Transport taxes and charges in Europe

An overview study of economic internalisation measures applied in Europe

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Glossary

Term	Explanation
Airbridge charge	Charge for the use of airbridge at an airport.
Aircraft parking charge	Charge for the parking of aircrafts at an airport.
Bus	Passenger road motor vehicle designed to carry more than 24 persons (including the driver), and with the provision to carry seated as well as standing passengers.
CEMT	Classification of European Inland Waterways, based on a set of standards for interoperability of large navigable waterways forming part of the Trans-European Inland Waterway network within Continental Europe and Russia. The range of dimensions are referred to as CEMT Class I to VII. CEMT is also used to categorise inland waterway vessels according to their dimensions, in line with the waterway category they have minimally access to.
Charge	Compulsory requited payment, where requited means that the payer does receive anything directly in return.
Charge for ground handling services	Charge for ground handling services at an airport.
Coach	Passenger road motor vehicles designed to seat 24 or more persons (including the driver) and constructed exclusively for the carriage of seated passengers.
Company car taxation	Tax to charge the benefit in kind that is attributed to company cars.
Dues for locks and bridges	Charge for using/passing a lock or bridge.
Electricity tax	Consumption tax on electricity use.
En route charge	Charge to be paid for the use of navigation facilities, communication, etc. en route for a specific flight by an airplane.
Excise duty	Excise duties are indirect taxes (see: Tax) on the sale or use of specific products. For example, fuel excise duties are taxes on the sale of (motor) fuels.
External cost	Unintended cost imposed on third parties for which no compensation is received. Important types of external costs are: air pollution, climate change, noise, accidents and congestion.
Fairway dues	Charge for using a specific waterway.
Freight charge	Charge for freight transport by an aircraft.
Fuelling charge	Charge for the fuelling of aircrafts.
Gross Domestic Product (GDP)	Aggregate measure of production equal to the sum of the gross value added of all residents, institutional units engaged in production.
Heavy Goods Vehicle (HGV)	Goods road vehicle with a gross vehicle weight above 3,500 kg, designed, exclusively or primarily, to carry goods.
High speed train (HST)	Trains designed to operate at a speed of at least 250 km/h on dedicated high speed lines (see: High speed line).
Infrastructure charge	Charge for the use of infrastructure incl. IT at an airport.
Infrastructure costs	The direct expenses on infrastructure plus the financing costs or – regarded from a different point of view – the opportunity costs for not spending the resources for more profitable purposes.
Inland Waterway Transport (IWT)	Any movement of goods and/or passengers using inland waterway vessels which is undertaken wholly or partly on navigable inland waterways.
Landing and Take-Off (LTO)	Cycle of landing and take-off of an aircraft .
Levy	All kinds of compulsory payments, including both taxes and charges.
Light Commercial Vehicle (LCV)	Four-wheeled goods road motor vehicle with a gross vehicle weight of not more than 3,500 kg. Also known as van.
LTO charge	Charge for the landing and/or take-off of aircrafts at an airport.

Term	Explanation
Moped	Two, three or four-wheeled road motor vehicle which is fitted with an engine having a cylinder capacity of less than 50cc and a maximum authorized design speed in accordance with national regulations.
Motorcycle (MC)	Two-, three- or four-wheeled road motor vehicle not exceeding 400 kg of unladen weight. All such vehicles with a capacity of 50 cc or over are included.
MTOW	Maximum take-off weight.
Noise/emission charges	Charges for noise depending of noise class of the aircraft or emissions of the aircraft.
Ownership tax	Periodical tax levied on the ownership of a vehicle. Often referred to as circulation tax.
Passenger car	Road motor vehicle, other than a moped or a motorcycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver).
Passenger charge	Charge for passenger transport by an aircraft.
Passenger-kilometre (pkm)	Unit of measurement representing the transport of one passenger over one kilometre.
Pierage	A charge that has to be paid to port authorities if a vessel reaches a port for transhipment.
PRM charge	Charge to facilitate support for persons with reduced mobility to travel with an aircraft.
Price index figure	Indicator measuring the weighted average of prices in a predetermined basked of goods (and/or services). Changes in this indicator are used to correct monetarised data for inflation.
Port charges	Charge for the use of a port.
Powered two-wheelers	Motorcycles (see: Motorcycle) and mopeds (see: Moped).
Purchase Power Standard (PPS)	Indicator reflecting the purchasing power of countries. This indicator is used to correct monetarised figures for differences in purchasing power of a Euro across countries.
Rail infrastructure access charge	Charge for the use of rail infrastructure. In this study the rail infrastructure access charge is defined in line with the minimum access package, meaning that charges related to three cost components are considered, i.e. 1) wear and tear, 2) the willingness to pay of a train undertaking to buy a time slot to run a train, and 3) the cost of electricity supply.
Registration tax	Tax levied on the (first) registration of a vehicle in a country. Often referred to as purchase tax. Registration fees are not included as part of registration taxes, as these are direct payments for actual activities carried out (i.e. registering vehicles).
RoPax	Roll-On-Roll-Off Passenger ship. This ship is designed to carry passengers and wheeled cargo (e.g. cars, trucks, railroad cars), that are driven on and off the ship on their own wheels or using a platform vehicle (e.g. a self-propelled modular transporter).
Security charge	Charge for security services and infrastructure at an airport.
Ship kilometre	Unit of measurement representing the movement of a ship over one kilometre.
Subsidy	Fiscal support with direct relevance to public budgets and with no direct service in return.
Tax	Compulsory unrequited payment, where unrequited means that the payer does not receive anything directly in return.
Terminal charge	Charge that consider the costs of air navigation services regarding the control of landing and take-off of airplanes.
Tonne-kilometre (tkm)	Unit of measurement of goods transport which represents the transport of one tonne over one kilometre.
Train kilometre	Unit of measurement representing the movement of a train over one kilometre.
Value added tax (VAT)	Indirect tax (see: Tax) on the domestic consumption of goods and services. VAT is imposed on the added value at each stage of production. Producers are VAT-registered and they are entitled to deduct from the VAT amount the VAT paid on his or her purchases. For the final consumer, not being VAT registered, VAT is a tax on the consumption of a good or service.
Vehicle-kilometres (vkm)	Unit of measurement representing the movement of a vehicle over one kilometre.
Water pollution charges	Fuel surcharge to bear the costs for the collection and disposal of bilge water, waste oil, and other oily and greasy water.

Country abbreviations

Abbreviation	Country
EU28	All 28 EU Member States
EU27	All 28 EU Member States except the UK
AT	Austria
BE	Belgium
BG	Bulgaria
HR	Croatia
CY	Cyprus
CZ	Czech Republic
DK	Denmark
EE	Estonia
FI	Finland
FR	France
DE	Germany
EL	Greece
HU	Hungary
IE	Ireland
IT	Italy
LV	Latvia
LT	Lithuania
LU	Luxembourg
MT	Malta
NL	The Netherlands
PL	Poland
PT	Portugal
RO	Romania
SK	Slovakia
SI	Slovenia
ES	Spain
SE	Sweden
UK	United Kingdom
NO	Norway
CH	Switzerland
CA-AB	Alberta (province in Canada)
CA-BC	British Columbia (province in Canada
US-CA	California (state in United States)
US-MO	Missouri (state in United States)
JP	Japan
WEC	Western European Countries, covering Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, The Netherlands, Portugal, Spain, Sweden, UK, Norway, and Switzerland
CEEC	Central and Eastern European Countries, covering Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia

1 Introduction

1.1 Background of the study

Transport is a precondition for a proper functioning of our modern society, for the well-being of people and for the economy. At the same time, transport gives rise to various external effects, like air pollution, noise and congestion. Moreover, constructing, maintaining and managing transport infrastructure results in significant costs. In contrast to the benefits of transport, these external and infrastructure costs are, without policy intervention, generally not borne by transport users and hence not taken into account when they make a transport decision. By internalising the external and infrastructure costs (i.e. making these costs part of the decision making process) the efficiency of the transport system can be increased.

The internalisation of external (and infrastructure) costs is one of the leading principles in EUs transport policy. The 2011 White Paper on Transport argues that transport charges and taxes must be restructured in the direction of wider application of the 'polluter-pays' and 'user-pays' principles (EC, 2011). Recently, the European Parliament has called for renewed efforts in internalisation and also the Commission Communication of 2016 on 'A European Strategy for Low-Emission Mobility' emphasized the need for making steps forward in applying the 'polluter-pays' and 'user-pays' principles (EC, 2016). A central element in the EU policy for internalisation of external costs is the so-called Eurovignette Directive 1999/62/EC, which provides the basis for the EU charging policy for heavy goods vehicles. This Directive 1999/62/EC has been amended twice: in 2006 and recently in 2011 (European Parliament, 2006); (European Parliament, 2011). This Directive enables Member States to charge the full infrastructure costs and, since its 2011 revision, also some external costs (air pollution and noise). In addition, charges can be differentiated to some extent, in order to reduce road congestion or to provide incentives to use cleaner vehicles. In 2017 the European Commission presented a proposal to amend the Eurovignette Directive again, among other things, by extending its scope to buses/coaches and light commercial vehicles and by enabling the modulation of charging according to CO_2 emissions (EC, 2017a).

In addition to the Eurovignette Directive, the EU has adopted the Energy Taxation Directive (European Council, 2003)[1], which provides a European framework for taxing motor fuels, heating fuels and electricity. This Directive provides mandatory minimum levels for fuel taxes that should be used by all EU Member States, but also mandatory (e.g. for energy use by commercial aviation or shipping in Community waters) and optional (e.g. electricity use by rail transport) exemptions from these taxes.

For the non-road modes, the EU has implemented several policies to internalise the external costs. For example, CO_2 emission from intra-EU aviation have been included in the EU emission trading system (EU ETS) since 2012 (European Parliament, 2008), while Directive 2012/34/EU provides a framework for rail usage charges in the EU (European Parliament, 2012). Furthermore, the EU has introduced frameworks to ensure that airport charges and (maritime) port charges do reflect the actual (air)port costs, without setting any minimum levels to European (air)ports (European Parliament, 2009; European Parliament, 2017). One of the main aims of these frameworks is to improve the financial transparency of airports and ports in Europe.

1 At the moment this report has been written, this Directive has been evaluated.

At global level, the International Maritime Organization (IMO) has adopted in April 2018 an initial strategy to reduce greenhouse gas (GHG) emissions from ships which defines an emission reduction objective of at least 50% reduction by 2050 compared to 2008 annual GHG emissions coupled with a vision for the decarbonisation of the sector. For international aviation, the 2016 International Civil Aviation Organisation (ICAO) General Assembly Resolution sets out the objective and key design elements of a global scheme, as well as a roadmap for the completion of the work on implementing modalities. In June 2018, ICAO endorsed the Standard and Recommended Practises (SARP) detailing the Carbon Offsetting Scheme for International Aviation due to start its voluntary phase in 2021. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) aims to stabilise CO_2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020. As of 29 June 2018, 73 States, representing 75.96% of international aviation activity, intend to voluntarily participate in CORSIA from its outset.

Although the EU has taken several initiatives in implementing the 'user-pays' and 'polluter-pays' principles in EU transport charging, there are still several areas with little EU legislation or harmonisation of national fiscal provisions. For example, road vehicle taxation is fully the responsibility of each Member State[2] .

The level and structure of transport taxes in the EU have been thoroughly investigated in the study 'An inventory of measures for internalising external costs in transport in 2012' (CE Delft, TML, TNO, TRT , 2012). This study provides a complete overview of all transport taxes and charges levied on the various transport modes in all EU Member States in 2012. As up-to-date information on transport taxes and charges is key in the debate of the state-of-play of internalisation of external costs of transport, the current study provides an update for the 2016 situation.

This study is part of a broader project on the internalisation of external and infrastructure costs of transport in Europe. This is explained in more detail in the following text box.

This report is produced with in the project 'Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities'. The overall aim of this project is to assess to what extent EU Member States and some other countries (i.e. Norway, Switzerland, US, Canada and Japan) have implemented the 'user-pays' and the 'polluters-pays' principles. It should provide an overview of the progress EU Member States have made towards the goal of full internalisation of external (and infrastructure) costs of transport and to identify options for further internalisation.

As part of this broad internalisation project, the following five deliverables are produced:
- Overview of transport infrastructure expenditures and costs, which provides an overview of the infrastructure costs of all transport modes in all relevant countries.
- Handbook on the external costs of transport – version 2018, which provides an overview of methodologies and input values that can be used to provide state-of-the-art estimates for all main external costs of transport. Furthermore, this report present the total, average and marginal external costs for all relevant countries.
- Transport taxes and charges in Europe – An overview study of economic internalisation measures applied in Europe (current report). This study provides an overview of the structure and level of transport taxes and charges applied for the various transport modes in the EU28 Member States (and the other relevant countries). Furthermore, this study presents the total revenues from transport taxes and charges for the various transport modes and countries.

[2] Although there is no EU legislation or harmonisation of national fiscal provisions in the area of vehicle taxation, the Commission has provided some guidelines for passenger car taxation, including some best practices that Member States could implement (European Commission, 2012). These include providing better information on the application of car taxes in cross-border situations, refunding part of the registration tax for cars which are permanently transferred to another Member State, and making provisions for the temporary use of vehicles (particularly rental cars) which are registered in another Member State.

- The state-of-play of internalisation in the European transport sector, which shows for all countries and transport modes to what extent external and infrastructure costs are internalised by current taxes and charges and which options for further internalisation are recommended.
- Summary report, providing an overview of the main findings of the other four deliverables.

1.2 Objective

The objective of this study is to provide an overview of the structure and level of transport taxes and charges applied in road transport, rail transport, IWT, maritime transport and aviation in the EU28 Member states. These taxes and charges are compared to levies applied in some other (non-European) Western countries.

In addition, this study presents the total revenues from transport taxes and charges for the various vehicle categories and countries, as well as the average compensation paid by users per vehicle category per country. Finally, the share of these revenues earmarked for transport infrastructure expenditures (or mitigation measures for the external costs of transport) is identified.

All data on tax/charge structures, levels and revenues can be found in the Excel Database accompanying this report (for more details, see Annex F). Based on these data, the topics as discussed above are assessed and presented in this report. The sources from which all data has been extracted are presented in the Excel database as well.

1.3 Scope of the study

1.3.1 Transport modes

In this study an overview of the taxes and charges for road transport, rail transport, inland waterway transport (IWT), maritime transport and aviation is given. As tax/charge levels often depend heavily on the technical and/or operational characteristics of the vehicles, they are presented for a set of representative reference vehicles (see Table 1). For all these reference vehicles, the tax/charge levels can be found in the Excel Database accompanying this report. Additionally, for (a subset[3] of) these reference vehicles comparative analyses are presented in this report.

A detailed definition of these reference vehicles (including their technical and operational characteristics) can be found in Annex A.

Table 1 – Overview reference vehicles

Transport mode	Vehicle type	Reference vehicle
Road transport	Passenger car	- Petrol, high fuel efficiency 2016 car - Petrol, low fuel efficiency 2016 car - Petrol, high fuel efficiency 2000 car - Petrol, low fuel efficiency 2000 car - Diesel, high fuel efficiency 2016 car - Diesel, low fuel efficiency 2016 car - Diesel, high fuel efficiency 2000 car

[3] As for some vehicle categories (e.g. passenger cars) a large number of reference vehicles have been defined, including all reference vehicles in the assessments carried out results in unreadable graphs. For these vehicle categories, only results for a subset of reference vehicles has been presented in this report. These subsets has been selected in a pragmatic way, in order to show the ranges in results found in the various assessments.

Transport mode	Vehicle type	Reference vehicle
		- Diesel, low fuel efficiency 2000 car - LPG, average fuel efficiency 2016 car - CNG, average fuel efficiency 2016 car - Full electric, 2016 car - Plug in hybrid (petrol), average fuel efficiency 2016 car
	Powered two-wheeler	- Petrol, high fuel efficiency motorcycle - Petrol, low fuel efficiency motorcycle - Petrol, average fuel efficiency moped - Electric motorcycle
	Bus	- Diesel, high fuel efficiency bus - Diesel, low fuel efficiency bus - CNG, average fuel efficiency bus - Electric bus
	Coach	- Diesel, high fuel efficiency coach - Diesel, low fuel efficiency coach
	LCV	- Petrol, high fuel efficiency 2016 LCV - Petrol, low fuel efficiency 2016 LCV - Petrol, high fuel efficiency 2000 LCV - Petrol, low fuel efficiency 2000 LCV - Diesel, high fuel efficiency 2016 LCV - Diesel, low fuel efficiency 2016 LCV - Diesel, high fuel efficiency 2000 LCV - Diesel, low fuel efficiency 2000 LCV - Full electric LCV
	HGV – small truck (3.5-7.5 t)	- Diesel, high fuel efficiency truck - Diesel, low fuel efficiency truck
	HGV – medium truck (7.5-16 t)	- Diesel, high fuel efficiency truck - Diesel, low fuel efficiency truck
	HGV – large truck (16-32 t)	- Diesel, high fuel efficiency truck - Diesel, low fuel efficiency truck
	HGV – heavy truck trailer (+32 t)	- Diesel, high fuel efficiency truck - Diesel, low fuel efficiency truck - LNG, average fuel efficiency truck
Rail transport	High speed train	- High speed train (500 seats)
	Regular electric passenger train	- Intercity train (500 seats) - Regional train(350 seats)
	Regular diesel passenger train	- Intercity train (500 seats) - Regional train (350 seats)
	Electric freight train	- Long container (90 TEU) - Long bulk (1,500 t) - Short container (60 TEU) - Short bulk (1,020 t)
	Diesel freight train	- Long container (90 TEU) - Long bulk (1,500 t) - Short container (60 TEU) - Short bulk (1,020 t)
IWT	Freight vessels	- CEMT II – bulk (600 t) - CEMT II – container (600 t) - CEMT IV – bulk (1,500 t) - CEMT Va – bulk (3,000 t) - CEMT Va – container (1,980 t)

Transport mode	Vehicle type	Reference vehicle
		- Pushed convoy – bulk (11,000 t)
Maritime transport	Passenger vessels	- Ferry/RoPax (660 passengers)
	Freight vessels	- Small container vessel (2,824 TEU) - Large container vessel (13,200 TEU) - Small bulk vessel (29,000 t) - Large bulk vessel (203,000 t)
Aviation	Short haul passenger aircrafts	- Bombardier CRJ900 - Embraer 170 (ERJ-170-100)
	Medium haul passenger aircraft	- Airbus A320–232 - Boeing 737–700
	Long haul passenger aircraft	- Airbus A340–300 - Boeing 777–300 ER

As mentioned in Section 1.2, in this study we also present the revenues from transport taxes and charges in 2016 in the various countries. These revenues have been presented for the aggregate vehicle categories as presented in Table 2.

Table 2 – Vehicle categories for which tax/charge revenues are presented

Road transport	Rail transport	IWT	Maritime transport	Aviation
- Passenger cars - Motorcycles - Busses - Coaches - Light Commercial Vehicles (LCVs) - Heavy Goods Vehicles (HGVs)	- High speed passenger trains (HSL) - Passenger trains electric - Passenger trains diesel - Freight trains electric - Freight trains diesel	- Inland vessels	- Freight vessels - Ferries	- Passenger aviation - Freight aviation

1.3.2 Geographical coverage

For road transport, rail transport and IWT we consider the transport taxes for all EU28 countries, Norway, Switzerland, Canada, US, and Japan. As transport taxes and charges in Canada and the United States are often regulated at the state level and hence states/provinces differ considerably in the taxes and charges they levy, taxes and charges are considered at the province/state level for Canada and the US. For Canada, the provinces British Columbia and Alberta are considered, while for the US transport taxes and charges applied in California and Missouri have been assessed[4].

[4] Both for the US and Canada, a front runner and laggard state/province with respect to the internalisation of external costs have been selected. For the US, California has been selected as a front runner state, among other things because fuel and vehicle taxes are among the highest in the US and broad enabling legislation for toll roads has been implemented. Furthermore, California is known for its progressive policies in the transport sector (e.g. regarding electric vehicles). Missouri, on the other hand, shows relatively low fuel and vehicle taxes as well as limited road charging legislation, suggesting a low level of internalisation. For that reason, Missouri is selected a laggard state. According to Corporate Knights (2015), British Columbia can be regarded as the Canadian province with the highest environmental performance for the transport sector, while Alberta is ranked lowest. Therefore, British Columbia (front-runner) and Alberta (laggard) has been selected as Canadian provinces in this study.

For maritime shipping and aviation, taxes and charges have not been assessed at the national/regional level, but at the level of individual (air)ports. The main reason to apply this scope is that (air)port charges may differ widely (with respect to structure and level) and that these differences can only be reflected by assessing them at the (air)port level. The selection of (air)ports considered in this study is given in Table 3. This selection is made based on the following criteria:

- Airports:
  1. Of all considered countries the largest airport is analysed.
  2. In Canada and the US, the two largest airports are included.
  3. In Europe, the five largest airports, which are not already included in the criteria above, are considered as well.
  4. Only international airports (with international flights) are covered in the analysis.
- Maritime ports:
  1. All 24 maritime ports considered in the study *'Assessment of potential of maritime and inland ports and inland waterways and of related policy measures, including industrial policy measures'* (EY, et al., ongoing) are covered. The maritime ports considered in this study provide a good representation of main EU ports with growth potential up to 2030.
  2. As not all countries were covered by the ports selected in Step 2, an additional set of ten ports was included to cover the main maritime ports for all European countries considered in this study.
  3. In order to provide a good representation of the main ferry/RoPax ports as well, an additional German port was added to the list.
  4. A sample of five overseas ports in the US, Canada and Japan have been selected.

Table 3 – Airports and maritime ports covered

Country	Airport(s)	Maritime port(s)	
		Freight ports	**Ferry/cruise ports**
Austria	- Wien – Schwechat		
Belgium	- Brussels	- Antwerp	-
Bulgaria	- Sofia	- Varna	-
Croatia	- Zagreb Pleso	- Rijeka[1] - Split	- Rijeka[1] - Split
Cyprus	- Larnaka	- Limassol	
Czech Republic	- Prague Ruzyne		
Denmark	- Copenhagen – Kastrup	- Arhus - Helsingør (Elsinore)	- Arhus - Helsingør (Elsinore)
Estonia	- Lennart Meri Tallinn	- Tallinn	- Tallinn
Finland	- Helsinki – Vantaa	- Helsinki	- Helsinki
France	- Paris – Charles de Gaulle - Paris – Orly	- Calais - Le Havre - Marseille	- Calais - Le Havre - Marseille
Germany	- Frankfurt - Munich	- Hamburg - Bremerhaven	- Hamburg - Travemünde
Greece	- Athens Eleftheriios Venizelos	- Piraeus	- Piraeus
Hungary	- Budapest Liszt Ferenc		
Ireland	- Dublin	- Dublin	- Dublin
Italy	- Roma – Fiumicino	- Genova - Trieste[1] - Venice[1]	- Genova - Trieste[1] - Venice[1]
Latvia	- Riga	- Riga	- Riga
Lithuania	- Vilnius	- Klaipeida	- Klaipeida

Country	Airport(s)	Maritime port(s)	
		Freight ports	Ferry/cruise ports
Luxembourg	- Luxembourg		
Malta	- Luga	- Marsaxxlokk	
Netherlands	- Amsterdam – Schiphol	- Rotterdam	- Rotterdam
Poland	- Warsaw Chopina	- Gdansk	- Gdansk
Portugal	- Lisboa	- Sines	
Romania	- Bucharest Henri Coandă	- Constanta	
Slovakia	- Bratislava M.R. Stefanik	-	
Slovenia	- Ljubljana Brink	- Koper[1]	- Koper[1]
Spain	- Barcelona – El Prat - Adolfo Suarez Madrid – Barajas - Palma de Mallorca	- Algeciras - Barcelona - Bilbao - Valencia	- Algeciras - Barcelona - Bilbao - Valencia
Sweden	- Stockholm – Arlanda	- Goteborg	- Goteborg
United Kingdom	- London – Heathrow - London – Gatwick	- Felixstowe	
Norway	- Oslo – Gardermoen	- Oslo	- Oslo
Switzerland	- Zurich		
Canada	- Toronto/Lester B Pearson Intl. Ont. - Vancouver International B.C.	- Vancouver - Montreal	- Vancouver - Montreal
United States	- Atlanta Hartsfield – Jackson International - Los Angeles International	- Los Angeles - Savannah	- Los Angeles
Japan	- Haneda Airport Tokyo	- Tokyo	- Tokyo

[1] The ports of Venice, Trieste, Koper and Rijeka are included under the North Adriatic Port Association (NAPA).

1.3.3 Transport performance

For some of the assessments carried out in this study (e.g. calculating average tax/charge revenues, allocating total revenues to various transport modes) several types of transport performance data (e.g. vehicle-kilometres, tonne-kilometres, passenger-kilometres) have been used. For the purpose of this study a set of transport performance data have been composed, mainly based on EU aggregated sources (like Eurostat and COPERT). For maritime transport and aviation, (air)port specific transport performance data (e.g. number of calls, LTOs) has been collected directly from port authorities and annual reports of the considered (air)ports.

Road transport performance data is taken from Eurostat, following the nationality principle, i.e. transport activity is allocated to countries where the vehicle is registered. In the alternative approach, the territorial principle, transport activity is allocated to the countries where the activity actually takes place. For example, kilometres driven by Polish vehicles in Germany are accounted to Poland if the nationality principle applies, and to Germany if the territorial principle applies. Some taxes follow the nationality principle (registration, circulation, accident insurance tax, etc.) whereas other follow the territorial approach (fuel taxes, road charges), so there is not a perfect solution. As a detailed EU-wide data set on road transport performance based on the territorial principle is not available, the official Eurostat data set based on the nationality principle has been used for this study. This affects the results of this study and in some cases hampers some of the assessments to be carried out in this study. In the latter cases alternative approaches have been applied, as explained in more detail in Sections 3.3.4 and 3.4.2.

1.3.4 Existing and planned taxes and charges

In this study, we focus on the transport taxes and charges that have been in place in 2016. For these taxes and charges we discuss in detail their structure and level, as well as the revenues they raised. Additionally, we briefly identify the main taxes and charges that are planned to be implemented in the coming years in the EU28. For the planned instruments, no discussion on structure and charge levels is provided, as these kind of information is often not available.

1.3.5 Transport subsidies

In this study we do not consider transport subsidies and public service obligations (PSO), with the exception of tax/charge breaks or exemptions. The latter are implicitly addressed when assessing taxes and charges. Other subsidies are not considered, as data availability on subsidies is rather poor. Only a few, incomplete and older studies have been done on this subject at the European level (e.g. (CE Delft, 2017; Ecologic; CE Delft; TU Dresden, 2006; Ecologic, 2005)). Collecting data on all transport subsidies applied in Europe has therefore been out of the scope of this study (also because a large number of subsidy and PSO schemes exist, both at the national and regional/local level).

1.3.6 Base year

The results of this study are presented for the year 2016. For some taxes and charges, only information for 2017 was available. However, as the differences between 2016 and 2017 are in general small, this does not significantly affect the results of the study. As for tax/charge revenue, data for 2016 (or 2017) was not always available. In these cases data for earlier years were used as proxy.

1.3.7 Price level

All financial figures are expressed in Euro price levels of 2016. Data from sources where price levels from other years were used, are translated into constant prices of the year 2016 by using relevant price index figures (from Eurostat). Furthermore, all financial figures are adjusted for differences in purchase power between countries (by using Purchasing Power Standards (PPS) from Eurostat), in order to allow for direct comparisons between counties. This implies that all financial figures are shown for the EU28 average price level. In Annex D, all total tax/revenues not adjusted for PPS are presented as well.

1.4 Outline of the study

In Chapter 2, we present an overview of the general methodology used to assess the taxes and charges for the various modes. Using this methodology, the transport taxes and charges are assessed in Chapters 3 (road transport), Chapter 4 (rail transport), Chapter 5 (IWT), Chapter 6 (maritime transport), and Chapter 7 (aviation).

This deliverable presents the main findings from the assessment of transport taxes and charges. A complete overview of the data collected on tax/charge structures, levels and revenues can be found in the Excel database accompanying this report.

2 Methodological overview

2.1 Introduction

In this chapter we present an overview of the general methodology used to assess transport taxes and charges in the EU28 Member States and some other Western countries. Mode-specific methodological issues are discussed in the relevant chapters per mode (Chapters 3 to 7). We start this chapter by presenting the definitions of transport taxes and charges (see Section 2.2). Next, we briefly discuss the approaches that have been used to collect data on transport taxes and charges as well as the main methodologies to assess these data. Finally, in Section 2.4 the main uncertainties in the data and methodology and their implications for the reliability of the results of this study are discussed.

2.2 Defining transport taxes and charges

Although taxes and charges are often used interchangeably, they are different concepts. Taxes are compulsory, unrequited payments to the general government (Eurostat, 2001). They are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments. The revenue of taxes normally goes to the general budget or is earmarked for specific purposes (Määttä, 2006). Charges, on the other hand, are compulsory, requited payments to either general government or to (semi-)private bodies (Eurostat, 2001). In other words, they can be seen as payments for a service delivered by the government or (semi-)private body. Finally, the term levy is often used to cover all kinds of compulsory payments, referring to both taxes and charges.

In this study, we consider a specific subset of taxes and charges, i.e. transport taxes and charges. In line with CE Delft et al. (2017) we define transport taxes as all taxes that are directly related to the ownership and use of transport vehicles, including the taxes related to infrastructure use. This definition excludes general taxes like profit taxes and wage taxes (e.g. for truck drivers), as they are only indirectly related to transport activities. As for transport charges, all compulsory (non-administrative) payments to governments and infrastructure operators (e.g. road and rail authorities, ports, airports, etc.) are considered. Payments for transport services delivered by other semi-private agents are considered internal costs of transport and hence are not taken into account.

As mentioned above, general taxes are excluded from the assessments in this study. This implies that company car taxation is not included in this study, as this is regarded as income tax and not as transport tax (i.e. company car taxation is a type of income taxation as it taxes the benefit in kind that is attributed to company cars). Additionally, VAT on vehicle and fuel purchased are not considered transport taxes. This is in line with Eurostat (2001), which excluded VAT from the concept of environmental/transport taxes. However, as stated by Steinbach et al. (2009), there is one exception where VAT should be included. In cases where VAT is levied on a tax/charge that is considered a transport tax/charge, VAT should be included in the concept of transport taxes/charges. For example, VAT levied on fuel excise duties is considered a transport tax in this study, while VAT on the production costs of fuel is not.

In this study we categorize transport taxes and charges in two ways:
- Energy, vehicle or infrastructure tax/charge, depending on the charge basis applied (the vehicle considered, the use of energy or the use of infrastructure).
- Fixed or variable taxes/charges, depending on the extent by which the level of taxes/charges depend on actual transport movements. For example, purchase taxes for passenger cars can be considered fixed, as its level does not depend on the extent by which the car is used. On the other

hand, fuel taxes are directly related to the use of the vehicle and hence can be considered as variable.

This categorisation of transport taxes and charges may help in presenting the aggregate results found for the various countries. Furthermore, it may support the comparison of taxes and charges with external and infrastructure costs. For example, marginal external and infrastructure costs should be compared with variable taxes and charges only , while total external and infrastructure costs should be compared with both fixed and variable taxes and charges (in order to have the same scope for costs and taxes/charges).

2.3 Data collection and assessment

To provide a complete and consistent set of data on transport taxes and charges, a four step approach have been applied:

1. *Data collection from international aggregated sources*
   The collection of data has been started by assessing international aggregated sources, including the ACEA Tax Guide, Eurostat, OECD database on environmental taxes, Taxes in Europe database, etc. Although these sources do provide relevant data for this study, data gaps remain (both on tax/charge structure and levels as well as on tax/charge revenues).

2. *Data collection from national sources*
   In addition to the data collection from international aggregated sources, data on transport taxes and charges have been collected from national sources as well. For that purpose, national statistical agencies, Ministries of Finance and Transport and transport infrastructure managers have been contacted. The data collected in this way have been used to complement and cross-check the data collected from the international aggregated sources.

3. *Estimating missing data*
   Although most of the data has been collected in Step 1 and 2, for some countries/modes data on tax/charge revenues was not available. In a few cases no information was available on the structure and/or level of specific taxes or charges (e.g. information on port charges was not available for some privately operated maritime ports). These cases are indicated as N/A in this report and in the Excel Database.

For some taxes/charges data on total revenue and/or revenue per vehicle category was missing. Where possible these data have been estimated by using different approaches:

- Total tax/charge revenue in 2016; in general two approaches have been used to estimate this revenue:
  - Data on total tax/charge revenue for earlier years (e.g. 2015 or 2014) were used as proxy for the 2016 revenue. If necessary, corrections were made e.g. for changes in number of vehicles or amount of fuel sold.
  - If the former approach was not feasible, a bottom-up approach was used to estimate the total tax/charge revenue. For example, total revenue of fuel taxes can be estimated by multiplying the amount of fuel sold with the fuel tax rate.

    The methods used to estimate any missing data are discussed in more detail in Annex B.

- Revenue per vehicle category; for some of the transport modes, the total tax/charge revenue have to be allocated to various vehicle categories. For example, for road transport the total fuel tax revenue have to be allocated to passenger cars, motorcycles, busses, coaches, LCVs and HGVs. These disaggregated data is often not available and had to be estimated. For this purpose specific allocation keys have been defined, which reflect the contribution the various vehicle categories have in the total revenue. An overview of the allocation keys used is given in Annex B.

Finally, data on the extent by which tax/charge revenues are earmarked for expenditures on transport infrastructure (or mitigation measures for external costs of transport) is not always available.
These cases are clearly reported in this study and the Excel Database.

4. *Compiling a complete and consistent dataset per mode per country*
   Based on the data collected/estimated in Step 1 to 3 an (almost) complete and consistent dataset is composed. Therefore, all data have been transferred in Euro values and the same price level in order to make them comparable. Additionally, PPS adjustments have been carried out.
   Finally, relevant crosschecks have been carried out to verify the data quality. Finally, all data have been put in the Excel Database accompanying this report (see Annex F for more details).

2.4 Robustness of results

This study provides an overview of the structure and level of transport taxes and charges applied in the EU28 and some other (non-European) countries. This overview is based on actual data collected from reliable sources like the ACEA Tax guide, documents of the national Tax authorities, documents/websites of infrastructure managers, etc. Therefore, the data on the structure and level of transport taxes/charges presented in this study can be considered robust.

In addition to the tax/charge structure and levels, this study also discusses the total/average revenues from transport taxes and charges. The main uncertainties with respect to these results are:
- For some taxes/charges (or countries), the total revenues in 2016 have been estimated, using data for earlier years or a bottom-up approach (see Section 2.3).
- The allocation of total tax/charge revenues to various vehicle categories has often been estimated (see Section 2.3), resulting in a certain extent of uncertainty in the final results.
- To estimate the average revenues (e.g. in €/1,000 passenger-kilometre or €/1,000 tonne-kilometre), transport performance data have been used. These data have been based on reliable sources (see Section 1.3.3), but inconsistencies between sources and missing data cause some biases in these results as well. An important bias with respect to input data is related to the transport performance data used for road transport. As explained in Section 1.3.3, in this project we use road transport performance data from Eurostat, which is reported on the basis of the nationality principle. However, the scope of these data differs from the scope of some of the taxes and charges applied for road transport (e.g. fuel taxes, road tolls, vignettes) as these are more in line with the territoriality principle. These differences in scope may seriously affect some of the assessments that we wants to carry out in this study, particularly for lorries (e.g. calculation of average revenues from taxes/charges in tonne-kilometre) and in some cases we even had to apply alternative, second-best approaches. This is explained in more detail in Sections 3.3.4 and 3.4.2. As a consequence, the results for road transport, as found by this study, are not always comparable to the results found by previous studies (e.g. (CE Delft, 2016)).

3 Road transport

3.1 Introduction

This chapter discusses the taxes and charges levied on road transport in the various countries. In Section 3.2, first an overview of the taxes and charges addressed in this chapter is given. The structure and level of the road taxes and charges is discussed in detail in Section 3.3. The revenue of road taxes and charges in the various countries in 2016 is presented in Section 3.4. The extent by which these revenues are earmarked for road infrastructure expenditures is discussed in this section as well. Finally, the revenue of road taxes and charges that can be allocated to motorways are presented in Annex D.

3.2 Overview of road taxes and charges

An overview of the road taxes and charges considered in this study is presented in Table 4. For each tax/charge it is indicated whether it can be categorised as energy, vehicle or infrastructure tax/charge and whether it should be considered a fixed or variable tax/charge.

Table 4 – Overview of road transport taxes and charges

Tax/charge	Description	Energy, vehicle or infrastructure tax/charge	Fixed or variable tax/charge
Taxes			
Fuel taxes	Consumption tax on transport fuel (including carbon/CO_2 taxes where relevant).	Energy	Variable
Electricity tax	Consumption tax on electricity charged for vehicles (including carbon/CO_2 taxes where relevant).	Energy	Variable
Vehicle purchase or registration tax[1]	One-off tax on the purchase or registration tax of a new vehicle.	Vehicle	Fixed
Vehicle ownership or circulation tax	Periodic (e.g. annual) tax on the ownership of a vehicle.	Vehicle	Fixed
Insurance tax	Indirect tax levied on general insurance premiums. For this study the tax on motor third party liability (MTPL) premiums and vehicle damage premiums is considered.	Vehicle	Fixed
VAT on transport taxes/charges	Indirect tax levied on taxes/charges levied on road transport (e.g. fuel tax). This tax is only relevant for private passenger transport, as VAT can be reclaimed by companies.	Energy, vehicle or infrastructure	Fixed/variable
Charges			
Distance-based road charges (tolls)	Charge for the passage along the road network.	Infrastructure	Variable
Time-based road charges (vignettes)	Charge for access to road network for a specific period.	Infrastructure	Variable
Tolls on specific parts of the network (e.g. tunnels, bridges)	Charge for passing a specific part of the road network.	Infrastructure	Variable
Urban road pricing schemes	Charge for using urban roads.	Infrastructure	Variable
ETS	CO_2 emissions of electricity production (used by electric vehicles) are covered by the EU Emission Trading schemes.	Energy	Variable

[1] In some countries, fees are charged to cover the administration costs of registering a vehicle. These charges are not considered in this study.

As is shown in Table 4, this study considers insurance taxes as a transport tax. However, it can be argued whether insurance taxes should be considered a specific transport tax. As insurance taxes are applied on all insurance premiums, it affects all economic sectors. Therefore, insurance taxes may be considered a general tax (like VAT, see Section 2.2), which does not affect relative prices on the transport market. However, insurance taxes can also be seen as a mark-up on the insurance premiums and hence as a direct internalisation measure of (external) accident costs. Given this close relationship of insurance taxes with accident costs, we take the revenue from insurance taxes into account in this study. This is in line with the approach applied in CE Delft et al. (2012).

Parking charges are not considered in this study, as the data availability on this issue is very fragmented (CE Delft, 2016). However, based on a case-study approach several studies (e.g. (Ecorys and CE Delft, 2012; Litman, 2018)) conclude that parking charges may effectively contribute to the reduction of external costs of vehicles in specific areas (i.e. mainly the charging area). Parking charges may also significantly contribute to the total revenue of transport taxes and charges. CE Delft (2016) finds that in The Netherlands, parking charges for public parking places contribute about 4% of the total road transport tax/charge revenue in 2013. In the UK, this contribution was about 2.5%.

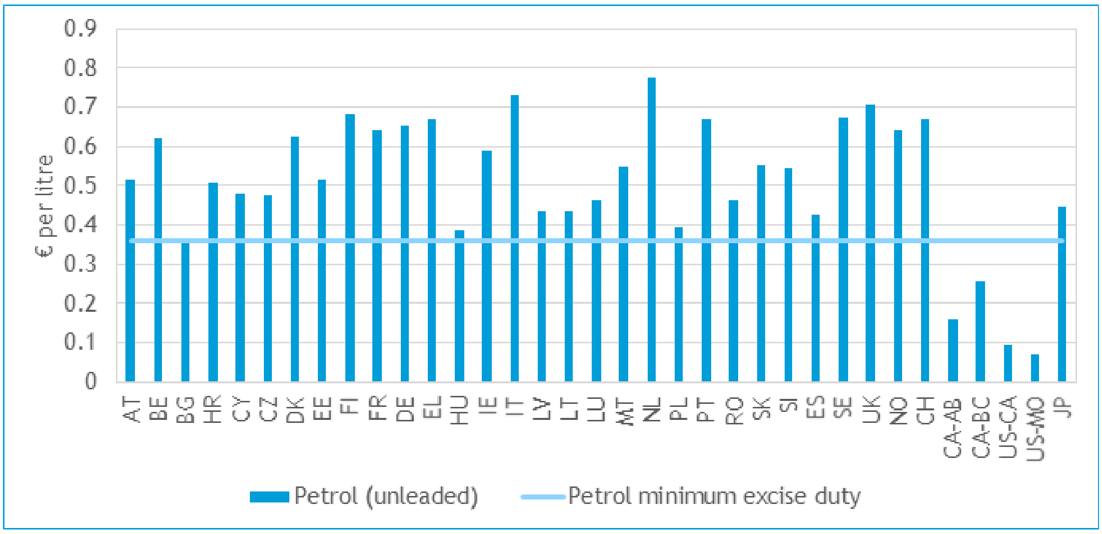
3.3 Detailed assessment of road taxes and charges

3.3.1 Fuel and electricity taxes

Fuel taxes, the bulk of which are formed by excise duties, are levied in all countries. In some countries (i.e. Denmark, Finland, France, Ireland, Luxembourg, Portugal, Slovenia, Sweden) specific carbon or CO_2 are applied for road transport as part of the fuel excise duties and electricity taxes. In this report, these carbon/CO_2 taxes are all considered as part of the fuel excise duties and are not discussed separately.

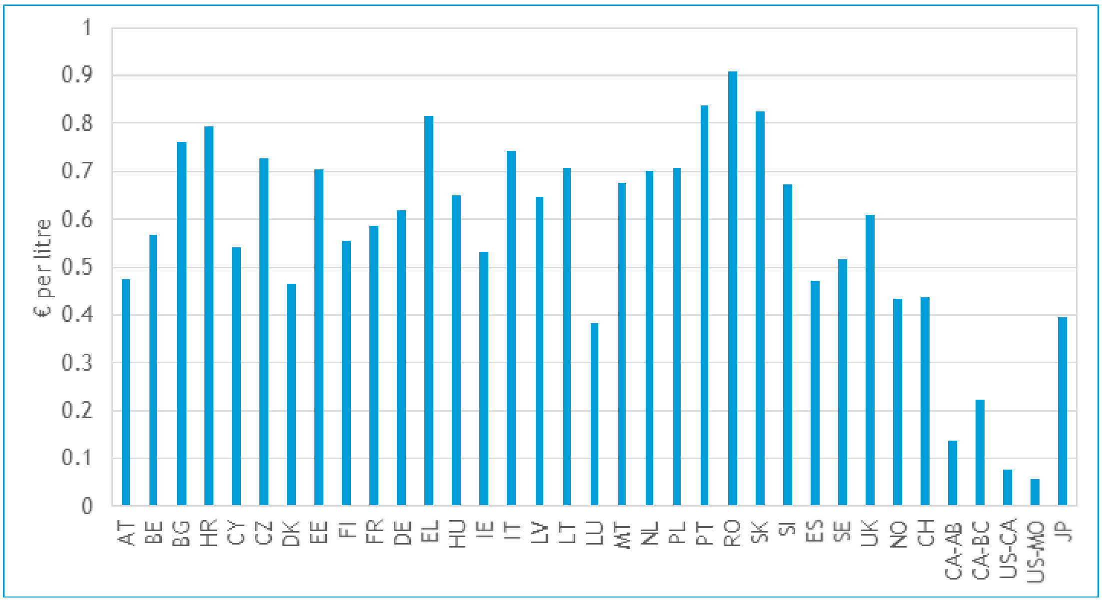
The tax rates applied for petrol in 2016 (not PPS corrected) are shown in Figure 1. The tax levels are equal to (in Bulgaria and Poland) or above (in the other countries) the minimum level set in Directive 2003/96/EC in all European countries. However, still there are significant differences in the tax rates applied. The highest tax rates are applied in The Netherlands with € 0.78 per litre, while the lowest tax level is levied in Poland and Bulgaria with € 0.36 per litre. The fuel taxation of petrol in the Canadian and US provinces/states is considerably less than in Europe. Not one of the four North American regions has petrol taxation higher than € 0.2 per litre. In Japan, the petrol tax levels are well beyond the European minimum levels.

Figure 1 – Petrol tax levels in 2016 (not PPS corrected) compared to the European minimum excise duty levels



Correcting the petrol tax levels for PPS results in considerably different figures, as is shown in Figure 2. After correction for differences in purchase power, the highest tax levels on petrol exist in Greece, Malta, Portugal, Romania and Slovakia. The lowest tax levels (after PPS correction) on petrol exist in Denmark, Luxembourg and Spain.

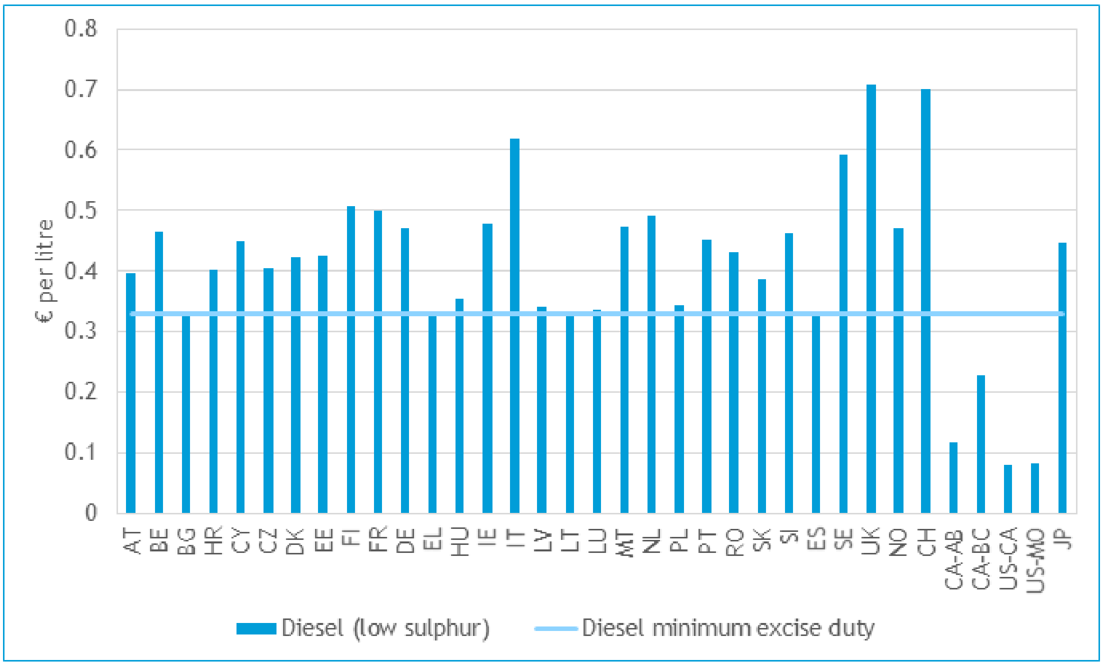
Figure 2 – Petrol tax levels in 2016 (PPS corrected)



The fuel tax levels for diesel applied in 2016 (not PPS corrected) are presented in Figure 3. In general, diesel taxation is lower than petrol taxation in Europe, although in all countries the minimum levels set by Directive 2003/96/EC are met. Exceptions are the UK and Switzerland. In the UK, diesel and petrol excise duties per litre are equal, while in Switzerland diesel tax levels are slightly higher than the tax levels for petrol. Diesel excise duties in these two countries are also highest in Europe (about

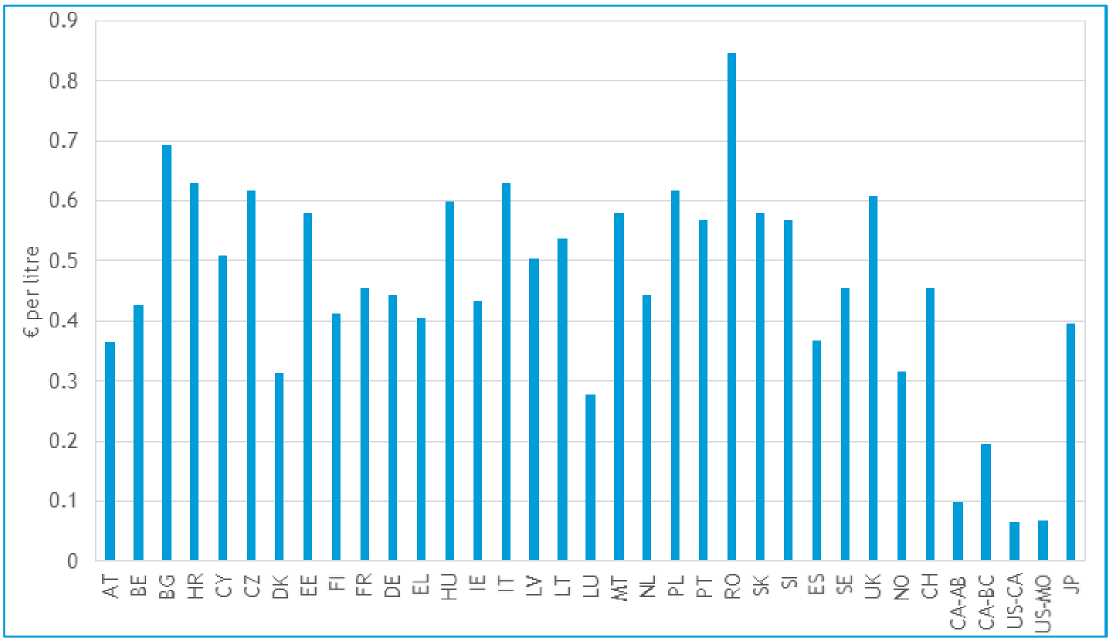
€ 0.7 per litre) and are more than twice as high as in countries like Bulgaria, Lithuania and Spain (€ 0.33 per litre). The diesel tax rates in the US states and Canadian provinces are (with the exception of California) slightly higher than the petrol tax rates, but still considerably lower than in Europe. In Japan, the fuel tax levels for diesel and petrol are equal.

