs for inland water transport only comprise 0.1 ‰ in Europe and 0.3 ‰ in the US. Thus, the total economic significance is relatively low.

6.2 Short Sea Shipping

Short Sea Shipping (SSS) is regarded in the EU as an alternative to road transport: Short Sea shipping is the intermodal transport of Intra-European cargo on a door-to-door basis, usually in containers or trailers. A large part of the transport traject is done by sea. In the EU Short Sea Shipping accounted for 63% of the entire volume of goods transported by sea in the EU-15 in the year 2003, totalling over 1.6 billion tonnes, transported over an average distance of about 700 km. The United Kingdom and Italy accounted for the largest share of cargo handled in Short Sea Shipping, totalling 342 and 302 million tonnes respectively. The amount of Short Sea Shipping varied widely from one country to another.

Liquid bulk (including liquefied gas, crude oil and oil products) played a predominant role in cargo handled in Short Sea Shipping; in France, Italy and the Netherlands in particular, it accounted for more than 60% of total cargo In all the maritime regions, liquid bulk is the most common SSS cargo, both leaving and entering the EU-15, however, its share varied from one region to the next, from 77% in the Black Sea to 39% in the Atlantic Ocean.

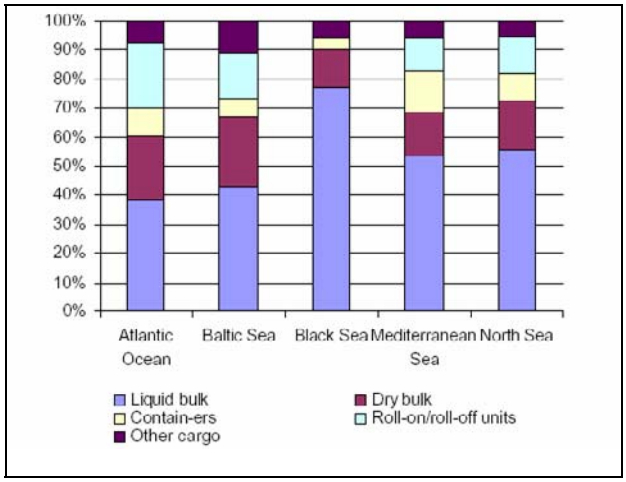


Figure 6-3: SSS in the EU by type of cargo

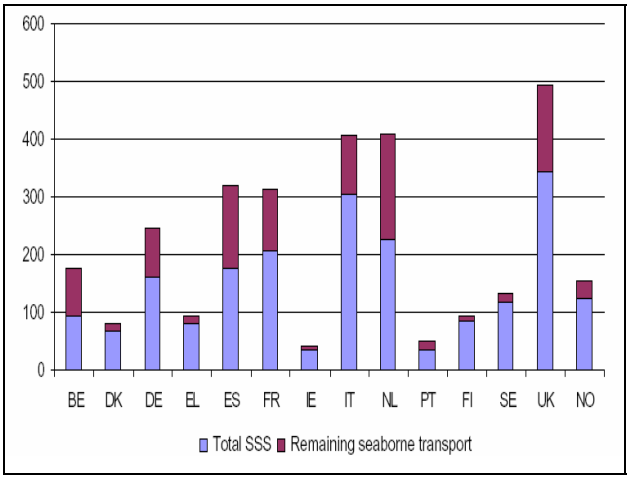


Figure 6-4: Share of SSS on turnover, in million tons 2003

Table 6-12: Europe's most important ports for SSS

	Total SSS (1000 tons)	Share of EU-15 SSS		Total SSS (1000 tons)	Share of EU-15 SSS
Liquid Bulk			**Container**		
Rotterdam	120373	11,70%	Rotterdam	20526	8,97%
Marseilles	53367	5,19%	Hamburg	19801	8,65%
Le Havre	34460	3,35%	Gioia Tauro	17702	7,73%
Wilhelmshaven	32016	3,11%	Antwerp	17329	7,57%
Tees & Hartlepool	31944	3,10%	Bremerhaven	10447	4,56%
Dry Bulk			**Roll on Roll off**		
London	13470	3,70%	Dover	18241	5,40%
Rotterdam	12612	3,47%	Luebeck	15193	4,49%
Amsterdam	10572	2,91%	Zeebrugge	14762	4,37%
Hamburg	9290	2,55%	Calais	14034	4,15%
Ravenna	8745	2,41%	Grimsby & Immingham	11851	3,51%
Source: Eurostat 2004					

Short Sea Shipping in the USA[2]

In 2003 coastal shipping in the USA amounted to 200 million tons of goods, which were transported over an average distance of 2000 km. This implies, that the European definition of SSS, which assumes shorter distances, is not comparable to USA. The majority of cargo carried in the US have been bulk commodities that travel through an established inland waterway system and along the U.S. coasts by barge, tanker and freighter. The existence of these bulk carriers already contributes to a reduction of rail and highway congestion. Without these coastal movements the cargo would require transport by rail or truck. Container on barge services the current inter-modal coastal trade. Larger Ro/Ro and container ship services exist between the U.S. west coast and Alaska. Similar services exist between the U.S. East Coast and Puerto Rico.

[2] Source: www.bts.gov, 2006

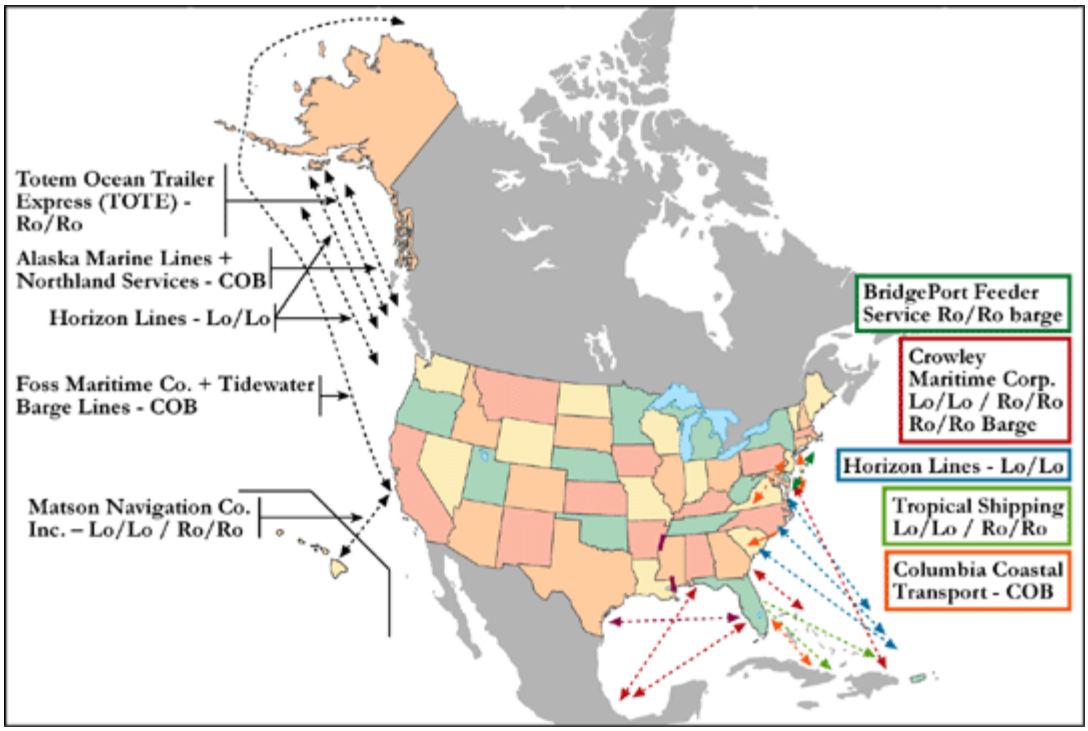


Figure 6-5: Important coastal shipping routes in the US (source: www.bts.gov)