Figure 3 – Diesel tax levels in 2016 (not PPS corrected) compared to the European minimum excise duty levels



As for petrol, the fuel tax levels for diesel change considerably when corrected for differences in purchase power between countries. After applying this correction, the highest tax levels are found for countries like Romania, Bulgaria, Italy, Croatia and Czech Republic, indicating that in relative terms diesel in these countries is heavily taxed (see Figure 4). The lowest tax levels (after PPS correction) for diesel exist in Denmark and Luxembourg.

Figure 4 – Diesel tax levels in 2016 (PPS corrected)

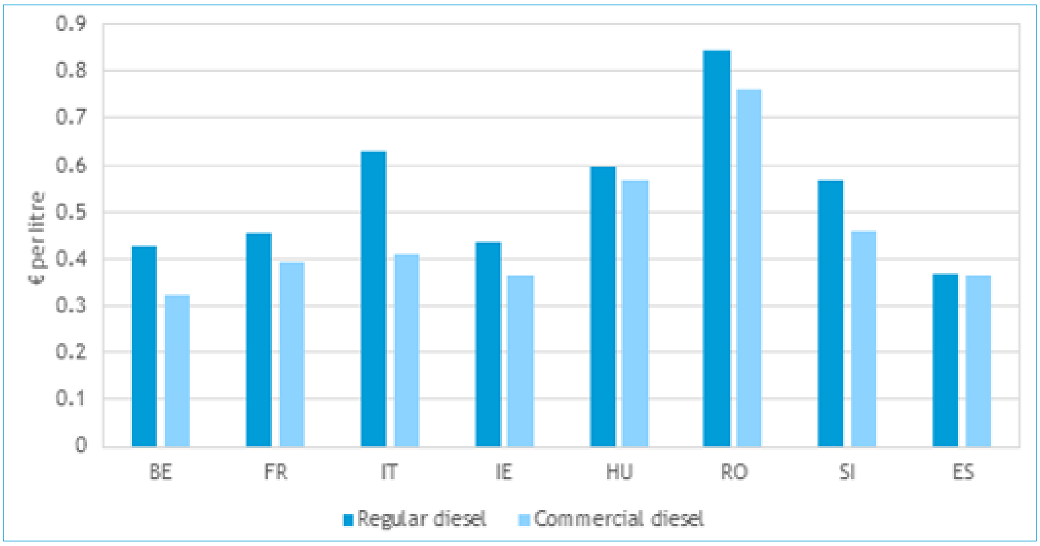


In some EU countries a refund scheme for part of the excise duty exist for diesel that is used for commercial purposes (i.e. HGVs), which implicitly results in lower (net) diesel taxes as is shown in Figure 5. This is the case in Belgium, France, Hungary, Ireland, Italy, Romania, Slovenia, and Spain[5]. In all these countries, the lower levels for commercially used diesel do meet the minimum levels set by Directive 2003/96/EC (European Council, 2003)[6]. The largest difference in excise duties on commercial and regular diesel is found for Italy, while in Spain the difference is only very small.

5 According to CE Delft et al. (2012), six of these eight countries did apply commercial diesel excise duty rates in 2011 as well. Only in Ireland and Romania the lower tax levels for commercial diesel are introduced since then.

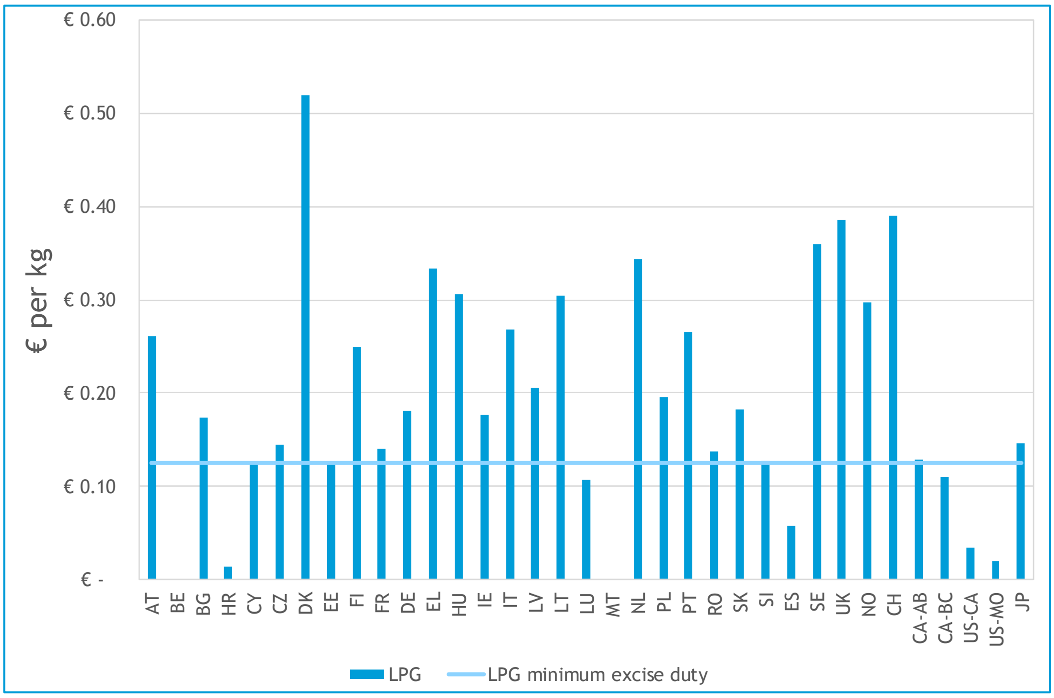
6 Actually, Directive 2003/96/EC (European Council, 2003) allows Member States to differentiate between commercial and non-commercial use of diesel used as propellant, provided that the Community minimum levels are met. Furthermore, the rate for commercial diesel is not allowed to fall below the national level of taxation in force on 1 January 2003.

Figure 5 – Differentiated tax levels for regular and commercial use of diesel in several EU countries (PPS corrected)



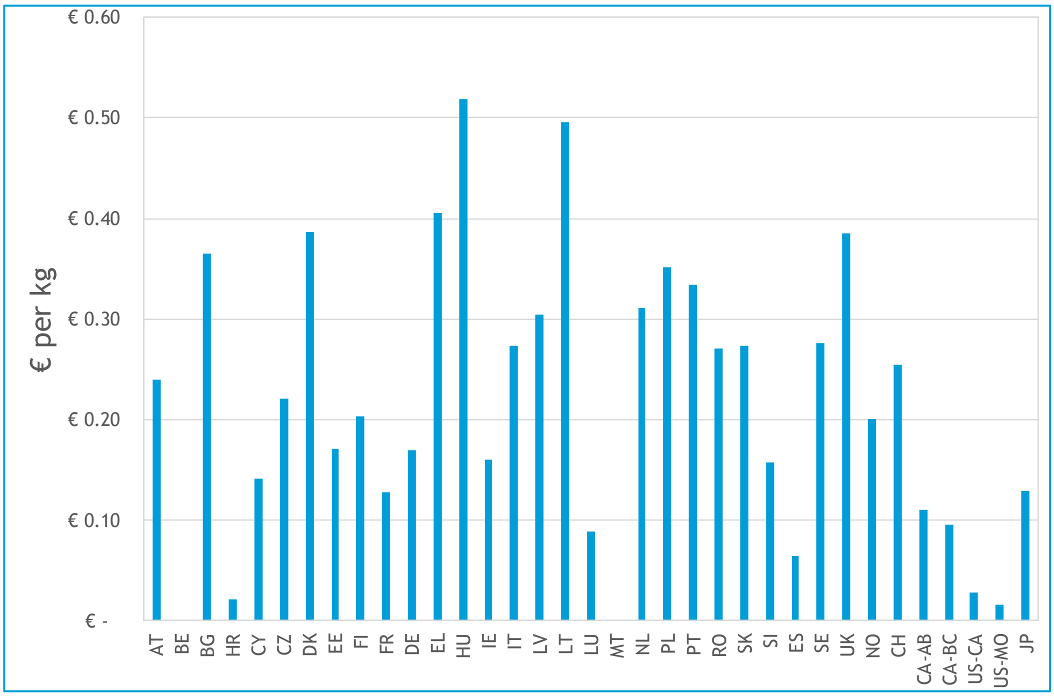
The fuel tax levels for LPG applied in 2016 are presented in Figure 6. Croatia, Luxembourg and Spain have tax levels below the minimum levels set by Directive 2003/96/EC, in line with the reduced rates allowed by the Directive. LPG is not used as propellant in Malta while Belgium does not levy a fuel tax on LPG used as a propellant at all (also in line with the exemptions allowed by Directive 2003/96/EC). The highest tax levels are in found in countries like Denmark (€ 0.52/kg), Sweden (€ 0.36/kg), Switzerland (€ 0.39/kg) and the United Kingdom (€ 0.39/kg). As for the non-EU countries, the LPG tax levels in the Canadian states are comparable with the European minimum level, while the tax levels in the US states are considerably below this minimum level. Finally, the LPG tax level of Japan is slightly above the European minimum tax level.

Figure 6 – Excise duties LPG levels in 2016 (not PPS corrected) compared to the European minimum excise duty levels



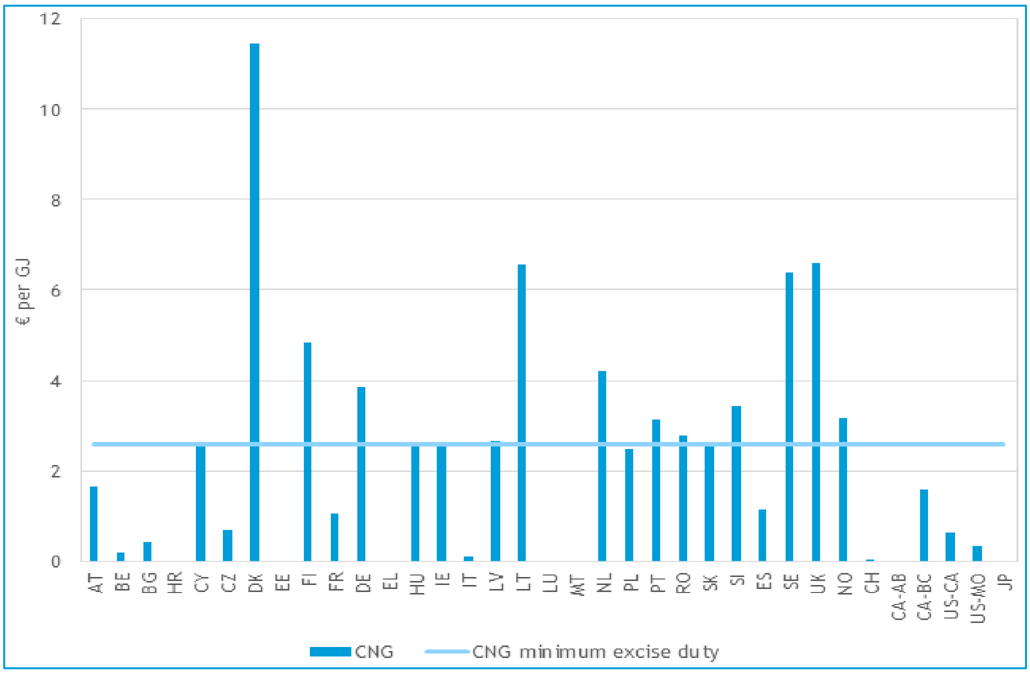
The LPG tax levels change considerably after correcting for differences in purchasing power as is shown in Figure 7. The highest tax rate on LPG after PPS correction exist in Greece (€ 0.51/kg) and Lithuania (€ 0.49/kg). The countries with the lowest LPG tax rates (after PPS correction) are: Belgium (exemption), Croatia (€ 0.02/kg), Luxembourg (€ 0.09/kg) and Spain € 0.06/kg).

Figure 7 – Excise duties LPG in 2016 (PPS corrected)



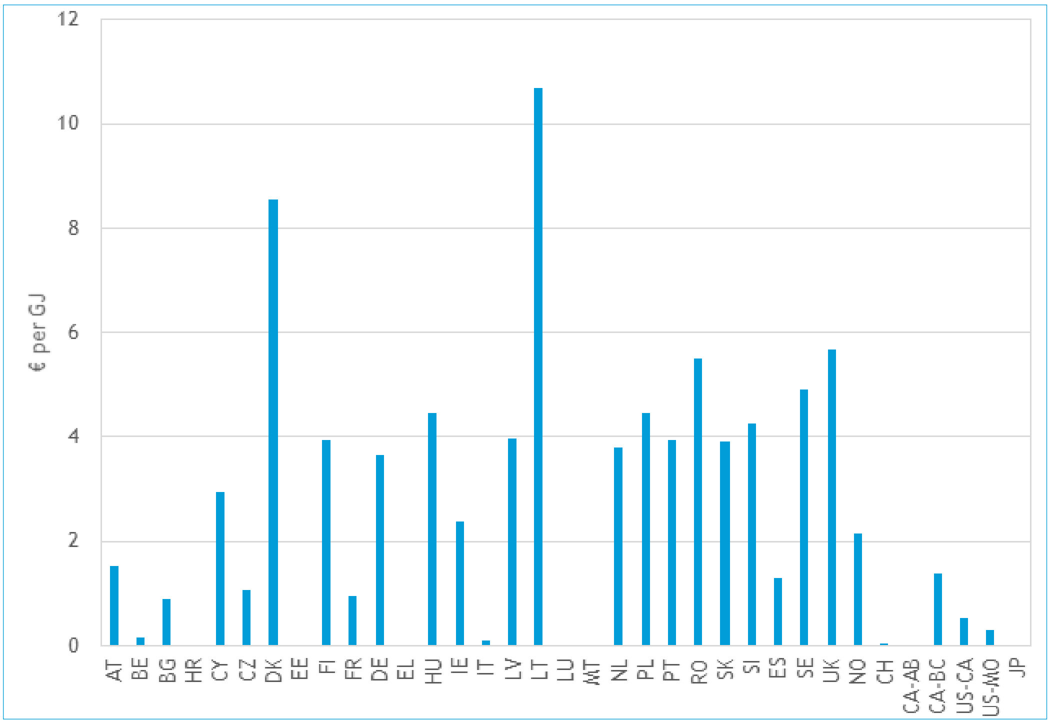
The fuel tax levels (not PPS corrected) for CNG used as a propellant are shown in Figure 8. Tax rates differ substantially between countries. Several countries have tax levels below the European minimum level (in line with the reduced rates and exemptions allowed by Directive 2003/96/EC). On the other hand, the tax level in Denmark (€ 8.5/GJ) far exceeds the European minimum level. Croatia, Greece, and Luxembourg exempt CNG used as a propellant from fuel taxes, while in Estonia and Malta no taxes are applicable for CNG used as a propellant. The lowest tax levels are found in Belgium (€ 0.18/GJ), Italy (€ 0.09/GJ) and Switzerland (€ 0.01/GJ). The tax levels in the countries outside Europe are all below the European minimum level.

Figure 8 – CNG tax levels in 2016 (not PPS corrected) compared to the European minimum excise duty levels



The PPS corrected fuel tax levels for CNG used as propellant in 2016 are presented in Figure 9.

Figure 9 – CNG tax levels in 2016 (PPS corrected)



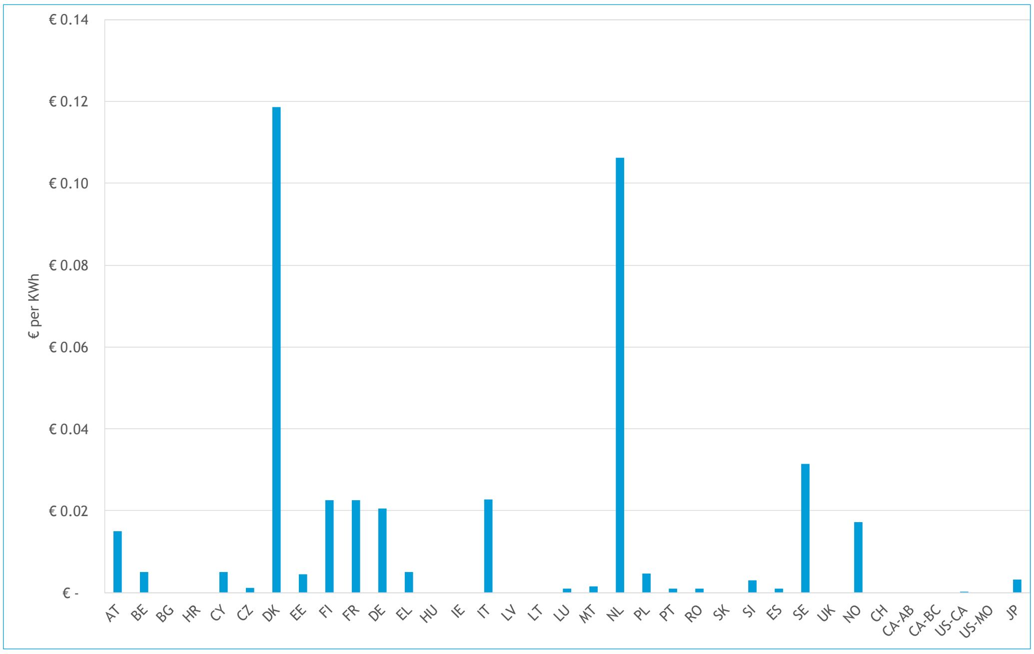
Information on the way biofuels are treated with respect to fuel taxes in the EU is rather fragmented and hence we were not able to provide a complete overview for all EU Member States. Our assessments showed, however, that in several EU countries reduced excise duties are applied to biofuels or to the biofuel share blended with fossil fuels. For petrol, reduced rates are, for example, applied in Austria, Denmark, Finland, France, Hungary, Ireland, Latvia, Slovakia, Sweden, Switzerland and Japan. For example, in France petrol taxes are reduced from € 0.64 per litre to € 0.62 per litre for petrol that contains 10% biofuel. European countries that differentiate fuel taxes on diesel according to its biofuel content include the Czech Republic, Denmark, Finland, Ireland, Malta, Slovakia, Sweden and Switzerland. For example in the Czech Republic diesel taxation is reduced from € 0.40 per litre to € 0.34 per litre when the biofuel content is at least 30%. Finally, there are also countries that do not incentivize biofuels via fuel tax exemptions or reductions, including Bulgaria, Cyprus, Estonia, Slovenia and Spain.

Finally, the electricity tax levels relevant for transport purposes are shown in Figure 10. The electricity tax levels displayed apply for households (non-business use)[7]. The majority of countries in the EU28 apply electricity taxes. The only exception is the United Kingdom. As shown in Figure 10, there are large differences in electricity tax level between the different countries. Tax levels are highest in Denmark (about € 0.12 per KWh) and the Netherlands (about € 0.11 per KWh), although reduced rates apply for business use of electricity (see Figure 12). Furthermore, the electricity tax rates in Italy and the Netherlands decrease stepwise when certain volumes of electricity are consumed. As a result actual electricity tax rates in these countries are lower for heavy users of electricity.

[7] In many European countries, electricity tax levels are differentiated to business and non-business use and in some countries (e.g. The Netherlands, Italy) these tax rates are differentiated to the level of consumption as well. Furthermore, some countries (e.g. The Netherlands) apply specific tax levels for electricity at public charging stations. Therefore, the relevant electricity tax level depend s on the location where the electric vehicle is charged. In this study, we assume that electric vehicles are charged at home, such that the tax levels relevant for households (i.e. non-business use) are relevant.

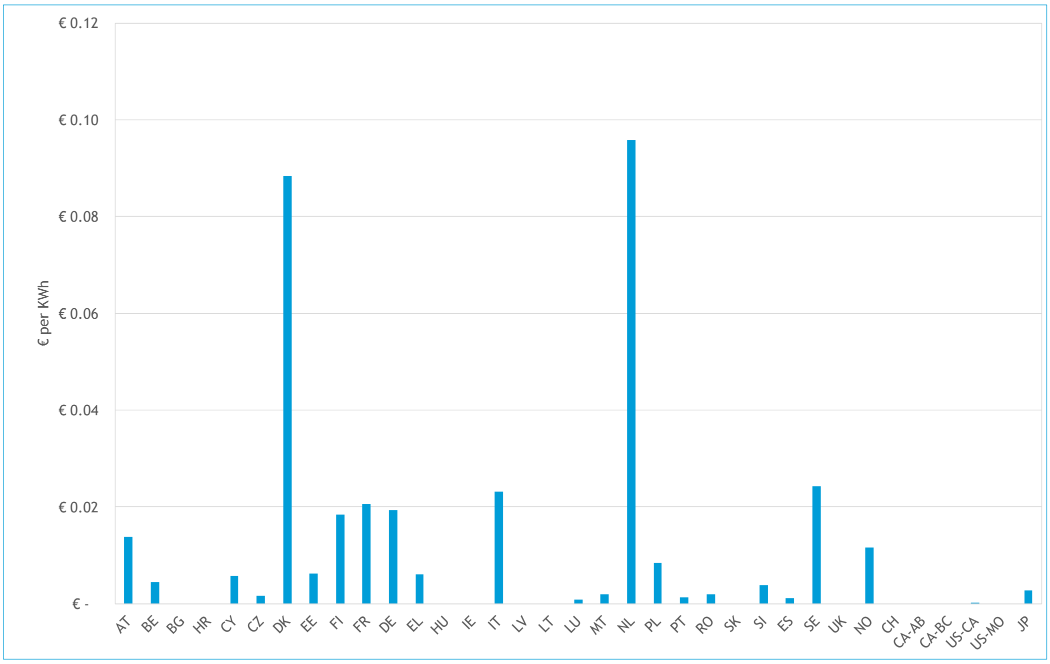
As for the countries outside the EU28, Switzerland, the Canadian provinces Alberta and British Columbia and the US state Missouri do not levy an electricity tax. In the US state California an electricity tax applies of 3.5% of the electricity price Japan levies an electricity tax of € 0.00-275 per KWh.

Figure 10 – Electricity tax levels for non-business use (households) in 2016 (No PPS correction)



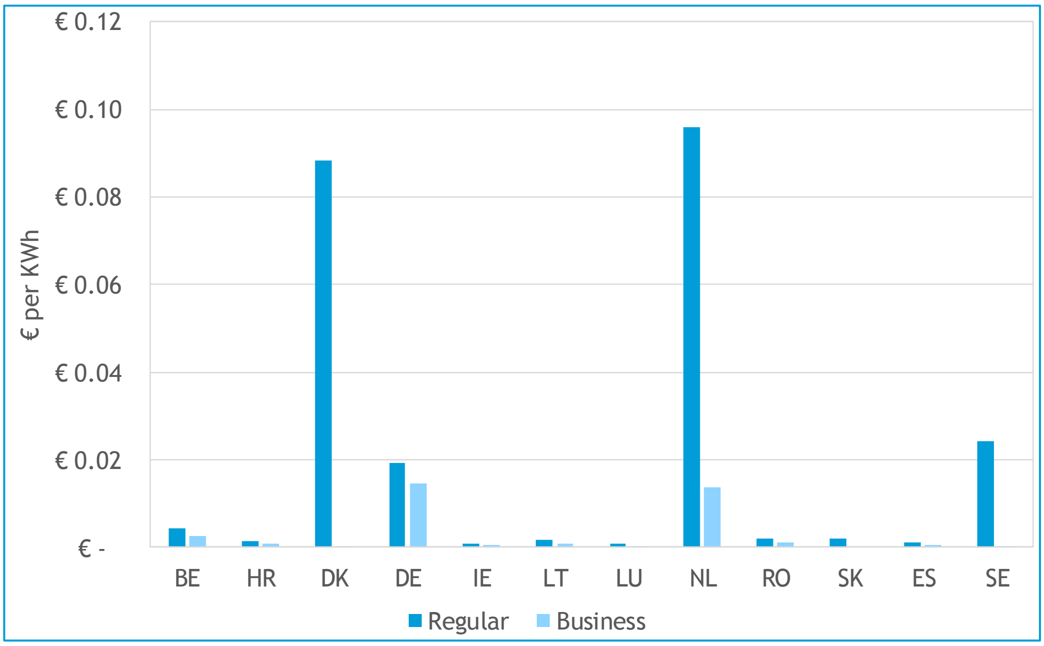
The PPS corrected electricity tax levels (for non-business use) for the various countries are presented in Figure 11. The tax levels after PPS correction are still the highest in The Netherlands (€ 0.10 per kWh) and Denmark (€ 0.09 per kWh).

Figure 11 – Electricity tax levels for non-business use (households) in 2016 (PPS corrected)



As mentioned above, electricity tax levels are differentiated to business use and non-business use in various EU countries (see Figure 12). In Slovakia business use of electricity is fully exempted from electricity taxes, while the tax levels after PPS correction in Denmark (€ 0.0004 per KWh), the Netherlands (€ 0.013 per KWh) and Sweden (€ 0.0004 per KWh) are significantly lower for business use than for non-business use.

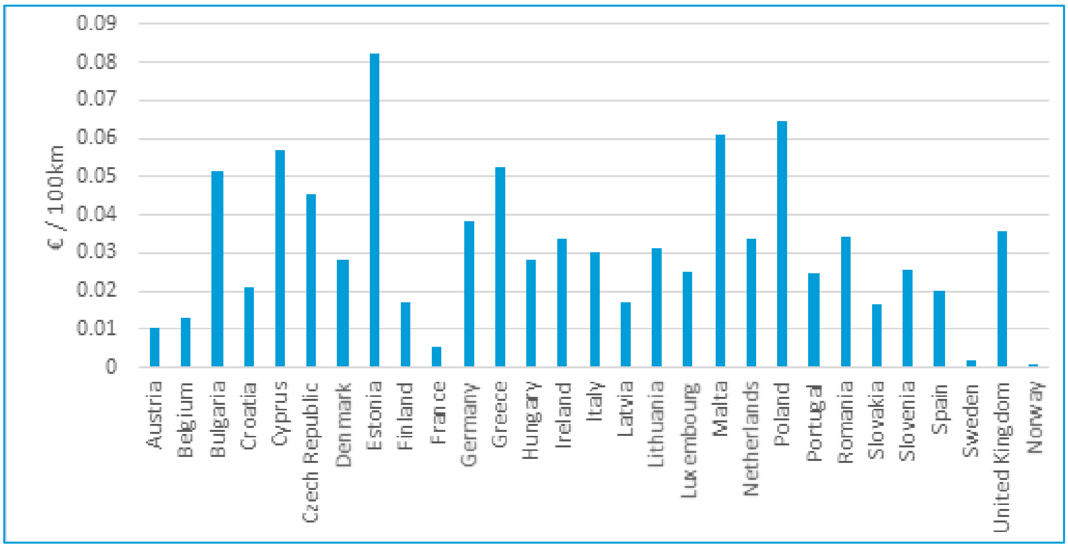
Figure 12 – Differentiated tax levels for regular and business electricity tax rates (PPS corrected)



Note: The tax rates displayed for Netherlands applies for average business consumption levels.

ETS (European emission system) charges are included in the electricity price which is paid by users of electric vehicles. ETS charges are therefore an indirect tax for electrified road transport. The charge level differs in each country depending on the average CO_2 emissions of electricity production.
The results for passenger cars are shown in Figure 13. In France, Sweden and Norway electricity with low carbon intensity (e.g. nuclear or hydropower) is consumed and as a result ETS charges are the lowest in these countries. ETS charges for electric passenger cars are highest in Estonia, Malta and Poland due to carbon intensive production of electricity in these countries.

Figure 13 – ETS costs for reference electric passenger car in 2016



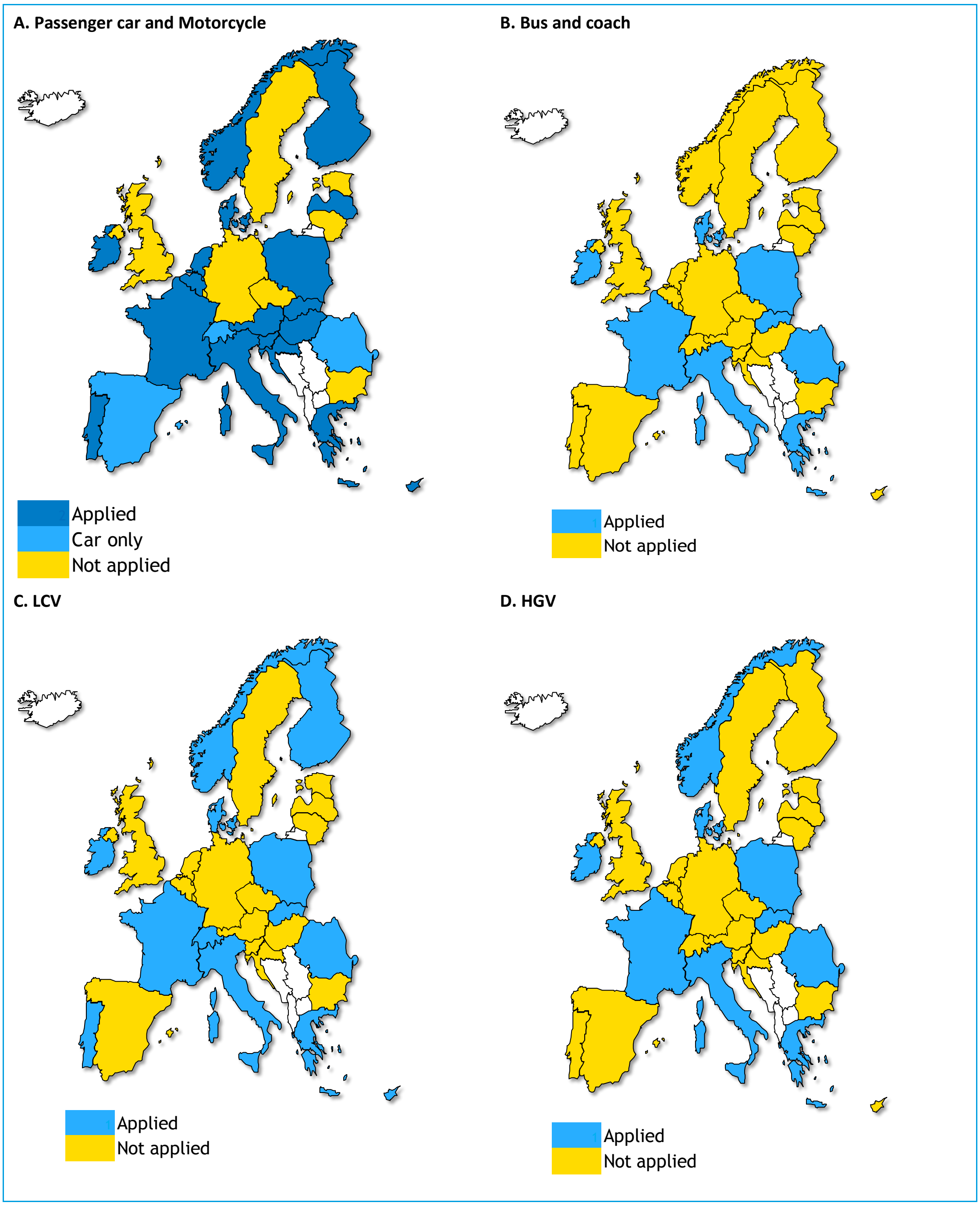
3.3.2 Purchase/registration taxes

Taxation of the purchase or registration of a vehicle is applied on a broad scale in Europe, although there are large differences between vehicle categories (see Figure 14). In most countries purchase/registration taxes apply only to the first registration of vehicles in that country. In Belgium, France, Hungary, and Italy, (certain) second hand vehicles are included as well.

The purchase or registration of passenger cars and motorcycles is taxed in most European countries. In Bulgaria, Czech Republic, Estonia, Germany, Lithuania, Luxembourg, Sweden and the United Kingdom no purchase tax on passenger cars is levied. In these countries also motorcycles are excluded from a purchase/registration tax, which is also the case in Romania and Switzerland. On light commercial vehicles a purchase/registration tax is levied in a significant number of European countries as well, although in considerably fewer cases than for passenger cars. Only a minority of countries apply purchase/ registration taxes for heavy vehicles (buses, coaches and HGVs). This tax is, for example, applied for heavy vehicles in France, Ireland, Italy, Poland, Romania , and Greece. Also Denmark applies registration taxes for busses and HGVs. However, only HGVs up to 4,000 kg are considered, such that in practice most HGVs are exempted from purchase taxes in Denmark.

In the US states California and Missouri and the Canadian province British Columbia, purchase/ registration taxes are applied for all vehicle categories. In Alberta, on the other hand, none of the vehicle categories is charged with this tax. Finally, in Japan only motorcycles are exempted from purchase/registration taxes. For all other vehicle categories this tax is applied.

Figure 14 – Purchase taxes in the EU in 2016

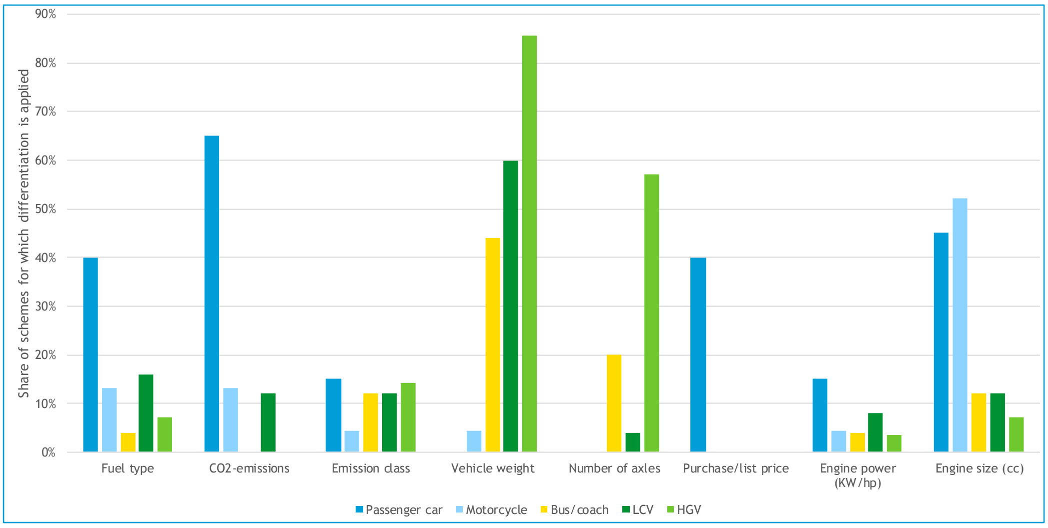


Differentiations applied

The purchase/registration taxes levied in Europe are based on several parameters. The main parameters applied in the EU28 are shown in Figure 15. Notice, that multiple differentiation parameters can be used within a scheme and hence the scores for all the parameters together may be more than 100%.

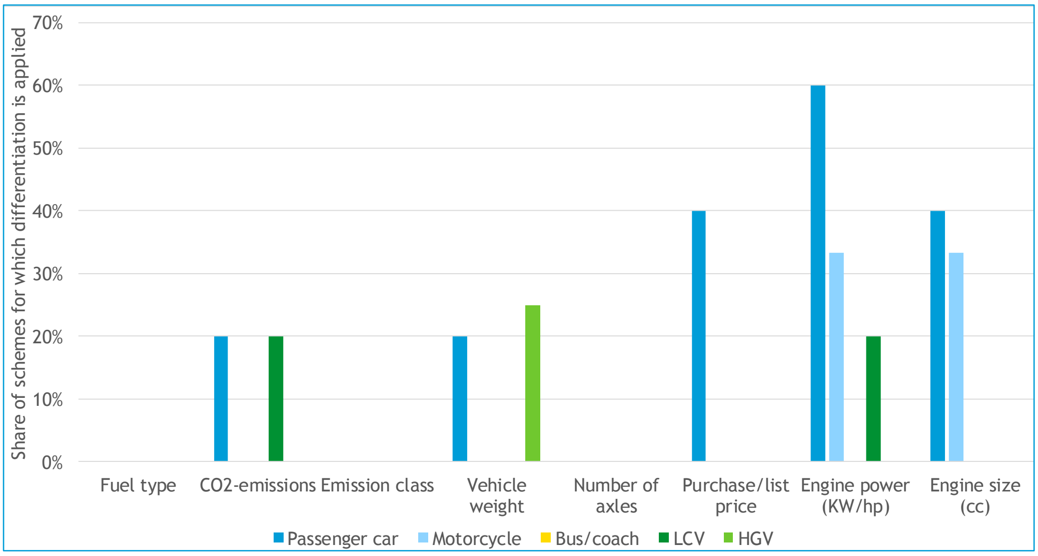
CO_2 emissions represent the parameter to which the purchase/registration tax of passenger cars is most often differentiated: about 55% of the schemes in the EU28 are (partly) based on the CO_2 emissions of the car. In addition to CO_2 emissions, purchase/registration tax schemes for passenger cars are often differentiated to fuel type (almost 40%), purchase/list price (about 35%) and engine size (45%). Also for motorcycles and LCVs CO_2 emissions are a relevant parameter, but not as relevant as for passenger cars. Vehicle weight (about 60%) is the most important differentiation parameter for taxation of LCVs. The taxation of motorcycles is mostly differentiated to engine size (about 50%). Finally, heavy vehicles (bus/coach and HGV) do not report official CO_2 emissions figures. Therefore CO_2 emissions are not a parameter for busses and trucks. However, vehicle weight and the number of axles are important parameters for differentiating purchase/registration taxes for these vehicles.

Figure 15 – Main differentiations used in the various purchase/registration tax schemes applied in the EU28 in 2016



Outside the EU28, different parameters for differentiation are often used compared to the situation in the EU28 (see Figure 16). For example, CO_2 emissions is not a very relevant differentiation parameter for purchase/registrations taxes on passenger cars outside the EU28, while it is the most important one within the EU28. Only in Norway the passenger car purchase/registration tax is differentiated to CO_2 emissions. Instead, purchase price and engine power are the most applied differentiation parameters for passenger car purchase/registration taxes outside the EU28. Whereas, vehicle weight and the number of axles are relevant parameters in the EU28 to differentiate the purchase/registration tax for heavy vehicles, outside the EU28 these parameters are less applied. Some of the countries do use vehicle weight as differentiation parameter for heavy vehicles.

Figure 16 – Differentiations used in the various purchase/registration tax schemes applied outside the EU28 in 2016



Tax levels

Purchase/registration tax levels do differ widely between vehicles in most countries, among other reasons due to the differentiations applied in these taxes (see above). To show this variance, we present the tax levels for a selection of reference vehicles (see Section 1.3.1).

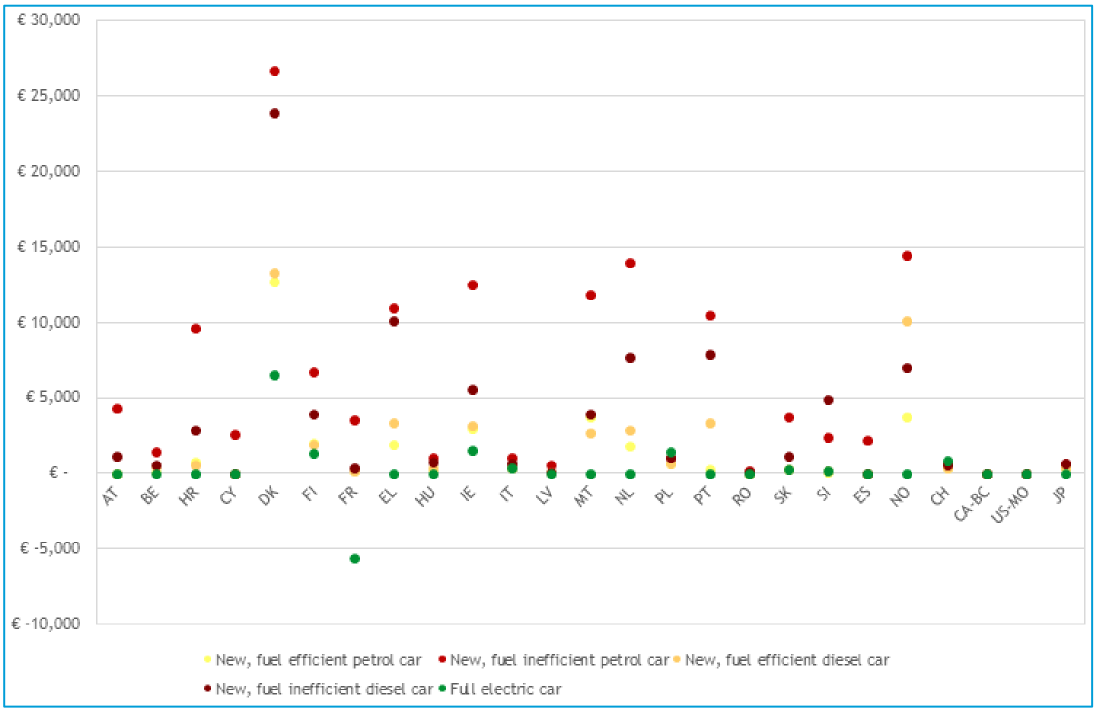
For passenger cars, the tax levels after PPS correction for five reference vehicles[8] are presented in Figure 17. In most countries the fuel inefficient cars are taxed higher than more fuel efficient cars. These cars have higher CO_2 emissions, which often results in higher tax levels (as purchase taxes are differentiated to CO_2 emissions in many countries). Fuel inefficient cars often have a relatively high engine capacity and (hence) purchase price, resulting in a higher tax levels in many countries as well. The highest purchase tax is levied in Denmark where the fuel inefficient passenger cars are taxed around € 25,000 after PPS correction. Also in countries like Ireland, The Netherlands and Norway fuel-inefficient cars are taxed significantly.

In most European countries no purchase tax is levied on electric passenger car. Poland is the only European country where the purchase tax for the electric reference car is higher than for the reference cars with an internal combustion engine. But as the tax level in Poland is among the lowest in Europe, the absolute purchase tax levied on electric cars in Poland is still limited. Buyers of an electric vehicle in France receive a bonus of € 5,600 after PPS correction, which is presented in Figure 17 as a negative purchase tax level.

The Canadian State Alberta does not levy a purchase tax on passenger cars, while the taxes in the US state of Missouri are very low. The Canadian state of British Columbia and Japan do levy a purchase tax on passenger cars which level is comparable with the lower levels applied in the European countries.

[8] As in most countries purchase/registration taxes are only levied on new vehicles, we only consider the purchase/registration tax levels for new reference road vehicles.

Figure 17 – Purchase/registration tax levels for some reference passenger cars in 2016 (PPS corrected)

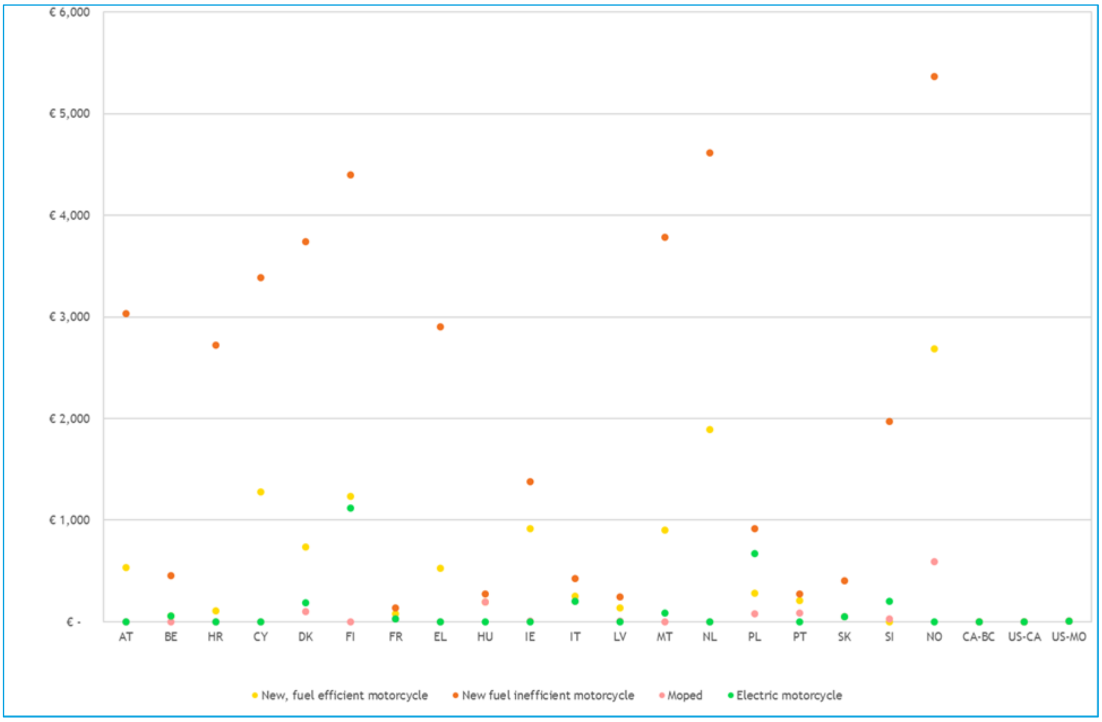


Note: Countries not included in the graph (i.e. BG, CZ, EE, DE, LT, LU, SE, UK) do not levy purchase/registration taxes on passenger cars. See also Figure 14.

An overview of the purchase/registration tax levels after PPS correction for the reference motorcycles are presented in Figure 18. In general, tax levels are high in countries like Norway and The Netherlands, although there are large differences between different types of motorcycles. In all countries, the fuel-inefficient motorcycle is taxed higher than the fuel-efficient motorcycle. Austria, Croatia, Cyprus, Greece, Ireland, Latvia, the Netherlands and Norway exempt electric motorcycles from purchase/registration tax.
Only in Poland, the electric motorcycles is taxed at a higher rate than the fuel-efficient fossil fuelled one. This is because registration taxes for motorcycles are mainly based on the purchase price/market value of the motorcycle, which is in general higher for electric motorcycles than for comparable fossil-fuelled ones (see also Table 35 in Annex A.2).

The tax levels after PPS correction in the non-European countries are, particularly for the fuel-inefficient motorcycle, considerably lower than the rates applied in many EU countries. Japan and the Canadian state of Alberta do not levy purchase taxes on motorcycles.

Figure 18 – Purchase/registration tax levels for reference motorcycles in 2016 (PPS corrected)

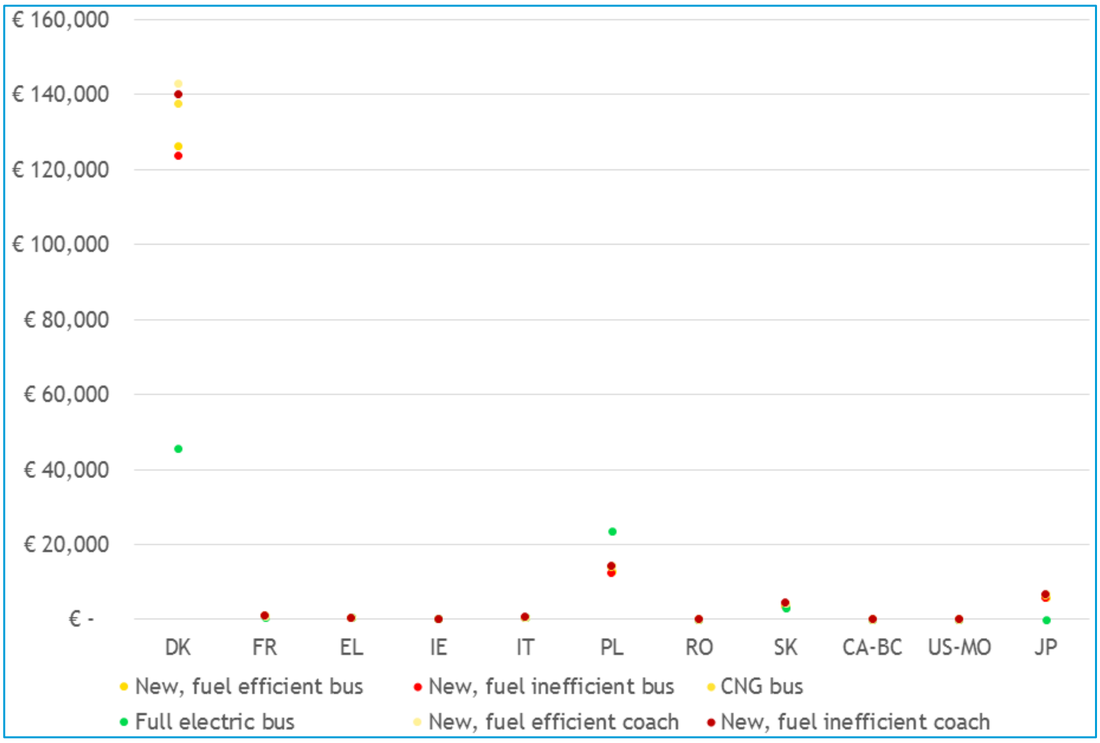


Note: Countries not included in the figure do not levy purchase/registration taxes on motorcycles.

Eight EU countries levy purchase/registration taxes for busses and coaches as was shown in Figure 14. In Europe, only Denmark, France, Greece, Ireland, Italy, Poland, Romania and Slovakia tax the purchase or registration of a bus or coach. The tax levels for the reference buses and coaches can be seen in Figure 19. Denmark and Poland apply the highest tax levels in Europe. The tax level in Denmark is considerably higher than in Poland: purchase/registration taxes can amount up to € 143,000 after PPS correction for a new diesel bus, while in Poland the highest tax rate (found for the electric reference bus) is € 24,000 after PPS correction. In all other European countries, the purchase/registration tax on buses and coaches is very low. Euro 6 buses and coaches are exempt from paying purchase taxes in Romania.

Outside Europe, the US state Missouri levies a very small registration tax of only € 8. Japan also taxes the purchase or registration of buses and coaches, but the tax levels are relatively low.

Figure 19 – Purchase/registration tax levels for some reference buses and coaches in 2016 (PPS corrected)



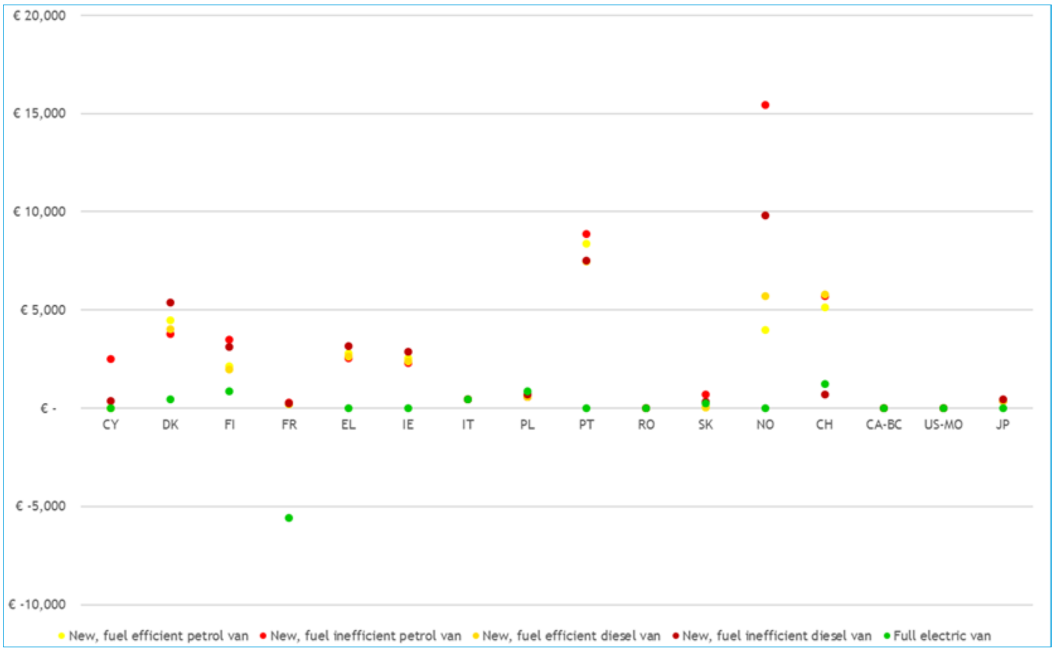
Note: Countries not included in the figure do not levy purchase/registration taxes on buses and coaches. Euro 6 buses and coaches are exempt from purchase tax in Romania, purchase taxes do apply for vehicles of Euro 5 and lower.

As was indicated above, purchase/registration taxes on LCVs are differentiated to a variety of parameters. As a result, the tax levels for the reference LCVs vary between countries. In most countries purchase/registration taxes for electric LCVs are lower than for LCVs powered by petrol or diesel. Poland, Slovakia and Switzerland are the only European countries where the full electric van is not taxed lower than vans with an internal combustion engine.

Comparing tax levels between countries, the highest tax levels in the EU28 can be found in Portugal where diesel and petrol LCVs are taxed around € 8,000 (after PPS correction). In Slovakia on the other hand, relatively low purchase/registration tax levels for LCVs are round. The highest tax rate for the reference LCVs in Slovakia equals € 716 (after PPS correction). Outside the EU28, LCVs in Norway and Switzerland are taxed substantially. In Norway the highest purchase/registration taxes are paid for fuel inefficient vehicles, while electric vehicles are fully exempted from this tax. In Switzerland, electric LCVs are taxed, but at a relatively low level, although it is still higher than the tax rate for the reference fuel inefficient diesel LCV.

As for the non-EU countries, the Canadian state of British Columbia, the US state Missouri and Japan levy purchase/registration taxes on LCVs. The tax levels are lower than in most European countries and the variance between types of LCVs is small.

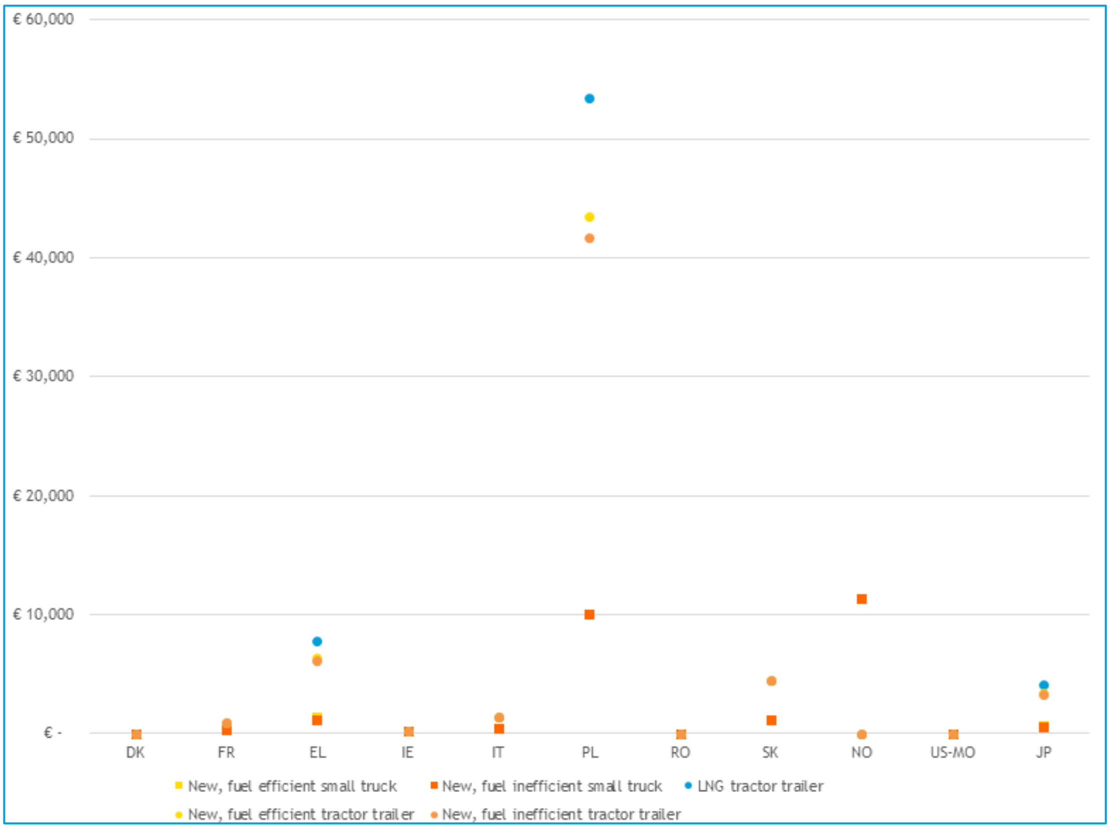
Figure 20 – Purchase/registration tax levels for some reference LCVs in 2016 (PPS corrected)



Note: Countries not included in the figure do not levy purchase/registration taxes on LCVs. Euro 6 LCVS are exempt from purchase tax in Romania, purchase taxes do apply for vehicles of Euro 5 and lower.

As shown earlier, nine European countries levy purchase/registration taxes for HGVs. As is illustrated by Figure 21, Denmark, France, Greece, Ireland, Italy, Norway, Romania, Poland and Slovakia are the only European countries that tax the acquisition of HGVs. Purchase/registration taxes of HGVs in Poland are considerably higher than in the other countries. This is in contrast with the purchase/registration tax levels that apply for other vehicle types in Poland, as they are taxed relatively low compared to other countries. Purchase/registration tax levels for fuel efficient HGVs are in Poland higher than for the fuel inefficient counterparts. The US state Missouri has a fixed purchase tax (€ 8) for all vehicle types, while Japan has differentiated purchase taxes on HGVs.

Figure 21 – Purchase/registration tax levels for some reference HGVs in 2016 (PPS corrected)



Note: Countries not included in the figure do not levy purchase/registration taxes on HGVs. Euro 6 HGVs are exempt from purchase tax in Romania, purchase taxes do apply for vehicles of Euro 5 and lower. HGVs over 4,000 kg are exempt from purchase taxes in Denmark.

Planned introduction of new or changes in existing purchase/registration taxes

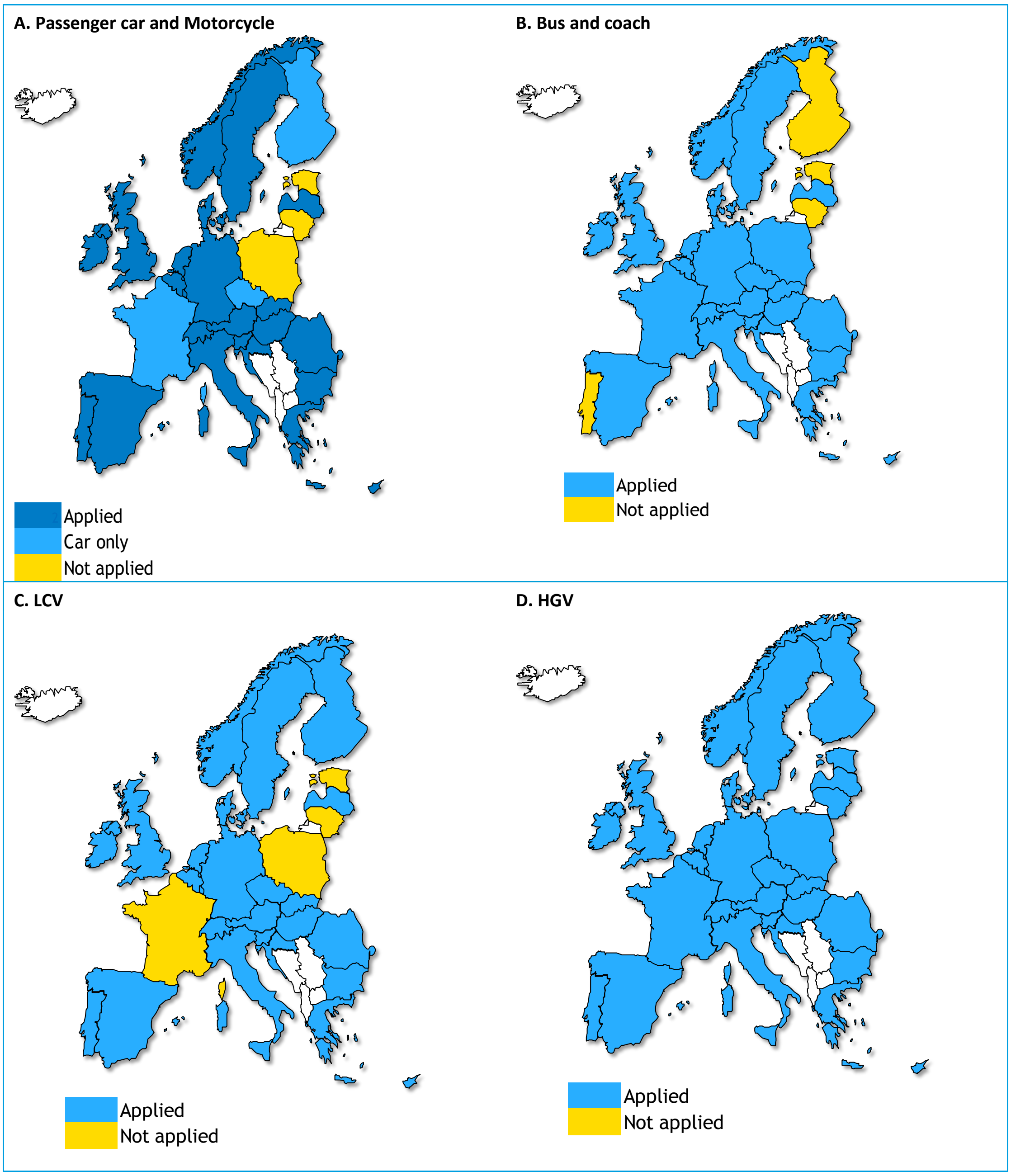
Two countries have planned changes in purchase/registration taxes. Greece has abolished in 2017 the luxury tax which was an additional tax for passenger cars based on the wholesale price of a vehicle. The tax was specifically aimed at vehicles with a price over € 20,000. Denmark has agreed to reform the purchase tax in order to include safety aspects into the tax. Additionally, it is discussed in Denmark to introduce a road charging scheme together with a reduction in vehicle taxes.

3.3.3 Ownership/circulation taxes

Taxation of the ownership of a vehicle is applied in all European countries. There are, however, large differences between vehicle categories in the extent by which ownership taxes (also called circulation taxes) are applied (see Figure 22). Passenger cars and motorcycles are taxed in most European countries. In Estonia, Lithuania and Poland no ownership tax on passenger cars is levied. In these countries also motorcycles are excluded from an ownership/circulation tax, which is also the case in Finland, France and the Czech Republic. Ownership taxation of busses and coaches is also common across Europe. Only in Estonia, Lithuania and Portugal no ownership/circulation taxes apply for busses and coaches. Estonia and Lithuania are the only countries that do not levy a ownership/circulation tax for LCVs. In all European countries HGVs are charged with an ownership tax. In the EU, this is required by Directive 1999/62/EC. Finally, in the Czech Republic and Slovakia only for vehicles used for business purposes an ownership tax applies.

Outside Europe, the US states California and Missouri and the Canadian province Alberta apply ownership/circulation taxes for all vehicle categories. In British Columbia, on the other hand, none of the vehicle categories is charged with this tax. Finally, in Japan only motorcycles are exempted from a ownership/circulation tax. For all other vehicle categories this tax is applied.

Figure 22 – Ownership taxes in the EU in 2016



Differentiations applied

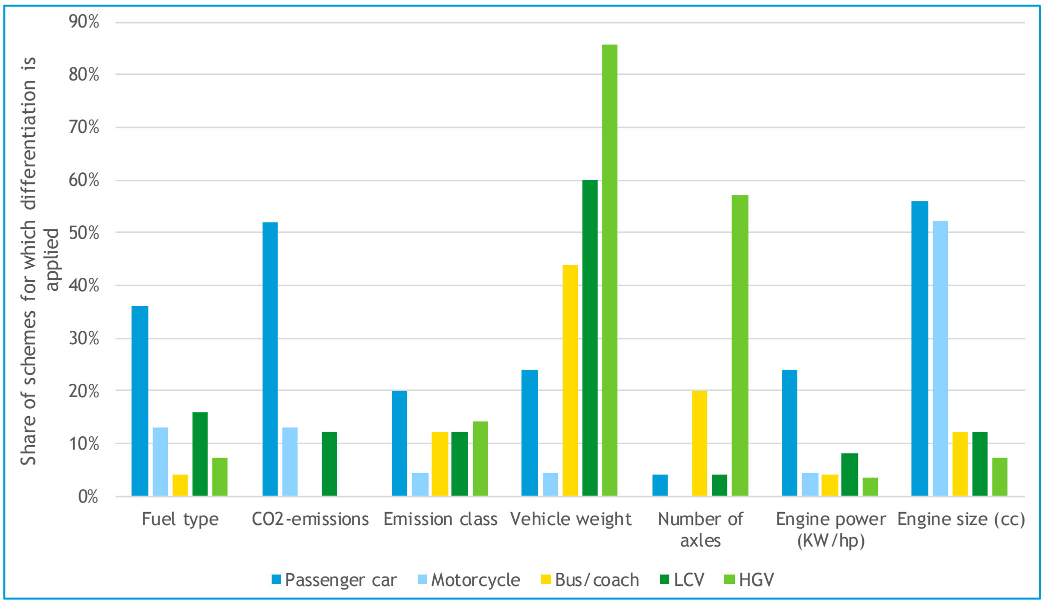
The ownership/circulation taxes levied in Europe are based on several parameters. The main parameters applied in the EU28 are shown in Figure 23. Notice that ownership/circulation taxes can be differentiated to multiple parameters simultaneously and hence that that the scores for all the parameters together may be more than 100%.

Engine size and CO_2 emissions are the parameters to which the ownership/circulation tax of passenger cars is most often differentiated: about 55% of the schemes in the EU28 are (partly) based on the engine size and about the same share on CO_2 emissions of the car. In addition to CO_2 emissions and engine size, ownership/circulation tax schemes for passenger cars are often differentiated to fuel type (about 35%). Emission class, vehicle weight and engine power are also relevant parameters, as they are all three used in about 20% of the ownership/circulation tax schemes for passenger cars in the EU28.

Vehicle weight and the number of axles are the most used parameters to differentiate tax levels for heavy vehicles. More than 80% of the schemes for HGVs are differentiated to vehicle weight, while almost 60% of the schemes are differentiated to the number of axles. Vehicle weight (40%) is also the most occurring parameter for busses and coaches, while number of axles (20%) is the second most occurring parameter. CO_2 emissions are not used to differentiate the ownership tax for busses or HGVs, among other things as no official CO_2 figures for these vehicles are available.

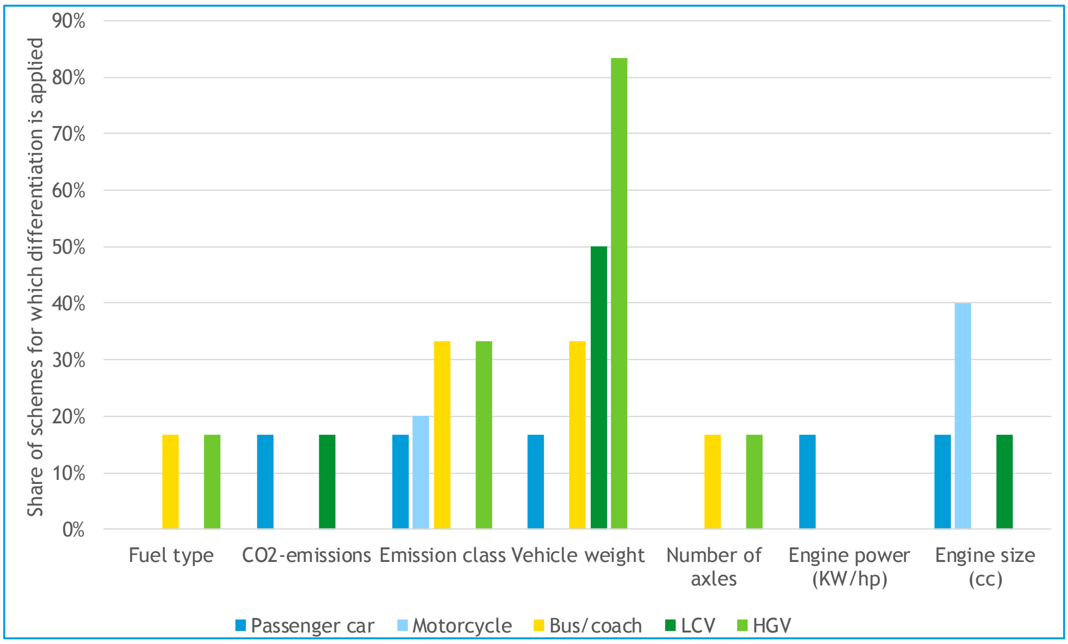
The ownership/circulation taxes for LCVs are mostly differentiated to vehicle weight (almost 60%), while other differentiations are less common. Finally, the differentiations applied for motorcycles is similar to the purchase/registration taxes: engine size is the most important parameter with 52%, while other differentiations are less common.

Figure 23 – Differentiations used in the various ownership/circulation tax schemes applied in the EU28 in 2016



Ownership/circulation taxes in the countries outside the EU28 apply similar differentiations as is shown in Figure 24. Vehicle weight is the most relevant parameter for HGVs, LCVs and buses and coaches, while for passenger cars a wide range of parameters is used to the same extent.

Figure 24 – Ownership differentiations outside EU28 in 2016



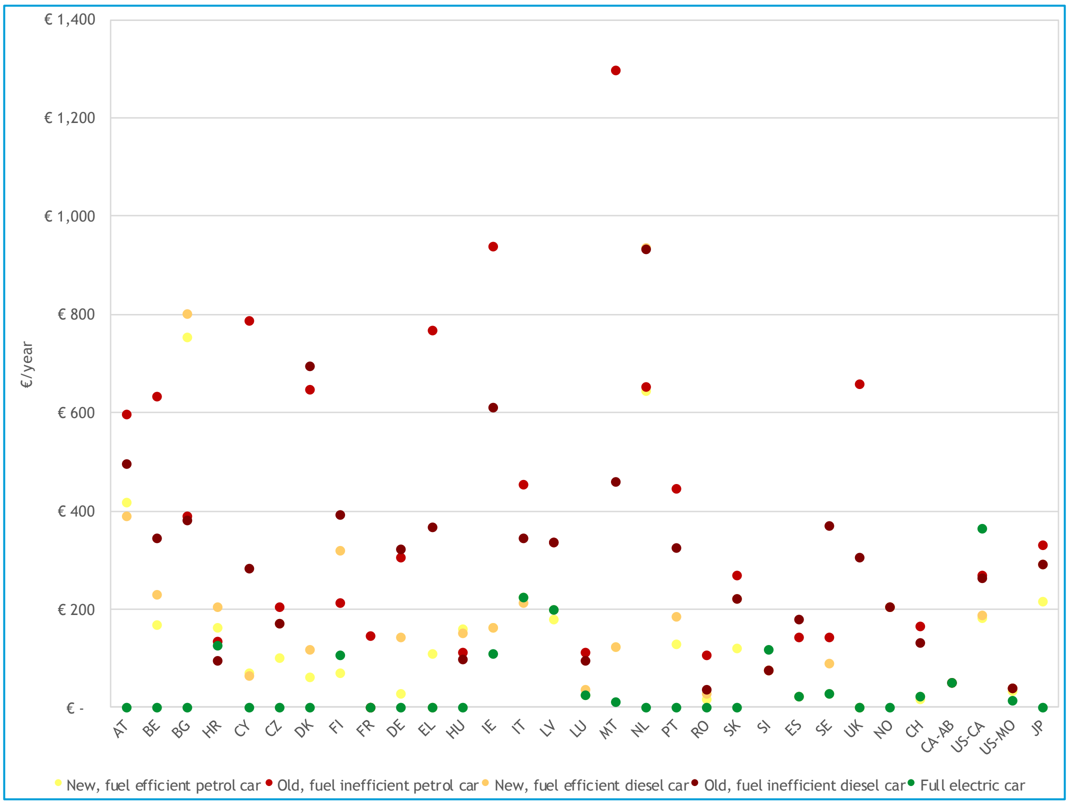
Tax levels

Figure 25 shows the ownership/circulation tax levels after PPS correction for a variety of reference passenger cars. In most countries ownership/circulation taxes for electric passenger cars are lower than for cars with an internal combustion engine as was the case for purchase/registration taxes. In many countries (e.g. Austria, Belgium, Denmark, Poland, Portugal, etc.) electric cars are even fully exempted from an ownership tax. From Figure 25 it also becomes clear that in most countries older cars (Euro 3 cars) are taxed higher than new, Euro 6 cars. Only in Bulgaria , Croatia and Hungary fuel efficient Euro 6 cars are taxed higher than the fuel inefficient Euro 3 cars. The difference is not necessarily due to the absence of a differentiation to Euro standard in the tax scheme, as many characteristics of vehicles are correlated with each other. For example, newer cars in general weight more and have a higher engine power, which may result in a higher tax level as the tax scheme is differentiated to vehicle weight or engine power.

The highest ownership/circulation tax level after PPS correction is found in Malta (€ 1,298) for the old, fuel inefficient diesel car. Ownership/circulation taxes in France, Hungary, Luxembourg, Romania, Slovenia and Spain are among the lowest after PPS correction in Europe: taxes for the selected reference vehicles are less than € 200 a year.

Outside Europe, the Canadian state of British Columbia does not levy ownership/circulation taxes on passenger cars, while the Canadian state of Alberta has low tax levels which are not differentiated. Also the situation in the US states differs per state: Missouri does not tax the ownership of passenger cars, while in California tax levels are comparable with European levels. Japan also has ownership/circulation tax levels that are comparable with the ones in European countries.

Figure 25 – Ownership tax levels reference passenger cars (PPS adjusted)



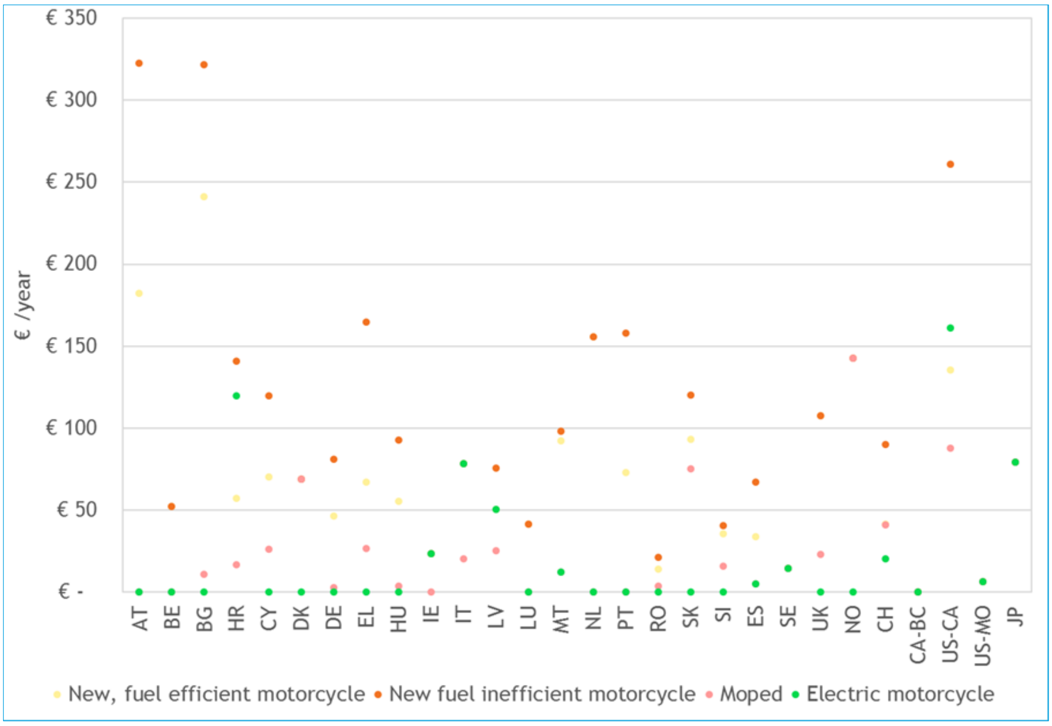
Note: Countries not included do not levy ownership/circulation taxes on passenger cars. Ownership/circulation taxes in the Czech Republic and Slovakia only apply for vehicles which are used for business purposes.

Although in ownership/circulation taxes for motorcycles less differentiations are used than for passenger cars, this does not result in a uniform tax level for the references motorcycles (see Figure 26). All countries have lower tax levels for motorcycles than for passenger cars. Furthermore, the fuel inefficient motorcycle is taxed higher than the fuel efficient motorcycle in most countries. Many countries do even exempt electric motorcycles from ownership/circulation taxes. Only in Ireland and Italy electric motorcycles are taxed the same rate as the reference motorcycles powered by petrol.

Austria and Bulgaria levy the highest ownership/circulation taxes after PPS correction: the fuel inefficient motorcycle pays more than € 300 a year in these countries. Relatively low tax levels (after PPS correction) are applied in countries like Belgium and Luxembourg. In these countries the ownership tax for motorcycles is equal to or less than € 50 per year for all reference motorcycles.

Outside Europe, only the US state of California and Japan levy a substantial amount of ownership/ circulation tax for motorcycles. The tax levels in the other states/provinces are low or motorcycles are even exempted.

Figure 26 – Ownership/circulation tax levels reference motorcycles in 2016 (PPS corrected)

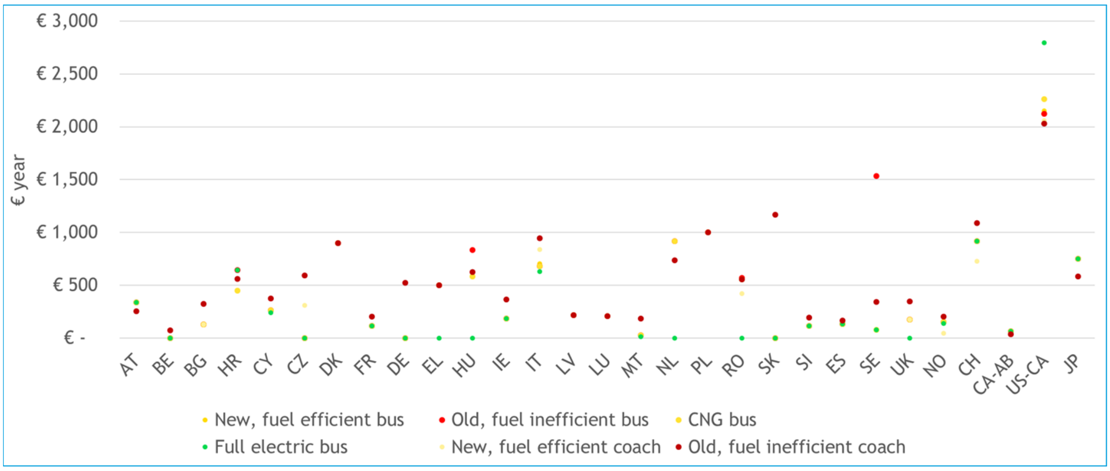


Note: Countries not included do not levy ownership/circulation taxes on motorcycles. Ownership/circulation taxes in the Czech Republic and Slovakia only apply for vehicles which are used for business purposes.

Figure 27 show the ownership tax levels after PPS correction for some reference buses and coaches. While only a few countries levy purchase/registration taxes on buses and coaches, many countries levy ownership/circulation taxes on these vehicles. Electric buses are in general taxed lower than the other type of buses, although several countries do not differentiate taxes for buses and coaches at all.

In Austria, electric buses are even taxed higher than an old, fuel-inefficient bus. The highest tax levels (after PPS correction) in Europe can be found in Slovakia and Sweden. However, these levels are lower than the ownership/circulation tax levied in the US state California, which are at least € 2,000 a year for the reference buses/coaches. The tax levels in California are especially high compared to the other North American states/provinces where buses and coaches are exempted from ownership taxes or are taxed only a low rate.

Figure 27 – Ownership tax levels reference busses and coaches (PPS corrected)

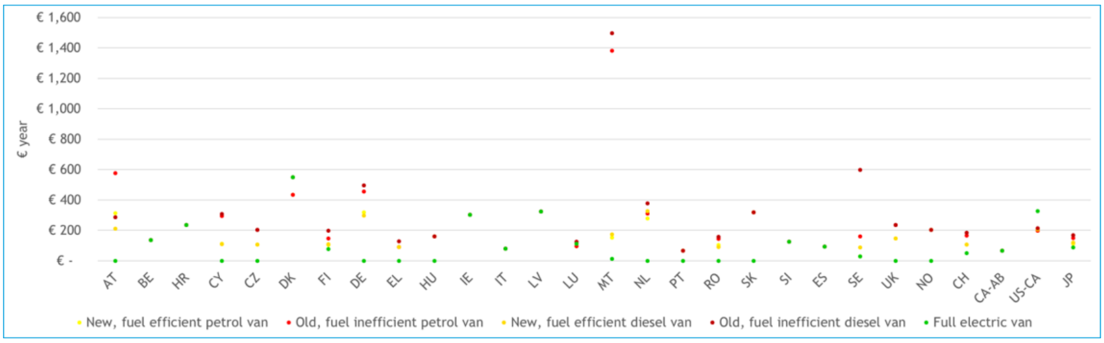


Note: Countries not included do not levy ownership/circulation taxes on buses and coaches. Ownership/circulation taxes in the Czech Republic and Slovakia only apply for vehicles which are used for business purposes.

Ownership/circulation taxes on LCVs are levied by the majority of the countries. The tax levels after PPS correction for LCVs are shown in Figure 28. In general, tax levels for LCVs are comparable with tax levels for passenger cars. Most countries differentiate tax levels for LCVs. Only Belgium, Ireland, Italy, Latvia, Poland, Slovenia and Spain apply the same tax level for all reference LCVs. In the other countries old, fuel inefficient LCVs are taxed higher than new, fuel efficient ones. Electric vans are exempted in most countries where ownership taxes are differentiated. Only in Denmark and Luxembourg (some) conventionally fuelled LCVs are taxed less than the electric LCV. Malta levies the highest taxes after PPS correction (around € 1,400 a year) for the old, fuel inefficient diesel and petrol LCVs. At the same time, Malta taxes new, fuel efficient LCVs only around € 200 a year (after PPS correction).

Ownership/circulation taxes in the non-European countries are in most cases lower than in Europe. Japan and the Canadian state Alberta do levy taxes on LCVs but the rate is low (around € 65). Taxes in the US state of California are higher and amount up to € 327. The highest tax rate in this state is applied for electric LCVs. Finally, the US state of Missouri and the Canadian state of British Columbia do not levy ownership/circulation taxes on LCVs at all.

Figure 28 – Ownership/circulation tax levels reference LCVs in 2016 (PPS corrected)



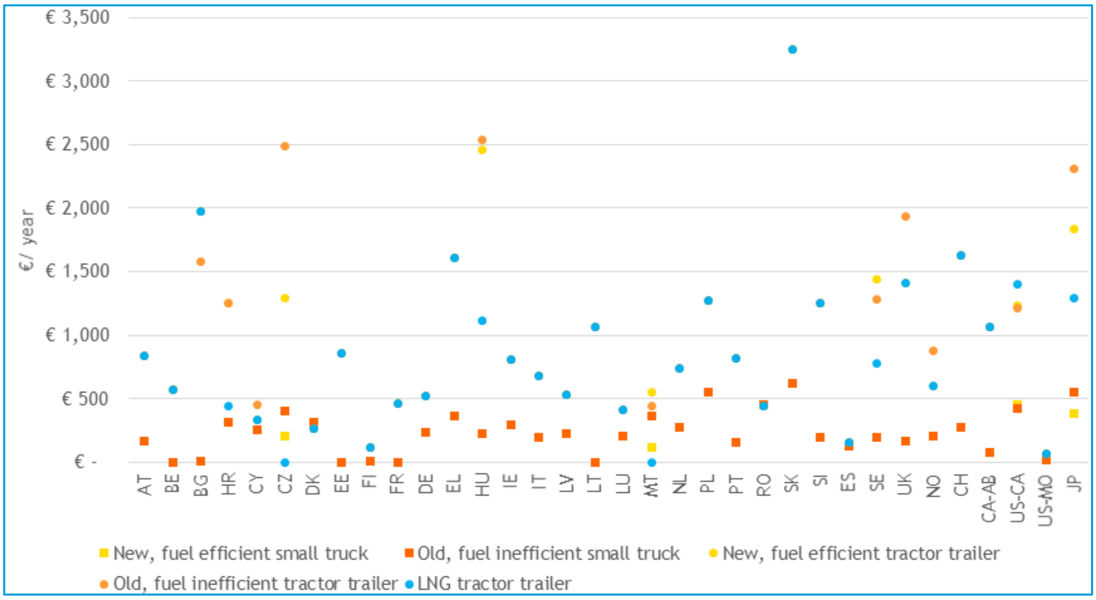
Note: Countries not included do not levy ownership/circulation taxes on LCVs. Ownership/circulation taxes in the Czech Republic and Slovakia only apply for vehicles which are used for business purposes.

As is shown in Figure 29, ownership/circulation taxes after PPS correction for HGVs vary between HGV type and between countries. In general, larger and heavier trucks pay higher ownership/circulation taxes, which is the result of the differentiation to vehicle weight (and number of axles) applied in many countries. The results show that some countries have higher tax levels for an Euro 6 truck than for an Euro 3 truck. For example, in Bulgaria an Euro 3 truck is taxed € 1,580 after PPS correction per year while a comparable Euro 6 truck is taxed € 1,975 after PPS correction per year.

The highest ownership taxes after PPS correction for HGVs are levied in Slovakia, the Czech Republic, Hungary and the United Kingdom. The Czech Republic is the only country where LNG trucks are exempt from paying an ownership/circulation tax. In Sweden and Japan LNG trucks pay lower taxes than a comparable diesel powered truck. In the other countries, LNG trucks are taxed at comparable rates as their diesel fuel counterparts.

Concerning the non-EU countries, ownership taxes for HGVs in the US state of Missouri are very low, while tax levels in California are comparable to the European levels. HGVs in the Canadian state British Columbia are exempted from ownership taxes, while in Alberta tax levels comparable as in Europe are applied. Finally, also in Japan the ownership tax levels for HGVs are in the same range as the ones applied in Europe.

Figure 29 – Ownership/circulation tax levels reference HGVs in 2016 (PPS corrected)



Note: Countries not included do not levy ownership/circulation taxes on HGVs. Ownership/circulation taxes in the Czech Republic and Slovakia only apply for vehicles which are used for business purposes. LNG is not used as propellant in Malta.

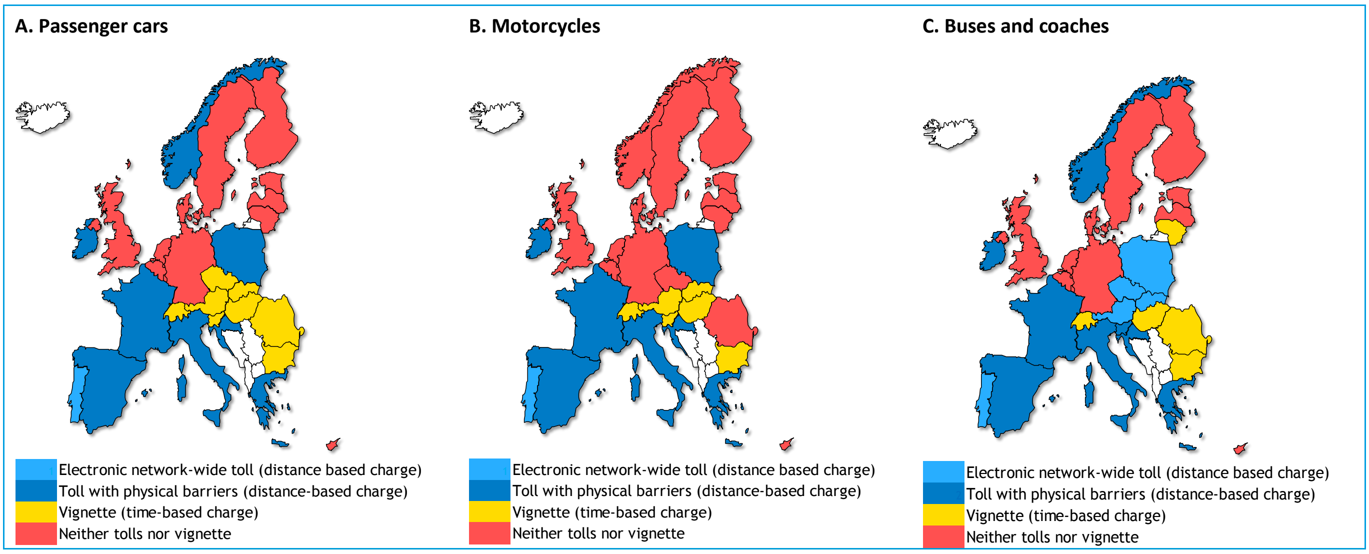
3.3.4 Road tolls and vignettes

Distance-based road tolls and vignettes are applied in almost all European countries. In 2016 only Cyprus, Estonia, Finland and Malta did not have such a system in place. Estonia has introduced road user charges for HGVs in 2018. Details about this system and planned changes to road charging systems in other countries are discussed at the end of this section.

An overview of the road charging schemes applied in Europe is given in Figure 30. National road charging schemes for passenger cars and LCVs are applied in 17 European countries, of which nine apply a distance-based road charge[9], while the other eight countries have implemented time-based road charges (vignettes)[10]. In most of these countries, also motorcycles are covered by the road charging schemes. Only in the Czech Republic, Norway and Romania motorcycles are exempted.
As for heavy goods vehicles, 17 EU countries applied distance-based road charges in 2016, of which eight by using physical barriers (e.g. France, Spain, Italy, Croatia) and nine by applying an electronic network-wide scheme (e.g. Germany, Austria, Switzerland, Czech Republic, Hungary). In 2017 Slovenia switched to an electronic network-wide scheme as well. Additionally, Denmark, Luxembourg, the Netherlands and Sweden[11] apply the Eurovignette[12] for HGVs above 12 tonnes, while Bulgaria, Latvia, Lithuania, Romania and the UK apply alternative vignettes for HGVs . Finally, for buses/coaches, road pricing schemes are applied 18 countries, of which 13 apply distance-based charges.

In the US states California and Missouri and the Canadian provinces Alberta and British Columbia, no road tolls or vignettes are applied for any vehicle categories. In Japan, on the other hand, road toll is levied on all motorways for all vehicle categories.

Figure 30 – Road charging schemes in the EU in 2016



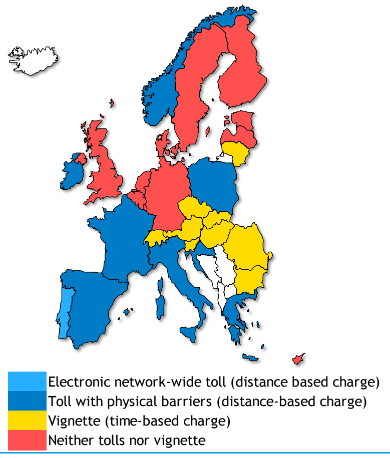
9 Mainly toll schemes with physical barriers. Only in Portugal an electronic network-wide toll system is used for all vehicle categories.

10 In some countries applying vignettes (e.g. Austria), some specific sections of the network (mainly tunnels and/or bridges) can still be subject to distance based tolls. In this study, these tolls are considered ‘tolls on a specific part of the network’ and hence they are taken into account separately.

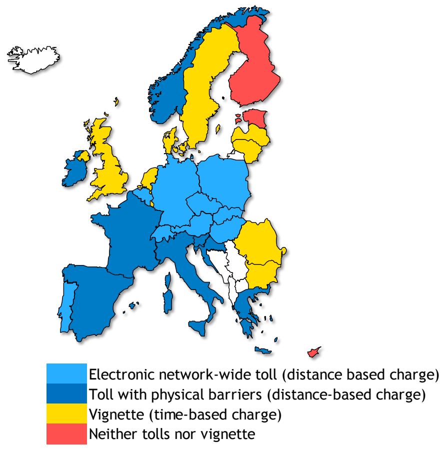
11 The Eurovignette used to apply for Belgium as well. Since 1 April 2016 Belgium has switched to an electronic distance-based tolling system for heavy vehicles.

12 See The Eurovignette.

D. LCV



E. HGVs



Urban road pricing is applied in various European cities (see Table 5). Jurmala and London levy a flat charge for entry of the tolled area. Other urban tolls are differentiated to time, for example in Palermo and Stockholm, while the urban road charges in Valletta depend on the duration of the stay. Finally urban road charges in Oslo are differentiated to fuel type and time of entry.

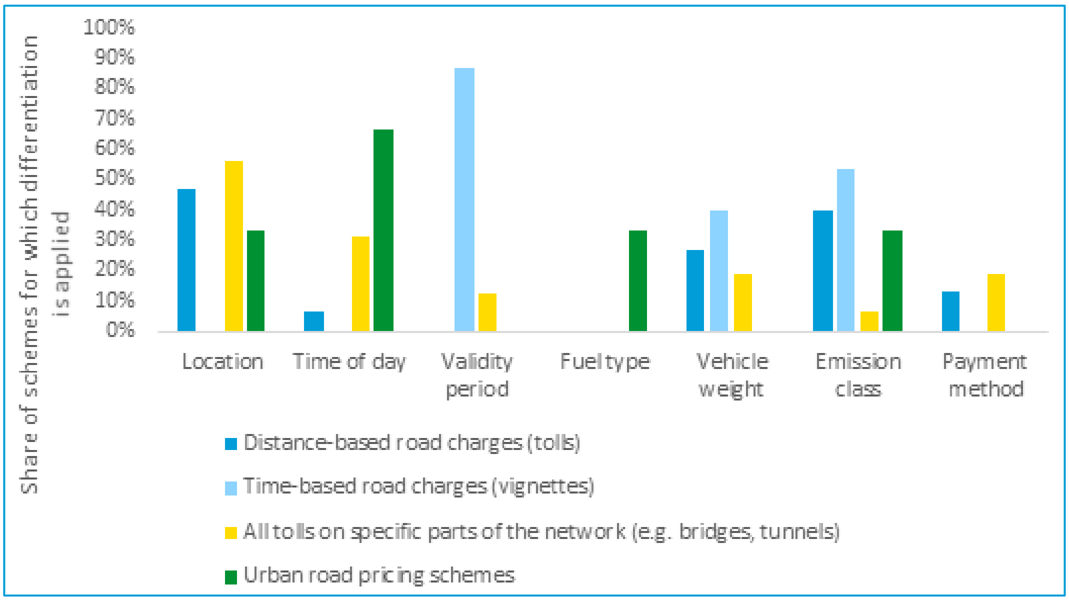
Table 5 – Cities that apply urban road pricing

Italy	Latvia	Malta	Norway	Sweden	United Kingdom
Milan Palermo	Jurmala	Valetta	Bergen Kristiansand Namsos Nord-Jaeren Oslo Tonsberg	Goteborg Stockholm	London

Differentiations applied

An overview of the types of differentiations applied in the various road toll and vignette schemes is given in Figure 31. Distance-based road charges are mostly differentiated to location (50%), vehicle weight (30%) and emission class (44%). The latter two are mainly/only applied for heavy vehicles. Vignettes, on the other hand, are mostly differentiated to validity period (86%), vehicle weight (36%) and emission class (50%). Again, vehicle weight and emission class are mainly applied for heavy vehicles. Tolls on specific parts of the network (e.g. bridges, tunnels) mostly depend on the location (56%) and time of the day (30%). This is not surprising as usage of larger or busier tunnels and bridges is often charged higher. Finally, urban road pricing schemes mostly apply differentiations to the time of the day (67%). Fuel type (32%), emission class (32%) and location (32%) are also important differentiation parameters.

Figure 31 – Differentiations used in the various road toll/vignette schemes applied in the EU28 in 2016

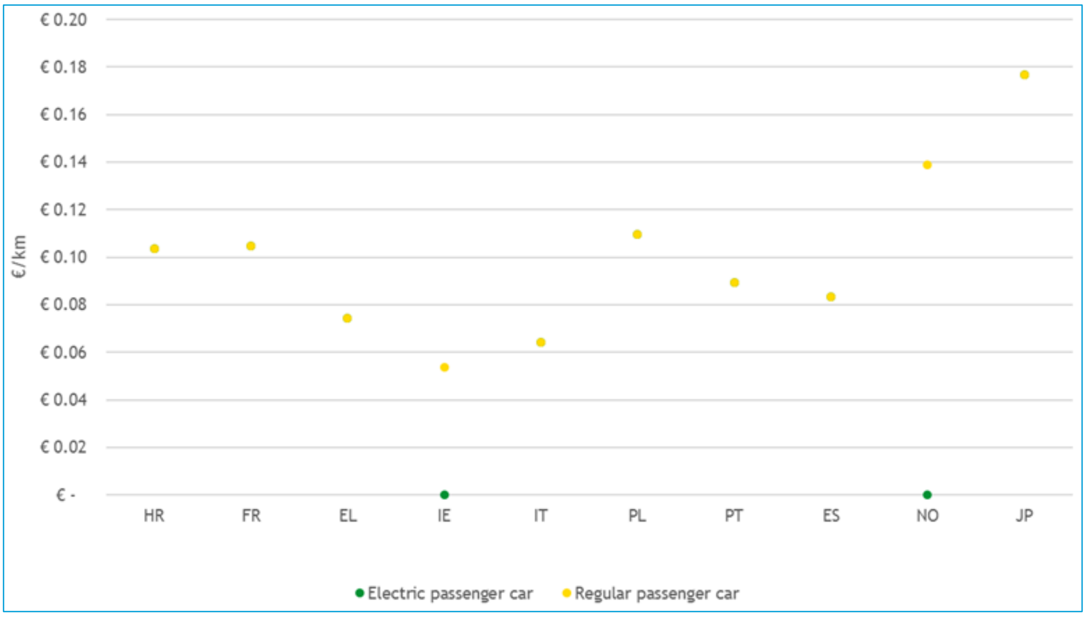


Charge levels

In contrast to vehicle taxes, road charges for private vehicles (passenger car, motorcycle and LCVs) do not differ between reference vehicles. The only exception are electric vehicles which are exempt from paying distance-based tolls in certain countries. Therefore, we only show the charge levels for regular vehicles (e.g. fossil-fuelled vehicles) and electric ones (where relevant). Furthermore, in some countries toll levels are differentiated to location. In these cases, toll levels that best reflect an average toll level for the respective country is presented in the graphs. It should be noted, however, that there are differences in the scope of road charging schemes between countries. In Japan, for example, road tolls are applied on the entire motorway network, while in most European countries only use of part of the motorway network is charged.

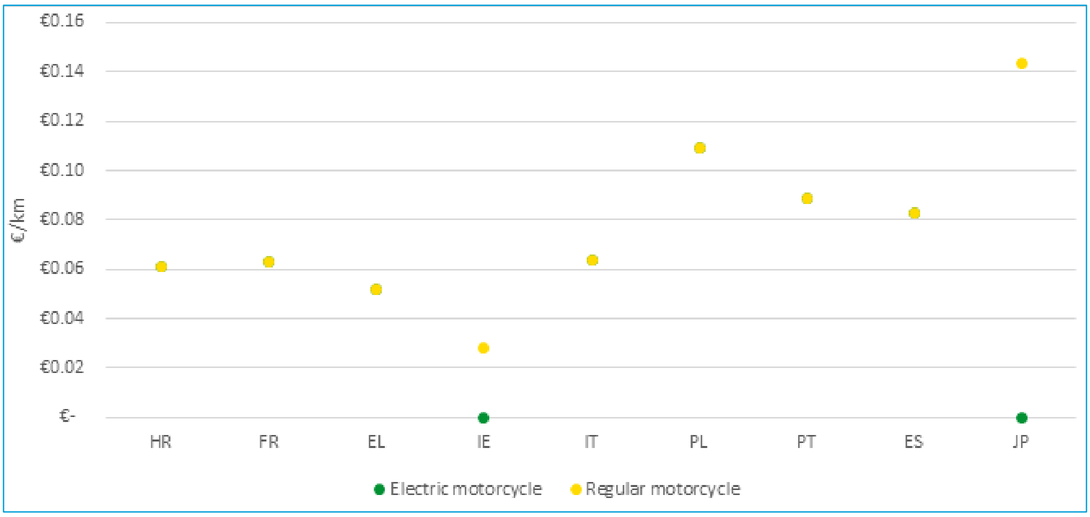
Figure 32 shows the PPS corrected distance-based toll levels for passenger cars. Ireland and Norway exempt electric passenger cars from road tolls. In all other countries charge levels are the same for electric and conventional cars. The highest level after PPS correction is charged in Japan (about € 0.18 per km) while Norway (€ 0.14 per km) has the highest charges in Europe. The lowest charges after PPS correction apply in Ireland with less than € 0.06 per km.