Table 6-13: Most important ports for Short Sea Shipping (SSS) in the USA

All Ports	million metric tons
South Louisiana, LA	180
Houston, TX	173
New York, NY and NJ	132
Beaumont, TX	79
New Orleans, LA	76
Huntington, WV-KY-OH	70
Corpus Christi, TX	70
Long Beach, CA	63
Texas City, TX	56
Baton Rouge, LA	56
Source: BTS 2006, WCSC, 2006	

Operating Costs for SSS in North America

Daily operating costs at the east coast of North America have been recently composed by Brooks et al. (2006). The costs vary considerably depending on the loading capacity of the ship. Unfortunately, a comparable study was not available in Europe. Therefore the actual prices for selected transport links were compared.

Table 6-14: Estimated daily operating costs for selected vessels at the east coast of North America (in USD)

Name of vessel	Loaded TEU	Time charter or own-ership	Crew	Main-tenanc e	Insu-rance	Stores	Fuel	Total	Per TEU and day
Avalon	502	15812	1487	1743	755	201	9087	29085	58
Damen	402	6896	1487	1743	755	201	7633	18715	46
Shamrock	198	6350					6932	13282	67
Stena	185	11188	1487	1743	619	201	20510	35749	193
Altinia	91	5844					5193	11037	121
Incat (slow speed)	47	22505	1347	3574	619	201	30094	58339	1241
Incat (high speed)	32	22505	1347	3574	619	201	68290	96536	3017
Brooks et al 2006									

Comparison of transport tariffs

Two research projects in North America and Europe deliver comparable data on the prices for short sea shipping. The prices relate purely to the transport services and do not include trans-shipment and mooring costs. Data in Table 6-15 are sorted according to the distance and the American prices are highlighted. With the exception of Rotterdam -Felixstowe, the prices in the USA and in Europe are comparable. It seems to be, that the international competition in shipping has resulted in uniform prices charged by the carriers in Europe and America.

Table 6-15: Comparison of transport prices for SSS in Europe and North America

	Distance*	20 ft Container	40 ft Container
	Km	Euro/TEU and km	
Rotterdam - Felixstowe	216	1.62	1.04
Vancouver - Seattle	260	0.40	
Patrasso - Brindisi	453	0.50	0.29
Transport Le Havre - Rotterdam	466	0.38	0.38
Vancouver - Portland	680	0.28	
Gioia Tauro - Voltri	920	0.21	0.21
Bilbao - Antwerp)	1464	0.14	0.13
Vancouver - San Francisco	1630	0.21	
* Distance in America estimated Sources: Europe: Release WP 4.2 Annex 1 Results. America: Cambridge Systematics Inc. (2004)			

Since the table above only considers containers, which comprise a share of 10% of total European SSS volume, a comparison of the tariffs for other loads would be desirable. However, only in the US the BTS delivers useful data on the overall revenues from SSS, given in Table 6-16. The only possible comparison is given by the European Commission, which uses

the costs of 0.9 cent/tkm to analyse the effects of modal shift in its Marco Polo Project on SSS.

Table 6-16: Revenues for coastal transport services in the USA

	1990	1994	1995	1996	1997	1998	1999	2000	2001
Euro cent/tkm	0.34	0.35	0.33	0.37	0.36	0.32	0.34	0.39	0.40
Source: BTS 2006									

Transshipment costs and harbour fees

Next to the transport tariffs, the costs for transshipment are of importance in an intercontinental comparison. However, Transshipment fees and harbour costs are not regulated uniformly within Europe. The fees are dependent on many factors, such as communal rates of the port, duration of the stop over, operator of the facilities, type of load transhipped, mode of transport, etc. Thus, only examples of transshipment costs and harbour fees can be given within this study. Table 6-17 lists selected transshipment costs for containers in Europe, derived form the RELEASE research project. The cheapest operations are the transfer to and from trucks, which cost 25-47 Euro/TEU, followed by railways with 25 up to 111 Euro/TEU and transfers from boat to ship with 70-83 Euro/TEU.