Figure 32 – Distance-based toll levels for reference passenger cars 2016 (PPS corrected)



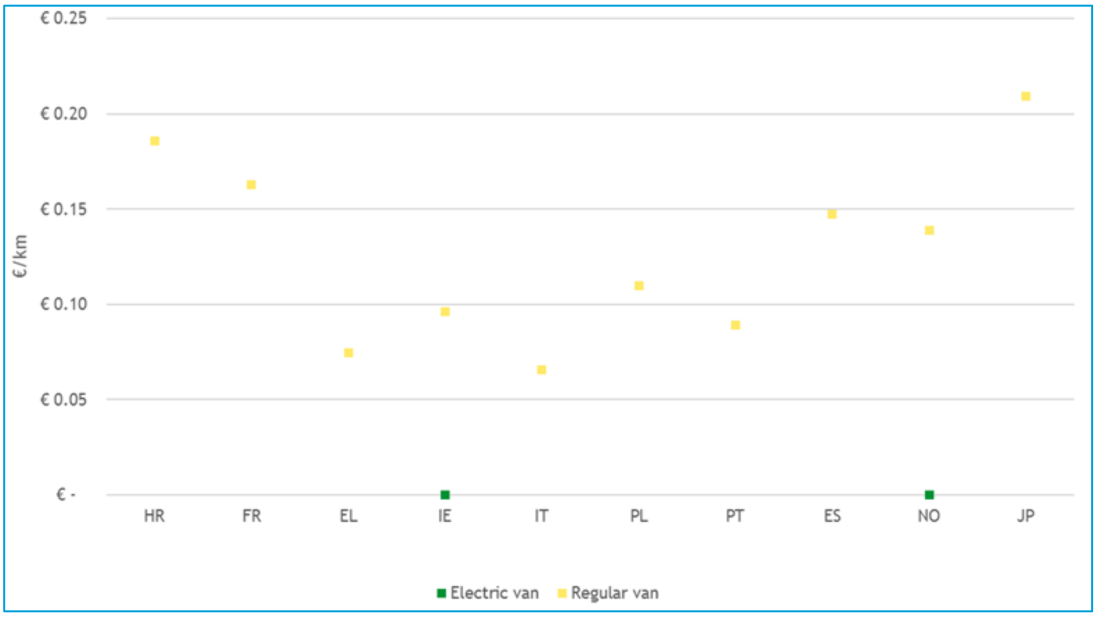
The distance-based road charge levels after PPS correction for motorcycles are shown in Figure 33. Charge levels for motorcycles are in some countries (e.g. Croatia, France, Greece, Spain) lower than for passenger cars. However, in Italy, Poland, and Portugal the same amount is charged for passenger cars and motorcycles. Ireland and Japan exempt electric motorcycles from road tolls, while in the other countries the same charge levels applies for electric and regular motorcycles. The highest charge levels after PPS correction can be found in Japan (€ 0.14 per kilometre) and Poland (€ 0.11 per kilometre). Charge levels after PPS correction for motorcycles are lowest in Ireland (€ 0.03 per kilometre).

Figure 33 – Distance-based toll levels for reference motorcycles 2016 (PPS corrected)



The distance-based road charge levels after PPS correction for LCVs are shown in Figure 34. The same charge levels apply for LCVs and passenger cars in Greece, Poland, Portugal and Norway, while in the other countries LCVs are charged at a higher rate. As for passenger cars, Ireland and Norway are the only countries exempting electric LCVs from road tolls. The highest charge levels after PPS correction are again applied in Japan (€ 0.21 per kilometre), but also in Croatia relatively high charge levels for LCVs exist (€ 0.19 per kilometre). Charge levels after PPS correction for LCVs in Italy and Greece (both € 0.07 per kilometre) are among the lowest in the countries applying a road toll for LCVs.

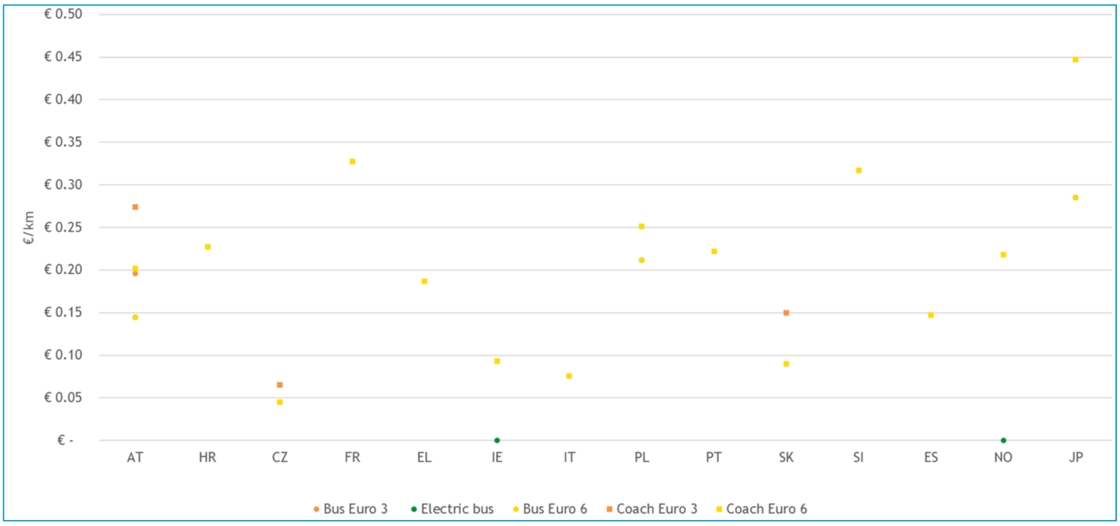
Figure 34 – Distance-based toll levels for reference vans 2016 (PPS corrected)



Distance-based road charge levels after PPS correction for buses/coaches are shown in Figure 35. France (€ 0.33 per kilometre) and Slovenia (€ 0.32 per kilometre) have the highest road charges after PPS correction in Europe, while the lowest rates after PPS correction are charged in the Czech Republic (about € 0.05 per kilometre). Austria, the Czech Republic, Poland, Portugal and Slovakia levy toll on buses and coaches via an electronic network-wide toll system, which provide them the opportunity to apply differentiations in charge levels. For example, in Austria, the Czech Republic and Slovakia a differentiation to EURO standard is applied, such that Euro 3 buses/coaches are charged higher than Euro 6 buses/coaches. Ireland and Norway are the only countries that exempt electric buses from distance-based road charges.

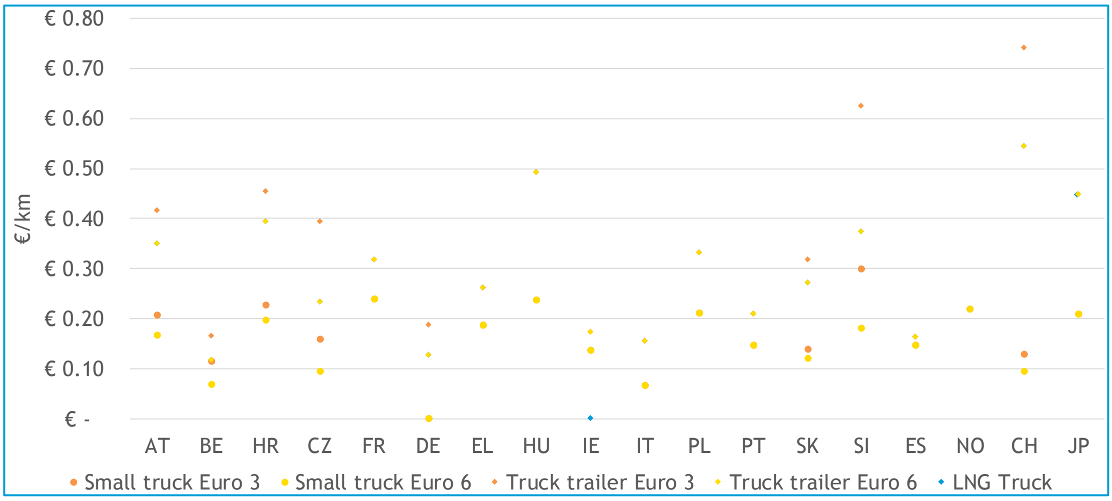
With regard to the non-EU countries, we find that distance-based road charges for coaches after PPS correction are higher in Japan (€ 0.45 per kilometre) than in European countries. Buses are charged less than coaches in Japan; the charge level after PPS correction (€ 0.29 per kilometre, both for electric and fossil-fuelled buses) is comparable with European values.

Figure 35 – Distance-based toll levels for reference buses and coaches in 2016 (PPS corrected)



Charge levels for distance-based HGV toll schemes are displayed in Figure 36. The highest charge levels (after PPS correction) are levied in Switzerland (€ 0.74 per kilometre), Slovenia (€ 0.53 per kilometre), and Hungary (€ 0.49 per kilometre). In most countries, charge levels are different between truck type and emission standard of the truck, reflecting the fact that these charges are often differentiated to vehicle weight and emission standard. As a result, larger and older trucks pay higher charges in countries like Austria, Czech Republic, Germany and Switzerland. In countries where toll schemes are operated by physical barriers (e.g. France, Italy) distance-based charges are (often) not differentiated towards emission standard and hence the same charge levels are applied for Euro 3 and Euro 6 trucks. Finally, in France, Portugal and Norway no differentiation at all is applied for distance-based road charges, resulting in the same charge levels for all reference trucks.

Figure 36 – Distance-based toll levels for some reference HGVs in 2016 (PPS corrected)



The PPS adjusted prices of vignettes applied for the various reference vehicles are shown in Figure 37 to Figure 41. First, the vignette levels applied for passenger cars in eight European countries are shown in Figure 37. Vignettes do not differentiate by type of passenger car (and therefore only one dot per country is presented in the graph). The highest charge level after PPS correction is applied in Hungary (about € 235 per year), which is considerably higher than the charge levels in the other countries. Switzerland (€ 23 per year) applies the lowest charge level after PPS correction for passenger cars.

Figure 37 – Vignette levels for passenger cars in 2016 (PPS corrected)

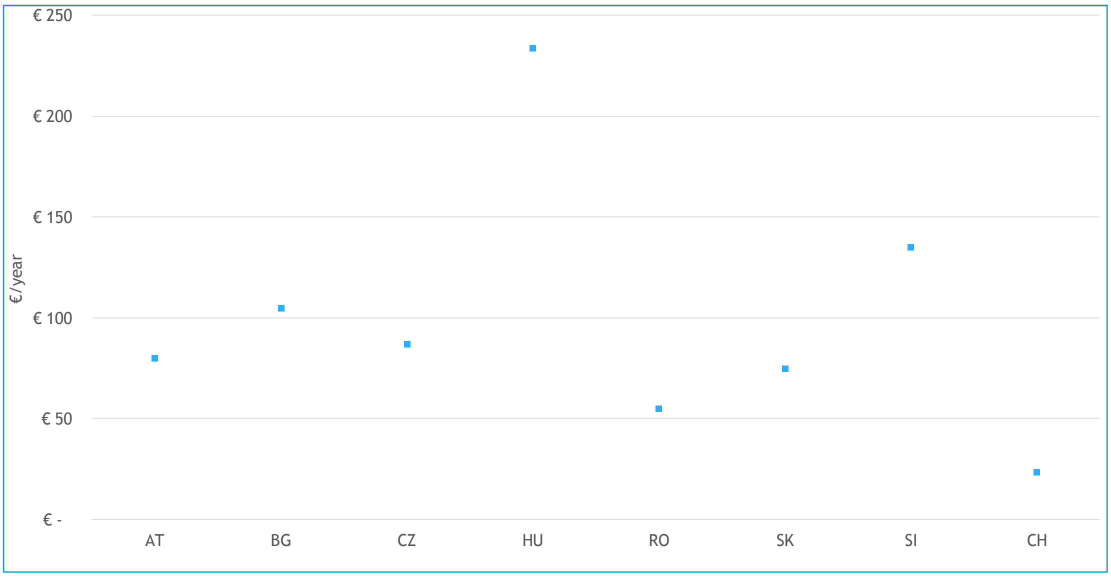


Figure 38 shows the charge levels after PPS correction for motorcycle vignettes in the various countries. The highest charge level after PPS correction is again applied in Hungary (€ 234 per year), which is the same level as paid for passenger cars. Austria and Slovenia apply lower rates for motorcycles than for passenger cars. For example, Slovenia charges motorcycles € 68 per year after PPS correction, while passenger cars are charged € 135 per year after PPS correction.

The lowest rate after PPS correction is again charged in Switzerland (€ 23). As for passenger cars, the vignette prices are the same for all types of motorcycles.

Figure 38 – Vignette charge levels for motorcycles in 2016 (PPS corrected)

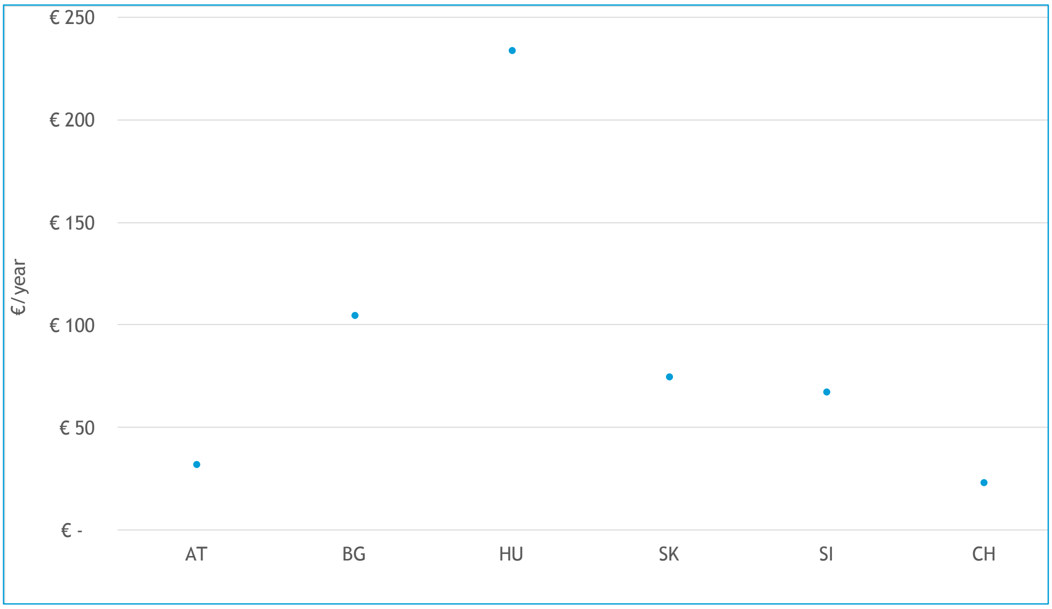
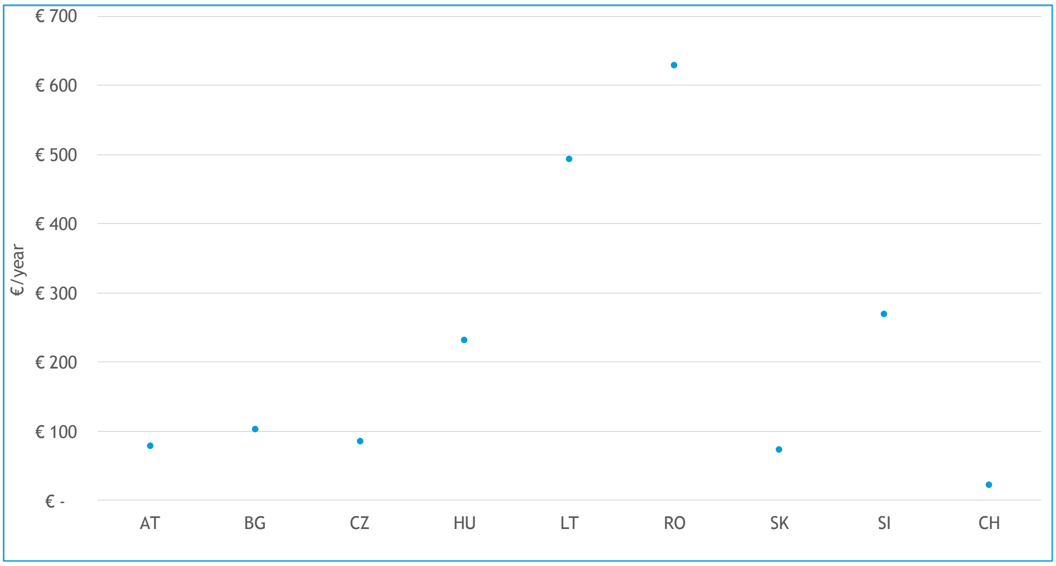


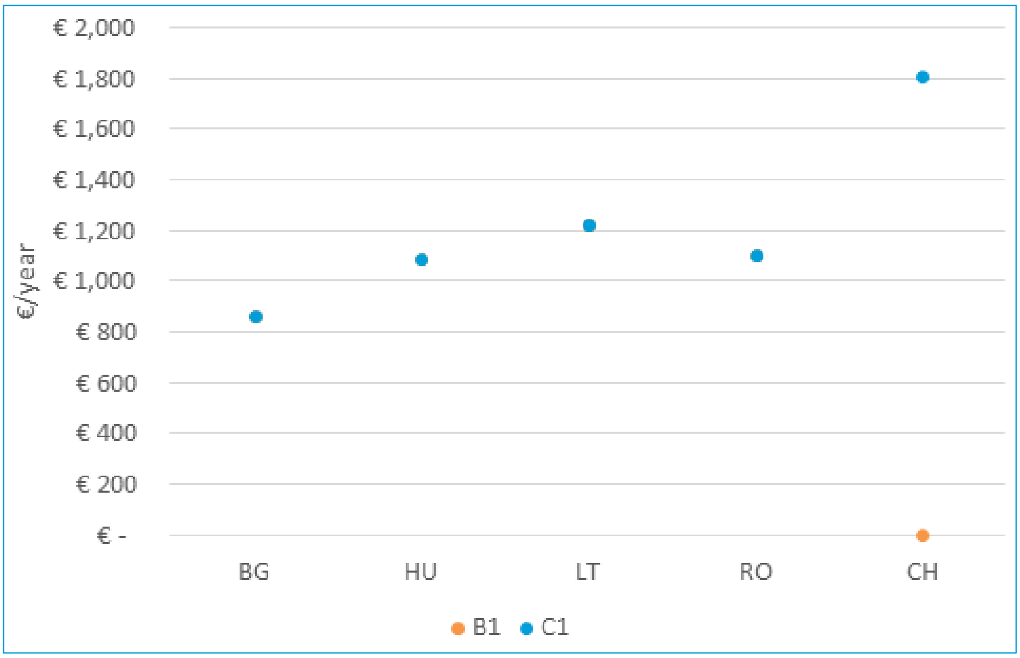
Figure 39 shows the charge levels after PPS correction for LCVs in the nine European countries where a vignette for vans is charged on (part of) the road network. Lithuania is the only country where a vignette applies for LCVs but not for passenger cars. The highest rate after PPS correction is charged in Romania (€ 630 per year) which is a higher rate compared to passenger cars. No differentiation in vignette prices between the reference LCVs is applied in any of the countries.

Figure 39 – Vignette charge levels for vans in 2016 (PPS corrected)



Five European countries have a vignette in place that applies for buses and coaches. The charge levels after PPS correction are displayed in Figure 40. Public buses are exempt from the vignette in Switzerland, while for coaches a vignette is required. In all other countries, both for buses and coaches a vignette should be bought (for the same price). The highest charges after PPS correction are levied in Switzerland (€ 1,811 per year) while the lowest charges after PPS correction apply in Bulgaria (€ 866 per year).

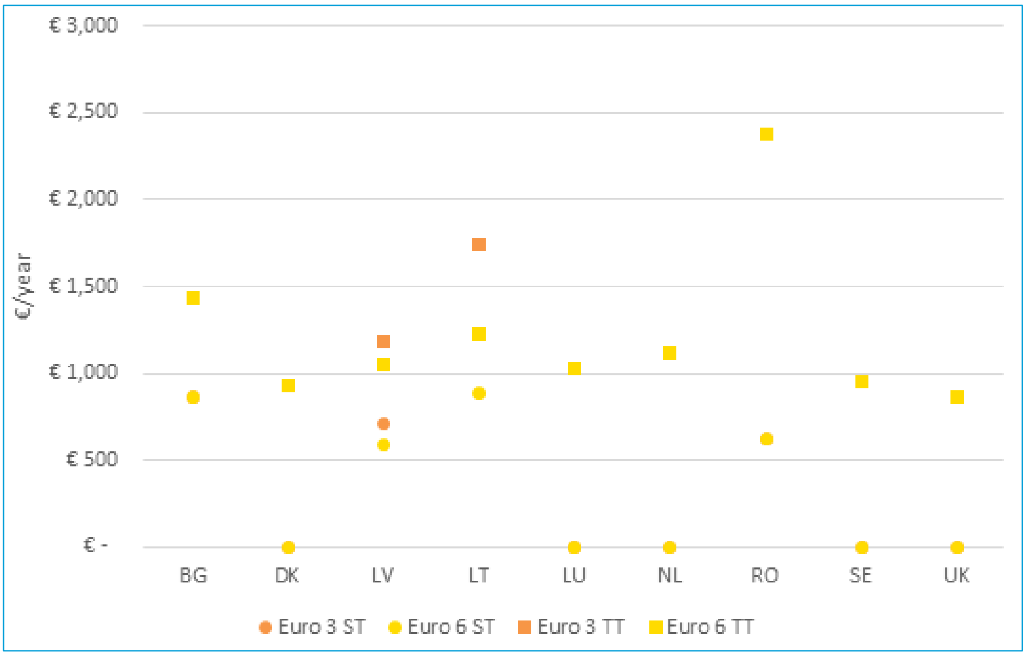
Figure 40 – Vignette charge levels for buses and coaches in 2016 (PPS corrected)



Note: B1 = bus, C1 = coach.

Figure 41 shows the vignette prices after PPS correction for some reference HGVs. Vignettes for HGVs are in many cases differentiated to emission class and vehicle weight. For example, in Latvia and Lithuania different charge levies apply for Euro 3 and Euro 6 trucks, while in Bulgaria and Romania different rates apply for small and large reference trucks. The smaller trucks are exempted in Denmark, Luxembourg, the Netherlands, Sweden and the UK.

Figure 41 – Vignette charge levels for HGVs in 2016 (PPS corrected)



Note: ST = small truck, TT = truck trailer.

Indicative comparison of distance-based road tolls and vignettes

In Figure 42 an indicative comparison of distance-based road tolls and vignettes for passenger cars is made. The rates after PPS correction of both distance-based road tolls and vignettes are presented in € per vehicle- kilometre driven on a tolled road. For distance-based road tolls, these rates are equal to the (average) toll level. However, for vignettes the annual price has to be transferred to rates per vehicle-kilometre. Various methodologies can be used for this transfer, as discussed in the following box.

Methodologies to estimate vignette charge levels in € per vehicle-kilometre

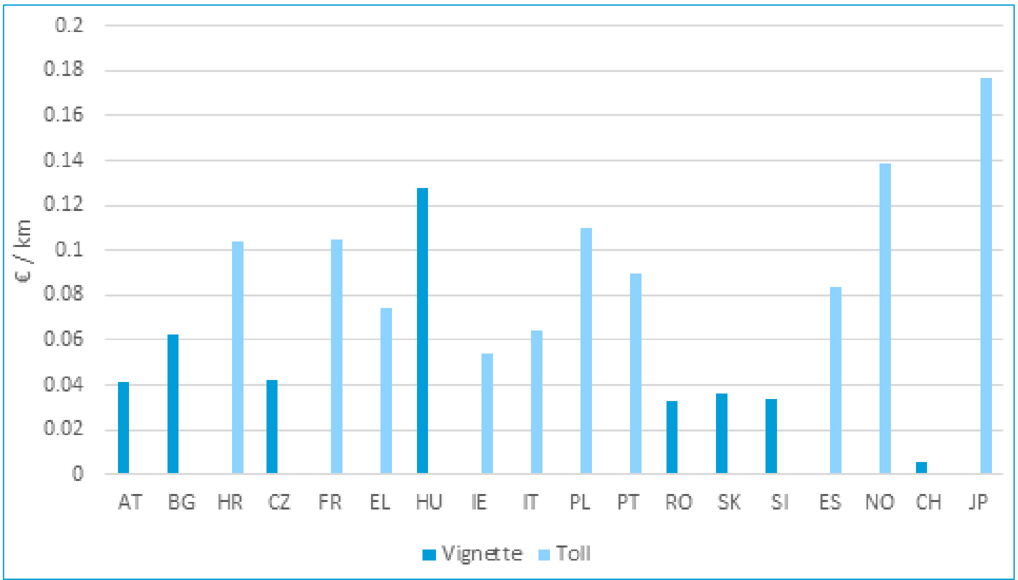
In order to make a direct comparison between distance-based road tolls and vignettes possible, the annual vignette price has to be transferred to a charge level in € per vehicle-kilometre. There are two methods to do this, both with their own pros and cons.

The preferred method is to divide the total annual revenues from vignettes (per vehicle category) by the total number of annual vehicle-kilometres (of that vehicle category) driven on roads where the vignette applies. This indicator would provide a good reflection of the average charge level of vignettes in € per vehicle-kilometre. However, due to data limitations this method cannot be applied in this study. First, the total number of vehicle-kilometres (of that vehicle category) driven on such roads is not available. Then, as discussed in Section 1.3.3, the Eurostat transport performance data used is based on the nationality principle (i.e. activity is reported based on the country of registration of a vehicle). This scope is not in line with the scope of the vignettes, among other things, because foreign vehicles are also obliged to buy a vignette and, particularly for lorries, local vehicles can drive a significant share of their trips outside the country of registration. Estimating vignette charge levels in € per vehicle-kilometre based on Eurostat transport performance data is therefore not feasible. For these two reasons, we were not able to apply this preferred method in this study.

An alternative approach to estimate the vignette charges levels per vehicle-kilometre is dividing the annual vignette price by the average number of vehicle-kilometres an average vehicle drives yearly on roads for which the vignette is necessary. In this approach the scope of the vehicle-kilometres and the vignette is similar. However, as data on the average annual mileages on the charged road network for this specific group of vehicles is not available, this has to be based on an assumption (see the explanation below this text box). Despite this abstraction from real transport performance, this approach results in more useful comparisons of distance-based road tolls and vignettes.

Given the limitations of the transport performance data available for this study (as discussed in the text box above) a methodology is chosen in which the charge levels of vignettes (in € per vehicle-kilometre) are derived by dividing the annual vignette price after PPS correction by the average vehicle-kilometre driven by an average passenger car on roads where vignettes apply. The results are based on a yearly domestic mileage of 15,000 kilometres, while motorway shares in these kilometres are taken from COPERT[13]. The results of this assessment are shown in Figure 42. In general, charge levels for distance-based road tolls exceed the charge levels of vignettes. An exception are the Hungarian vignettes, which is due to the relatively high vignette price in Hungary (€ 234 after PPS correction, which is considerably higher than the vignette prices in other European countries[14]).

Figure 42 – Indicative comparison of charge levels on tolled roads of distance-based charges and time based charges for passenger cars (PPS corrected)

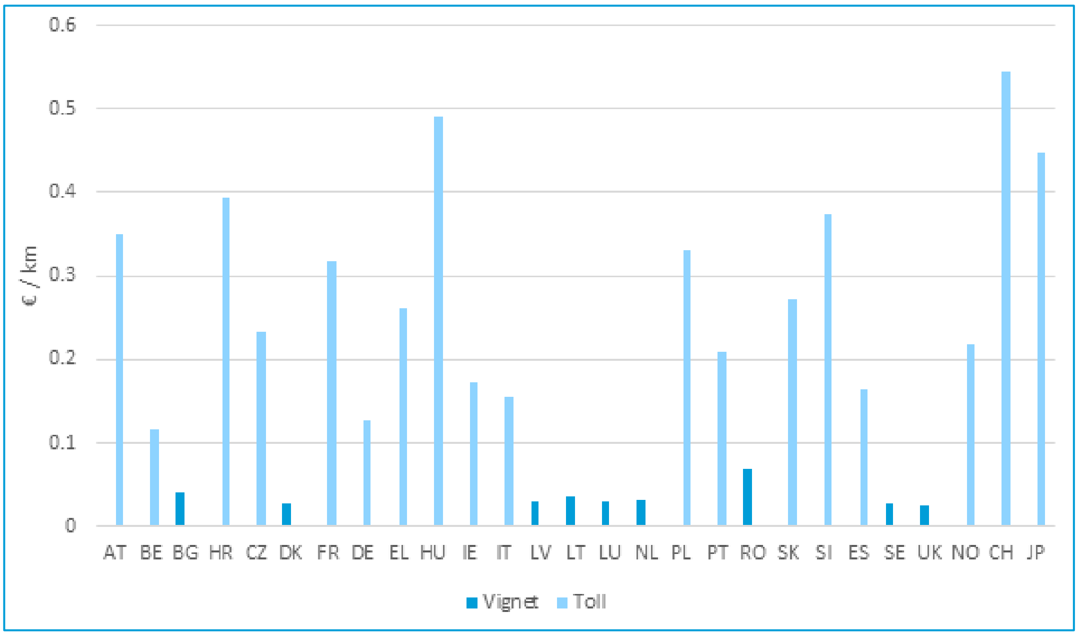


[13] In some countries (i.e. Bulgaria, Hungary, Romania, Slovakia and Slovenia) vignettes apply for certain secondary roads as well. Data availability limit sus to include vehicle kilometres of secondary roads into account, leading to higher estimated charge levels than the actual ones. However, as the length of the these roads is relatively limited in these countries, this bias in the results is relatively small.

[14] Because of this relatively high annual vignette price, many Hungarians take either short-term vignettes or yearly vignettes valid for only one or two counties . The actual burden of vignettes borne by Hungarian passenger car users is therefore often lower than the figures of this analysis suggest.

Figure 43 provides an indicative comparison of charge levels after PPS correction for distance-based and time-based charges for HGVs. For this comparison it is assumed that an average heavy truck drives 35,000 km on roads where a vignette applies. The results are indicative and sensitive to the annual vkm a HGV drives on tolled roads. Vignette costs are higher for trucks that drive less on roads where a vignette applies, while average vignette costs decrease when more distance is driven on roads where a vignette applies. The results show that charges for vignettes are lower than for distance-based road tolls, which is in line with the results found by the EC (2017c).

Figure 43 – Indicative comparison of charge levels on tolled roads of distance-based charges and time based charges for heavy truck (PPS corrected)



Planned introduction of new or changes in existing road charging schemes

There are various countries that have introduced or are planning changes to road charging schemes compared to the 2016 situation. These include Bulgaria, the Czech Republic, Estonia, Denmark, Finland, Germany, Latvia, Lithuania, and the Netherlands.

Since 2016, Estonia has introduced a new road charging scheme, while in Latvia and Germany significant changes to the existing schemes have been made between 2016 and the end of 2019. From 1 January 2018, it is required to pay a user charge(vignette) for all heavy goods vehicles that weigh over 3.5 tonnes and are used on the public road network in Estonia[15]. The toll rate depends on the maximum authorised mass of the heavy goods vehicle and its trailer, the number of axles, and the emission class of the heavy goods vehicle. The vignette should be purchased before entering the road network. In 2017, Latvia extended its vignette scheme to vehicles with a gross weight exceeding 3 tonnes[16]. Germany has extended the HGV toll to other road types, i.e. not only motorways and selected federal roads, but newly now to all federal roads. The extension came into force the 1st of July 2018. The toll levels were adapted on 1 January 2019. This, together with a larger proportion of the network charged additional revenues are expected.

[15] More information can be found on https://teetasu.ee/

[16] https://www.lvvignette.eu/

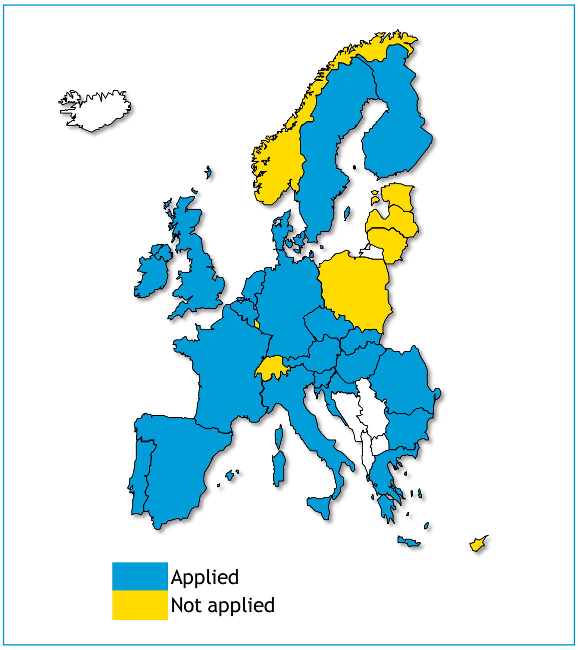
Plans to introduce or change road charging schemes in the years after 2018 exist for Bulgaria, Czech Republic, Denmark, Germany, Finland, Lithuania and The Netherlands as well:

- Bulgaria plans to introduce a new network-wide distance-based tolling system for heavy goods vehicles and coaches in August 2019.
- The Czech Republic is planning to change the structure of toll rates (charging for the use of infrastructure by road motor vehicles with at least 4 wheels and with a gross weight over 3.5 tons). There will be a charge for infrastructure and an external cost charging. The date of implementation is not yet known, however it can be assumed that the division between and infrastructure and external cost charge will be valid at the earliest on 1 January 2020.
- The German HGV charging scheme has been updated with infrastructure and external costs included in the HGV toll since the beginning of 2019. The new toll levels were determined based on the latest infrastructure cost assessment. For vehicles above 18 tonnes, the toll will increase by more than 30% on average. Both changes mentioned above will lead to additional revenues of around € 3 billion per year. Furthermore, Germany is also considering a new time-based charge for passenger cars and vans. Plans have been there for a long time, but due to the legal dispute with the EU, it is unclear when and whether it will be introduced.
- Denmark is considering a similar tolling system for passenger cars as Germany.
- Finland is considering a time-based road user charge for heavy goods vehicles (i.e. a vignette) to the entire Finnish road network for vehicles of more than 12 tonnes. The vignette is planned to be introduced in 2021.
- Lithuania is planning to start introducing distance-based e-tolling in 2020 and the goal is to harmonise legislation to EU documents regulating this area.
- The Netherlands is planning to introduce a distance-based road charging scheme for HGVs in 2023.

3.3.5 Insurance taxes

Insurance taxes on motor insurance are levied in most European countries (see Figure 44). Only Cyprus, Estonia, Latvia, Lithuania, Norway, Poland and Switzerland do not levy insurance taxes. Insurance taxes are levied over the insurance premium and most countries do not differentiate tax levels. Only in Belgium, Denmark and France insurance taxes differ between vehicle types. In the US states California and Missouri, and the Canadian provinces Alberta and British Columbia insurance taxes are applied for all vehicle categories. Japan does not levy an insurance tax on motor insurances.

Figure 44 – Insurance taxes on motor insurance in the EU in 2016



Charge levels

The level of insurance taxation differs substantially between countries as is shown in Figure 45. Denmark (43%), France (33%) and Sweden (32%) have the highest levels in Europe, while Ireland (5%), Italy (5%) and Bulgaria (2%) have considerably lower taxation of motor insurances. The insurance tax rates in the Canadian states Alberta (10%) and British Columbia (17%) are comparable with the tax rates in Europe, while tax rates in the US states Missouri (2%) and California (2%) are considerably lower. Table 6 shows the insurance tax levels for countries where tax rates differ between vehicle type.

Figure 45 – Insurance tax levels for passenger cars

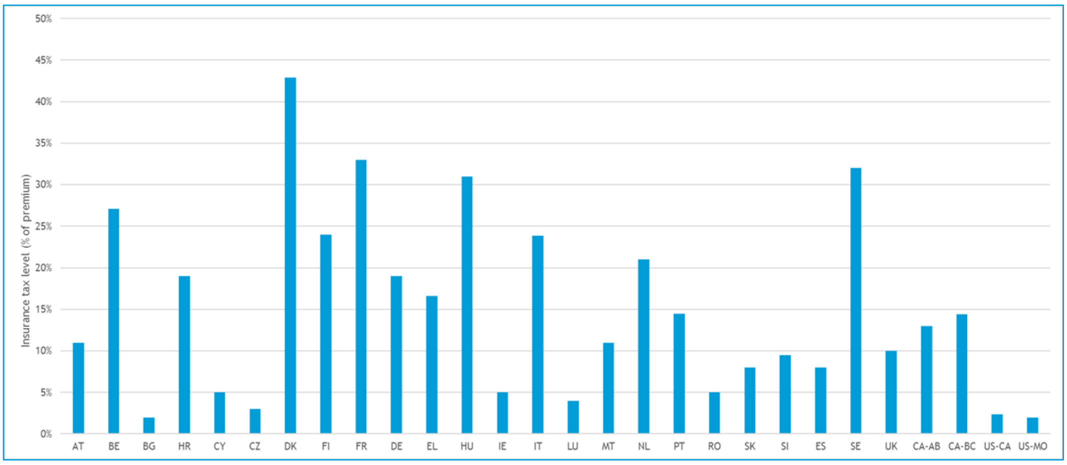


Table 6 – Differentiated insurance tax levels (% of insurance premium)

	PC and MC	Bus	Van	HGV
Belgium	27%	14%	27%	13%
Denmark	43%	43%	43%	0%
France	33%	15%	33%	15%

3.3.6 VAT on taxes/charges

As mentioned in Section 2.2, VAT levied on other transport taxes are considered indirect transport taxes in this study and therefore they are taken into account in our assessments. Figure 46 shows for which transport taxes and charges VAT applies per country. As mentioned in Table 4, VAT is only relevant for private passenger transport, as companies can reclaim the VAT paid. Therefore, we only consider VAT levied on taxes/charges that have to be paid by final consumers in this section.

All countries levy VAT over fuel excise duties and electricity taxes. With respect to purchase/ registration taxes there are 13 countries that levy VAT, while ten countries levy VAT over ownership taxes. No European countries levy VAT over insurance taxes. In general, the various countries levy VAT on road pricing schemes (i.e. distance-based tolls, vignettes and urban road pricing schemes). There are, however, a few exceptions[17]: both in Bulgaria and Czech Republic, road vignettes are fully exempted from VAT. Additionally, the urban road charges applied in Italian, Latvian, Maltese and UK cities are exempted from VAT as well.

Regarding the non-EU countries/regions, they levy sales taxes over fuel taxes and electricity. Table 7 provides more information about sales taxes in the non-European countries.

Table 7 – Sales taxes applied outside Europe in 2016

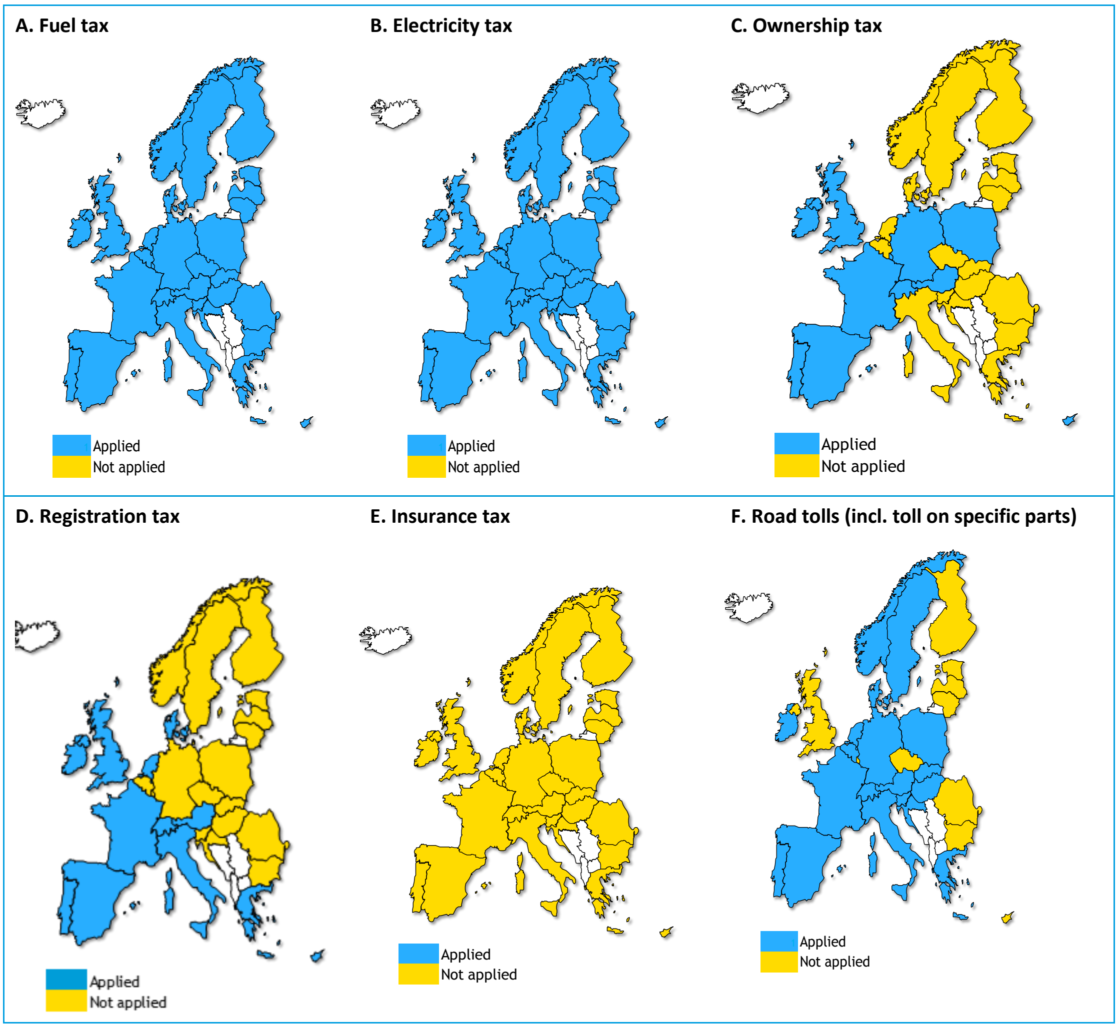
	Sales taxes on fuel tax	Sales taxes on electricity tax	Sales taxes on vehicle ownership or circulation tax	Sales taxes on purchase or registration tax	Sales taxes on insurance tax	Sales taxes on tolls	Sales taxes on vignettes	Sales taxes on urban road charges
Canada – Alberta	Yes	Yes	Yes	No	Yes	No	No	No
Canada – British Columbia	Yes	Yes	No	Yes	Yes	Yes	No	No
United States – California	Yes	Yes	No	No	Yes	Yes	No	No
United States – Missouri	Yes	Yes	Yes	Yes	Yes	No	No	No
Japan	Yes	Yes	Yes	Yes	No	Yes	No	No

The VAT levels that apply in the various countries are shown in Table 8. All countries apply the standard VAT rate for fuel taxes, vehicle taxes, insurance taxes and road tolls and vignettes. However many countries do apply reduced VAT rates for bus tickets, domestic coach tickets. VAT rates on international coach trips are often reduced or exempt as well. All these VAT exemptions or

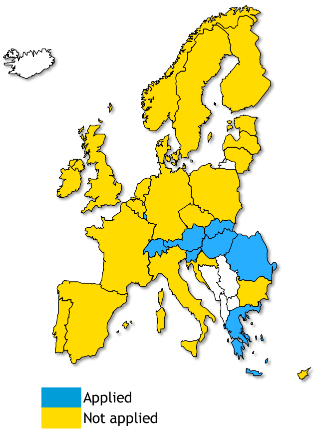
[17] Exempting road charges from VAT is allowed as the scheme is operated by a public body (and in case also private operators exist, the toll must be operated under different conditions than those applying to private operators.

reductions can be considered an implicit transport subsidy. Please notice that these kind of subsidies are out of scope of this study (see Section 1.3.5) and will therefore not considered in other assessments carried out in this study.

Figure 46 – Overview of countries that apply value added tax applied in EU28 in 2016



G. Vignettes



H. Urban road tolls

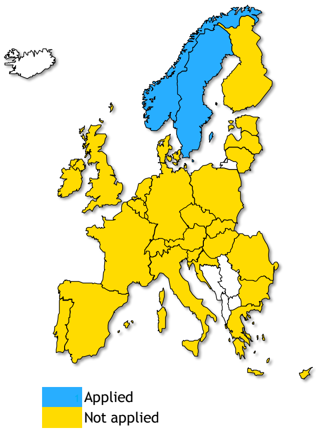


Table 8 – VAT rates applied in 2016

	Standard VAT rate applied in the country (%)	VAT rate on bus tickets (%)	VAT rate on coach tickets (%) Domestic trips	VAT rate on coach tickets (%) Domestic[18] part of international trips
Austria	20%	10%	10%	10%
Belgium	21%	6%	6%	6%
Bulgaria	20%	20%	20%	20%
Croatia	25%	25%	25%	25%
Cyprus	19%	9%	9%	19%
Czech Republic	21%	15%	15%	0%
Denmark	25%	0%	0%	0%
Estonia	20%	20%	20%	0%
Finland	24%	10%	10%	0%
France	20%	10%	10%	10%
Germany	19%	7%[a]	19%[a]	19% [a]
Greece	24%	24%	24%	24%
Hungary	27%	27%	27%	0%
Ireland	23%	0%	0%	0%
Italy	22%	10%	10%	0%
Latvia	21%	12%	12%	0%
Lithuania	21%	9%	9%	0%
Luxembourg	17%	3%	3%	0%
Malta	18%	0%	0%	0%
Netherlands	21%	6%	6%	6%
Poland	23%	8%	8%	8%
Portugal	23%	0%	0%	0%
Romania	20%	20%	20%	0%
Slovakia	20%	20%	20%	0%
Slovenia	22%	10%	10%	10%
Spain	21%	10%	10%	10%

[18] E.g. for a trip from Vienna to Munich, 10% VAT has to be paid for the Austrian part of the trip and 19% for the German part.

	Standard VAT rate applied in the country (%)	VAT rate on bus tickets (%)	VAT rate on coach tickets (%) Domestic trips	VAT rate on coach tickets (%) Domestic[18] part of international trips
Sweden	25%	6%	6%	0%
United Kingdom	20%	0%	0%	0%
Norway	25%	8%	8%	0%
Switzerland	8%	8%	8%	8%
Canada – Alberta	0%	0%	0%	0%
Canada – British Columbia	0%	0%	0%	0%
United States – California	0%	0%	0%	0%
United States – Missouri	4%	0%	0%	0%
Japan	8%	7%	7%	0%

[a] A VAT rate of 7% is applied on scheduled busses and unscheduled busses/coaches for transport distances less than 50 kilometres. For unscheduled trips above 50 kilometres, a VAT rate of 19% applies.

3.4 Revenues from road taxes and charges

3.4.1 Total revenue

An overview of the total tax/charge revenue in 2016 in the various countries is given in Table 9. All figures are PPS adjusted to allow comparison between countries (see also Section 1.3). The unadjusted figures can be found in Annex E.2.

Table 9 – Total revenue from road taxes and charges in 2016 (billion €, PPS adjusted)

Member State	Fuel excise duty and electricity tax	Registration tax	Ownership tax	Tolls and vignettes	Insurance tax	VAT on taxes/charges	Total revenue
EU28	198.02	16.49	42.56	32.18	19.40	41.33	349.97
EU27	169.07	16.49	36.79	31.60	17.78	36.10	307.83
Austria	3.92	0.39	2.08	1.79	0.32	1.25	9.74
Belgium	4.73	0.36	1.48	0.69	0.89	0.80	8.95
Bulgaria	2.40*	-	0.30	0.35	0.01	0.36	3.42
Croatia	1.70	0.21	0.09	0.54	0.11	0.41	3.06
Cyprus	0.34*	0.01	0.11	-	0.01*	0.06	0.53
Czech Republic	4.46	-	0.34	0.82	0.07	0.57	6.27
Denmark	1.90	1.95	1.06	0.49	0.15	0.86	6.41
Estonia	0.69	-	0.01	-	-	0.11	0.81
Finland	2.20	0.78	0.88	-	0.32	0.42	4.60
France	26.04	2.00	0.78	8.98	4.33	5.72	47.85
Germany	34.85	-	8.45	4.37	4.06	6.99	58.71
Greece	4.46	0.23	1.36	0.61	0.55*	0.98	8.19
Hungary	3.35	0.13	0.40	1.13	0.18	0.68	5.86
Ireland	2.25	0.76	1.02	0.20	0.08*	0.71	5.01
Italy	30.16	1.72	6.93	6.05	3.95	6.75	55.56
Latvia	0.69	0.02	0.12	0.03	-	0.09	0.95
Lithuania	1.08	-	0.10	0.07	-	0.14	1.39

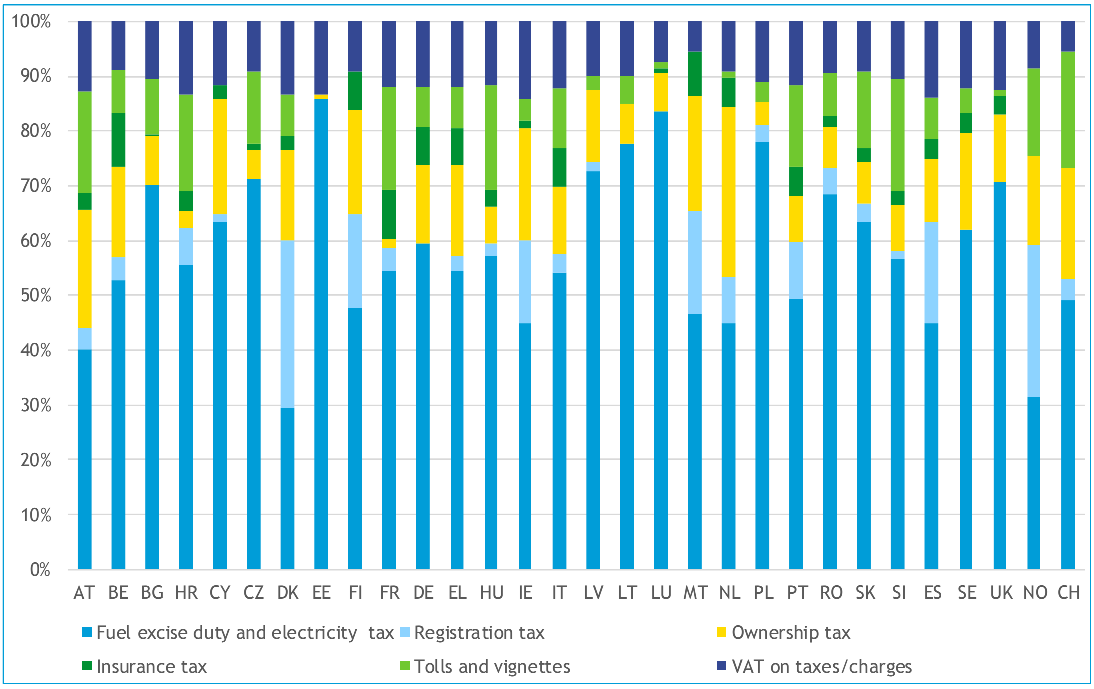
Member State	Fuel excise duty and electricity tax	Registration tax	Ownership tax	Tolls and vignettes	Insurance tax	VAT on taxes/charges	Total revenue
Luxembourg	0.68	-	0.06	0.01	0.01*	0.06	0.82
Malta	0.14*	0.05	0.06	-	0.02	0.02	0.29
Netherlands	7.29	1.40	5.03	0.17	0.87	1.51	16.27
Poland	8.45	0.35	0.44	0.40	-	1.21	10.84
Portugal	4.08	0.86	0.69	1.23	0.43	0.95	8.25
Romania	4.55*	0.32	0.50	0.52	0.14*	0.62	6.64
Slovakia	1.79	0.09*	0.21	0.39	0.08*	0.26	2.82
Slovenia	1.33	0.03	0.18	0.44	0.05	0.23	2.28
Spain	11.72	4.85	3.02	2.04	0.91*	3.60	26.13
Sweden	3.82	-	1.08	0.28	0.23	0.75	6.17
United Kingdom	28.95	-	5.77	0.58	1.62	5.23	42.15
Norway	1.39	1.23	0.72	0.71	-	0.37	4.43
Switzerland	2.75	0.21	1.13	1.19	-	0.30	5.58
Canada – Alberta	0.77	-	0.29	-	0.37	0.05	1.48
Canada – British Columbia	0.20	-	-	-	0.34	0.05	0.59
United States – California	6.26	-	2.69	0.23	0.38	---	9.56
United States – Missouri	0.49	-	0.12	-	0.05	0.02	0.68
Japan	26.30	0.79	17.75	15.03	-	4.07	63.94

* Estimated amounts.