Table 6-17: Transshipment cost for containers in Europe (in Euro/TEU)

Port	Company	Transfer from ... to ...	20 ft Container	40 ft Container
Port of Patras		Truck to SSS vessel	25	25
Port of Brindisi		SSS-Vessel to truck	25	25
Le Havre		Truck to SSS vessel	37	45
Bilbao	Terminal operator	Railway to SSS vessel	25	30
Felixstowe	Terminal operator	SSS-Vessel to railway	107	107
Genova	Voltri Europa Terminal	SSS-Vessel to railway	111	109
Antwerp	Terminal	SSS-Vessel to railway	36	36
Rotterdam	Rotterdam ShortSeaTerminal	Inland water barge to SSS vessel	70	70
Rotterdam	Rotterdam ShortSeaTerminal	SSS vessel to inland water barge	70	70
Gioia Tauro	Terminal M.C.T.	Internat. Seefreight to SSS-Vessel	83	83
Souce: Release WP 4.2 Annex 1 Results				

These values have to be compared to the costs in America. Cambridge Systematics, Inc. (2004) used the following costs for North American ports:

- Drayage costs 96 Euro/20ft container
- Handling costs 201 Euro/20ft container

The price difference between USA and Europe is corroborated by a comparison of the service delivery in US ports as given in Figure 6-6: The high cost per move are regarded as one of the major factors negatively influencing the competitiveness of US ports.

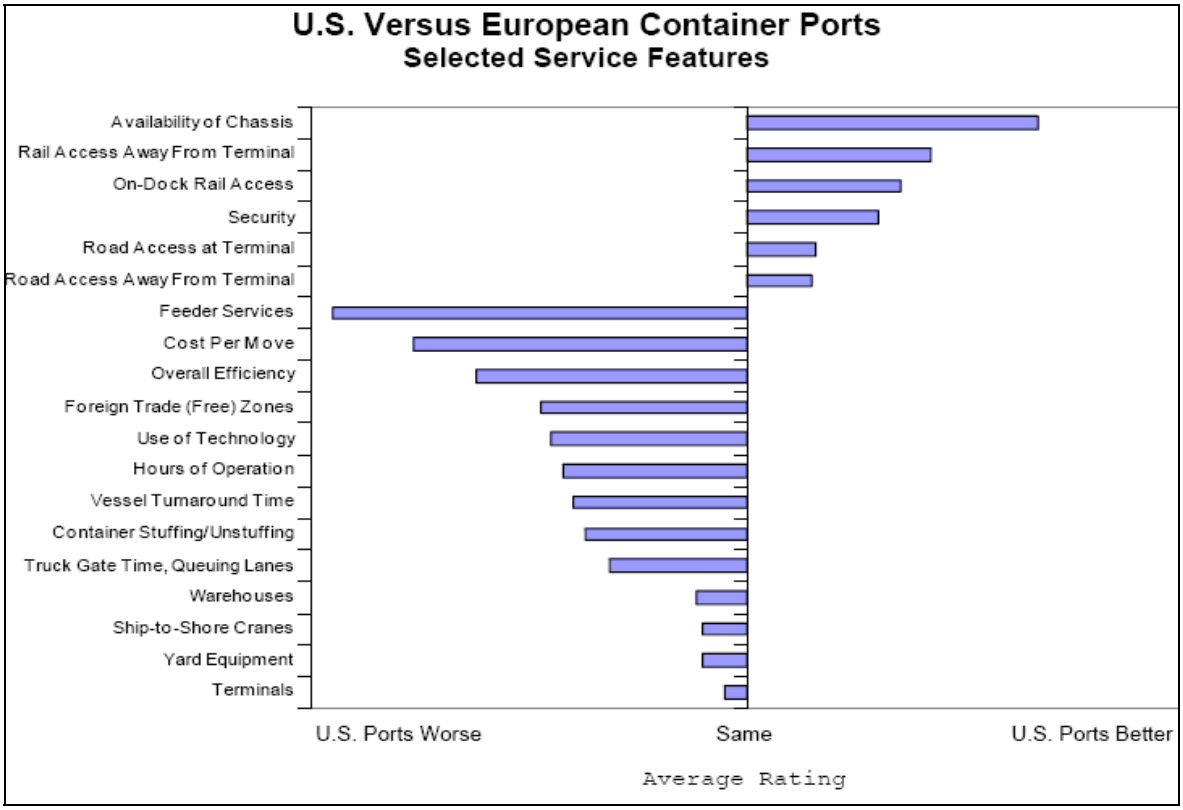


Figure 6-6: Comparison of quality of service in US and European ports

Other fees and charges

Taxes on fuel have only a minor impact on transport costs in Europe. The Recordit Study (RECORDIT 2001) estimates a range of 0.4 to 20 Euro Cent/TEU for Greece and the Netherlands. Compared to the above costs these fees can be neglected.

Cost for maritime transport in relation to total commodity prices

Considering the main commodity flows for import and export in Europe, the NEI (2001) calculated the share of the transport cost on the total commodity price as given in Figure 6-7. The study concludes that "the transport costs have little or no effect on the European economy, because:

- no alternative flows exists (iron ores and crude oil);
- the transport costs are negligible (medical and pharmaceutical products, road vehicles and iron and steel products) and therefore a rise in transport costs does hardly effect total product costs;
- of European policy (wheat): the transport costs have no effect what so ever on the flows. In some cases (road vehicle and crude oil) the possible higher costs will be transferred to the consumers."

A distinction has to be made between 'high' and 'low' value commodities. Freight rates are only of minor relevance for high value commodities, which represent the main exports of Europe. The low value imports are much more sensitive to transport costs and thus their increase might entail a relocation to areas where raw materials are produced.