The total revenue of road transport taxes and charges in the EU28 in 2016 is about € 350 billion. As is shown in Table 9, the main part of the revenue is from fuel excise duties (57%), followed by vehicle taxes (17%), VAT on taxes (12%), infrastructure charges (9%) and insurance taxes (5%) Fuel tax preponderance is linked to the fact that it is levied in every country for all vehicle categories.

Figure 46 shows that the contribution of the various taxes and charges to total revenue varies significantly between countries. In Estonia, for example, more than 80% of tax revenue comes from fuel taxes, while in Denmark it represent less than 30% of total revenue. In the latter country the revenue from vehicle taxes (particularly registration and ownership taxes) are relatively high, as is this case for countries like The Netherlands, Norway, Malta and Ireland. In France, Croatia, Portugal, Slovenia and Austria infrastructure charges contribute significantly to total road tax/charge revenue (more than 20%).

Figure 46 – Share of different types of taxes and charges in total road tax/charge revenue in 2016



3.4.2 Average revenue

Average revenues per vehicle-kilometre allow cross country comparison of revenues from the various taxes and charges. As the scope of the various taxes and charges differ, the preferred approach to estimate these average revenues differ between the various types of taxes/charges:

- For vehicle taxes (purchase and ownership taxes) and insurance taxes, the scope is well in line with the nationality principle and hence average revenues should be estimated by dividing total revenues by the total transport performance of vehicles registered in the respective country.
- For fuel taxes, road tolls, and vignettes, the scope is in line with the territoriality principle and therefore the average revenues for these taxes/charges are preferably be estimated by dividing the total revenues by the total transport performance on the national territory.

As was discussed in Sections 1.3.3 and 2.4, in this project we apply transport performance data from Eurostat, which is reported based on the nationality principle. Consequently, for fuel taxes, road tolls and vignettes we cannot estimate the average revenues by just dividing the total revenues by these transport performance data, as this results in incorrect results. For example, consider a country with a lot of transit traffic (e.g. Austria). Dividing the total toll revenues by the Eurostat transport performance data will result in too high average revenues, as the vehicle-kilometres driven by foreign vehicles in Austria are not taken into account[19]. For this reason, an alternative approach is applied to estimate the average revenues for road transport taxes and charges.

A complete overview of the methodologies to estimate the average revenues for road transport taxes and charges is given in Table 10. As the scope and characteristics of the various taxes and charges vary (as discussed above), different methodologies have been applied per tax/charge.

[19] The kilometres of Austrian vehicles abroad are taken into account, but as they are less than the kilometres driven by foreign vehicles in Austria, too high average toll revenues are found.

Table 10 – Methodologies to estimate average revenues for road transport

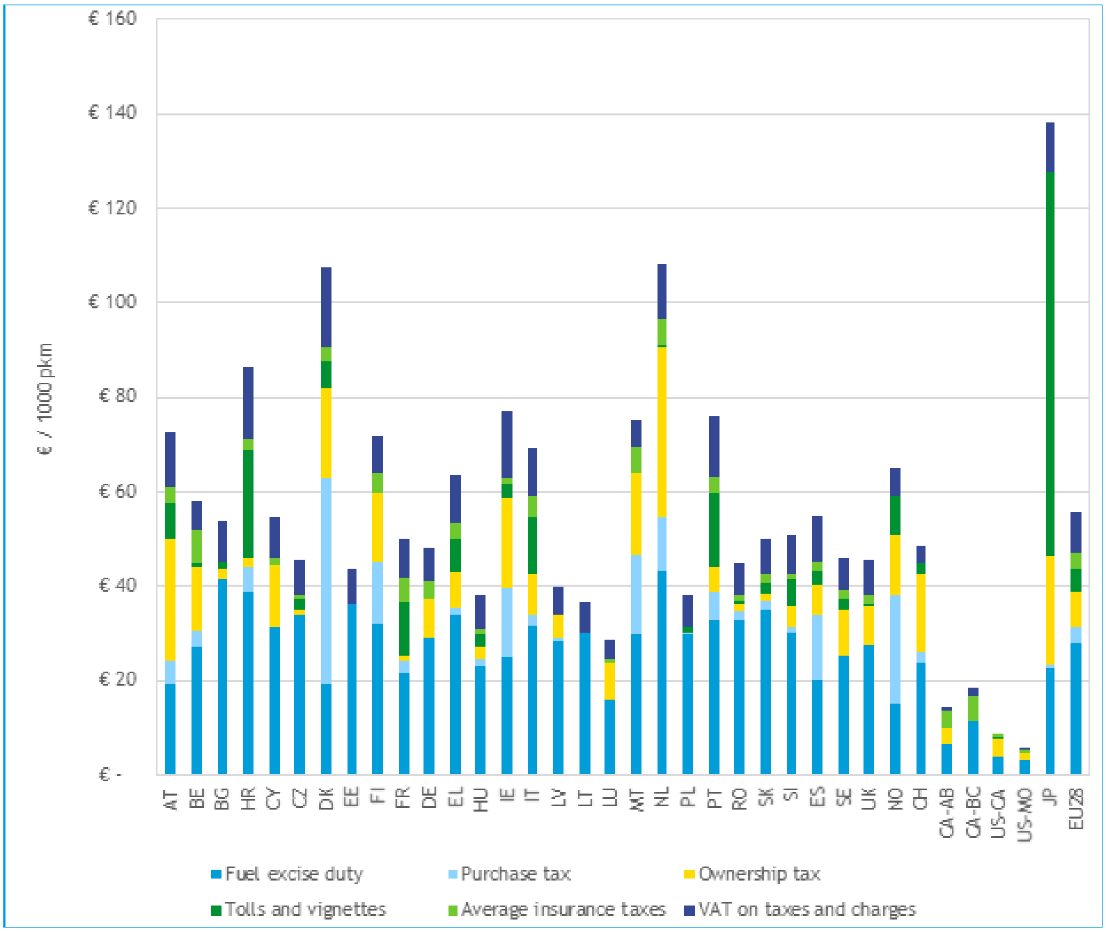
Tax/charge	Methodology to estimate average revenues
Fuel taxes	Average fuel consumption figures (in l/vkm) are estimated (based on COPERT), which are multiplied with the relevant fuel tax rates.
Purchase/registration taxes	Total revenues are divided by Eurostat transport performance data. As purchase taxes are only paid by domestic vehicles, the scope of tax revenues and Eurostat transport performance data is well in line.
Ownership/circulation taxes	Same approach as for purchase/registration taxes.
Road tolls	Total revenues are divided by the vehicle-kilometres made on the tolled road network. These data is taken from the ASECAP country reports, which present the vehicle-kilometres as reported by the national road toll operators. These average revenues for tolled roads have to be scaled down to figures for the entire road network. This is done by using the shares of motorway kilometres in the total number of vehicle-kilometres in a country (from COPERT).
Vignettes	Same approach as for purchase/registration taxes. This approach may result in incorrect results for some vehicle categories/countries, as the scope of the Eurostat transport performance data and the vignette revenues differ. However, no alternative approach is available to estimate these average revenues.
Insurance taxes	Same approach as for purchase/registration taxes.

The results of our assessment on average revenues are shown in Figure 47 to Figure 51. The average revenues adjusted for PPS for passenger cars in 2016 are presented in Figure 47. These revenues are highest in Croatia, Malta, the Netherlands, and Denmark. In the first three countries, the average fuel tax revenues are relatively high, particularly caused by high average fuel consumption figures (according to COPERT). Additionally, average road toll revenues significantly contribute to the high revenues in Croatia, while in Malta and the Netherlands vehicle taxes are relatively high. The high revenues in Denmark are mainly explained by the relatively high vehicle taxes. Lowest average revenues are estimated for Luxembourg and Lithuania, which can be explained by the limited number of taxes/charges applied for road transport (in addition to fuel taxes) and the relatively low fuel tax levels in these countries.

Fuel excise duties are the main source of revenue for most EU countries. Main exceptions are Austria, Denmark and Norway. These countries have rather high vehicle tax levels (and road tolls), while the average fuel economy of passenger cars in these countries are relatively high (according to COPERT). In countries like Croatia and Portugal road tolls also significantly contribute to the total revenues, while in Austria, Denmark, Ireland, Malta, the Netherlands, Spain, and Norway vehicle taxes are a main source of revenue.

Average revenues in North America are considerably lower than in Europe. In Missouri revenues are about € 5 per 1,000 pkm, while in California and the Canadian states the average revenues are only slightly higher. In Japan average revenues for passenger cars are higher than in any Europe country. This is mostly due to relatively high revenue from toll charges, as Japan levies toll on all expressways and charge levels exceeding European charge rates.

Figure 47 – Average revenue from taxes and charges for passenger cars in 2016 (€/1,000 pkm, PPS adjusted)



The average revenues from taxes and charges for motorcycles are displayed in Figure 48. The highest charges are paid in Austria, Bulgaria, and Portugal. Ownership tax levels for motorcycles in Austria are relatively high while in Portugal the toll rate for motorcycles is relatively high (in Portugal no reduced toll rate applies for motorcycles as is the case in most other countries). In Bulgaria, average fuel tax revenues are relatively high as are the ownership tax revenues. The lowest average revenues are found for Ireland and Luxembourg, which is due to a combination of low charge levels and PPS correction.

Average revenues in North America are again lower than in Europe. Only in California tax revenue is comparable with European countries due to a high revenue from ownership tax. Finally, average revenues in Japan are comparable with European levels.

Figure 48 – Average revenue from taxes and charges for motorcycles in 2016 (€/1,000 pkm, PPS adjusted)

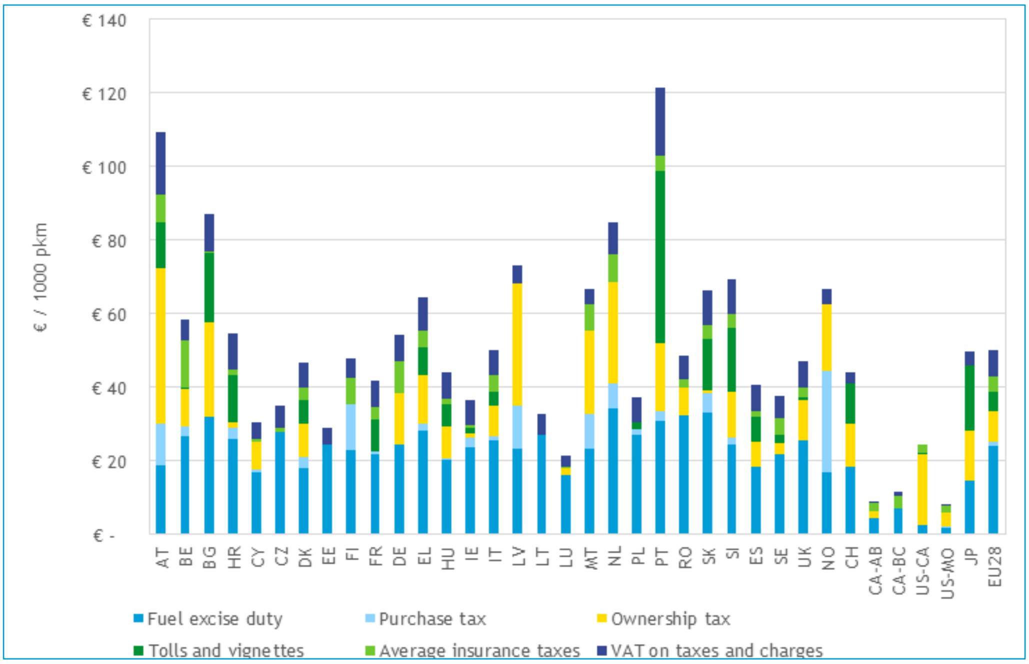


Figure 49 displays the average revenue from taxes and charges for buses and coaches. The highest tax levels can be found in Croatia, Romania and Switzerland. In Croatia and Switzerland tolls and vignettes significantly source revenues, while in Romania diesel tax is relatively high as is explained in Section 3.3.1. The lowest average revenues are found in Luxembourg and Spain, which is partly explained by the relatively low diesel taxes in both countries. Finally, average revenue from purchase taxes is only relevant in Denmark.

Average tax revenues for buses/coaches in North America are, in general, lower than in Europe, while average tax/charge revenues in Japan are comparable with the levels in Europe.

Figure 49 – Average revenue from taxes and charges for buses and coaches in 2016 (€/1,000 pkm, PPS adjusted)

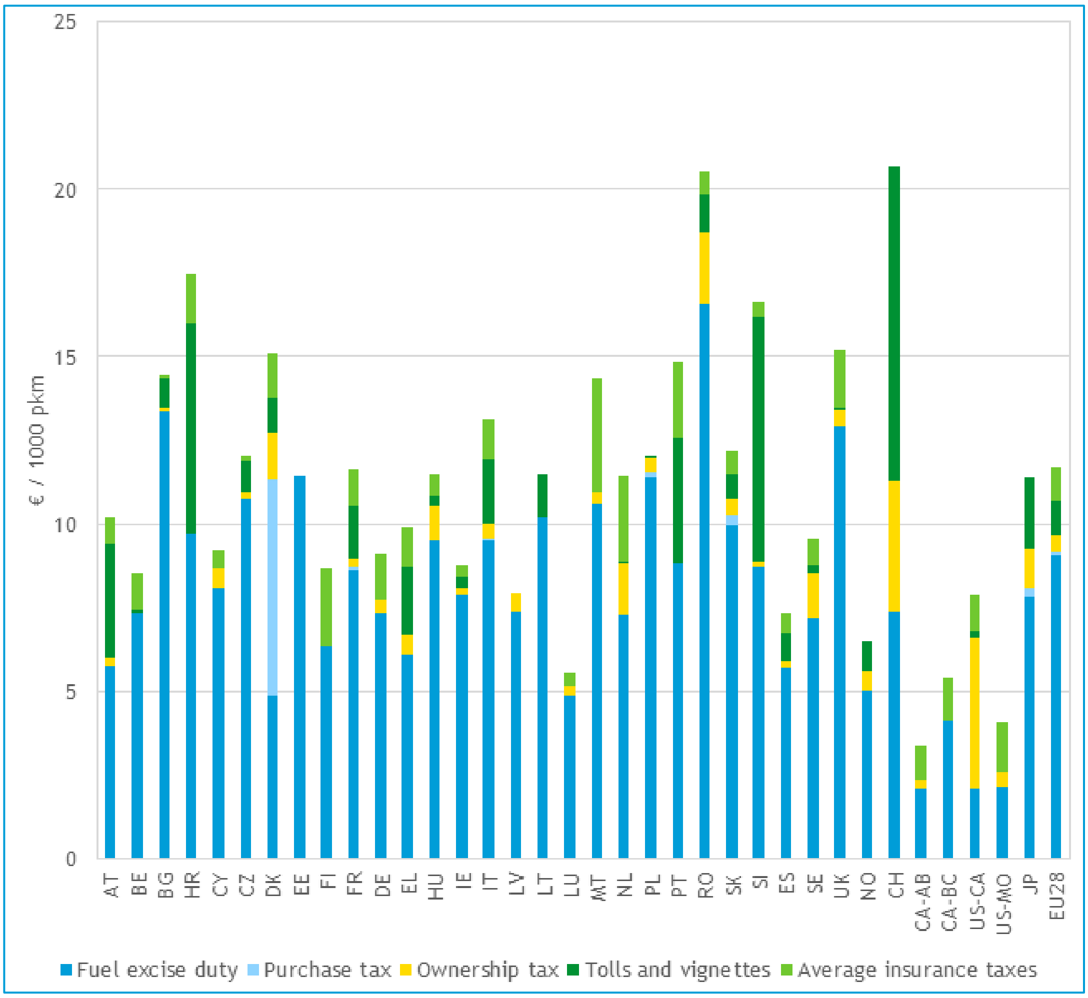
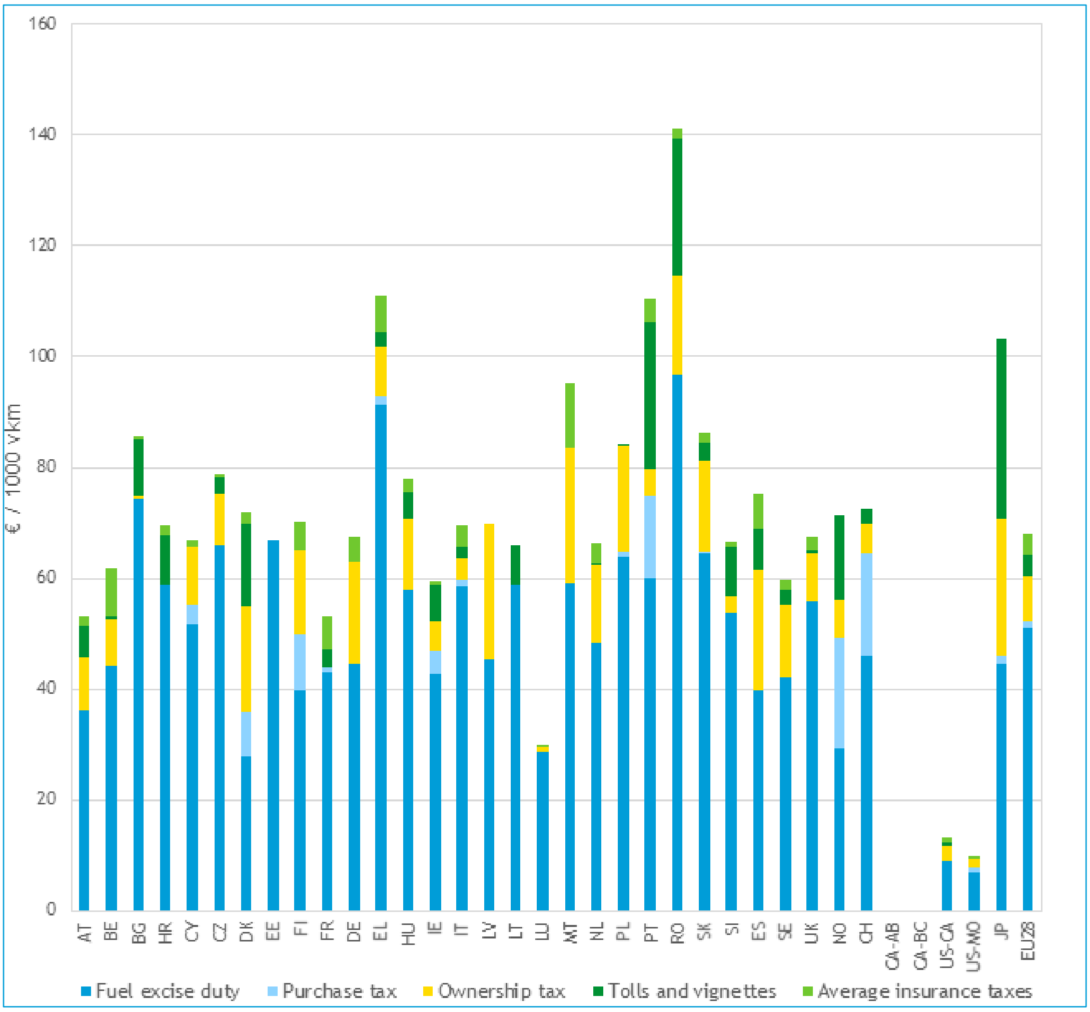


Figure 50 shows the average revenue from taxes and charges for LCVs. The highest tax revenue can be found in Greece, Romania, Portugal and Malta. This is due to a combination of relative fuel inefficient vehicles, and relative high fuel and vehicle taxes. In Portugal and Romania revenue from tolls and vignettes also play a role. The lowest tax level is found in Luxembourg, where fuel taxes are relatively low and other taxes/charges are hardly applied.

Tax levels in the US are lower than in any European country, while taxes in Japan exceed average tax levels in the EU28. It was not possible to estimate the average tax/charge revenues for the Canadian states, as data on transport performances of LCVs for these states was not available.

Figure 50 – Average revenue from taxes and charges for LCVs in 2016 (€/1,000 vkm, PPS adjusted)



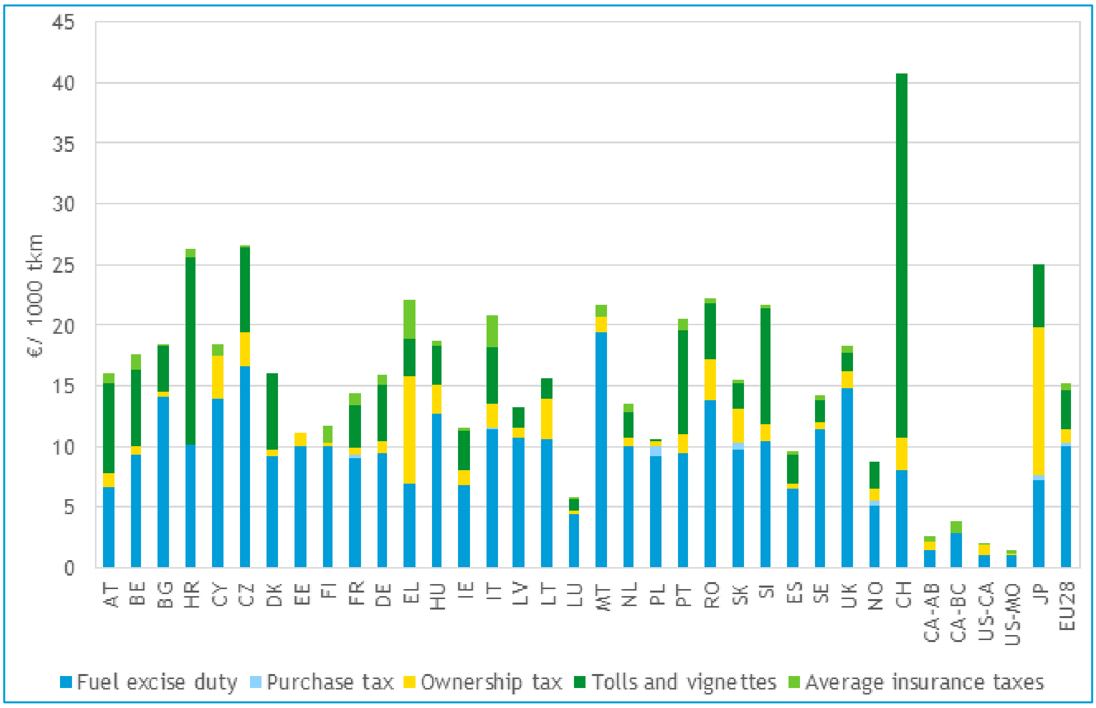
Note: The Canadian provinces Alberta and British Columbia do not report separate transport performance data for LCVs.

The average revenue from taxes and charges for HGVs is shown in Figure 51. As for the other modes of transportation, fuel excise duty revenue account for a main part of the revenues. However, in countries with HGV charging schemes (Austria, Belgium, Czech Republic, Germany, Hungary, Slovakia, Slovenia and Switzerland) and countries with more general road charging schemes (e.g. Croatia, Portugal, Spain) the contribution of tolls to total revenue is significant as well. In general, the average revenue in these countries is higher than in most countries without a large-scale HGV road charging scheme.

Considering individual countries, the highest average revenues are found for Switzerland, Croatia, and Czech Republic. As mentioned above, average revenues in these countries depend for a large portion on the distance-based tolls that apply on major roads these countries. In Switzerland toll is levied on all type of roads, resulting in a very high share of revenue from tolls. Malta has a high share of revenue from fuel taxes. As the average load factor of trucks in Malta is relatively low, relatively high average fuel tax levels (in €/tkm) are found.

Average revenues in North America are considerably lower than in Europe, due to much lower tax/charge levels applied in the US and Canada. Average revenues of HGVs in Japan are relatively high, which is partly explained by relative high ownership tax levels.

Figure 51 – Average revenue from taxes and charges for HGVs in 2016 (€/1,000 tkm, PPS adjusted)



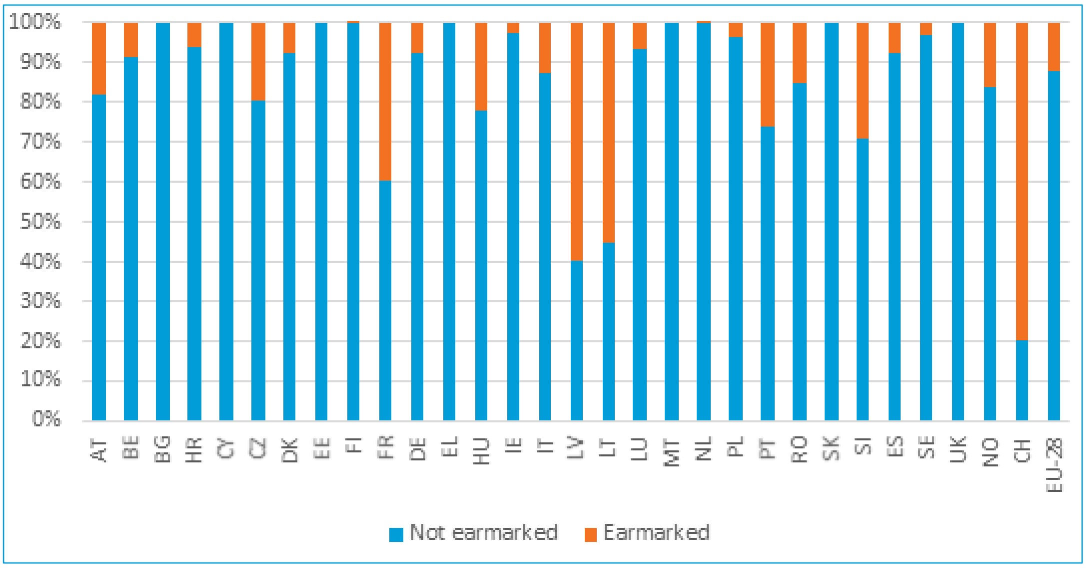
3.4.3 Earmarking of revenue

The share of the total revenue in road tax/charge revenue that is earmarked for expenditures on transport infrastructure is shown in Figure 52. A further breakdown, showing the results for the various taxes/charges, can be found in Annex C.

In the EU28, about 10% of the revenues from road transport taxes and charges are earmarked for transport infrastructure expenditures (or mitigation measures for external costs of transport). In most EU countries, the share is estimated between 0 and 25%, but in Latvia, Lithuania and Switzerland a much larger share of the total revenues are earmarked (about 60, 55 and 80%, respectively).
The main reason for this relatively high shares is the fact that fuel taxes are (to a large extent) earmarked for transport infrastructure expenditures in these countries. As fuel taxes make up the main part of the total tax/charge revenues, this implies that also a significant share of the total tax/charge revenues are earmarked. A significant share of total tax/charge revenues in Switzerland is due to tolls and vignettes. These revenues are earmarked as well resulting in the high share (80%) of earmarking.

Finally, revenues from road transport taxes and charges in the US state California and Canadian provinces are not earmarked at all, while in Missouri 14% of revenues are earmarked and in Japan 22% of the total revenues are earmarked.

Figure 52 – Share of earmarked revenue in total road tax/charge revenue



4 Rail transport

4.1 Introduction

In this chapter we discuss the taxes and charges applied for rail transport. We do this for all countries considered in this study (see Section 1.3.2), except for Malta and Cyprus as these countries do not have a railways network. As for high speed trains, we considered Belgium, France, Germany, Italy, Netherlands, Spain, UK and Japan[20].

In Section 4.2, we first provide an overview of the rail taxes and charges that are considered in this study. The structure and level of the rail taxes and charges is discussed in detail in Section 4.3. Finally, the revenue of rail taxes and charges in the various countries in 2016 is presented in Section 4.4. In this Section, we also discuss the extent by which the revenues are earmarked for rail infrastructure expenditures.

4.2 Overview of rail taxes and charges

An overview of rail taxes and charges considered in this study is presented in Table 11. For each tax or charge it is indicated whether it can be categorised as, energy, vehicle, or infrastructure tax or charge and whether it should be considered as fixed or variable tax/charge.

Table 11 – Overview of rail transport taxes and charges

Tax/charge	Description	Energy, vehicle or infrastructure tax/charge	Fixed or variable tax/charge
Taxes			
Fuel tax (diesel)	Consumption tax on transport fuel.	Energy	Variable
Electricity tax	Consumption tax on electricity.	Energy	Variable
Charges			
Rail infrastructure access charge	Charges for the use of rail infrastructure. This charge may include track access charges, charges for using stations, congestion charges, environmental charges, etc. This is discussed in more detail below this table.	Infrastructure	Variable
Charges on specific parts of the rail infrastructure	Charges for using bridges or tunnels.	Infrastructure	Fixed or variable[21]
ETS	The CO_2 emissions of electricity production (consumed by electric trains) is covered by the European Emission Trading Scheme.	Energy	Variable

[20] For Sweden, the European Statistical Pocketbook presents transport performance data for high speed trains, while no data on high speed infrastructure is presented. Therefore, in this report high speed trains are considered as conventional trains in Sweden. For Poland, no specific data on taxes/charges for high speed trains was available and hence high speed trains were not considered separately for Poland as well.

[21] Depending on the rail infrastructure. For instance, the access to the Channel Tunnel consists of a fixed charge per each transit. The access charge for using other specific parts of the rail infrastructure at national level is charge per train-km.

The information on fuel and electricity taxes has been identified on a national basis, according to the legislation in force on taxation. VAT on fuel taxes and electricity is not considered in this overview, because infrastructure managers and rail undertakings can be entitled by a tax refund.

Infrastructure access charges have been calculated gathering the information from the network statements of the infrastructure managers. All in all, the approach to calculate the infrastructure access charges has been found different country by country. Therefore, to get the most homogeneous picture across the geographical scope covered by this study, the infrastructure access charges have been estimated with respect to a “minimum access package” of a typical train, which only considers the cost components that are actually charged to a train for accessing and using a railway line.

In so doing, the infrastructure access charges have been calculated with respect to three cost components, namely: (i) wear and tear of e.g., tracks and catenary consumption (called a ‘direct cost’ in Directive 2012/34/EU), (ii) the ability/willingness to pay of a railway undertaking (called a ‘mark-up’ in Directive 2012/34/EU) to buy a path to run a train (e.g., depending on the type of service, i.e., high speed, intercity, regional and freight) and (iii) the cost of electricity power supply.

Regarding other charges that a train undertaking may pay to an infrastructure manager, like for example for ancillary services at stations or depots, they are not part of the calculations done. First, because this distinction cannot be made, given the heterogeneity of the methodologies to charge this type of services. Second, this kind of services are usually provided by third parties from which data is (usually) not available.

Charges for specific parts of the rail infrastructure have been identified on a country basis, if any. Other specific infrastructures considered in this study are the Øresund bridge between Denmark and Sweden and the Channel Tunnel between France and UK[22].

4.3 Detailed assessment of rail taxes and charges

4.3.1 Fuel and electricity taxes

Fuel taxes come from the activities of diesel trains in form of excise duties. The tax rates that are applied to diesel fuel at country level are shown in Figure 53 (PPS corrected) and Figure 54 (not PPS corrected).

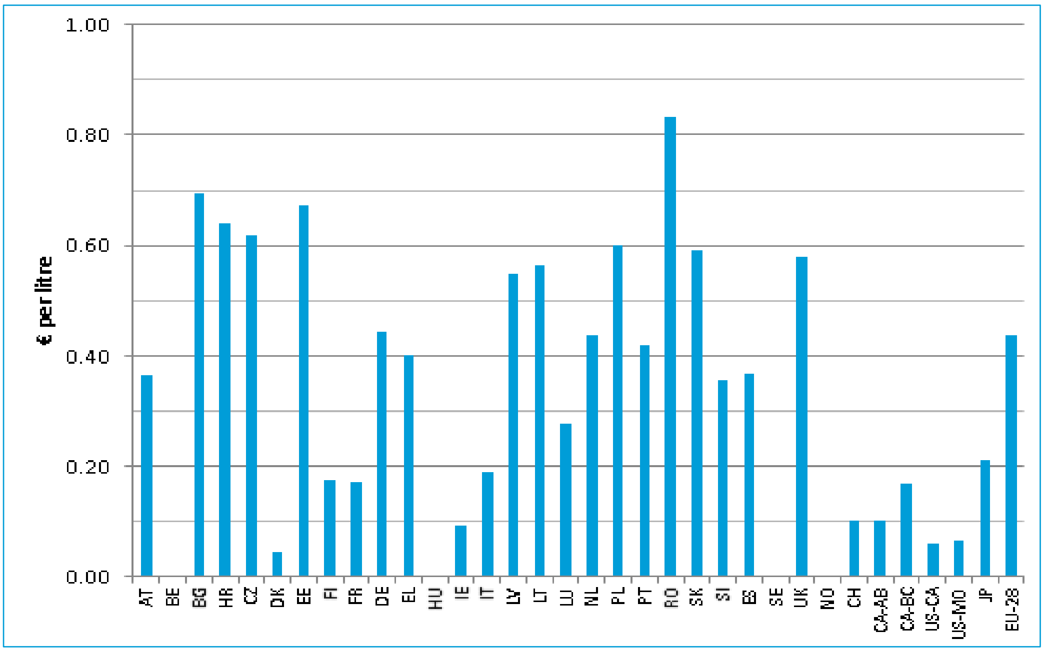
Within the geographical scope covered by this study, Belgium, Hungary[23], Norway and Sweden do not charge fuel taxes on diesel used for rail transport (EC, 2017b). For the other European countries, a relatively significant variation is found for the tax rates applied. Considering PPS corrected values, the highest tax rate is applied in Romania with € 0.83 per litre, while the lowest is found in Denmark with € 0.05 per litre. The average tax rate found in the states of Canada and US is considerably lower than that at EU28 level, namely € 0.10 against € 0.44 per litre. Also for Japan the tax rate (i.e., € 0.21 per litre) is found below the EU28 average.

In some Member States, reduced fuel tax rates are applied to the biofuel blended with fossil fuels. The data availability on the taxation of biofuel blended is rather poor and hence it was not feasible within this study to provide a complete overview of the exemptions applied in the EU. Some countries that apply reduced rates are Denmark, Italy and Slovakia (e.g. in Denmark diesel tax rate is reduced from € 0.043 to € 0.040 per litre that contains minimum 6.8% biofuel), while Romania and Slovenia

22 Revenues from access charges earned from these links have been assumed equally shared between the countries involved.
23 An exemption is applied via tax refund, as difference between the normal rate and the reduced rate.

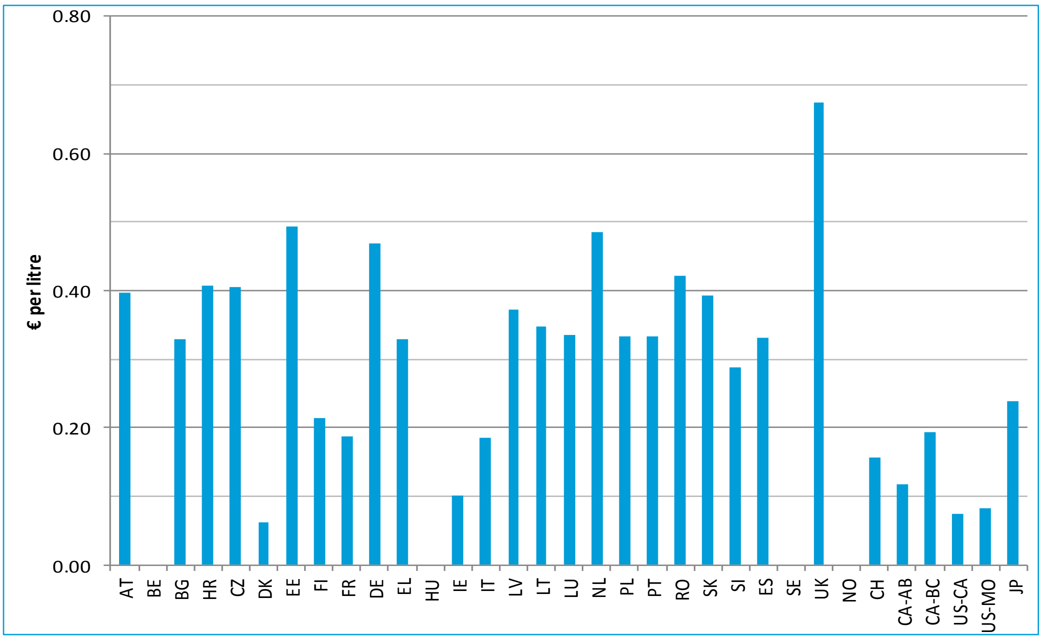
fully exempt the use of biofuel from taxation. For non-European countries a reduced rate is found for biofuel in California.

Figure 53 – Diesel tax levels rail transport in 2016 (PPS corrected)



Note: Cyprus and Malta do not have operating rail networks.

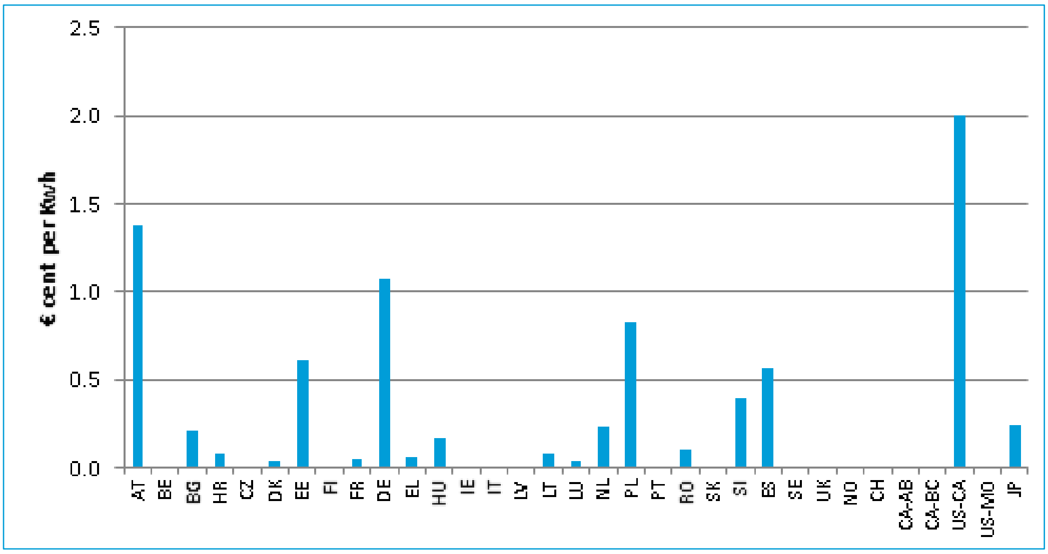
Figure 54 – Diesel tax levels rail transport in 2016 (not PPS corrected)



Note: Cyprus and Malta do not have operating rail networks.

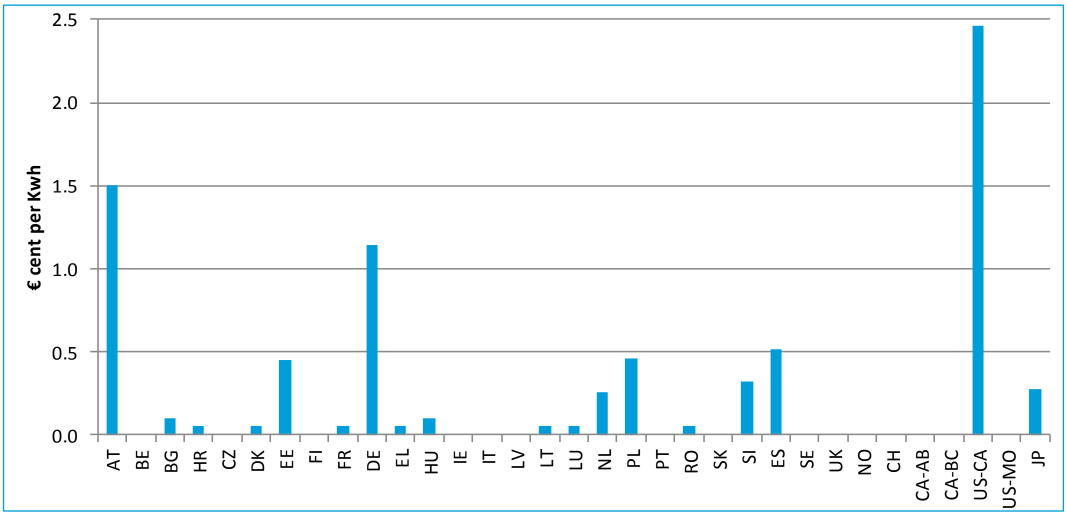
The electricity tax rates charged on rail transport are shown in Figure 55. In twelve European countries an electricity tax charged on rail transport is either not levied at all, or under a regime of exemption (e.g., in Italy, Latvia, Portugal, Slovakia, Sweden and Norway).
Looking at the PPS adjusted figures for the countries where the electricity tax is charged a significant variation is found, from the lowest rate in Denmark (i.e. 0.037 €cent per kWh) to the highest in Austria (i.e. 1.379 €cent per kWh). As regards non-European countries, an electricity tax is charged in California, where it is found significantly high (i.e. 2.00 €cent per kWh), and in Japan, where it is relatively in line with the average at EU28 level (i.e. 0.25 €cent against 0.23 €cent per kWh).

Figure 55 – Electricity tax levels in 2016 (PPS corrected)[24]



Cyprus and Malta do not have operating rail networks.

Figure 56 – Electricity tax levels in 2016 (not PPS corrected)[25]



Cyprus and Malta do not have operating rail networks.

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24 Where a tax level is not displayed means that an electricity tax is either not levied at all, or under a regime of exemption.

25 Idem.

4.3.2 Rail infrastructure access charges

Directive 91/440/EEC (European Council, 1991) was the first piece of EU legislation that introduced an infrastructure access charges for international freight rail undertakings. Currently, Directive 2012/34/EU (European Parliament, 2012) provides the legal basis for establishing the principles governing rail infrastructure access charges in the Member States. In particular, the Directive 2012/34/EU (European Parliament, 2012) requires to establish a charging framework according to the management independence initially laid down in Directive 91/440/EC (European Council, 1991), which set out the principles of accounting, legal, organisation and decision making separation between railway entities and the State, and between infrastructure managers, service facility managers and railway undertakings. The provisions of the Directive also envisage to establish a regulatory body, independent from any other public or private entity, in order to guarantee fairness and transparency to access to rail infrastructure.

The infrastructure access charging scheme provides a mechanism for the infrastructure managers to recover the costs borne. It can also be used to incentivise an optimal allocation of the infrastructure capacity. For example, infrastructure access charges can be based on cost signals to incentivise rail undertakings to use the infrastructure capacity in an efficient manner. Furthermore, the access charging scheme can also incentivise rail undertakings to reduce the costs they place on the network by, for example, investing in less damaging trains.

According to Directive 2012/34/EU (European Parliament, 2012), the infrastructure access charges specified in the network statements should cover the cost components included in the minimum access package (see also Section 4.2). In general for the Member States, the infrastructures access charging schemes are found to be based (at least partly) on the principle of marginal cost pricing, although the approaches by which the marginal cost is estimated vary. In most of the Member States multi-part charging schemes are found in place.

In this respect, it is also worth reminding that infrastructure access charges could incorporate public subsidies for a number of reasons (e.g., type or localisation of service). This implies that the revenues generated (i.e., total and average) as reported in this study could be gross of the subsidies and not a net value. As Section 1.3.5 anticipates the treatment of subsidies has been set out of the scope of this study, because data availability on subsidies is rather poor and a large number of subsidy and PSO schemes exist, both at the national and regional/local level.

Currently, infrastructure access charges schemes give little consideration for external costs, as only four out of EU28 countries consider this cost component in charging rail undertakings. In Sweden, an emission charge is levied on diesel-engine locomotives and multiple-unit trains (Trafikverket, 2017). Austria, Germany and the Netherlands differentiate infrastructure access charges with respect to noise[26]. As regards the non-EU28 countries, a noise differentiation is also applied in Switzerland[27].

Many countries are currently revising the access charging schemes to take noise emissions into account. For example, in Italy, a charging scheme has entered into force in 2018 to develop the infrastructure access charge calculation including certain elements related to externalities. According to the decision of the Italian transport regulator (ART, 2015) the total access charge can

[26] In Austria, a noise bonus of € 0.01 per axle kilometre is applied for trains equipped with cast iron brake blocks to support retrofitting with low-noise braking technology of freight wagons (OBB Infra, 2018). In Germany, a noise charge is levied on freight trains since 2013 (DB Netze , 2017). Finally, in The Netherlands the infrastructure manager applies a discount for running freight trains with reduced noise emissions. The discount is equal to € -175 per wagon kilometre run with a silent train (ProRail, 2018).

[27] In Switzerland, railway undertakings operating freight trains fitted with disc brakes, drum brakes or composite brake blocks are entitled with a low-noise bonus of CHF 0.01-0.03 per axle kilometre (SBB, 2017).

incorporate incentivising components for (i) scarcity of network capacity, (ii) noise externalities, (iii) use of lines equipped with ETCS and (iv) regional compensation regimes.

For the infrastructure access charges, differences also exist concerning (i) mark-up and market segmentation that are not found for all Member States (and, if applied, again they differ across countries) and (ii) the frequency for reviewing the access charge scheme. For example, in UK and Hungary, access charges are reviewed over relatively long periods (i.e., on a 5-year basis), while in France, Italy and Poland, this is done on annual basis.

Differentiations applied

In general, rail infrastructure access charges are differentiated according to a number of parameters (see Figure 57). It is worth mentioning that some differentiation principles currently applied will be phased out under the new rules to comply with Commission Implementing Regulation 909/2015[28].

Although no longer allowed under Directive 2012/34/EU[29], differentiation with respect to location is a parameter still often used, because the provisions of the Directive have not yet been applied universally across the Member States[30]. Depending on the classification of the lines (e.g., main or complementary) and nodes that are part of the rail network, around 77% of the schemes of European countries apply this type of differentiation. To some extent, it reflects the cost component related to the willingness to pay of a train undertaking to buy a path in a specific part of the network.

The second differentiation considers the weight of the train (i.e., 69% of the cases).
This is relevant for the cost borne for wear and tear and usage of railway equipment.
The weight of a train (i.e., measured in tonne-km), is normally used to estimate the level of damage a train can generate for infrastructure usage, and therefore the associated cost.

The third differentiation encountered refers to the number of stops[31]. This suggest that the infrastructure managers are (i) used to charge more the slots of trains that stop more often, because they are more time consuming in terms of network capacity, or (ii) that station charges are included in the infrastructure access package.

The differentiation with respect to the time of day (i.e., peak, off-peak and night) is found not extensively applied, neither is the level of congestion. This approach could depend on the actual level of capacity of the network. However, the legislation forbids to apply scarcity charge unless a railway section has been officially declared congested. And this is rarely the case as usually the infrastructure managers avoid to refuse request of train paths and similarly rail undertakings tend to take the paths allocated to not remain without the chance to run a train.

Also the length of the train is found relatively not significant for access charges differentiation and this can be explained by the fact that train weight may often be used as a proxy of train length.

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28 According to Article 4 of Regulation 909/2015 (EU, 2015), non-eligible costs for the infrastructure manager are (i) direct costs on a network-wide basis and (ii) costs to finance specific infrastructure investments, which it is not obliged to repay and where such investments are taken into account in the calculation of direct costs (the costs of such investments shall not increase the level of charges without prejudice to Article 32 of Directive 2012/34/EU (European Parliament, 2012)).

29 According to Article 29(2).

30 According to Article 9 of Regulation 909/2015 (EU, 2015), the infrastructure manager shall submit its method of calculation of direct costs and, if applicable, a phasing-in plan to the regulatory body no later than 3 July 2017.

31 According to data collected for this study, 15 out of 28 Member States use a differentiation with respect to the number of stops. Outside the EU, this is applied also in Norway and Switzerland.

A comparable frequency of differentiation is found for the type of traction, which can be used if electricity power is supplied with a different current (i.e., direct and alternate), voltage and frequency. As the previous section discussed, there is little consideration for external costs and this is evident from the low level of occurrence of differentiation with respect to emission and noise classes.

Figure 57 – Differentiations used in rail infrastructure access charging schemes

Charge levels

This section discusses the infrastructure access charge levels. They have been estimated based on the data collected at the national level, for both passenger and freight trains, in turn differentiated according to the reference vehicles assumed in this study.

As far as passenger trains are concerned, infrastructure access charges are presented for high speed, intercity and regional services. For the latter two, the access charges are differentiated with respect to electricity and diesel traction. Figure 58 shows the estimated values for the countries covered.