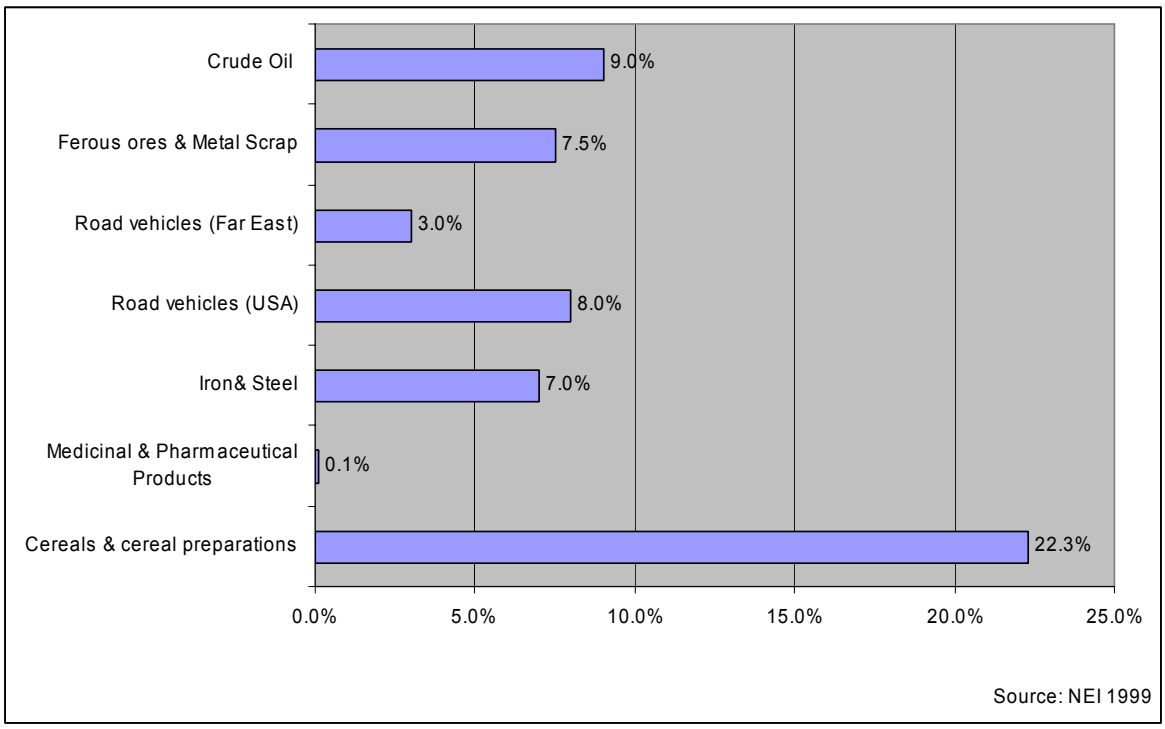


Figure 6-7: Share of maritime transport cost on production cost in Europe

Comparison of transport cost in Europe and USA

As already depicted in Table 6-15 the competitive environment in SSS results in relatively uniform prices in Europe and the USA. Therefore, it makes little sense, to list all European Countries using the same unit costs. Additionally, European data on SSS are still unsatisfactory. For example, a methodology for a conversion tool to convert tons into tonne-kilometres had just been developed in September 2005 by the project REALISE. Therefore, only lump sums for EU 15 are given in Table 6-18. The following assumption had to be made to compose the table.

- In the USA only revenues per tkm are given. In order to derive the operating cost, 5% return on sales is deducted.
- Transport volume in Europe is based on EU-15 in1998, transport unit costs on the Marco Polo Programme.
- Due to the complexity of the issue, transshipment costs and harbour fees are excluded from the analysis.

Table 6-18: Comparison of operating costs* in SSS in EU-15 and USA

	Specific Costs*	Volume	Total Costs	Share GDP
	Cent/tkm	bn tkm	Mill Euro	In %
EU 15	0.9	1166	10494	0.11%
USA	0.4	407	1536	0.02%
* excluding transshipment costs and harbour fees				

The results imply, that transport costs in the EU are significantly higher than in the USA. However, this is only based on one cost assessment. However, if the figures for container transport, given in Table 6-15 are taken into account as well, transport costs in the US and in

Europe do not differ considerably. A number of reasons might contribute to this contradiction:

- the average distance in Europe is 700 km, while coastal shipping amounts to 2000 km in USA.
- A comparison of the costs by the type of load would probably result in much more reliable outcomes.
- A detailed analysis of the costs and the transport volume is necessary in order to produce more reliable data.
- An inclusion of transshipment costs and harbour fees would be necessary.

Table 6-18 shows one important issue: SSS accounts for 0.11% of the GDP in Europe (EU15) and is thus 10 times more important than inland water transport. Due to the lower volumes and the lower costs, coastal shipping is of much lower importance in the USA.

7 Total operating costs of all transport modes

An overview about the total operating costs of the different countries is presented in the main report. The following figures give some additional information.

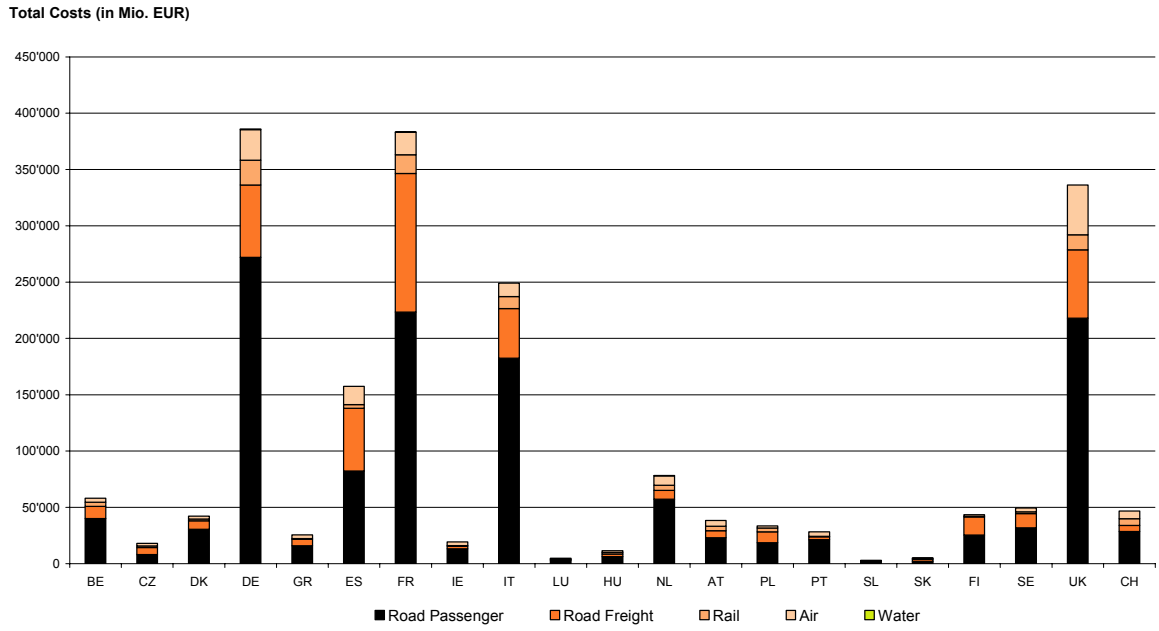


Figure 7-1: Total transport operating costs per country (2005) – EU and CH

- The data in Figure 7-1 above are mainly influenced by the transport performance: the biggest countries have the highest costs: Germany, France, UK, Italy, Spain.
- Road transport is dominating the overall costs. In Europe road passenger transport is, in absolute terms, the most important category, followed by road freight transport and then air transport. In the US, road freight transport is as important as passenger road transport.