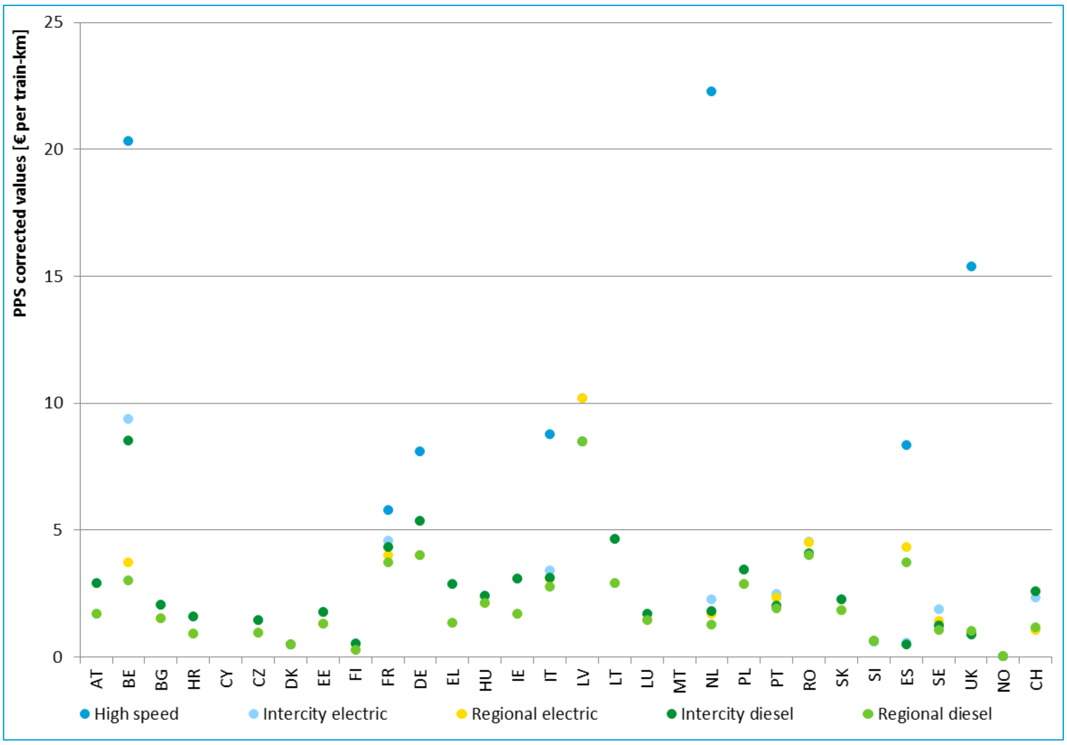
Not surprisingly, for all the Member States where high speed services are operated, the infrastructure access charges are higher compared to conventional services. That especially occurs in Belgium, the Netherlands and UK. Italy and Spain have relatively similar high speed access charges, but it is worth remarking that in Italy, they have been artificially reduced (by 30% during 2015) to foster competition between the two high speed rail undertakings (Desmaris, 2016). In Germany and France, the level of high speed access charges is more close to that of intercity services.

For intercity services, the average infrastructure access charge at EU28 level is found equal to € 3.06 per train-km, if electric, and € 2.78 per train-km if diesel, respectively. It is worth noticing that the average infrastructure access charge of intercity electric trains of the CEEC group is 16% higher than that found for the WEC group (i.e., € 3.18 against € 2.75 train-km) and the difference increases to 21% for diesel trains (i.e., € 2.98 against € 2.47 per train-km).

For regional trains, the average infrastructure access charge at EU28 level is found equal to € 2.40 per train-km, if electric, and € 2.20 per train-km, if diesel, respectively. Comparing the Central and Eastern European Countries (CEEC) and Western European Countries (WEC), the difference between the infrastructure access charges of regional trains increases compared to the corresponding figures of intercity trains. In this respect, the average infrastructure access charge of regional electric trains of the CEEC group is 37% higher than that found for the WEC group (i.e., € 2.71 against € 1.98 train-km) and the difference increased to 39% for diesel trains (i.e., € 2.51 against € 1.81 per train-km).
In general, the variation could be explained by different approaches at national level for provision of services under Public Service Obligation contracts.

For non-European countries, infrastructure access charges for passenger trains are applied to rail undertakings in California[32] and Japan[33], but the data either cannot be disclosed for confidentiality reasons, or is not available.

Figure 58 – Access charges for the reference passenger trains in 2016 (PPS corrected)



Cyprus and Malta do not have operating rail networks.

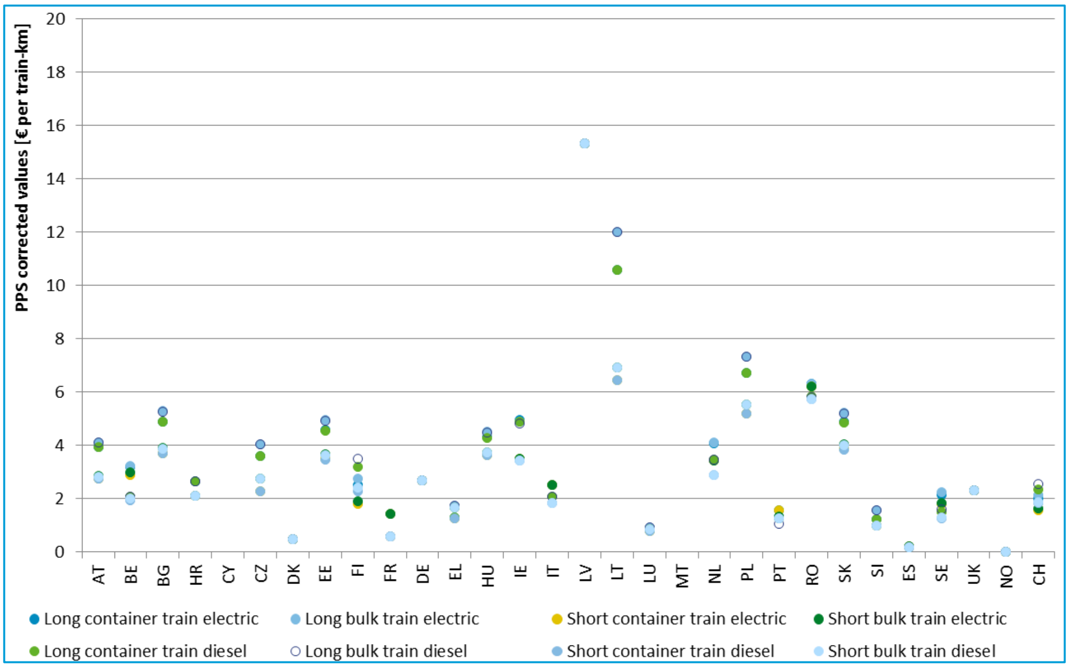
[32] So-called Trackage Rights. The two privately owned rail companies operate in California, namely Burlington Northern Santa Fe Railway and Union Pacific Railroad. They charge other rail companies for use of their infrastructure.

[33] Rail infrastructure is mostly owned and operated by the passenger train companies, so generally access fees are not in place. Japanese railway network is separated horizontally by regional subdivisions. Services are coordinated so that passenger trains can travel between regions. This is done by a through-train service, in which trains from one integrated railway (i.e., infrastructure and operations) (A) leave their own infrastructure and access tracks of another integrated railway (B). The fare of railway operations using A's tracks belong to railway A, even though railway (A) is using railway B's rolling stock. When railway A uses railway B's rolling stock, railway A pays rent for the rolling stock use to railway B. In addition, passenger train operators do not own the more recent high-speed lines (i.e., Shinkansen) and urban railways, as such they need to pay track usage fees to the state agency JRTT.

As far as freight trains are concerned, the estimations of the infrastructure access charges have been carried out for container and bulk trains, and for both cases with respect to short and long configurations. As done for passenger trains, electric and diesel tractions have been also considered. Figure 59 presents freight trains access charges according to the categories assumed.
On average at EU28 level, the infrastructure access charges of freight trains are found higher than those of conventional passenger trains, and equal to € 3.49 per train-km (against € 2.61 per train-km). That does reflect the impact caused by the heavier load on the rail infrastructure. When it comes to differentiate with respect to CEEC and WEC groups, the infrastructure access charges are found relatively higher for the former group (i.e., € 1.91 against € 5.49 per train-km). In this respect, it is worth observing that freight trains access charges of Latvia and Lithuania are significantly higher than the average, because of the higher axle load allowed.

For non-European countries infrastructure access charges for freight trains are applied to rail undertakings in Japan[34], but data is not available.

Figure 59 – Access charges for the reference freight trains in 2016 (PPS corrected)



Note: Cyprus and Malta do not have operating rail networks.

4.3.3 Charges on specific parts of the infrastructure

Looking across European railways, there are parts of the network that are subject to specific infrastructure access charges. First there are charges for using the cross-border Øresund bridge and Channel Tunnel. Both transport infrastructures are managed by specifically dedicated companies, which raise revenues from users to offset the costs borne. Other sections of the national rail networks are charged with some additional access charges to address specific purposes. If this is the case, these revenues are already incorporated in the totals earned by the infrastructure manager.

The Øresund bridge connects Denmark and Sweden. The infrastructure is managed by the Øresundsbro Konsortiet I/S, which is a Danish-Swedish company. It is jointly owned by A/S Øresund

[34] Freight train operators pay track usage fees to the passenger train companies for using their infrastructure.

and Svensk-Danska Broförbindelsen SVEDAB AB[35]. The infrastructure manager charges for the usage of the railway links and the revenues consists of the payments by Banedanmark and Trafikverket. Øresundsbro Konsortiet I/S earned approximately € 66.7 million in 2016, specifically from the use of the rail link operating on this bridge (Øresundsbro konsortiet I/S, 2017). The charges per passage of passengers and freight trains in 2016 were equal to € 291 and € 352, respectively.

The Channel Tunnel is the fixed link connecting France and UK. For rail transport, the Channel Tunnel fixed link concession manages the circulation of high speed passenger trains (i.e., Eurostar) and freight trains. The Eurotunnel Group earned revenues of € 290 million in 2016 from the use of its railway network (Groupe Eurotunnel, 2017). Table 12 presents average charging rates for passengers and freights trains (Eurotunnel, 2018).

Table 12 – Average charging scales for passengers and freights trains

Charging regime	Passenger train [€ per passage]	Freight train [€ per passage]
Reserved Weekly Train[36]	4,683.75 (+ € 17.68 per pax)	3,665.40
Reserved Individual Train[37]	5,152.50 (+ € 17.68 per pax)	4,722.40
Unreserved Additional Train[38]	5,386.50 (+ € 17.68 per pax)	5,728.14
Empty passenger train or locomotive only movement	4,683.75	3,037.50

Source: (Eurotunnel, 2018).

In Finland, the section between Kerava and Lahti is a specific part of the rail network subject to an additional investment tax (i.e., 0.50 €cent per gross tkm for both passengers and freight trains) (Finish Transport Agency, 2015). It generated revenues for € 4 million in 2016. The tax covers the environmental costs caused by train traffic and the fixed infrastructure expenditures. The tax was planned to be levied over a 15-year period (i.e., 2006-2021), but it will be abolished from 2019.

In France, there are six sections subject to specific charges to allow for cost recovery of the investments borne by the infrastructure manager. Table 13 presents an overview of these sections and their unit access charges (excluding VAT).

35 A/S Øresund is 100% owned by Sund & Bælt Holding A/S, which is owned by the Danish state. SVEDAB AB is owned by the Swedish state.

36 One weekly (or daily) single crossing in the annual working timetable, in the same days on the same train paths reserved for all weeks in the period of working timetable (or all remaining weeks if reserved during the working timetable), on the same service (origin/destination).

37 One or more single crossings on one or more individual single train paths reserved in the annual working timetable, or reserved during the working timetable.

38 One or more single crossings unreserved in the annual working timetable, and without 24h advance planning at the latest, or planned less than a week in advance following an ad hoc request.

Table 13 – Overview of specific rail access charges in France

Section	Unit charge [€/train-km]
Freight trains of the section 38080 'Montreollier-Buchy-Motteville'	1.021
Freight trains of the line 'Saint-Pierre-d'Albigny-Modane Frontiere'	0.500
Freight trains of the piggy back corridor through the Alps of the line 'Saint-Pierre-d'Albigny-Modane Frontiere'	1.291
Electric trains on the sections 53003 A 'Pasilly-Le Creusot' et 53003 B 'Le Creusot-Macon'	0.686
Use of the short link line at Mulhouse	389.768

Source: (SNCF Réseau , 2018).

In Italy, some sections of the railway network are subject to specific access charges. In particular, (i) cross-border sections, at the stations where the Italian railway is adjacent to the network of neighbouring countries[39] and (ii) to link regional networks. According to the Italian rail infrastructure manager, a charge of € 5,00 per train is applied to access to a cross-border section. Additionally, a charge of € 1,00 per train-km is applied depending on the length of the cross-border section. At stations linking the network of the national infrastructure manager with other regional networks, rail undertakings are charged for using the capacity of these stations (i.e., € 5,32 per train).

In Norway, specific rail access charges have been established in major cities and high speed line between Oslo and Gardermoen airport.

Charges on specific parts of the infrastructure are not reported for non-European countries covered in this study.

4.3.4 ETS

Carbon pricing imposes a cost on CO_2 emissions, incentivising firms to cut these emissions. Railway undertakings are users of electricity power supply and this makes rail transport an indirect sector for ETS. According to Eurostat figures of railway infrastructures, around 54% of the lines operated in the EU28 and Norway are electrified[40]. Approximately 72% of total rail transport (expressed in train-km) takes place on such lines[41].

According to estimations based on emission factors at national level, CO_2 emissions related to the production of electricity used by the rail sector were approximately equal to 13.1 million tonnes in 2016 for the countries where ETS is applied.

Assuming for the European Emission Allowance (EUA) an average value for 2016 equal to € 5.2 per tonne of CO_2 equivalent emitted (EEA, 2017), the rail transport paid € 75.5 million, of which 58% for passenger trains and 42% for freight trains.

Table 14 summarises the results at country level.

[39] Stations of Ventimiglia, Domodossola, Luino, Brennero, Tarvisio Boscoverde, Villa Opicina and San Candido.

[40] The ETS scheme operates in 31 countries, i.e. EU28 Member States plus Iceland, Liechtenstein and Norway.

[41] Own estimation based on data from Eurostat, UIC and some national rail infrastructure managers (for Belgium and Denmark).

Table 14 – Total ETS revenues from (indirect) emissions of electric trains (€ 2016)

Member State	Emission factor [g/kWh]	Total emissions [million tonnes]	Total ETS [€ million]
EU28	528.6*	13.012	75.24
EU27	525.7 *	12.254	71.85
Austria	180.0	0.358	1.71
Belgium	223.2	0.345	1.64
Bulgaria	871.2	0.163	1.77
Croatia	356.4	0.036	0.30
Cyprus	-	-	-
Czech Republic	766.8	0.492	3.92
Denmark	478.8	0.095	0.37
Estonia	1,386.0	0.001	0.01
Finland	288.0	0.126	0.53
France	93.6	1.058	5.02
Germany	648.0	4.674	22.93
Greece	885.6	0.010	0.07
Hungary	478.8	0.219	1.93
Ireland	565.2	0.007	0.03
Italy	511.2	1.059	5.61
Latvia	291.6	0.002	0.01
Lithuania	529.2	0.001	0.01
Luxembourg	421.2	0.015	0.06
Malta	-	-	-
Netherlands	568.8	0.469	2.20
Poland	1,087.2	1.357	12.68
Portugal	414.0	0.134	0.88
Romania	576.0	0.227	2.32
Slovakia	277.2	0.098	0.76
Slovenia	432.0	0.064	0.41
Spain	342.0	0.957	5.53
Sweden	32.4	0.288	1.15
United Kingdom	604.8	0.758	3.39
Norway	14.4	0.073	0.26
Switzerland	-	-	-
Canada – British Columbia	-	-	-
Canada – Alberta	-	-	-
US – California	-	-	-
US – Missouri	-	-	-
Japan	-	-	-

* Average value.

4.4 Revenues from rail taxes and charges

4.4.1 Total revenue

An overview of the total tax/charge revenue in 2016 in the various countries is given in Table 15. All figures are PPS adjusted to allow comparison between countries (see also Section 1.3). Additional explanation on the methodology assumed to allocate taxes and charges is presented in Annex B.3. The unadjusted figures can be found in Annex E.3.

Table 15 – Total revenue from rail taxes and charges (million €, PPS adjusted)

Member State	Electricity tax	Fuel excise duty	Rail access charges	Charges on specific parts of the infrastructure[42]	ETS	Total revenue
EU28	239.63	2,117.40	16,837.26	310.77	75.24	19,580.30
EU27	239.63	1,441.50	15,725.27	186.14	71.85	17,664.39
Austria	27.54	34.69	360.63	-	1.71	424.57
Belgium	-	-	642.91	-	1.64	644.55
Bulgaria	0.90	14.70	59.59	-	1.77	76.97
Croatia	0.14	28.90	25.13	-	0.30	54.47
Cyprus	-	-	-	-	-	-
Czech Republic	-	165.62	232.11	-	3.92	401.65
Denmark	0.16	7.67	25.33	24.86	0.37	58.39
Estonia	0.03	24.85	41.35	-	0.01	66.24
Finland	-	5.67	32.85	3.25	0.53	42.30
France	3.47	51.56	5,276.38	132.41	5.02	5,468.84
Germany	142.13	409.09	4,785.21	-	22.93	5,359.37
Greece	0.04	20.59	21.85	-	0.07	42.54
Hungary	1.70	-	215.96	-	1.93	219.60
Ireland	-	5.91	62.06	-	0.03	68.00
Italy	-	56.97	1,081.66	-	5.61	1,144.24
Latvia	-	119.75	91.61	-	0.01	211.37
Lithuania	0.00	84.81	267.19	-	0.01	352.01
Luxembourg	0.03	0.58	13.02	-	0.06	13.69
Malta	-	-	-	-	-	-
Netherlands	4.78	29.49	318.43	-	2.20	354.89
Poland	20.38	70.85	883.66	-	12.68	987.56
Portugal	-	18.89	85.89	-	0.88	105.65
Romania	0.90	127.22	387.03	-	2.32	517.47
Slovakia	-	34.86	124.29	-	0.76	159.91
Slovenia	-	9.18	10.61	-	0.41	20.19
Spain	37.41	119.64	545.20	-	5.53	707.78
Sweden	-	-	135.35	25.62	1.15	162.12
United Kingdom	-	675.91	1,111.99	124.63	3.39	1,915.92
Norway	-	-	25.15	-	0.26	25.40
Switzerland	-	1.38	869.51	-	-	870.89
Canada – British Columbia	-	8.39	-	-	-	8.39
Canada – Alberta	-	14.63	-	-	-	14.63
US – California	0.00	1.50	-	-	-	1.50
US – Missouri	-	-	-	-	-	0.00
Japan	30.98	143.12	-	-	-	174.10

Note: Due to rounding, total are not always equal to summing up the individual figures.

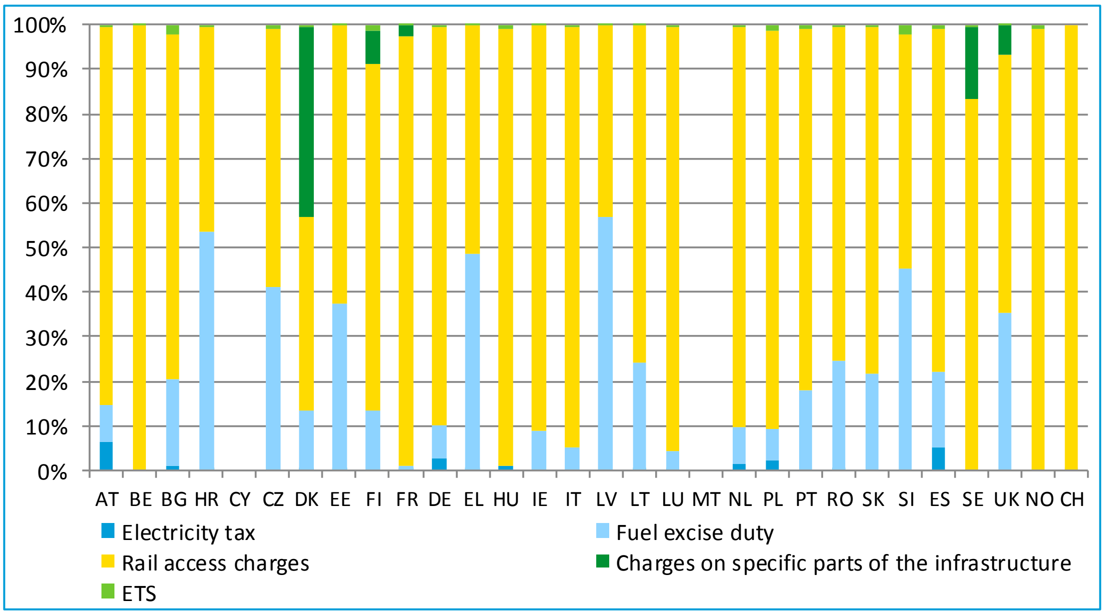
[42] For Øresund and Channel Tunnel fixed links the revenues have been assumed equally shared between bordering countries.

Figure 60 shows the share of various taxes and charges in the total revenues across European countries. Not surprisingly, the large majority of the revenues comes from infrastructure access charges, on average 86.6%.

The second contribution (i.e., 10.3%) comes from revenues of fuel excise duties from diesel trains and basically generated in countries with a more intense use of this type of traction. The share of revenues from charges on specific part of the infrastructure is equal to 1.5%, while that of revenues form electricity tax is equal to 1.2%. Revenues from ETS consist of 0.4% and those from taxation of electricity cover the rest.

For non-European countries covered in this study, taxes are charged on electricity in Japan, while a tax on diesel fuel is applied in all the cases addressed. Infrastructure access charges are applied in California to passengers trains, but data is not publicly available. In Japan, the rail infrastructure is mostly owned and operated by the passenger train companies, so generally access fees are not in place. Freight trains pay for track usage to the passenger train companies for using their infrastructure, but data is not available. See also Section 4.3.2.

Figure 60 – Share of various revenues from taxes and charges in the total revenues



4.4.2 Average revenue

This section presents the estimations of the average revenue for the categories of trains in Table 2. They are expressed in €/1,000 pkm for passenger trains and €/1,000 tkm for freight trains, respectively.

Figure 61 shows the average revenue for high speed trains, considering electricity tax, infrastructure access charge, the charge on specific part of the infrastructure (if any) and ETS. Not surprisingly, across all the countries, where high speed railway are operated, the access charge significantly contributes to the total average revenue, while the components related to the electricity tax and ETS are always negligible. France and UK are the only countries where the revenues from usage of specific infrastructures (i.e., the Channel Tunnel) contribute to the total average revenue. As regards non-European countries, Japan operates high speed lines, but data on access charges is not publicly available. The average revenue found at EU28 level is equal to € 37.4 per 1,000 pkm. For Belgium, the

Netherlands and the UK, the high average revenue for high speed trains depends mainly on the relatively high infrastructure access charges applied in these countries, compared to Germany, Italy and Spain. For France, the relatively high average total revenue found could be influenced by the high value reported for total revenues from infrastructure access charges.

Figure 61 – Average revenue from taxes and charges for high speed trains in 2016 (€/1,000 pkm, PPS adjusted)

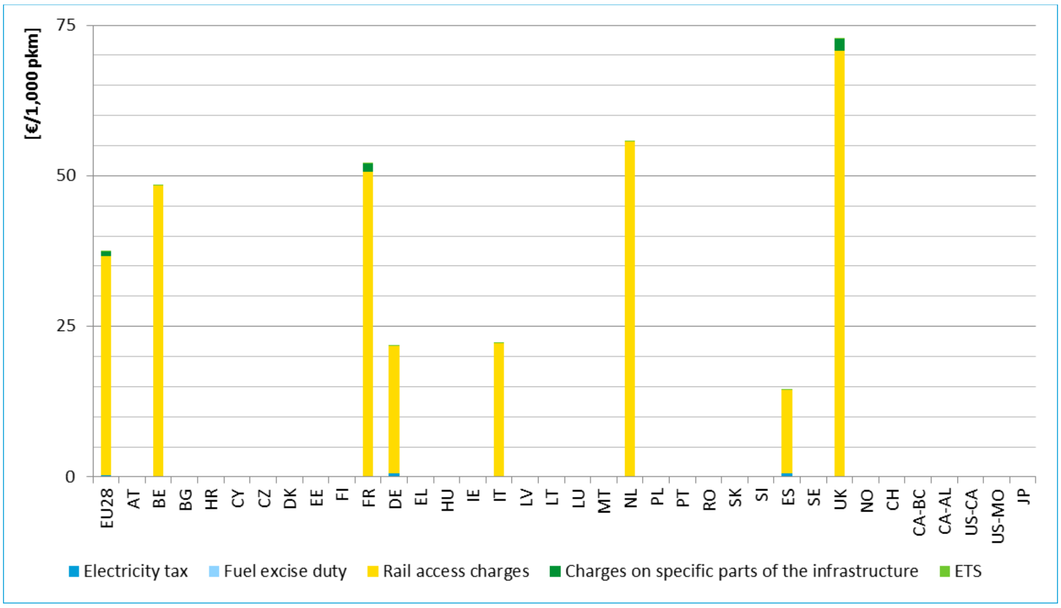


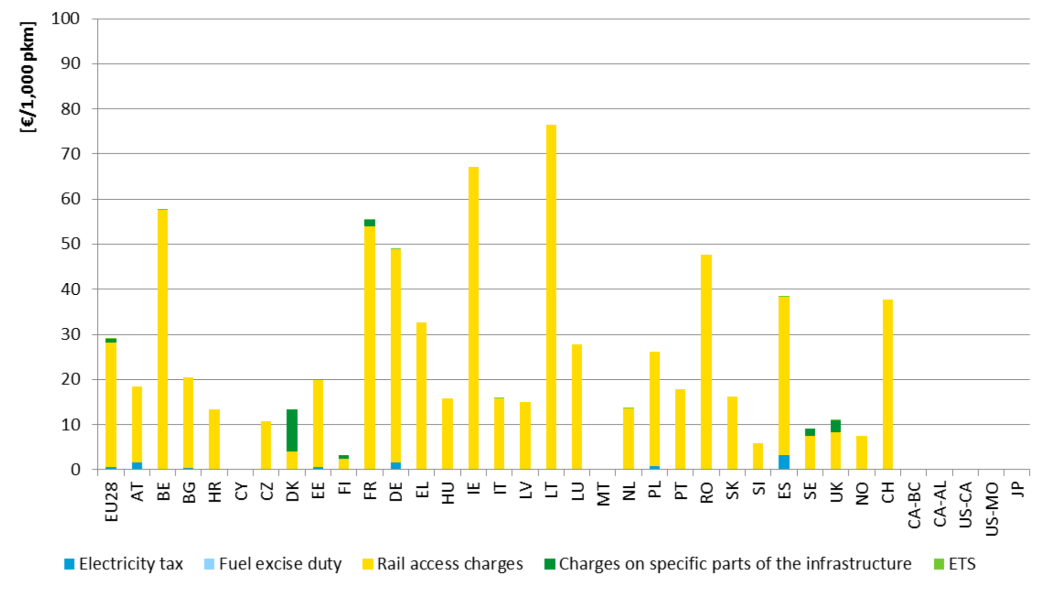
Figure 62 presents the average revenue for conventional electric passenger trains. Again, the infrastructure access charge represents almost the entire amount of the average total revenue, being the electricity tax component and ETS negligible. For Denmark[43], France, Sweden and UK, the specific access charges related to the usage of Øresund and Channel Tunnel fixed links contribute to the average revenue. As regards Finland, they depend on the revenues of the section between Kerava and Lahti[44].

The average revenue found at EU28 level is equal to € 29.2 per 1,000 pkm, while it is equal to € 30.5 and € 22.9 per 1,000 pkm for WEC and CEEC groups, respectively. The high average revenues found for Belgium, France, Lithuania and Romania could be influenced by the relatively high infrastructure access charges of these countries, while for Ireland by the very limited activity of this transport segment.

[43] For Denmark, the high revenue per 1,000 pkm found coming from charges of specific part of the infrastructure depends on the high infrastructure access charge of the Øresund bridge per passage of train, compared to the very low access charge of the conventional network.

[44] The tax will be abolished from 2019 (see Section 4.3.3).

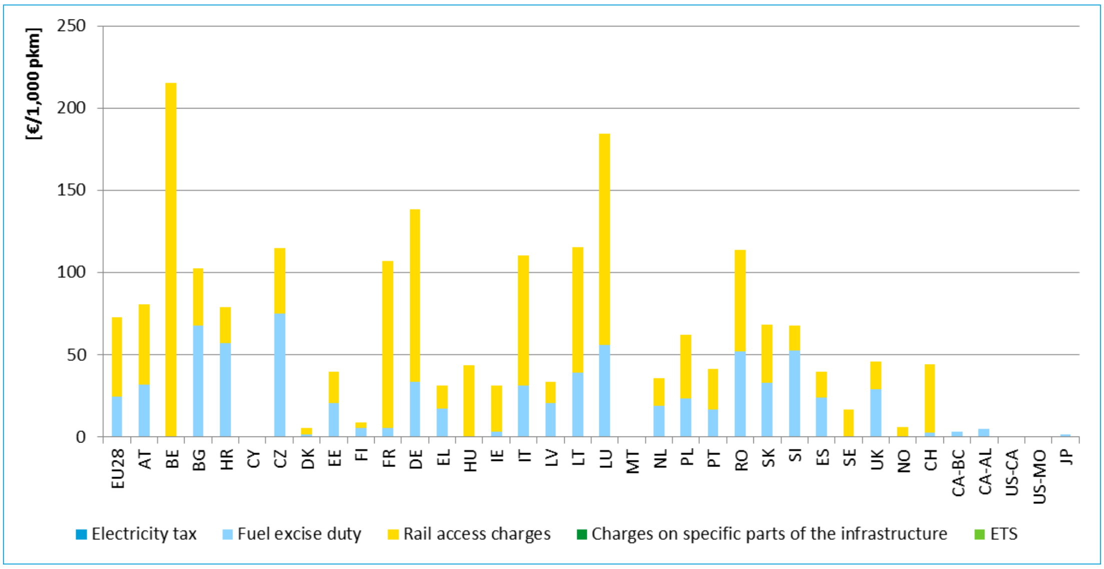
Figure 62 – Average revenue from taxes and charges for conventional electric passenger trains in 2016 (€/1,000 pkm, PPS adjusted)



On average, at EU28 level the total revenue for diesel trains is mostly generated by the infrastructure access charges (i.e. 66.3%) (see Figure 63). The average share of diesel excise duty is equal to 33.7% at EU28 level, and 30.8% and 49.6% for WEC and CEEC groups, respectively.

The average total revenue for diesel passenger trains at EU28 level is found higher compared to the value of electric trains (i.e., € 72.6 against € 29.2 per 1,000 pkm), because of the generally lower occupancy rates of this type of reference trains (i.e., 59 against 132 passengers per train). Distinguishing with respect to the WEC and CEEC groups, the average total revenue of diesel passenger trains is higher for the CEEC group (i.e., € 81.4 against € 72.1 per pkm). The high values found for Belgium and Luxembourg could depend on the very low occupancy factors (i.e., 19 passengers per diesel train for both countries).

Figure 63 – Average revenue from taxes and charges for diesel passenger trains in 2016 (€/1,000 pkm, PPS adjusted)



For freight transport, at EU28 level, the average total revenue of diesel trains is found higher compared to that of electric trains (i.e., € 13.3 against € 5.3 per 1,000 tkm), because of the generally lower transport performance and load factor of this type of reference trains (i.e., 452 against 552 tonnes per train). As for the other train categories discussed, the majority of the average revenue depends on the infrastructure access charge, regardless of the type of traction.

For electric freight trains (see Figure 64), the average total revenue at EU28 level is equal to € 5.3 per 1,000 tkm. Distinguishing with respect to WEC and CEEC groups, the average total revenues are found relatively comparable (i.e., € 4.8 against € 6.7 per 1,000 tkm). This could be explained considering that the transport performance(expressed in train-km) of CEEC countries is lower compared to those of WEC countries, but the average infrastructure access charge is significantly higher (i.e., € 4.9 against € 2.3 per train-km).

When it comes to diesel freight trains (see
Figure **65**), the average total revenue at EU28 level is € 13.3 per 1,000 tkm. Distinguishing with respect to WEC and CEEC, the average revenue is higher for CEEC group (i.e., € 16.7 against € 9.3 per 1,000 tkm). In this case, the transport performance does not significantly influence the result in terms of t-km, being the train-km and load factor relatively comparable amongst the groups. This result seems to be rather influenced again by the higher infrastructure access charges found for the countries of CEEC group. As for passengers trains, the highest value found for Ireland can be explained by the very limited activity of this transport segment.

Figure 64 – Average revenue from taxes and charges for electric freight trains in 2016 (€/1,000 tkm, PPS adjusted)

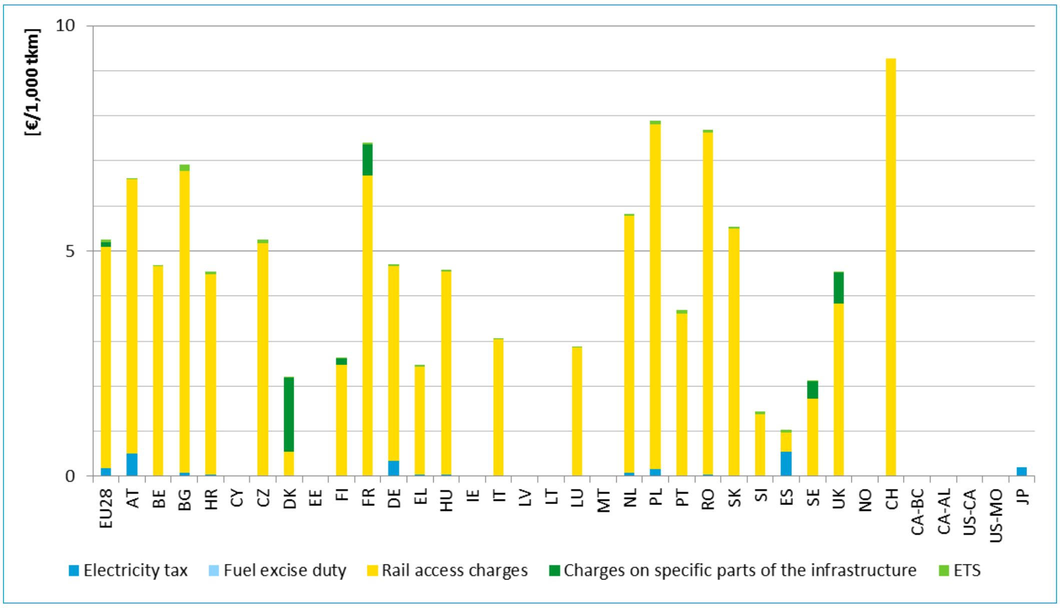
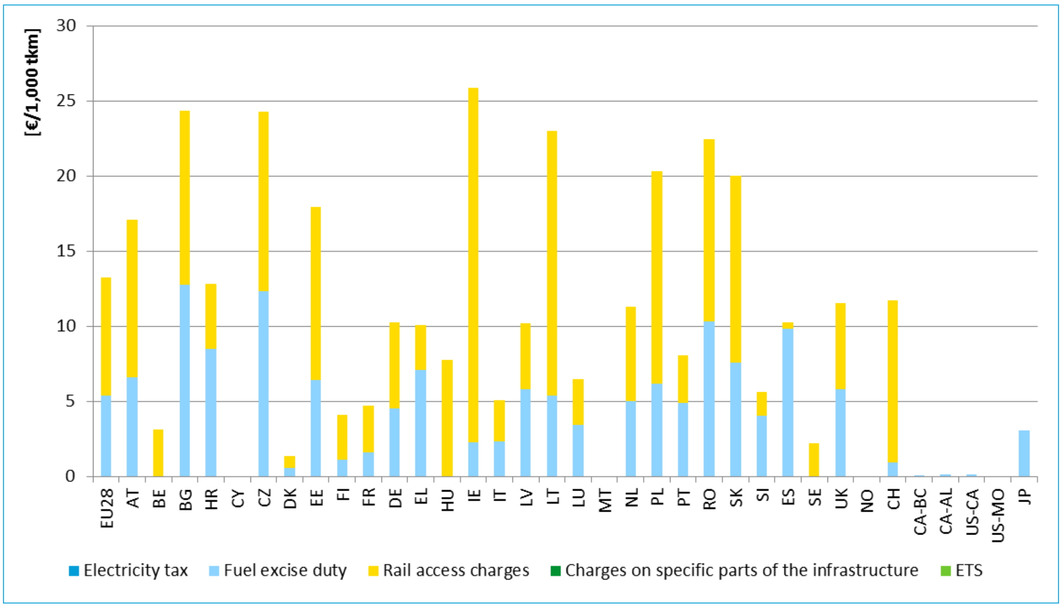


Figure 65 – Average revenue from taxes and charges for diesel freight trains in 2016 (€/1,000 tkm, PPS adjusted)



4.4.3 Earmarking of revenue

With respect to rail infrastructure access charges, which provides the bulk of the revenues generated, a common approach seems to prevail across the countries covered by this study. The revenues are typically devoted to cover the costs borne for the usage of the infrastructure (i.e., investment, maintenance and network management).

Very few countries are found to earmark revenues from electricity or fuel tax for the rail sector. For example, Poland provides that a 20% of excise charges from fuels shall be allocated to ‘Fundusz Kolejowy’ (i.e., the Railway Fund) for the development of the country's railway infrastructure, while the remaining 80% of is transferred to ‘Krajowy Fundusz Drogowy’ (i.e., the State Road Fund) for the country's road infrastructure. In the US, the diesel fuel tax revenue is deposited into the State Transportation Fund and used to construct and maintain public roads and public transport systems.

5 Inland waterway transport

5.1 Introduction

This chapter provides an overview of the taxes and charges applied for IWT. We do this for seventeen European countries that have relevant IWT volumes, i.e. Austria, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Hungary, Italy, Lithuania, Luxembourg, the Netherlands, Poland, Romania, Slovakia and Switzerland. For the non-European countries, we only consider the US state Missouri. No (significant levels of) transport by inland waterways is performed in California, the Canadian provinces and Japan.

In the remainder of this chapter, we first provide an overview of the IWT taxes and charges that are considered in this study (see Section 5.2). The extent by which these instruments are applied in Europe is discussed in Section 5.3. In this section, we also discuss the structure and level of the taxes and charges. The revenue of IWT taxes and charges in the various countries in 2016 is presented in Section 5.4. Furthermore, in this section we discuss the extent by which the revenues are earmarked for IWT infrastructure expenditures.

5.2 Overview of IWT taxes and charges

As for the other transport modes an overview of IWT taxes and charges considered in this study is presented in Table 16. For each tax/charge it is indicated whether it can be categorised as energy, vehicle or infrastructure tax/charge and whether it should be considered a fixed or variable tax/charge.

Table 16 – Overview of IWT taxes and charges

Tax/charge	Description	Energy, vehicle or infrastructure tax/charge	Fixed or variable tax/charge
Taxes			
Fuel tax	Consumption tax on transport fuel.	Energy	Variable
Charges			
Port charges	Charge for the use of a port.	Infrastructure	Variable
Fairway dues	Charge for using a specific waterway.	Infrastructure	Variable
Dues for locks and bridges	Charge for using/passing a lock or bridge.	Infrastructure	Variable
Water pollution charges	Fuel surcharge to bear the costs for the collection and disposal of bilge water, waste oil, and other oily and greasy water.	Energy	Fixed

As mentioned in Section 2.2, only taxes and charges which are directly related to the ownership and use of a transport vehicle and taxes or charges which are related to the use of infrastructure are considered. Most IWT charges are related to the use of the infrastructure or related services. Charges for the use of infrastructure include port charges (for using the port or for the transhipment, i.e. pierage[45]), fairway dues and dues for locks and bridges. The water pollution charge can be

[45] Pierage has to be paid if a vessel reaches a port for transhipment. Usually it is a tariff based on the amount of goods or the type of cargo. It is not the price, which has to be paid to the transhipment companies, but a charge to be paid to the port authorities.

considered a charge for services. Although It is paid when bunkering fuel, it is meant to cover for the costs of the disposal of oil waste.

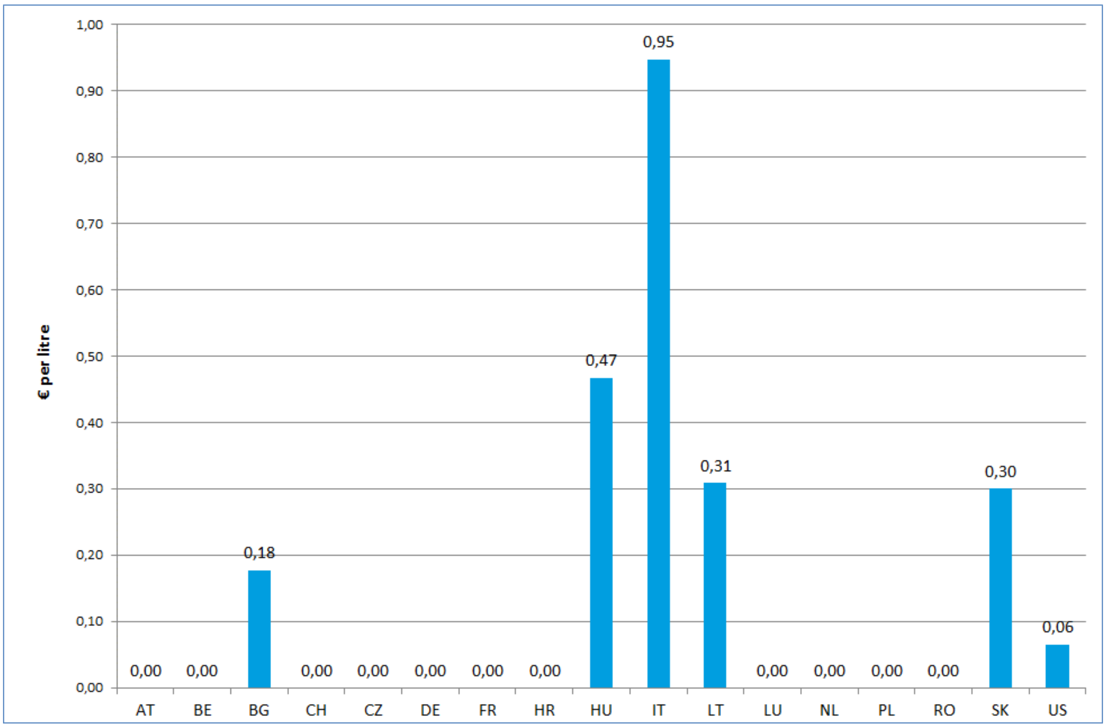
There are no specific taxes for owning inland vessels, but in some countries there is a tax which has to be paid for the use of the vessels, or more specific for the energy use of the vessel (i.e. fuel tax).
In some other countries the fuel for inland vessels is tax free.

5.3 Detailed assessment of IWT taxes and charges

5.3.1 Fuel taxes

Fuel taxes are the only taxes which are taken into account for inland waterway transport. Figure 66 shows the fuel tax levels for the countries with inland waterway transports.

Figure 66 – Fuel tax levels in 2016 (€/litre, PPS adjusted)



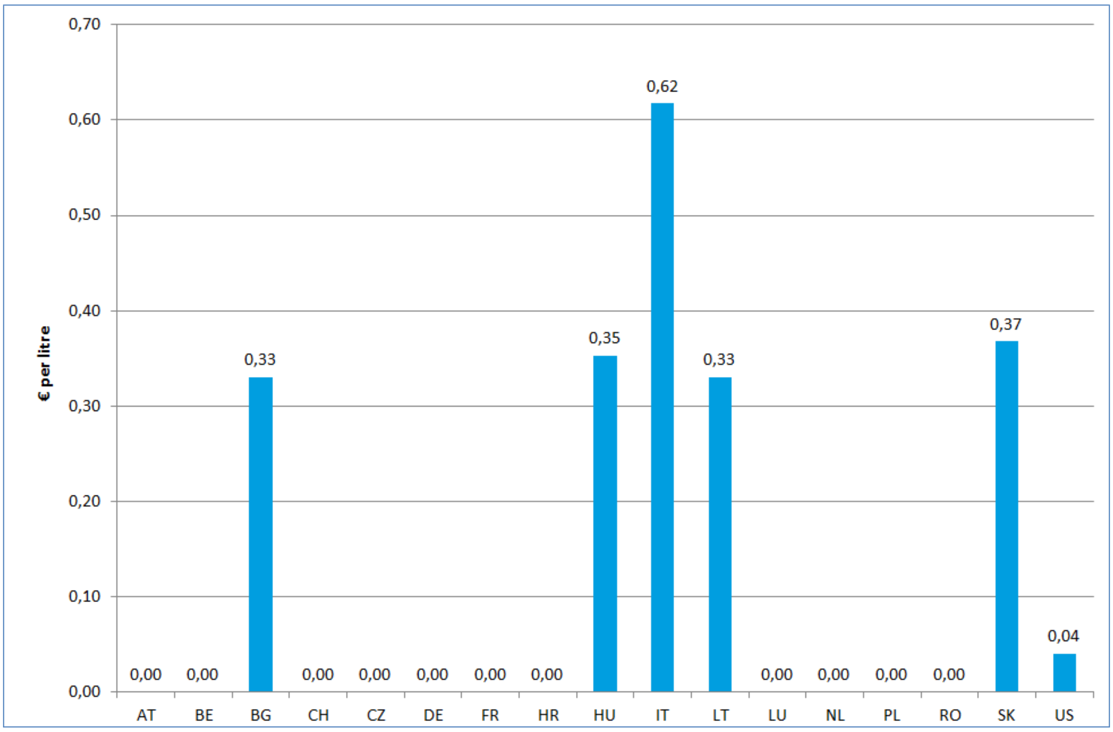
Note: There is no information about the fuel tax for inland navigation in Finland.

In some countries the fuel for inland navigation is tax free. This is, for instance, the case in Belgium, Switzerland, Germany, France and the Netherlands. This tax exemption is based on the Mannheim Convention. The Convention is an agreement between the Rhine-States and contains a set of rules that are referred to collectively as “the Rhine scheme”; they cover various aspects of navigation.
In application of Article 3 of the Mannheim Convention, the Member States must refrain from imposing any toll, tax, duty or charge based directly on the fact of navigation. This rule has not prevented the prescription of a fee for services rendered or taxes on another basis, such as added value. Since 1952 an additional agreement to the Mannheim Convention was adopted. The CCNR Member States do not receive any Customs duty or other tax in respect of diesel oil consumed as fuel by vessels on the Rhine.

For Luxemburg and Austria it would be difficult to raise a fuel tax, because ship owners could bunker their fuel in Germany, where no fuel tax has to be paid. Thus in these countries the fuel is also tax free. In the Danube region it is a bit different. Austria, as mentioned before, and Romania do not raise a fuel tax, but Bulgaria, Hungary and Slovakia do. Also in Italy a tax on fuel consumption by IWT is levied.

Figure 66 suggests that the tax levels in the various countries are extremely different, but actually the differences are mainly caused by the PPS-correction. Considering non-adjusted tax levels (see Figure 67, the tax levels applied in the EU are quite similar (ranging from € 0.333 to € 0.368 per litre), except for Italy.

Figure 67 – Fuel tax levels in 2016 (€/litre, not PPS adjusted)



Note: There is no information about the fuel tax for inland navigation in Finland.

5.3.2 Port charges

Port charges for IWT vessels differ not only between countries, but also between the (inland) ports within a country. For instance, the German ports of Duisburg and Frankfurt raise different pierages and fees. This is based on the fact that the ports are companies which are allowed to make their own prices for their services, and hence they are allowed to raise different fees and pierages.

Because of the differences in port charges between ports within a country, we have defined some reference ports per country for which we discuss the port charges. The reference ports considered are shown in Table 17. For the four main IWT countries (Germany, The Netherlands, Belgium and France) two ports are considered, while for all other countries one reference port has been taken. In all these reference ports, port charges are applied.

Table 17 – Overview reference inland ports

Country	Reference inland port
AT	Krems
BE	Antwerp, Gent
BG	Vidin
HR	Vukovar
CZ	Prague
FI	Imatra
FR	Paris, Lyon
DE	Frankfurt, Duisburg
HU	Budapest
IT	Mantova
LT	Kaunas
LU	Mertert
NL	Rotterdam, Nijmegen
PL	Szezecin
RO	Constanza
SK	Bratislava
CH	Basel
US-MO	St. Louis

Differentiations applied

Port charges differ between ports, not only because of differences in the charge level, but also because of different elements that are covered by the charge. For instance, in Frankfurt and Duisburg charge levels are different, but port charges in both ports include a fee for the vessel reaching the port and a pierage for the allowance of transhipment. In Krems in Austria, on the other hand, only a pierage of € 0.48 per ton transhipment is charged and no fee for the vessel reaching the port.
Table 18 shows whether or not pierage and a fee for vessels calling the port are included in the port charges applied in the various reference ports.[46] One can see that there are all possible combinations of pierages and fees.