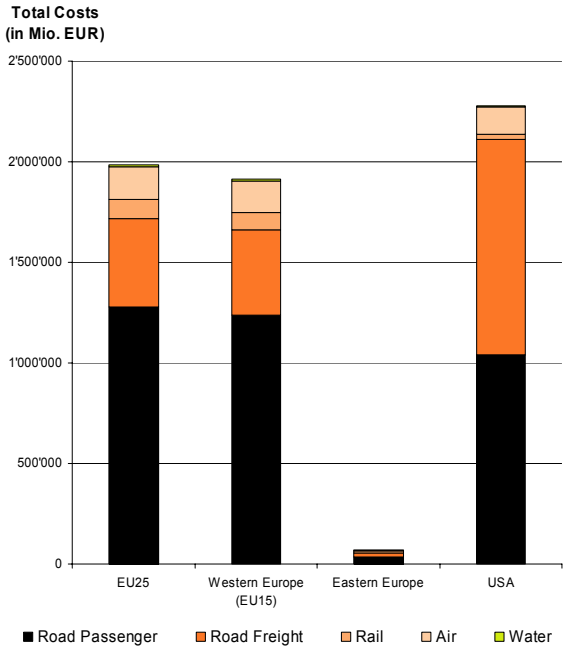


Figure 7-2: Total transport operating costs (2005) – aggregated data

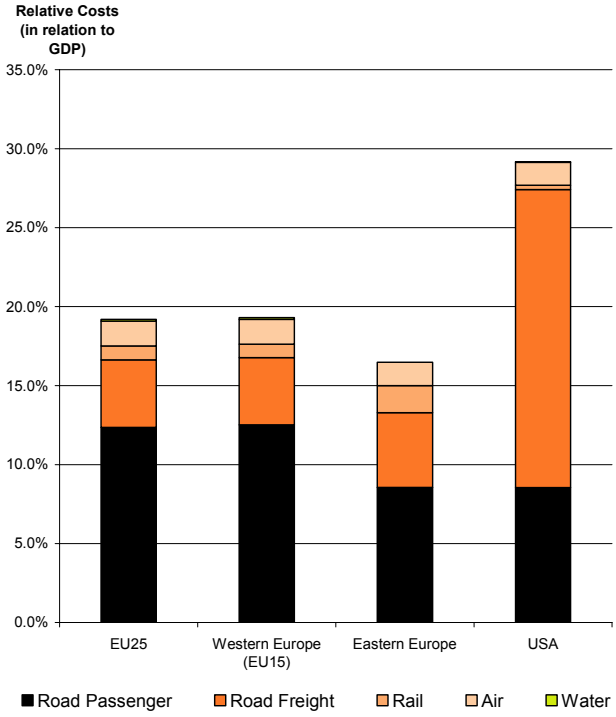


Figure 7-3: Total operating costs in relation to the GDP – aggregated data

- The relative costs for the US are the highest. The reason for this is the high transport performance of the USA, above all in road freight transport.
- In Eastern Europe, the total operating costs in relation to the GDP are slightly lower than in Western Europe (EU15).

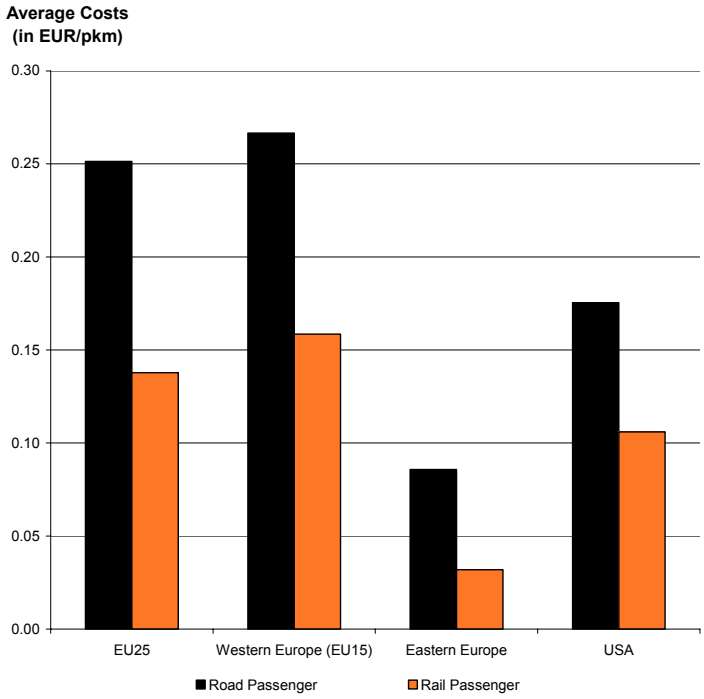


Figure 7-4: Average costs (per pkm) for passenger transport – aggregated data

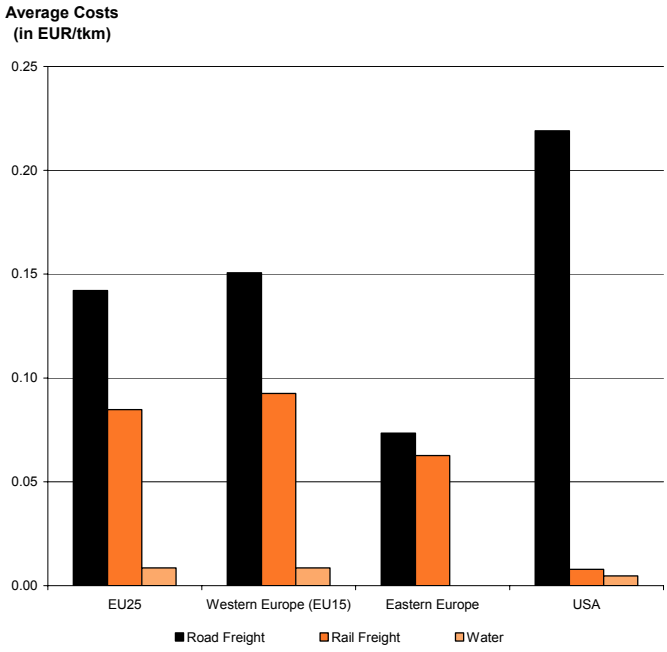


Figure 7-5: Average costs (per tkm) for freight transport – aggregated data

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