Table 18 – Overview of different types of IWT port charges

Country	Port(s)	Pierage	Fee
Austria	Krems	Yes	No
Belgium	Antwerp, Gent	No	Yes
Bulgaria	Vidin	Yes	Yes
Croatia	Vukovar	Yes	Yes
Czech Republic	Prague	No	Yes
Finland	Imatra	Yes	Yes
France	Paris, Lyon	Yes	No
Germany	Frankfurt, Duisburg	Yes	Yes
Hungary	Budapest	Yes	Yes
Italy	Mantova	No	Yes
Netherlands	Rotterdam, Nijmegen	No	Yes
Poland	Szezecin	No	Yes

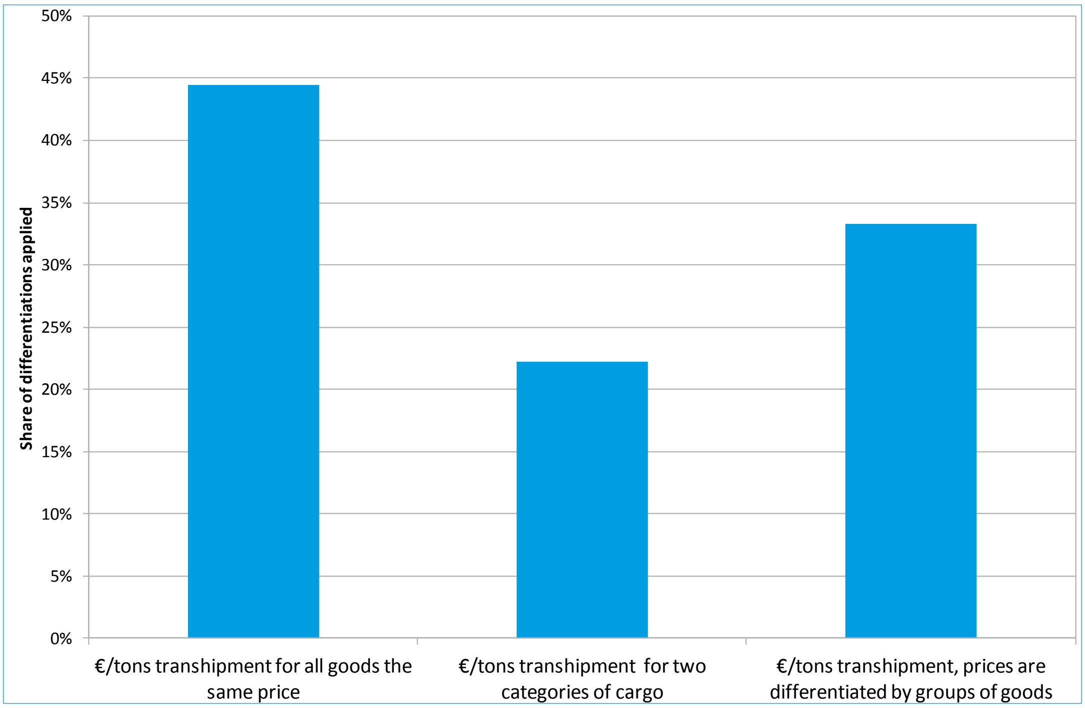
[46] Table 18 shows the charges for all reference ports, for which the information is available. For the ports in Luxembourg and Lithuania no information on port charges was found.

Country	Port(s)	Pierage	Fee
Romania	Constanza	No	Yes
Slovakia	Bratislava	Yes	No
Switzerland	Basel	Yes	No
US-Missouri	St. Louis	No	No

Note: There is no information available on the structure of port charges in Luxemburg and Lithuania.

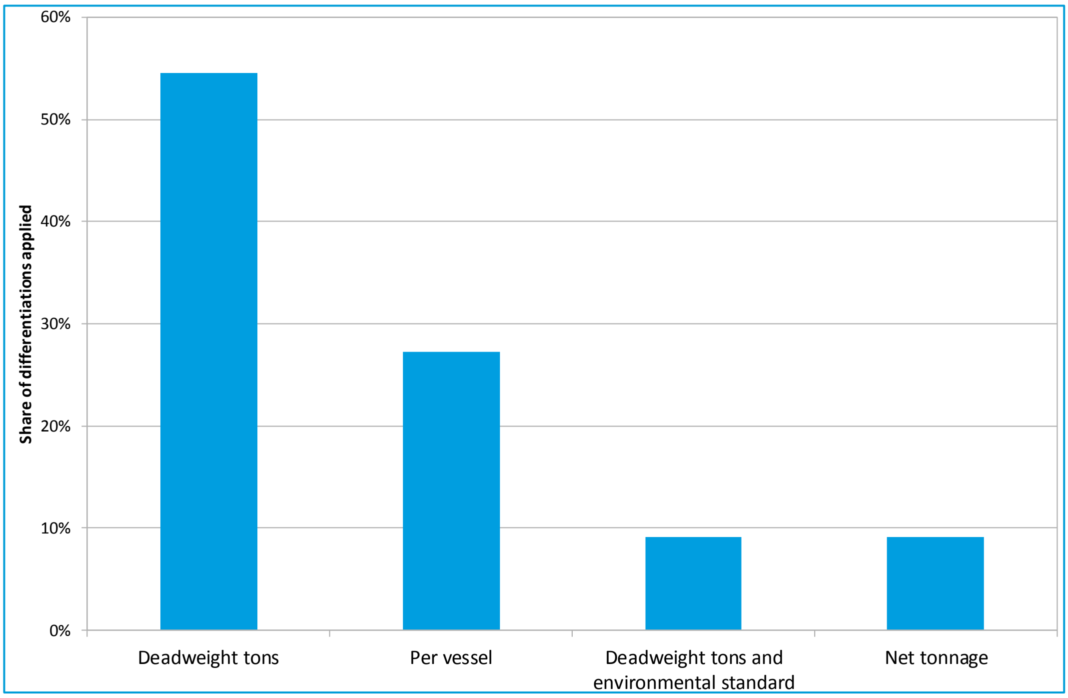
Different parameters are used to differentiate the pierages and fees. As is shown in Figure 68, pierages are always based on the number of tons transhipped. In most cases (44%) the pierage is the same for all types of cargo. However, there are also schemes that differentiate the pierage between various groups of cargo (33%) or between two types of cargo (23%).

Figure 68 – Differentiations used in the pierage tariffs



Also for the port fees various differentiation parameters are used. As shown in Figure 69, in 55% of the considered ports the fee depends on the deadweight tons of the vessel. A flat rate is applied in about 27% of the ports, while a differentiation to both deadweight tons and environmental standards is used in about 9% of the ports. Finally, a differentiation of the port fee to net tonnage is applied in 9% of the ports as well.

Figure 69 – Differentiations used in the port fees



Charge levels

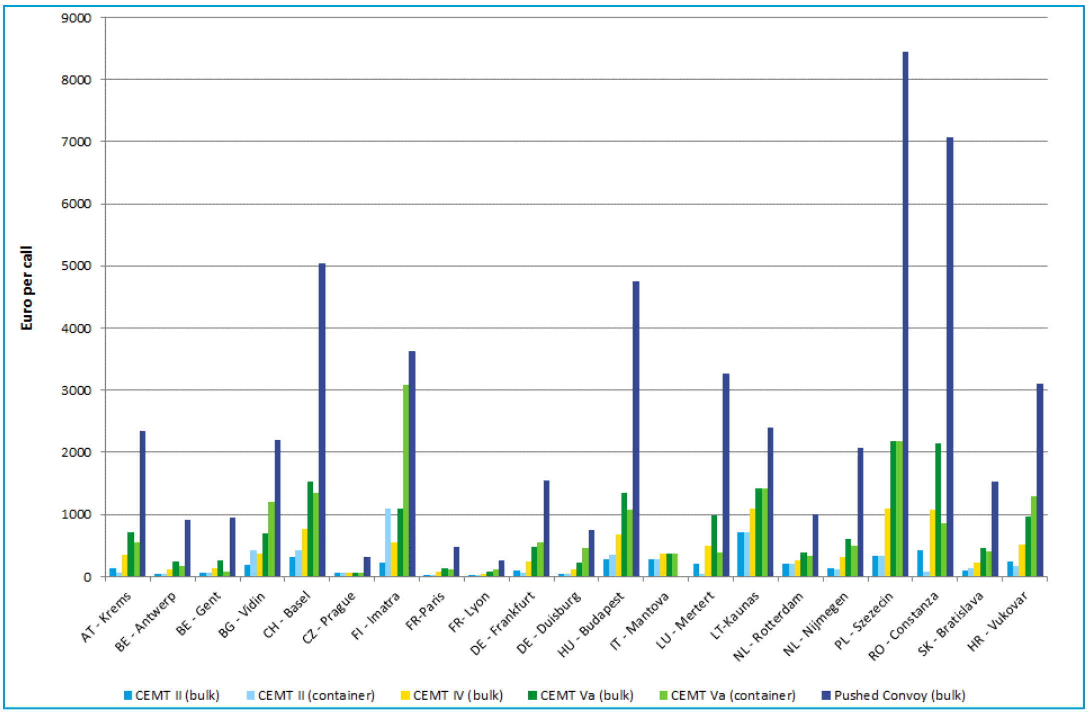
The port charge levels that are levied on the reference vessels in the various ports are shown in Figure 70[47]. Because in most ports the charge level depends on the loaded or deadweight tons, the port charge raises with the size of the vessel. One can also see that the differences in charge levels are not only between countries but also between ports within a country. For instance, the port calls in Frankfurt are more expensive than in Duisburg for all vessel types. Comparing the charge levels between the Dutch ports in Rotterdam and Nijmegen, it depends on the vessel type which port is more expensive.

Although not shown in Figure 70, the port charge level may also differ between vessels with different environmental characteristics. For example, in Antwerp and Rotterdam the port charges are differentiated to the environmental performance of the vessel. As a consequence, the port charges for a CCR-1 vessel are in these ports higher than for its CCR-2 counterpart. Particularly in Rotterdam these differences can be significant. For example, the port charge for the CCR-2 pushed convoy is about one third lower than for the CCR-1 pushed convoy.

The charges per transported tons are of course much more similar than the charges per vessel type. Bigger vessels are usually charged more extensively per port call, but they also carry usually more load.

[47] No data on port charge levels for Kaunas (Lithuania) were available.

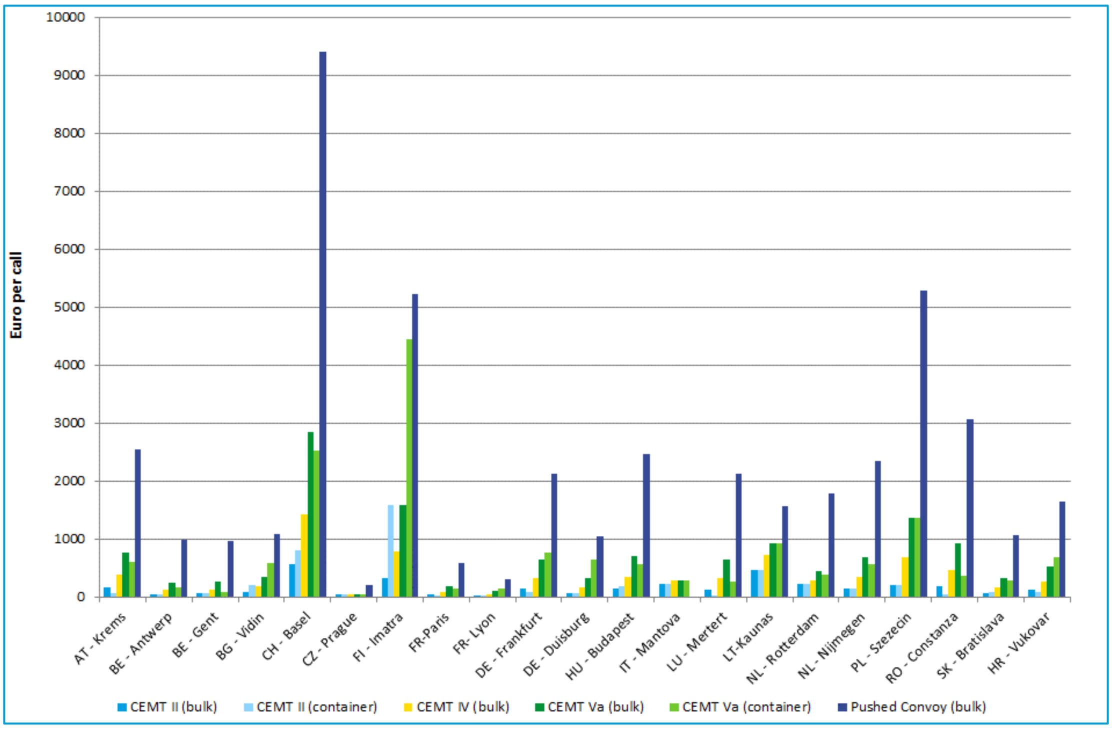
Figure 70 – Euro per port call of the reference vessels 2016 (PPS corrected)



Note: For each vessel type a CCR-2 variant is assumed.

Finally, it should be noted that the differences in port charges, as shown by Figure 70, are influenced by the PPS correction considered. One can see that the charges are not so different for the vessel owners when having a look at the non-adjusted charges (see Figure 71). Given the international character of IWT transport, these non-adjusted charge levels are interesting to compare as well. Notice that the port charges for large reference vessels in Basel (CH), Imatra (FI) and Szezecin (PL) are (theoretically) high, but these vessel types are not used in these countries.

Figure 71 – Euro per ports call of the reference vessels 2016 (unadjusted)



5.3.3 Fairway dues

As is shown in Table 19, only in seven countries fairway dues are collected. Because of the above mentioned Mannheim Convention, fairway dues on the Rhine are not allowed. Consequently, inland navigation to Basel is free of fairway dues, though the locks in Iffezheim and the Rhine-sidechannel (Grand Canal d'Alsace) have to be passed.

Table 19 – Overview of fairway dues

Country	Fairway Dues	Additional information
Austria	No	-
Belgium	Yes	Just on the Brussels-Scheldt channel
Bulgaria	No	-
Croatia	No	-
Czech Republic	No	-
Germany	Yes	Only Rhine and Elbe are free
Finland	No	-
France	Yes	Mosel Tariff
Hungary	No	-
Italy	No	-
Lithuania	No	-
Luxemburg	Yes	Mosel Tariff
Netherlands	No	-
Poland	Yes	Tariff based on tkm
Romania	Yes	Tariff based on loading capacity of the vessel
Slovakia	Yes	No further information available
Switzerland	No	-
US (Missouri)	No	-

Fairway dues are usually calculated as charges per ton-kilometre for different types of goods. For instance, in Germany there are three tariffs for fairway dues: one for the northern part of Germany, one for the southern part of Germany, and the Mosel tariff. Currently there is the discussion about the complete abolition of fairway dues with the exception of the Mosel[48]. In Belgium there is only one waterway with dues (i.e. the Brussels-Scheldt channel), while in France and in Luxemburg the Mosel tariff is relevant.

Differentiations applied

For six countries with fairway dues, information on the parameters on which the dues are calculated, is given: Belgium, Germany, Luxemburg, France, Romania, and Poland[49].

In Belgium a charge is levied for vessels using the channel Brussels-Scheldt. The charge is levied per kilometre and depends on the loaded tons. The charge is levied on inland vessels, maritime vessels, and passenger vessels. For loading and unloading an additional charge is levied, as well as for vessels which lay in the channel for a longer period.

As mentioned above in Germany there are three tariffs for fairway dues: one for the northern part of Germany, one for the southern part of Germany and the Mosel tariff. Thought these three tariffs are different in their dues, they are structured quite similar. For freight vessels the fairway due depends on the loaded cargo. If they are travelling empty in one direction the have just to pay a very small lump sum fee. For many transported goods there are discounts. Passenger vessels have to pay on the basis of their passenger capacity, but are allowed to pay a lump sum fee per year.

For France and Luxemburg the Mosel tariff is relevant. In Romania the vessel have to pay dues depending on the loading capacity and in Poland the fairway dues have to be paid for the transport performance (tkm).

Charge levels

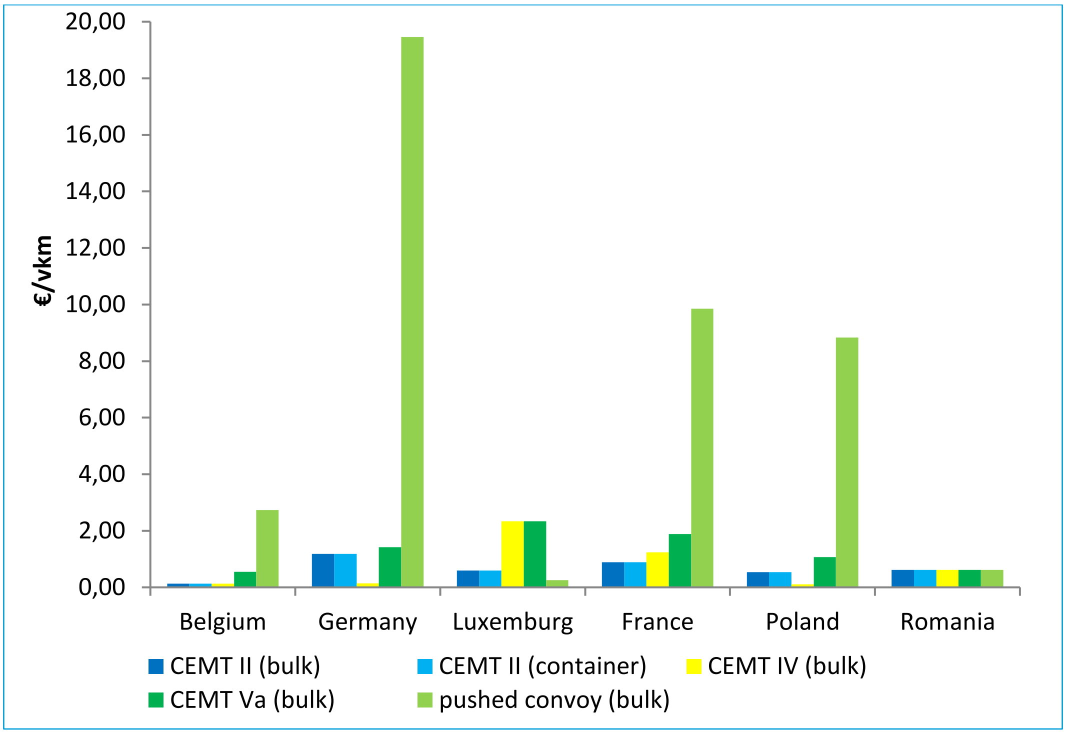
The fairway dues are calculated for Germany[50], Belgium, Luxembourg, France, Poland and Romania. A comparison shows that the dues are very different between Germany and Belgium, though both dues have been calculated for the use of channels. For Luxembourg, France and Poland they are quite similar (with a few exceptions), somewhere in the middle between Belgium and Germany (See Figure 72).

[48] The results of such abolition are estimated in Planco Consulting (2018).

[49] Information about the fairway due in Slovakia is missing.

[50] For the calculation of the German fairway due example, the southern tariff was chosen. The example could be a trip on the river Main or the Main-Danube-channel.

Figure 72 – Fairway dues (in €/vkm) in 2016 (PPP adjusted)



Note: Fairway dues are calculated for the average load of the reference vessels.

5.3.4 Dues for locks and bridges

Only in Belgium and Poland there are special dues for locks and bridges. In Belgium the dues for locks are part of the calculation of the fairway due for the use of the channel Brussels-Scheldt. In Poland the dues depends on the time when the lock is passed. For all other countries with complete information, there are no special dues for locks and bridges in the countries. The costs for the looks and bridges are compensated with the fairway dues.

5.3.5 Water pollution charges

From the fifteen countries for which data is yet available[51], seven do have some kind of water pollution charges and eight do not. Six of the countries with a water pollution charge are member of the CDNI, which is the convention on the collection, deposit and reception of waste produced during the navigation on the Rhine and inland waterways. Thus the CDNI members are countries with a link to the Rhine. Table 20 gives an overview of the countries that apply a water pollution charge.

Table 20 – Overview of the water pollution charges

Country	Water pollution charges (CDNI)
Austria	No
Belgium	Yes
Bulgaria	Yes
Croatia	No
Czech Republic	No

[51] No information is available for Hungary, Lithuania, Slovakia.

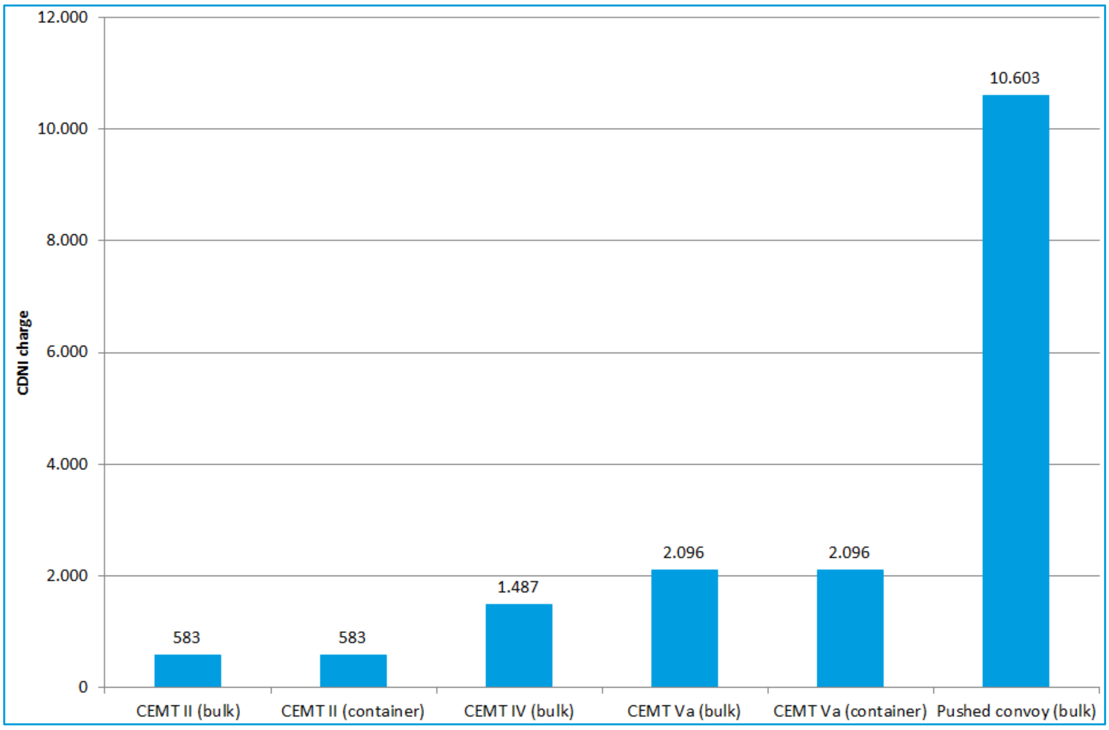
Country	Water pollution charges (CDNI)
Finland	No
France	Yes
Germany	Yes
Italy	No
Luxemburg	Yes
Netherlands	Yes
Poland	No
Romania	Yes
Switzerland	Yes
US (Missouri)	No

Charge levels

The water pollution charge in the CDNI-member countries is collected when the fuel is bunkered. The charge is € 7.5 per 1,000 litre fuel. Also there is an administrative fee of € 25 when ordering the bilge oil boats. Thus the charge is mainly paid in the country where the bunkering takes place and only the € 25 are directly paid in the country where the waste disposal takes place. However, there is a financial compensation between the member countries, so that the total revenues are relatively close to the costs of waste disposal in the countries.

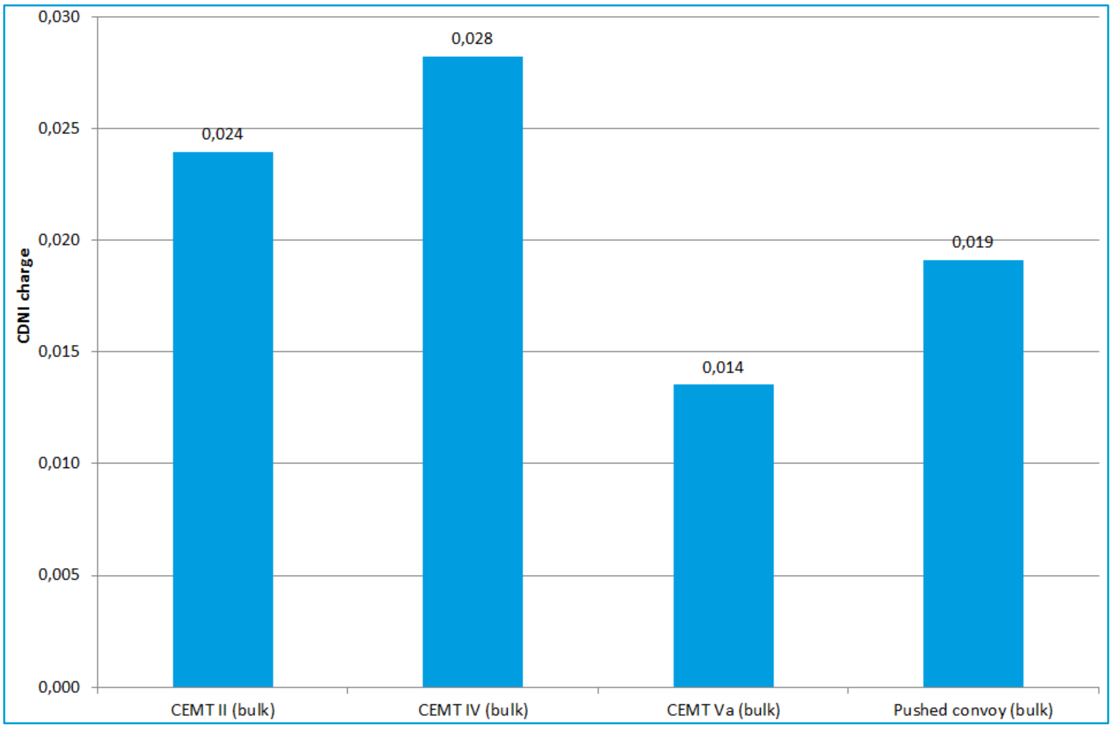
Assuming the vessel data of the reference vessels (see Annex A.4) the average CDNI charges shown in Figure 73 are levied on the various reference vessels. Per year, the highest charges have to be paid by the largest vessels.

Figure 73 – Average yearly CDNI charges of the reference vessels (€/year)



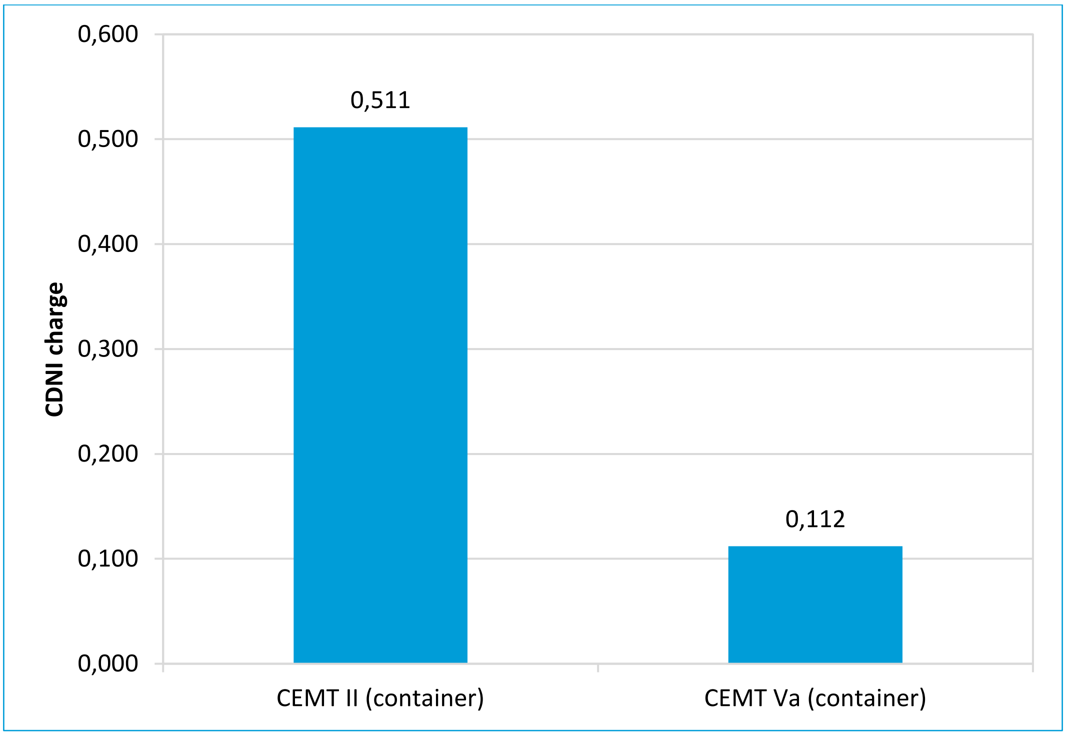
When we consider the CDNI charges per transported tonne, a completely different picture arise (see Figure 74). Bigger vessels overcompensate their higher fuel consumption by transporting more load.

Figure 74 – Average yearly CDNI charges of the reference vessels per transported tons (€ per tonne per year)



The same applies to the CDNI charges calculated on the basis of TEU (see Figure 75).

Figure 75 – Average yearly CDNI charges of the reference vessels per transported TEU (€ per TEU per year)



5.4 Revenues from IWT taxes and charges

5.4.1 Total revenue

An overview of the total tax/charge revenue in 2016 in the various countries is given in Table 21. As data availability on revenues from IWT taxes and charges is poor for some countries, it was not possible to present revenues for all instruments/countries. These cases are indicated by 'N/A' in the table. For all taxes and charges, including port charges, the total revenue per country are provided (i.e. covering the port charges for all inland ports). All figures are PPS adjusted to allow comparison between countries (see also Section 1.3). The unadjusted figures can be found in Annex E.4.

Table 21 – Total revenue from IWT taxes and charges (million €, PPS adjusted)

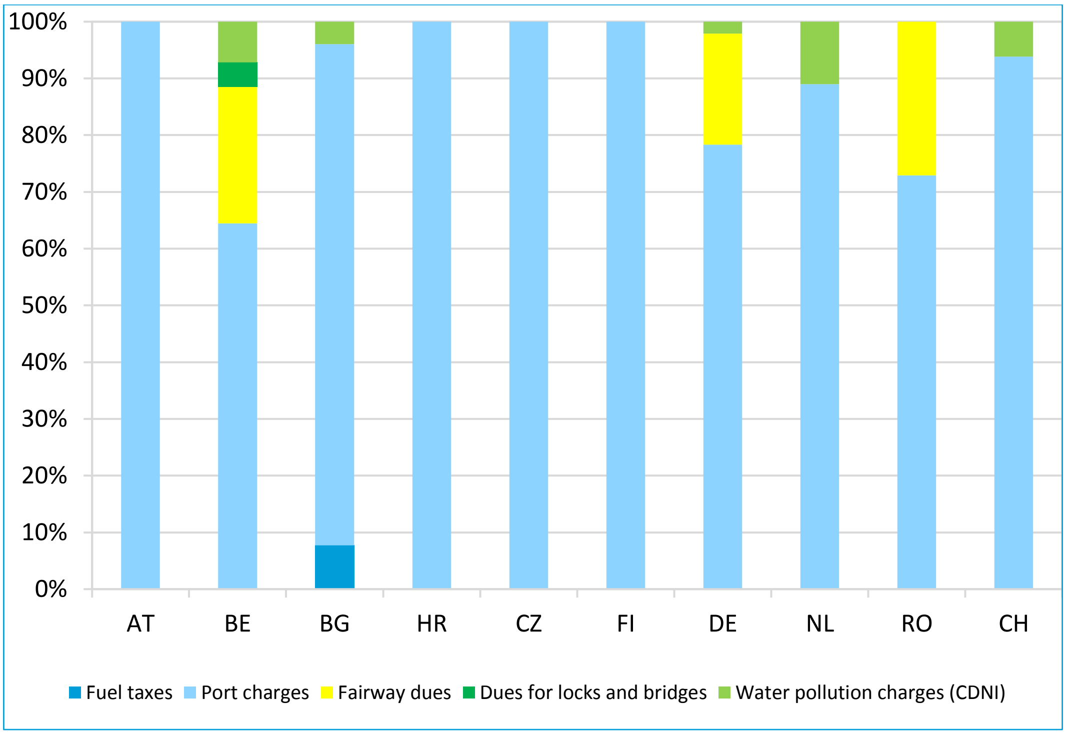
Member State	Fuel taxes	Port charges	Fairway dues	Dues for locks and bridges	Water pollution charges	Total revenue
EU28	6.1	299.5	53.0	1.0	9.8	369.3
Austria	-	3.1	-	-	-	3.1
Belgium	-	14.3	5.3	1.0	1.6	22.2
Bulgaria	2.7	30.7	-	-	1.4	34.8
Croatia	-	0.3	-	-	-	0.3
Czech Republic	-	5.2	-	-	-	5.2
Finland	-	0.7	-	-	-	0.7
France	-	5.6	N/A	-	0.02	5.6
Germany	-	140.7	35.2	-	3.8	179.7
Hungary	2.4	1.7	-	-	N/A	4.1

Member State	Fuel taxes	Port charges	Fairway dues	Dues for locks and bridges	Water pollution charges	Total revenue
Italy	0.3	N/A	-	-	-	0.3
Lithuania	N/A	N/A	-	-	N/A	N/A
Luxembourg	-	0.4	N/A	-	0.01	0.4
Netherlands	-	24.8	-	-	3.1	27.9
Poland	-	36.4	N/A	N/A	-	36.4
Romania	-	33.6	12.5	-	-	46.1
Slovakia	0.7	2.1	N/A	-	N/A	2.8
Switzerland	-	2.2	-	-	0.1	2.3
US - Missouri	N/A	0.0	-	-	-	N/A

The contribution of the various taxes/charges in total revenues are presented in Figure 76.
In all countries, port charges are responsible for the main part of the revenues. In some countries (e.g. Belgium, Germany and Romania) also fairway dues significantly contribute to the total revenues. Please notice that Figure 76 only considers the countries for which data on all taxes and charges are available. For that reason, no results for countries like France and Luxembourg are shown.

Figure 76 also shows that the share of revenues of fuel taxes, dues for locks and bridges, and water pollution charges in total revenues are generally small. The contribution of fuel taxes and dues for locks and bridges to total revenues is unknown, as no data on revenues from these taxes/charges is available.

Figure 76 – Share of different types of taxes and charges in total tax/charge revenue in 2016

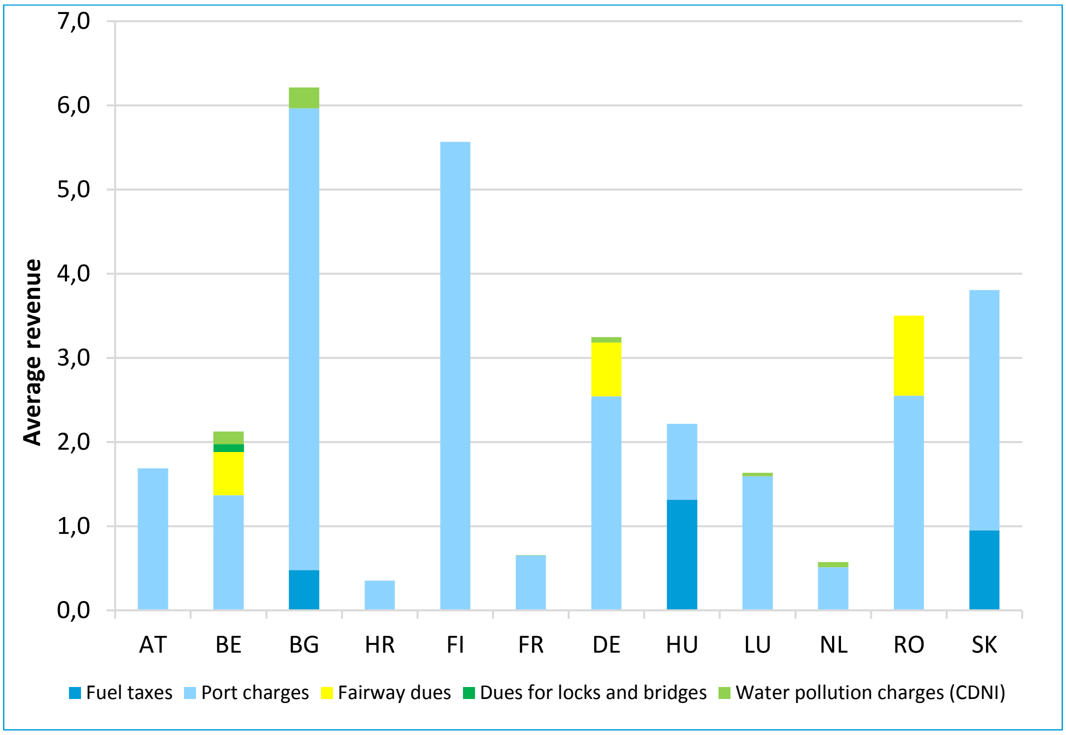


Note: France, Italy, Hungary, Lithuania, Luxembourg, Poland, Slovakia and Missouri are not covered by this graph, as for these countries not all revenues are known.

5.4.2 Average revenue

Figure 77 present the average tax/charge revenue for IWT in 2016. One can see that the average revenues in Germany are much higher than in countries like Austria and the Netherlands.
An important part of the revenues are the port charges, which are on average higher in Germany. Another point are the fairway dues in Germany. Germany is the only country of these three with fairway dues. Though the Rhine and the Elbe are free of dues the rest of the inland waterway system is not. But also compared to Belgium, which applies fairway dues as well, the average revenues in Germany are rather high. Relatively high average revenues are found for Finland, which can be explained by on average small vessels (resulting in higher average revenues per tonne-kilometre). The relatively high average revenues for Bulgaria, Slovakia and Romania are (partly) explained by the PPS correction applied.

Figure 77 – Average revenues from taxes and charges for inland navigation in 2016 (€/1,000 tkm, PPS adjusted)



Notes:

- As for France, Hungary, Luxembourg and Slovakia, no revenue data for all taxes/charges is available (see Table 21). Therefore, the average revenues shown in this figure are minimum levels.
- Switzerland and Czech Republic are missing because the data would disturb the chart. In these countries only port charges are collected. The transport performances are very low in both countries because of the very short inland waterway networks (a main share of the inland waterway transports are done on the German inland waterways). Hence the port charges per tkm are extremely high.
- Italy, Lithuania and Missouri are missing, as for (almost) all taxes/charges no revenue data was available.

5.4.3 Earmarking of revenue

As for earmarking of the various taxes and charges, the following conclusions can be drawn:

- Fuel taxes in Hungary, Italy and Lithuania are not earmarked. In Missouri, on the other hand, fuel tax revenues are earmarked to Missouri highways and bridges.
- In all countries, the port charges are income to the ports. To which part they are earmarked for expenditures on the port infrastructure is unknown.
- The water pollution charges (CDNI) in Germany, Belgium, France, Switzerland, Luxembourg and the Netherlands are income for the bilge oil companies and can be seen as a payment for the services provided by these companies. Therefore, they can be seen as earmarked to these infrastructure related services.
- The revenues from fairway dues in Germany, Bulgaria, and Luxemburg are earmarked to the Ministry of Transport, but the share used for infrastructure expenditures is not known[52].

[52] For Poland, Romania, and Slovakia the fairway dues are earmarked, most probably to the Ministries of Transport, but the volume is quite low. For Belgium and France, information on earmarking is missing.

6 Maritime transport

6.1 Introduction

In this chapter, we discuss the taxes and charges applied for maritime transport. First, an overview of the maritime transport taxes and charges considered in this study is given in Section 6.2. The extent by which these instruments are applied as well as a discussion on their structure and level is presented in Section 6.3. Finally, in Section 6.4 the revenue of maritime transport taxes and charges in 2016 is presented. In this section, we also discuss to what extent the revenue is earmarked for maritime port infrastructure.

6.2 Overview of maritime transport taxes and charges

An overview of the maritime transport taxes and charges considered in this study is presented in Table 22. For each tax or charge it is indicated whether it can be categorised as energy, vehicle, or infrastructure tax/charge and whether it should be considered a fixed or variable tax/charge.

Table 22 – Overview of maritime transport taxes and charges

Tax/charge	Description	Energy, vehicle or infrastructure tax/charge	Fixed or variable tax/charge
Taxes			
Fuel taxes	Consumption tax on transport fuel	Energy	Variable
Charges			
Port charges	Charge for the use of a port	Infrastructure	Variable
Fairway dues	Charge for using a specific waterway/territorial water	Infrastructure	Variable

As for the port charges, we only took the charges that are levied by the port authority into account. We neither considered port authorities service charges nor charges levied by third parties, e.g. piloting companies. For these reason, piloting charges, charges for port navigation services (including towing and mooring) and waste charges are not covered in this study. In most European ports these services are offered by private parties and hence data availability on charge levels and revenues is poor (as it is often considered confidential).

6.3 Detailed assessment of maritime transport taxes and charges

6.3.1 Fuel taxes

There are no fuel taxes to be considered for maritime transport for all ports in the sample selected for this study, as bunker volumes are exempted from fuel taxes. For EU ports this is based on the Energy Taxation Directive – ETD (2003/96/EC). Article 14 of this Directive states that energy products supplied for use as fuel for the purpose of navigation within Community waters (other than private pleasure craft) should be exempted from taxation.

6.3.2 Port charges

This section discusses charges to the ship and to the cargo levied by port authorities or other public entities, partly on behalf of a port authority. These port charges are applied in all ports considered in this study. However, it should be mentioned that the scale of fees vary from port to port, depending on the port-based management model and the individual economic strategies and spatial planning policies.

There are different forms of the ownership structure of ports and of port services: public/private, landlord only, full or part service provider. Most port authorities in Europe remain public owned. Mixed public-private ownership is rare and exists only in a limited number of ports, like Piraeus, Koper, Constanta and Marsaxxlok. Full private ownership is characteristic for some ports in the UK. This diversity of port structures are approved also in the EU Regulation 2017/352 (European Parliament, 2017). However, the regulation clarifies that the charging systems for vessel operators are expected to be transparent, easy identifiable and non-discriminatory. Moreover, the charging systems shall contribute to the development and maintenance of port infrastructures and the services and service facilities required for reliable and efficient port operations. The so-called 'Port Package' regulation stated also on the need of state aid guidelines for ports allowing a level-playing-field for the port sector.

Differentiations applied

For port charges many factors play a role in the fees charged:
- vessel size (gross tonnage, net tonnage, and/or vessel length);
- vessel type;
- lay time at berth;
- different services offered to vessels;
- type of cargo;
- navigation services offered;
- discount models (e.g. liner services or tramp shipping);
- trade region (origin or destination of the vessel);
- environmental performance of the vessel;
- number of calls;
- negotiable contracts.

These different factors used to differentiate port charges are reflected in the various components covered by the port charges in the selected ports (see Table 23 for some often used components). Most of the ports (28 out of 34 for which information was available) do apply tonnage dues (based on ship dimensions). In most ports, the gross tonnage of the vessel is used as base for this due, except for the Port of Helsinki where net tonnage of the vessel is used. Some ports (19) do apply a charge on the amount of handled cargo (charges on goods), while 22 port charge the use of quays (berth charges). For RoPax-ferries, often a charge is raised for passengers, cars and number of trailers that are embarking/disembarking, in addition to the tonnage charge. Finally, eleven ports grant a rebate on environmental grounds, based on the environmental ship index[53] (ESI) of the vessel.

[53] The ESI covers NO_x, SO_x and GHG emissions.

Table 23 – Different components of port charges applied in selected ports

Port	Tonnage dues	Charges on goods wharfage	Passenger/ vehicle cargo fee	Berth charges/ mooring/ towing	Charges on port facilities	ESI-discount
Antwerp (BE)	X			X		X
Varna (BG)	X			X	X	
Limassol (CY)	N/A	N/A	N/A	N/A	N/A	N/A
Hamburg (DE)	X	X		X	X	X
Bremerhaven (DE)	X			X		X
Travemünde (DE)	X		X	X		
Aarhus (DK)	X	X	X	X		
Helsingør (DK)	N/A	N/A	N/A	N/A	N/A	N/A
Tallinn (EE)			X	X		
Algeciras (ES)	X	X	X		X	
Valencia (ES)	X	X	X			
Barcelona (ES)	X	X	X			
Bilbao (ES)	X	X	X		X	
Helsinki (FI)	X		X	X		X
Marseille (FR)	X	X	X			X
Le Havre (FR)	X	X				X
Calais (FR)	N/A	N/A	N/A	N/A	N/A	N/A
Pireaus (GR)	N/A	N/A	N/A	N/A	N/A	N/A
Rijeka (HR)		X	X	X		
Split (HR)		X	X	X		
Dublin (IR)	X	X	X			
Trieste (IT)		X	X	X		
Genova (IT)	X	X	X	X		
Venice (IT)			X	X	X	
Klaipeda (LT)	X		X	X	X	
Riga (LV)	X		X	X	X	
Marsaxxlokk (MT)	N/A	N/A	N/A	N/A	N/A	N/A
Rotterdam (NL)	X			X	X	X
Oslo (NO)	X	X	X		X	X
Gdansk (PL)	X		X	X		
Sines (PT)	X	X		X		
Constanta (RO)	X			X		
Gothenburg (SE)	X		X			X
Koper (SL)		X		X		
Felixstowe (UK)	X			X		
Vancouver (CA)	X	X	X	X		X
Montreal (CA)	X			X		
Los Angeles (US)		X	X	X		X
Savannah (US)	N/A	N/A	N/A	N/A	N/A	N/A
Tokyo (JP)	X	X			X	

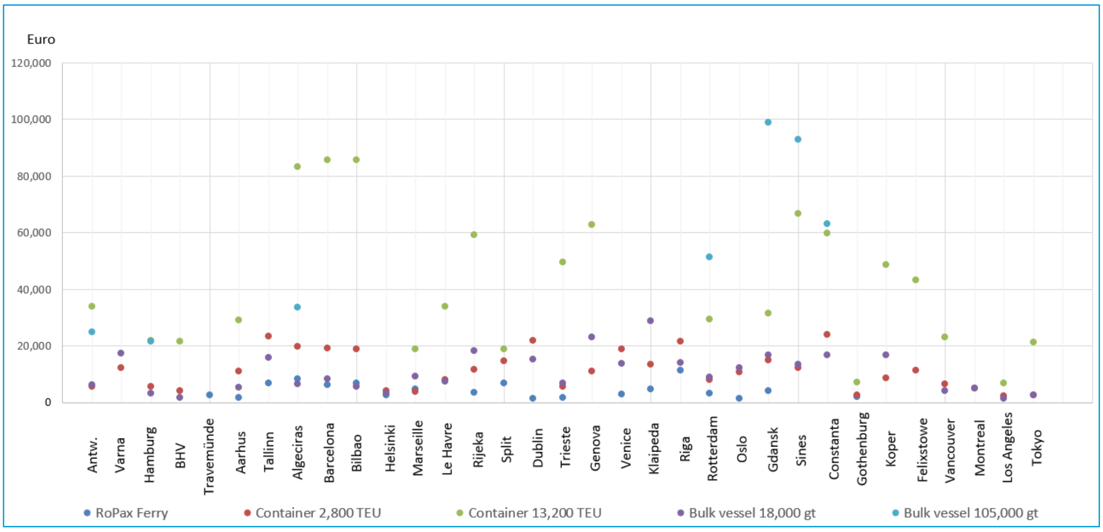
Charge levels

Based on the operational and technical characteristics of the reference vessels (see Annex A.5), we have calculated the port dues for five different types of vessels for sea ports considered in this study, e.g. RoPax vessel, container vessel (small, large) and dry bulk carrier (small, large).

Data on port charges are collected from the official port tariff documents. Charges of third private parties on port services were not considered due to lack of available information. As the charge structure for many port dues are complex, many assumptions have to be made for calculating the port charges, e.g. port specific areas, berths in ports have to be chosen.

For the following sea ports information on port charges was not available: Port of Helsingoer, Port of Calais, Port of Marsaxxlok, Port of Limassol, Port of Piraeus and Port of Savannah.

Figure 78 – Port charges for reference vessels, 2016 (in Euro/call, PPP adjusted)



Note: Excluding ports for which information on port charges is not available. Vessel types were only considered for ports where these reference vessels types occur (based on EUROSTAT).

As mentioned before, the level of port charges depends, among other factors, on the port pricing policies. This complicates the comparison between ports, also because (unofficial) discounts are provided, e.g. to vessel operators regularly calling the port. For these reasons, it is not possible to explain all differences in port charges between ports.

But generally speaking, port charges are higher for larger vessels, which can be explained by the fact that most schemes use gross tonnage as the charging base. In some ports, differentiations to ship types are made as well, generally resulting in higher charges for larger vessels. Finally, some port charge fees on handled tonnes, which is why larger ships (bulkers, containers) have to pay higher fees.

Bulkers and containers can only be compared in ports that charge tonnage related fees, differentiated by ship types. It should be also considered that container ships usually receive liner tariffs (liner services have to pay less than tramp services), while bulkers are engaged in the tramp trade. Basically, it can be stated that — with same ship sizes — container ships generate higher revenues than bulk carriers due to the fact that liner services have higher number of port calls than non-liner/tramp services.

Finally, RoPax ferries are often charged less than container or bulk vessels as these vessel have a different cargo structure (e.g. PAX and trucks/cars versus TEU) and sail with higher frequencies.

6.3.3 Fairway dues

Fairway dues are only applied in Sweden, Finland and Estonia, while in the two other Baltic States, Latvia and Lithuania, fairway dues are integrated into the port due system (i.e. fairway dues are not separately calculated and available).

Differentiations applied

In Sweden, fairway dues are taken by the Swedish Maritime Administration (SMA). The system for fairway dues relevant for 2016 was based on gross tonnage and the loaded and unloaded cargo. However, due to three characteristics, i.e. that fees were charged per call, that a maximum amount charged for a call was fixed, and that the number of calls that were charged per month differed for the various vessel types in combination with possible fee exemptions and reductions, the model was difficult to understand.

Finnish fairway dues are to be paid on ships' arrival in Finland's territorial waters and when sailing between Finnish ports. They are calculated based a unit price based on ice classification and the net tonnage of a ship. Reduction of fairway dues of 50 or 75% are calculated by taking into account used loading capacity.

Finally, fairway dues in Estonia are paid for navigational organisation and the use of icebreaking and information services on public waterways, as well as for the use of the infrastructure installed on public waterways to ensure maritime safety. Calculation of fairway dues is based on gross tonnage (GT) and a unit price for different vessel types. A maximum of fairways due per port call is fixed at € 20,000 for tankers, € 12,000 for cruise vessels and € 15,000 for other vessel types. Furthermore, reduction of fairway dues can be granted if a certain numbers of annual port calls are achieved which are defined for each category of vessel types.

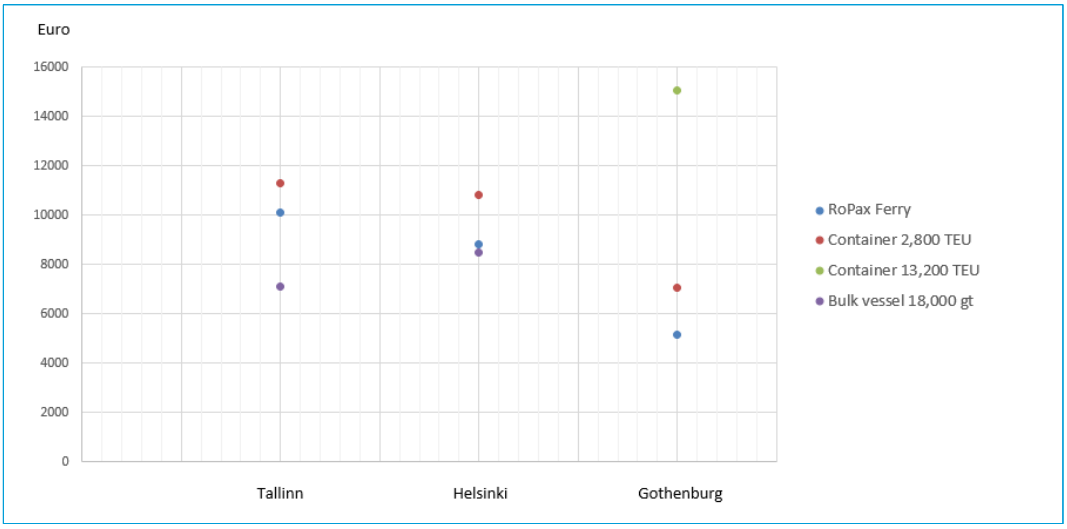
As a conclusion it can be stated that the applied fairway due systems were based mainly on tonnages, i.e. the Estonian fairway system was based on gross tonnage as well as the Swedish system which was complemented by cargo factors while the Finnish system is based merely on net tonnage.

Charge levels

Figure 79 shows the fairway dues calculated for the defined reference vessels. For the Port of Helsinki and the Port of Gothenburg, the calculated fairway dues for the reference vessels are higher than the port charges. For the Port of Tallinn the opposite is the case. Port pricing strategies may explain these differences between ports as well as differences in icebreaking costs (which are part of the fairway dues).

As for the port charges, fairway dues are, in general, higher for larger vessels. But due to other factors affecting the fairway due levels (e.g. type of cargo, pricing strategy of ports), this general pattern is not always shown in Figure 79.

Figure 79 – Fairway dues for reference vessels, 2016 (in Euro/call, PPP adjusted)



Note: Only the reference vessels relevant for the ports considered are shown in the graph.

Planned introduction of new or changes in existing fairway dues

From 2018 a new fairway due system has been introduced in Sweden. The main aim of the reform of the Swedish fairway due is to lower the emissions from vessels. The new system better contributes to a reduction of the environmental impact using a framed environmental index (Clean Shipping Index) comprising five categories of emissions, i.e. nitrogen oxides, carbon dioxide, sulphur and particulates, water and waste management and hazardous substances on board. It is assumed that through a consideration of a comprehensive environmental impact based on the new index, an increasing share of vessels calling Swedish ports aim to meet the index for paying lower fairway dues. Hence, fairway dues based on the new system do not differentiate among vessel types but simply calculates fairway dues by net tonnage, the achieved environmental class, and the cargo value class (i.e. high or low value).

6.4 Revenues from maritime transport taxes and charges

6.4.1 Total revenue

An overview of the total tax/charge revenue in 2016 in the various maritime ports is given in Table 24. For all taxes and charges, the total revenue per port are provided. All figures are PPS adjusted to allow comparison between ports (see also Section 1.3). The unadjusted figures can be found in Annex E.5.

In total, annual port charges have been gathered for 34 out of 40 ports (see Table 24). For most of the ports information on annual port charges/revenues was available from annual reports. Partly, information was split in several categories (like e.g. concessions, land rent), while for other ports merely total amounts were given in the annual reports.

For ports with information on total annual revenues only, the revenues from port charges are estimated based on a split of total revenues in different categories. This is based on a ESPO Study (ESPO, 2011) and selected ports where information of categories is also available. The Survey has revealed that about 65% of the total revenues accounted for port charges. Where only total figures are given, ports are marked with '*'.

Because of differences in price policies of port authorities, number of port calls and different ship types (types of cargos) which calling ports, annual revenues differ not only between countries/regions, but also between ports within a country. However, generally, ports with the largest turnover and highest number of port calls reported the highest revenues.

Table 19 shows the total tax and charge revenues in 2016 after PPP adjustments. In general, ports in the North Range with a focus on container traffic have the highest revenues with an average of 121 Mio Euro, while ports in the Mediterranean or in the Baltic Sea with a high proportion of ferry traffic reported smaller average revenues with 50 Mio Euro and 41 Mio EUR respectively[54].

Table 24 – Total revenue from maritime taxes and charges (million €, PPS adjusted)

Port	Fuel taxes	Port charges	Fairway dues	Total revenue
Antwerp (BE)	-	173.2	-	173.2
Varna (BG) *	-	36.7	-	36.7
Limassol (CY)	-	N/A	-	N/A
Hamburg (DE)	-	38.1	-	38.1
Bremerhaven (DE) *	-	12.9	-	12.9
Travemünde (DE)	-	N/A	-	N/A
Aarhus (DK)	-	15.4	-	15.4
Helsingør (DK)	-	16.6	-	16.6
Tallinn (EE)	-	98.9	18.7	117.6
Algeciras (ES)	-	67.1	-	67.1
Valencia (ES) *	-	106.8	-	106.8
Barcelona (ES) *	-	103.1	-	103.1
Bilbao (ES)	-	58.0	-	58.0
Helsinki (FI) *	-	40.5	8.6	49.1
Marseille (FR)	-	67.3	-	67.3
Le Havre (FR) *	-	95.3	-	95.3
Calais (FR)	-	N/A	-	N/A
Pireaus (GR) *	-	101.2	-	101.2
Rijeka (HR) *	-	27.3	-	27.3
Split (HR)	-	7.2	-	7.2
Dublin (IR)	-	48.8	-	48.8
Trieste (IT) *	-	19.5	-	19.5
Genova (IT) *	-	42.3	-	42.3
Venice (IT)	-	24.5	-	24.5
Klaipeda (LT) *	-	52.2	-	52.2
Riga (LV)	-	50.3	-	50.3
Marsaxxlokk (MT)	-	N/A	-	N/A
Rotterdam (NL)	-	261.4	-	261.4
Oslo (NO)	-	8.8	-	8.8
Gdansk (PL)	-	34.1	-	34.1
Sines (PT) *	-	33.6	-	33.6
Constanta (RO)	-	72.1	-	72.1
Gothenburg (SE) *	-	10.6	12.4	23.0

[54] North Range ports: Hamburg, Bremerhaven, Rotterdam, Antwerp.
Mediterranean ports: Marseille, Bilbao, Valencia, Barcelona, Algeciras, Sines, Split, Trieste, Genova, Venice, Koper, Rijek, Pireaus.
Baltic ports: Helsingör, Helsinki, Gdansk, Tallinn, Riga, Klaipeda.

Port	Fuel taxes	Port charges	Fairway dues	Total revenue
Koper (SL) *	-	45.0	-	45.0
Felixstowe (UK)	-	26.8	-	26.8
Vancouver (CA)	-	30.6	-	30.6
Montreal (CA)	-	23.1	-	23.1
Los Angeles (US) **	-	266.0	-	266.0
Savannah (US)	-	N/A	-	N/A
Tokyo (JP)	-	N/A	-	N/A

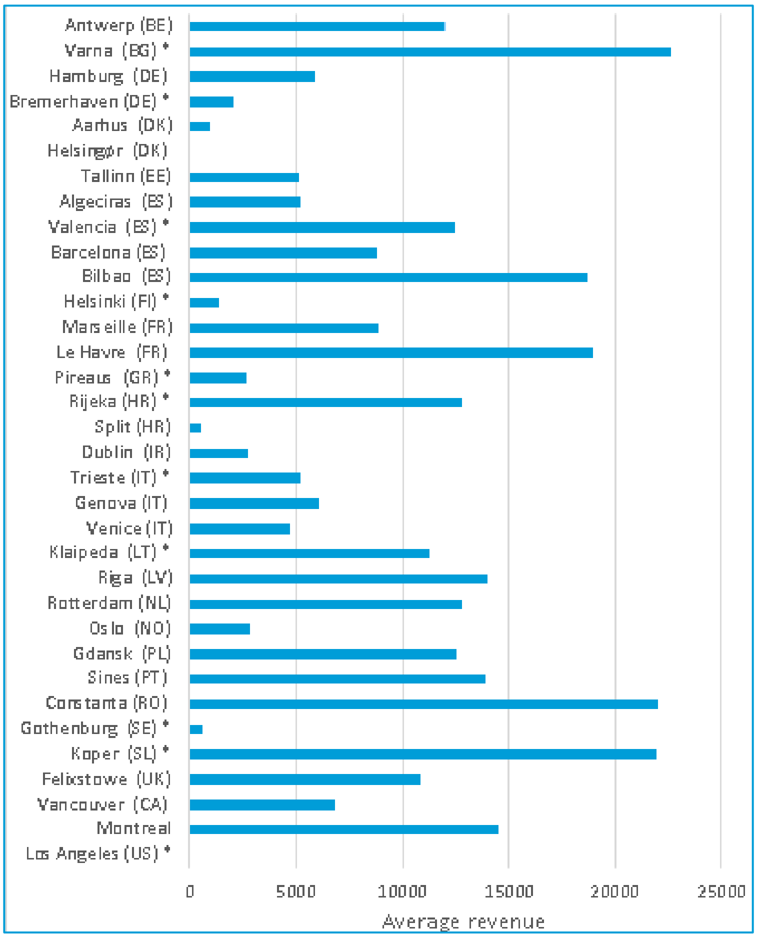
* Total revenues, no further differentiation.

** Figures for Los Angeles including wharfage.

6.4.2 Average revenue

Figure 80 and Figure 81 show the average revenues (charges) per port for a ratio on annual port revenues (charges) and port calls. Ports without information on revenues are excluded. The split was calculated on a weighted basis in order to balance out on one hand the differences between port charges for freight vessels and ferries — and on the other hand, the different frequencies in operations of freight vessels and ferries.

Figure 80 – Average revenues per port call for freight vessels, 2016 (in Euro/call, PPS adjusted)

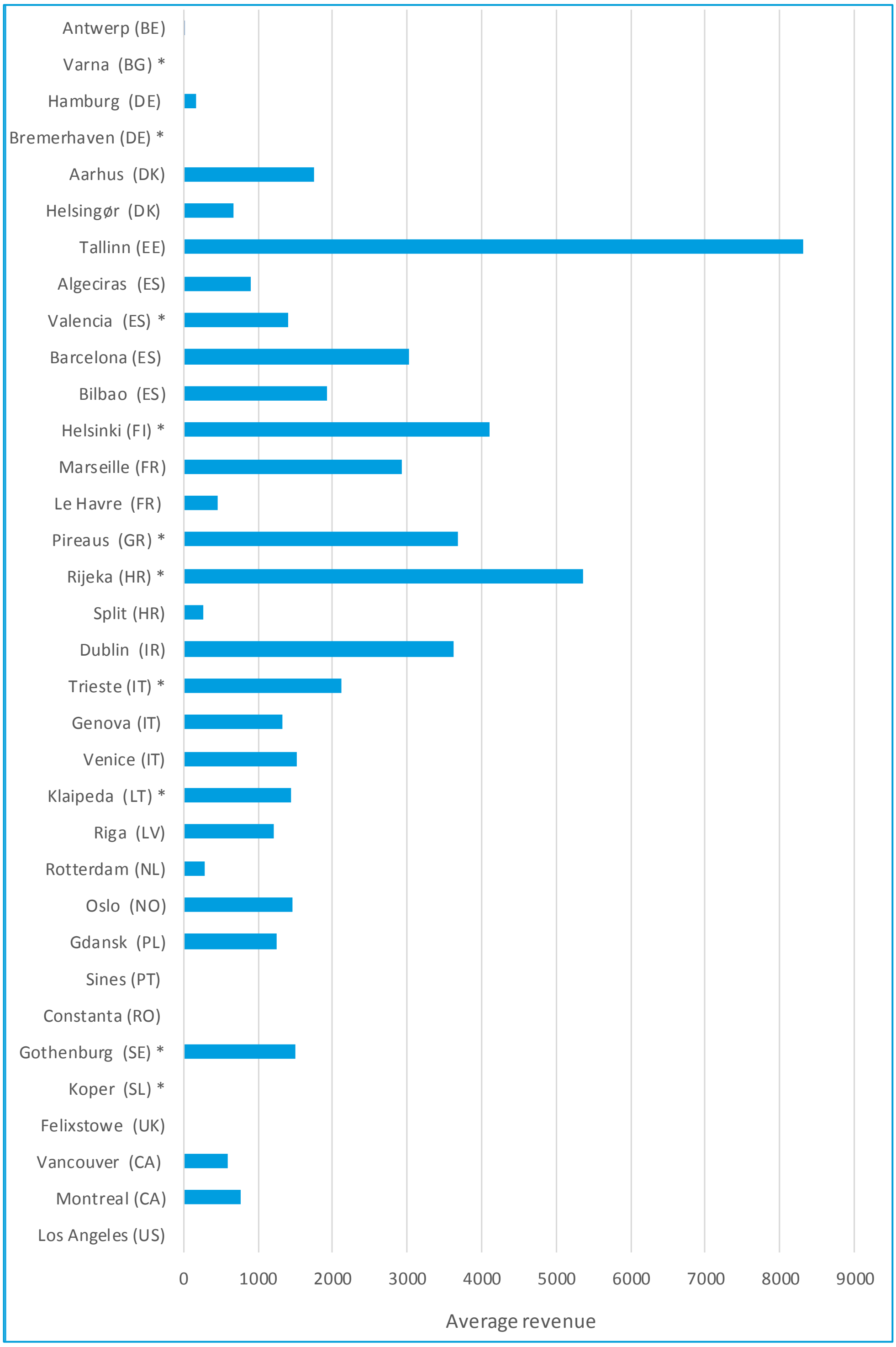


* Estimated.

Note: Figures for Los Angeles (including wharfage) reported about 266 Mio Euro on revenues and 1,757 calls for freight vessels (on average 140,000 EUR PPP adjusted). Result for this charge system does not correspond to the other port results.

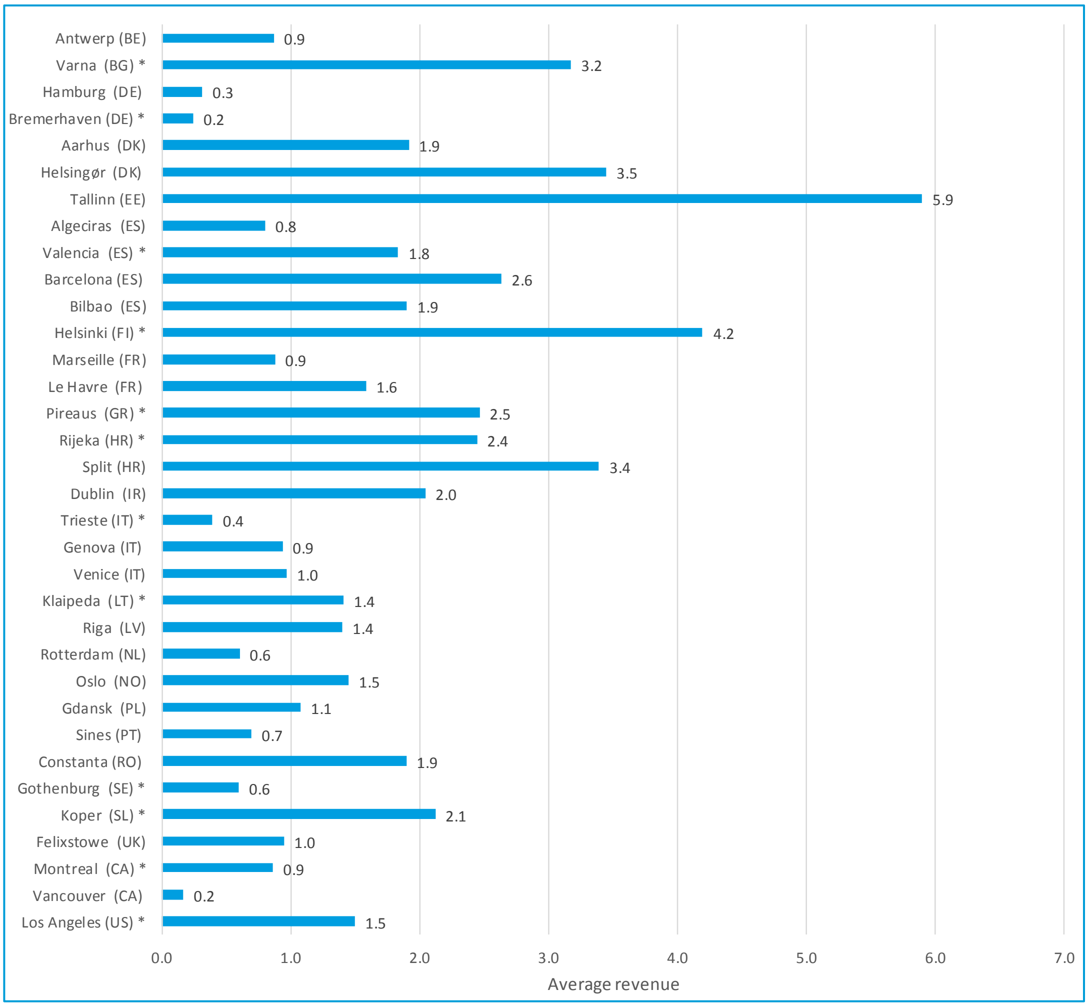
Due to PPPs adjustments, Figure 80 shows relatively high values for average revenues per port call for freight vessels for the ports of Varna and Constanta. But even without this correction, the average charge level in these ports seems to be higher than in bigger ports like Hamburg. This may be explained by differences in pricing strategies.

Figure 81 – Average revenues per port call for passenger/ferry vessels, 2016 (in Euro/call, PPS adjusted)



In addition, Figure 82 shows the average revenues (charges) per port for a ratio on annual port revenues (charges) and annual volumes of tonnes handled (including both freight vessels and RoPax vessels).

Figure 82 – Average revenues per ton handled, 2016 (in Euro/ton, PPS corrected)



* Total revenues, no further differentiation.

6.4.3 Earmarking of revenue

There have been no information available on earmarked charges. The Ports Regulation from 2017 (Regulation 2017/352) (European Parliament, 2017) has been aiming to ensure a level-playing-field with regard to port infrastructure financing through transparent public funding in order to enhance market access in ports and to increase the efficiency of port investments as well as port operations. Hence, the regulation shall ensure that charges on port infrastructure are accordingly levied. This may be done by integration of these charges into other charges like port charges. However, it has to be noted here, that the charges can vary taking into account the commercial strategy and investment plans of an individual port which includes also the earmarking of revenues. The relevant authority (e.g. port authority) should provide information on port infrastructure charges to the European Commission on its request. However, the information is not available for third parties as it is considered as confidential.

7 Aviation

7.1 Introduction

This chapter provides and overview of the aviation taxes and charges. In Section 7.2, we first provide an overview of the aviation taxes and charges that are considered in this study. The structure and level of these instruments are discussed in Section 7.3. Finally, the revenue of aviation taxes and charges in 2016 are presented in Section 7.4. In this Section, we also discuss the extent by which the revenues are earmarked for airport infrastructure.

7.2 Overview of aviation taxes and charges

Table 25 gives an overview of the taxes and charges for aviation covered in this study.

Table 25 – Overview of aviation taxes and charges

Tax/charge	Description	Energy, vehicle, user or infrastructure tax/charge	Fixed or variable tax/charge
Taxes			
Fuel taxes	Consumption tax on aviation fuel.	Energy	Variable
Aviation taxes	Aviation taxes, including taxes levied on passengers and environmental taxes.	User	variable
Charges			
LTO charges	Charge for the landing and/or take-off.	Infrastructure	variable
Passenger charge	Charge for passenger transport.	Infrastructure	variable
Security charge	Charge for security services and infrastructure.	Infrastructure	variable
PRM charge	Charge for persons with reduced mobility.	Infrastructure	variable
Noise/emission charges	Charges for noise depending of noise class of the aircraft or emissions.	Infrastructure	variable
Airbridge charge	Charge for the use of airbridge.	Infrastructure	variable
Aircraft parking charge	Charge for the parking of aircrafts.	Infrastructure	variable
Charges for ground handling services	Charge for ground handling services.	Infrastructure	variable
Fuelling charge	Charge for the fuelling of aircrafts.	Infrastructure	variable
Freight charge	Charge for freight transport.	Infrastructure	variable
Infrastructure charges	Charges for the use of infrastructure incl. IT.	Infrastructure	variable
Terminal charge	Charge that consider the costs of air navigation services regarding the control of landing and take-off of planes.	Infrastructure	variable
En route charge	Charge to be paid for the use of navigation facilities, communication, etc. en route for a specific flight. This charge is calculated per charging zone.	Infrastructure	variable
ETS	CO_2 emissions from intra-EEA flights are covered by the EU Emission Trading schemes.	Energy	Variable

Table 26 gives an overview of the airport specific aviation charges levied in the several airports as well as whether aviation and/or energy taxes are applied in the country where the airport is located.
Air navigations charges are and not included in the table.

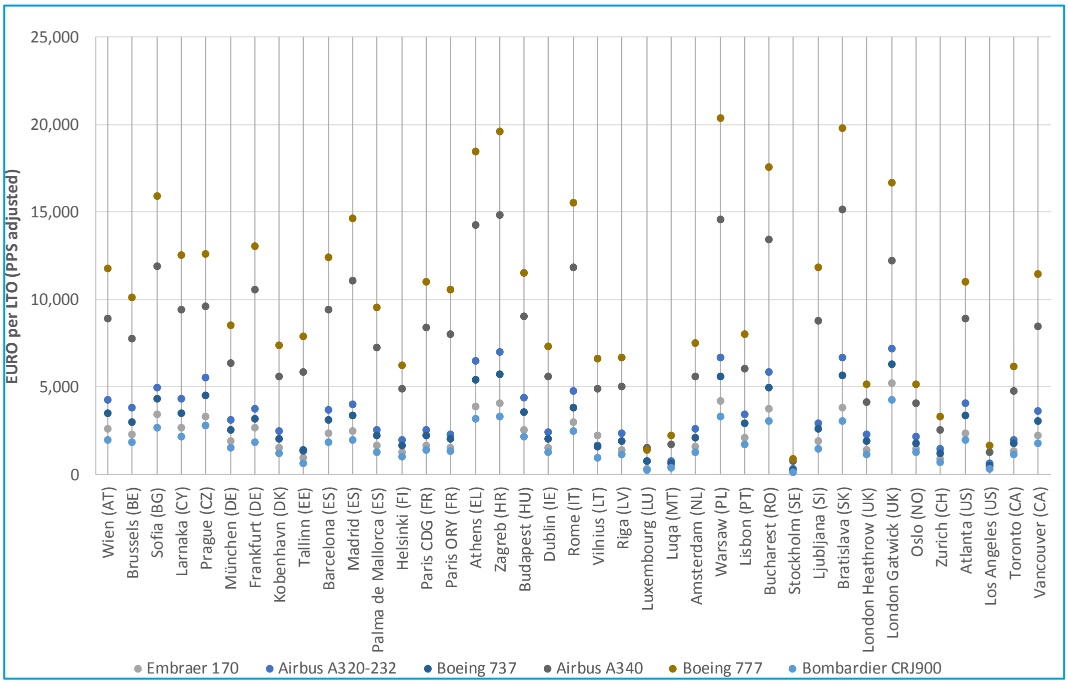
Table 26 – Overview of aviation taxes and charges for commercial transport by airport

	LTO charge	Airbridge charge	Aircraft parking	Charges for ground handling	Fuelling charge	Passenger charge	Passenger facility charges	Security charge	PRM charge	Noise charge	Emission charge	Freight charge	Infrastructure charge	other	aviation and/or energy tax
Vienna (AT)	x		x			x		x	x	x			x		x
Brussels (BE)	x		x	x		x		x	x					x	
Sofia (BG)	x	x	x			x		x		x					
Zagreb (HR)	x		x	x			x	x	x				x		x
Larnaka (CY)	x	x	x			x		x	x					x	
Prague (CZ)	x	x	x			x			x	x					
Copenhagen (DK)	x		x	x		x		x	x					x	
Tallinn (EE)	x	x				x							x		
Helsinki (FI)	x		x			x		x	x	x				x	x
Paris Charles de Gaulle/Orly (FR)	x	x				x			x	x			x		x
Frankfurt and Munich (DE)	x	x				x		x	x	x	x	x	x		x
Athens (EL)	x		x			x		x	x				x	x	
Budapest (HU)	x	x				x		x	x	x					x
Dublin (IE)	x	x	x			x			x					x	
Roma (IT)	x	x	x			x		x	x	x		x		x	x
Riga (LV)	x		x	x		x		x	x				x	x	
Vilnius (LT)	x	x	x		x	x			x				x	x	
Luxembourg (LU)			x			x	x		x						
Luga (MT)	x		x			x		x	x						
Amsterdam (NL)	x		x			x		x	x						x
Warsaw (PL)	x		x			x			x	x			x		
Lisbon (PT)	x	x	x	x	x	x		x	x			x	x	x	
Bucharest (RO)	x		x			x		x	x						
Bratislava (SK)	x		x												
Ljubljana (SI)	x		x	x		x		x	x				x		
Barcelona, Madria, Palma de Mallroca (ES)	x	x	x	x	x	x		x	x	x					x
Stockholm (SE)	x		x	x	x	x	x	x	x	x	x		x	x	x
London Heathrow (UK)	x	x	x			x		x	x		x			x	x
London Gatwick (UK)	x		x	x		x			x		x		x	x	x
Oslo (NO)	x					x		x						x	x
Zurich (CH)	x		x			x		x	x	x	x	x	x		x
Toronto (CA)	x					x							x	x	x
Vancouver (CA)	x					x							x	x	x
Atlanta (US)	x						x						x	x	x
Los Angeles (US)	x	x	x				x						x	x	x

A new airport charge is planned in Riga with respect to the new cargo apron to be opened by 2020. The cargo concession fee shall be introduced in 2020.

The estimated level of airport charges by type of aircraft are shown in Figure 83. These differ widely between airports, but also been aircraft types. In Section 7.3.3 the different elements of the airport charges are discussed in more detail.

Figure 83 – Estimated level of airport charges by type of aircraft, 2016 (in Euro/LTO, PPP adjusted)



7.3 Detailed assessment of aviation taxes and charges

7.3.1 Fuel taxes

The Convention on International Civil Aviation (Chicago Convention) determines that for international flights, i.e. flights to, from or across the territory of another contracting state, fuel, lubricating oils etc. on board of an aircraft of a contracting State shall be exempt from national or local duties and charges. In paragraph 1 Article 14 of the Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity it is even defined that Member States shall exempt energy products supplied for use as fuel for purpose of air navigation other than in private-pleasure-flying from taxation. The scope of this exemption may be limited to supplies of jet fuel (CN code 2710 19 21).

Hence, taxes on fuels may only be relevant for domestic flights in countries not Member States of the EU, but not for international flights. Fuel taxes for commercial domestic flights are raised only in some countries (see Table 27). The level of fuel tax for commercial domestic flights is quite different between countries, ranging from 83 Eurocent per litre in the US to 3 Eurocent per litre in Canada (Toronto). Some countries apply a fuel tax on kerosene for private flights only, which is not shown in Table 27.

Table 27 – Fuel taxes for commercial domestic flights

Country	Country specific name	Description	Charge level (€cent per litre), not PPS adjusted	Charge level (€cent per litre) PPS adjusted
Norway (NO)	CO_2 tax on fuel	Tax on fuel for domestic flights only.	12	8
Switzerland (CH)	Mineralölsteuer	Tax levied on air fuel and air petrol for domestic flights (excl. connecting international flights).	68	44
United Stated (US)	Jet fuel tax	Jet fuel tax for domestic, non-connecting flights which is differentiated for commercial and non-commercial aviation (tax level for commercial flights is presented only).	1.02	0.84
United States (US)	Leaking Underground Storage Tank fuel tax	Tax levied on each gallon of motor fuel sold nationwide for financing the Trust Fund.	0.02	0.02
Canada (CA) – Toronto	Gasoline tax for aviation fuel		4	3
Canada (CA) – Vancouver	Jet fuel tax	Jet fuel tax is composed of a motor fuel tax and a carbon tax for jet fuel.	7	6
Japan (JP)	Aviation fuel tax		15	13

Some relevant findings on fuel taxes are:
- The CO_2 tax on kerosene in Norway is raised for domestic flights.
- In Switzerland, on domestic flights an energy tax is levied which is subject to various exemptions.
- Based on the Gasoline Tax Act, a gasoline tax is imposed for aviation fuel in Toronto (Ontario). The provincial Gasoline tax in Toronto (Ontario) has been raised since 2014 by 0.01 Dollar/litre per year.
- The provincial jet fuel tax in Vancouver (British Columbia) is composed of a motor fuel and a carbon tax which will increase continually. Jet fuel for interjurisdictional flights are exempted from the carbon tax.
- Since 2003, a fuel tax is imposed on aviation fuel in Japan. A reduced tax rate is applicable until 2019.

7.3.2 Aviation taxes

In general, aviation taxes are applied in Austria, Germany, France, Croatia, United Kingdom, Norway, the United States and Canada (see Figure 84)[55]. The most common type is a general (civil) aviation tax. Further taxes applied are an airport tax, airport specific and a national noise tax (FR), and a solidarity tax (FR). In the US, a passenger, a flight segment, an international departure, an agriculture inspection fee on all in-bound passenger which funds agriculture quarantine and inspection services, customs user and an immigration fee are charged by the government. In addition, there were also taxes for private aircraft and air taxi (IT) reported, but as we focus on commercial aviation in this report these taxes are not considered in the remainder of this chapter.

[55] In the Netherlands a governmental planning compensation levy was taxed on airplanes landing on Schiphol in 2016. As this tax was only applied on Schiphol airport (and not on other Dutch airports), we considered this tax as part of the airport charges for Schiphol airport.

The level of aviation taxes for the different aircraft types and for the countries for which data are available is shown in Table 28. In the UK (*air passenger duty),* Germany (*Luftverkehrsabgabe)* and Austria (*Flugabgabe*), the level of the aviation tax is by far the highest of the countries for which data are available. Furthermore, the average level per passenger is three times higher in the UK than in Germany. In Germany, the tax is levied for flights starting and/or ending at German airports. Several exceptions are made e.g. for flights with intermediate stops in Germany. The level of the Austrian aviation tax was halved as from 2018 onwards to increase competitiveness and attractiveness of Austria.

Figure 84 – Overview of countries levying an aviation tax

Table 28 – Aviation tax levels 2016 for commercial flights, day time (€, PPS adjusted)

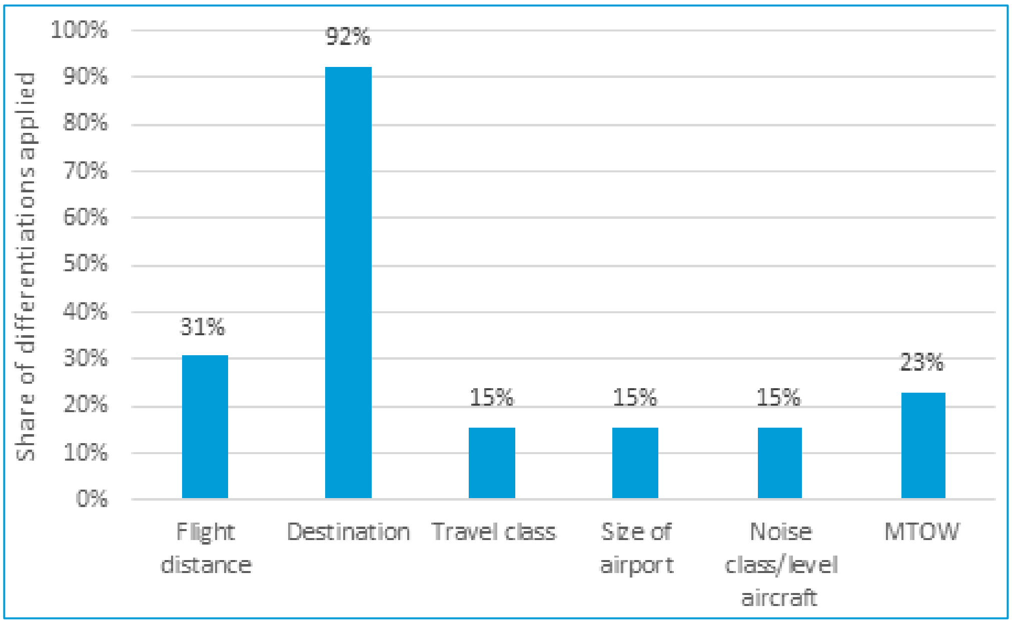
Aircraft type	Embraer 170		Bombardier CRJ900		Airbus A320		Boeing 737		Airbus A340	Boeing 737
Flight type	Dom.	Int.	Dom.	Int.	Dom.	Int.	Dom.	Int.	Int.	Int.
Flight distance	Short haul		Short haul		Medium haul		Medium haul		Long haul	
Austria (AT)	434	434	533	533	1,924	1,924	1,494	1,494	9,003	11,995
Croatia (HR)	161	1148	194	104	426	275	359	241	550	649
France (FR)	466	466	368	368	773	773	610	610	2,760	1,097
Germany (DE)	474	474	582	582	3,067	3,067	2,383	2,383	11,077	14,759
United Kingdom (UK)	1,837	1,837	2,256	2,256	3,803	3,803	2,954	2,954	42,838	57,078
Norway (NO)	365	331	429	390	889	808	690	628	1,628	4,285

Dom.: domestic, Int: international.

Differentiations applied

General aviation taxes for commercial flights are often differentiated by the destination and flight distance (see Figure 85). The tax is usually calculated based on the number of passengers and/or weight of goods (Austria, Croatia, Germany and the US) or the number of seats (France).

Figure 85 – Main differentiations of general (civil) aviation taxes



Planned introduction of new or changes in existing aviation taxes

New aviation taxes are planned to be or were recently introduced in some countries. A new air ticket tax was introduced at Stockholm airport in 1 April 2018. In Finland, there are ideas to levy an aviation tax but no concrete plans are available yet. In the Netherlands, a new aviation tax is discussed which may be introduced in 2021. A modernization and development airport tax was panned in Greece to fund investment in the regional airports. As stated above, as from 2018 aviation tax level was halved in Austria. Aviation tax in the UK slightly increases as of 2018 and 2019.

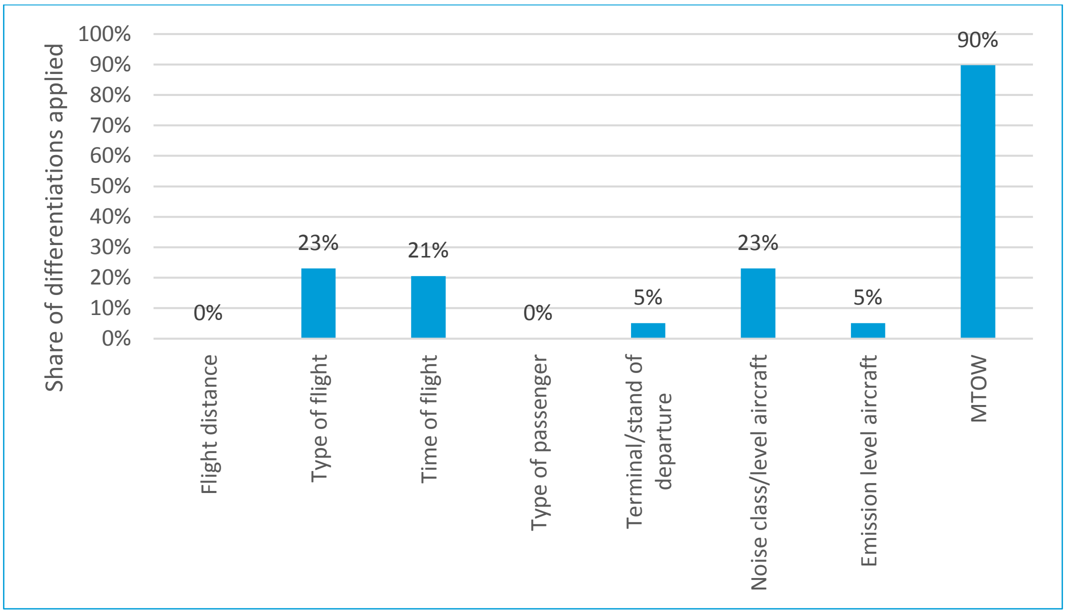
7.3.3 Airport and navigation charges

In this chapter, the most common airport and navigation charges are described. The level of charges by aircraft type are presented for those charges for which data seem comparable.

LTO charge

The LTO charge is the most common type of airport charge which is levied on passenger as well as freight transport for almost all airports considered. Luxembourg is the only airport without charging for take-off and landing. The share of the number of charging schemes considering a type of differentiation is shown in Figure 86.

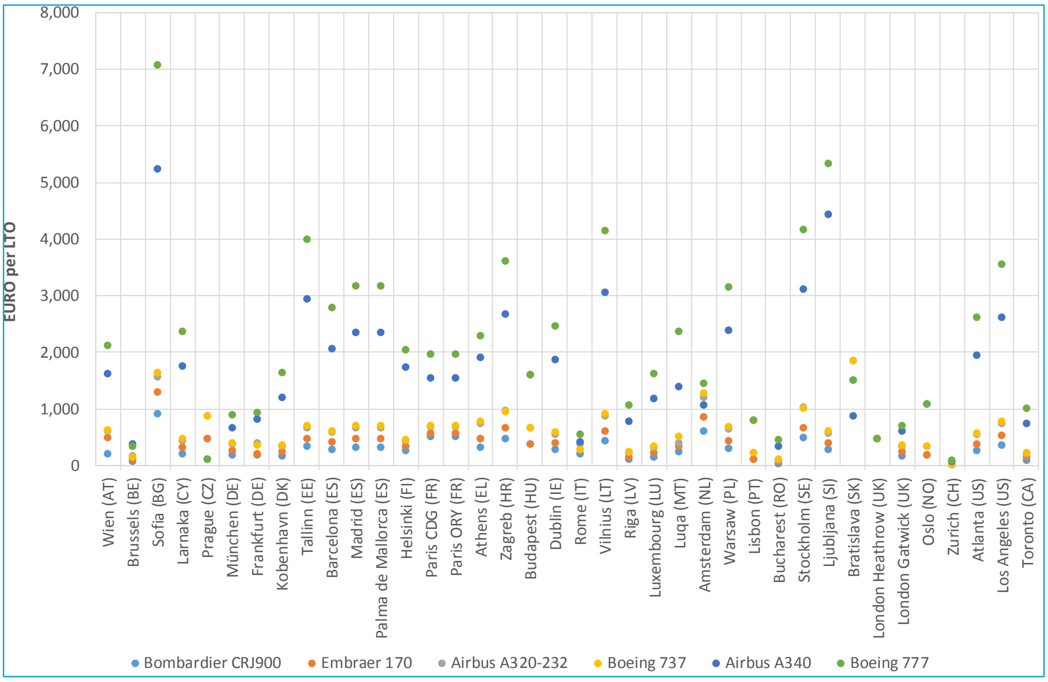
Figure 86 – Main differentiations of LTO charges



The level of charge is usually differentiated by the maximum take-off weight (MTWO).
A differentiation according to the type of flight (domestic, international, intracontinental) is applied in Tallinn (EE), Bratislava (SK), for the Spanish airports, Haneda (JP), Los Angeles (US) as well as Vancouver and Toronto (CA). In Brussels (BE), Budapest (HU), for the Spanish and the London airports as well as in Vancouver and Toronto (CA) the LTO charge is differentiated by the noise class or level of the aircraft. The time of flight (day, night, evening) is relevant in Brussels (BE), Larnaka (CY), Munich (DE), Luqa (MT), Amsterdam (NL), Stockholm (SE) and for the London airports (UK). Flight distance and the type of passenger is irrelevant for all charging schemes.

The level of LTO charges on daytime for the aircraft types is summarised in Figure 87. Due to the differentiation by the maximum take-off weight (MTOW), the charges generally increase with the aircraft size.

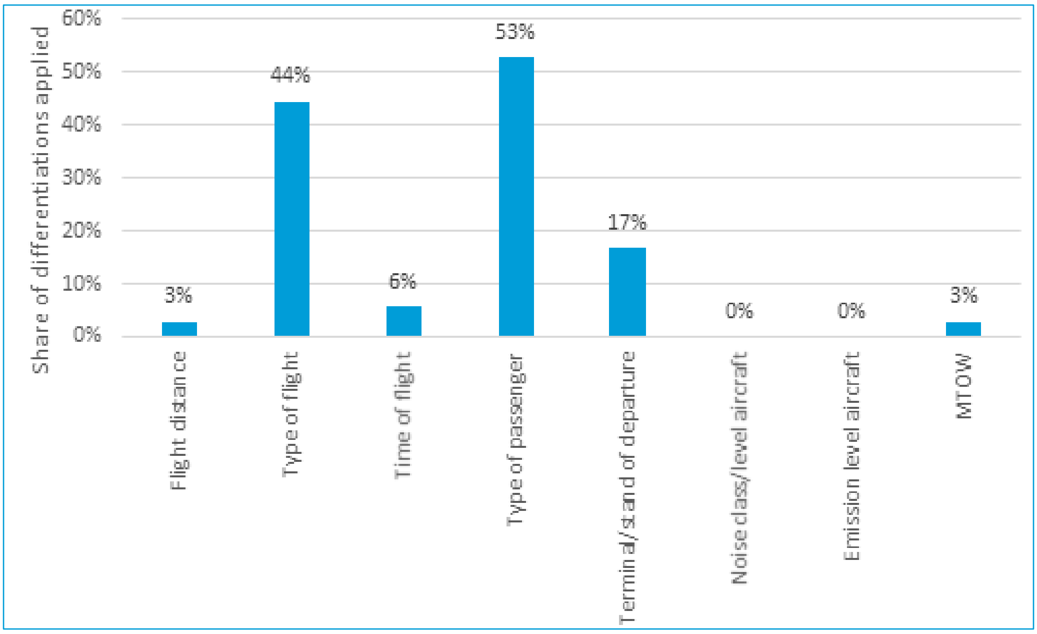
Figure 87 – LTO charge level by aircraft type, daytime (€/LTO, PPS adjusted)



Passenger charges

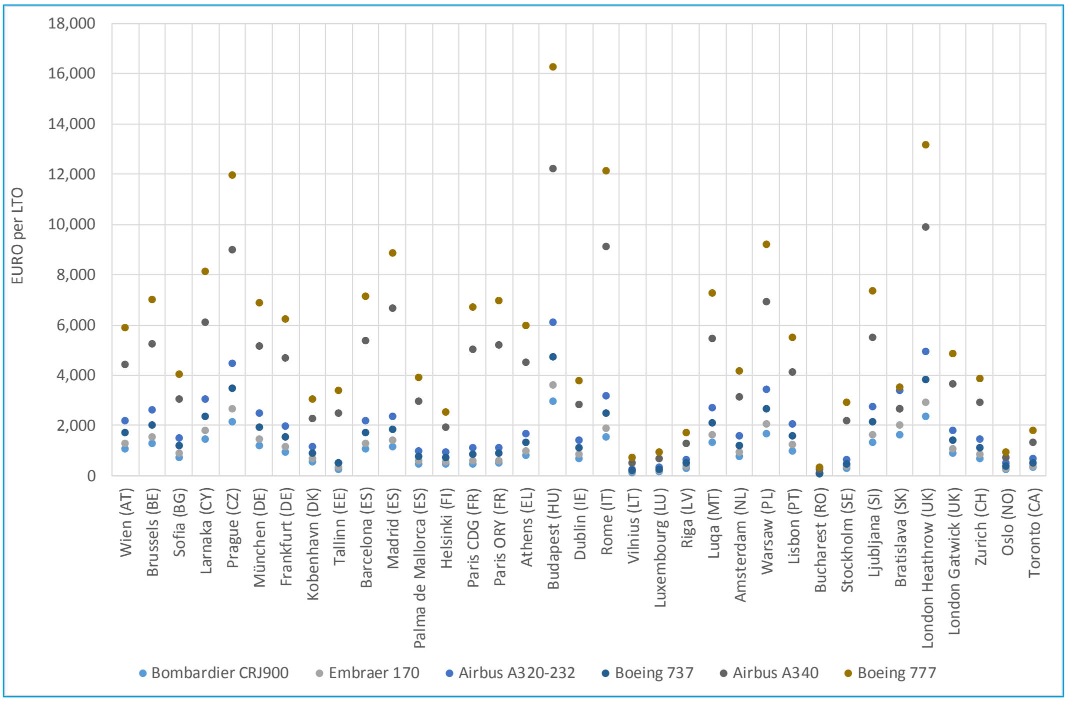
Passenger charges are typically applied at the European airports and in Canada, but not in Zagreb (Croatia) and the US airports (Los Angeles, Atlanta). Passenger charges are typically differentiated by the type of passenger (53%) and the type of flight (45%) (see Figure 88). Regarding type of passenger, it is typically considered whether transfer and transit passenger are charged or not (e.g. Munich, Frankfurt, Rome, London Heathrow, Lisbon, Vilnius). The type of flight usually differentiates between domestic and non-domestic/international flights (e.g. Stockholm, Toronto) and often also considers whether the flight takes place within Europe. Hence, the category ‘type of flight’ corresponds in a sense to the flight distance.

Figure 88 – Main differentiation of passenger charges



According to the charge levels estimated for the aircraft types, the highest spreading between a Bombardier CRJ900 and Boeing 777-300 was reported for the airports in Paris and in Tallinn. The passenger charge for the Boeing 777-300 is about 14 times higher than for the Bombardier (see Figure 89). Furthermore, the level of charges varies considerably between the airports. In addition, a transfer passenger charge is applied in Larnaka (Cyprus), Dublin and Riga.

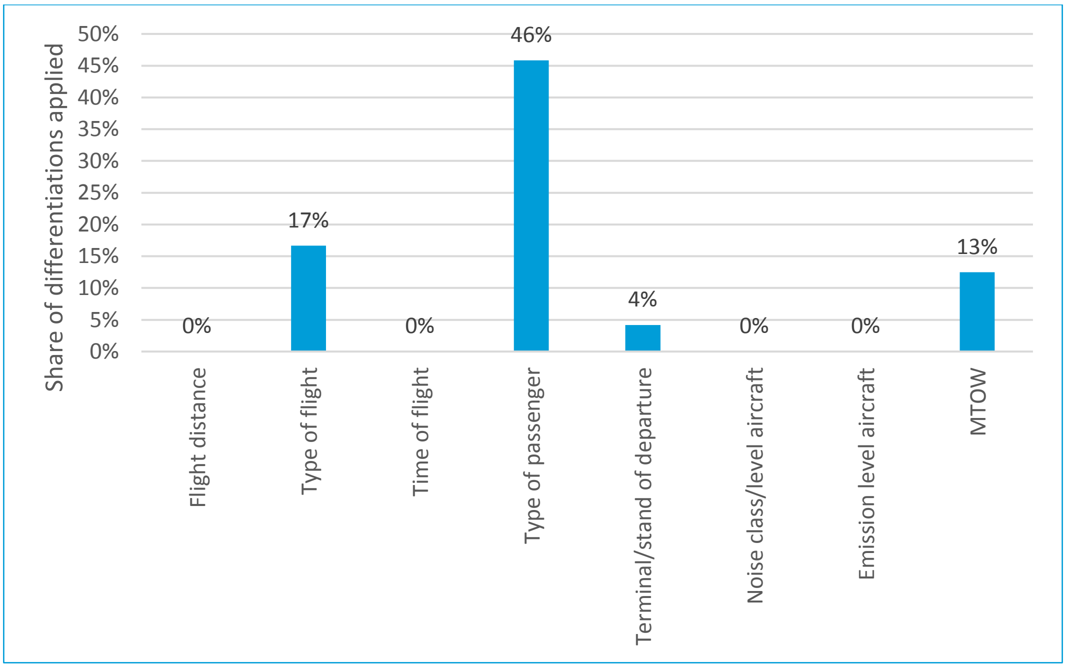
Figure 89 – Passenger charge level by aircraft type, daytime (€/LTO, PPP adjusted)



Security charge

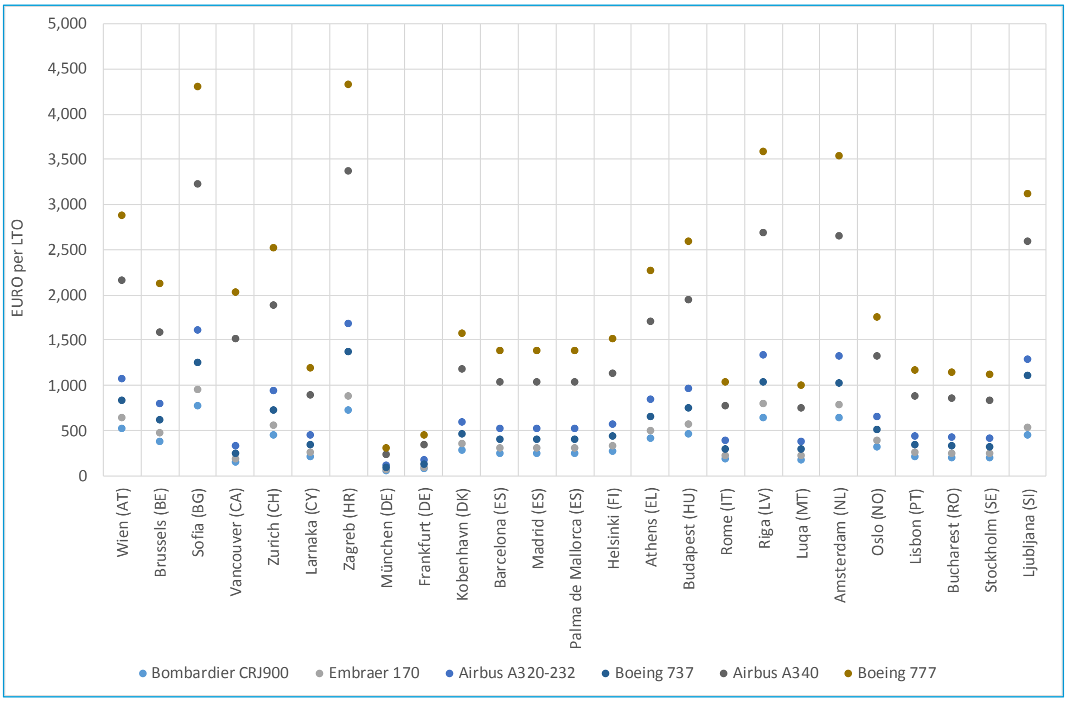
Security charges are usually differentiated by the type of passenger (see Figure 90), and in some cases also to the type of flight or the MTOW of the aircraft.

Figure 90 – Main differentiations of security charges



The level of charges varies by type of aircraft. The variation for the respective countries is quite similar (see Figure 91).

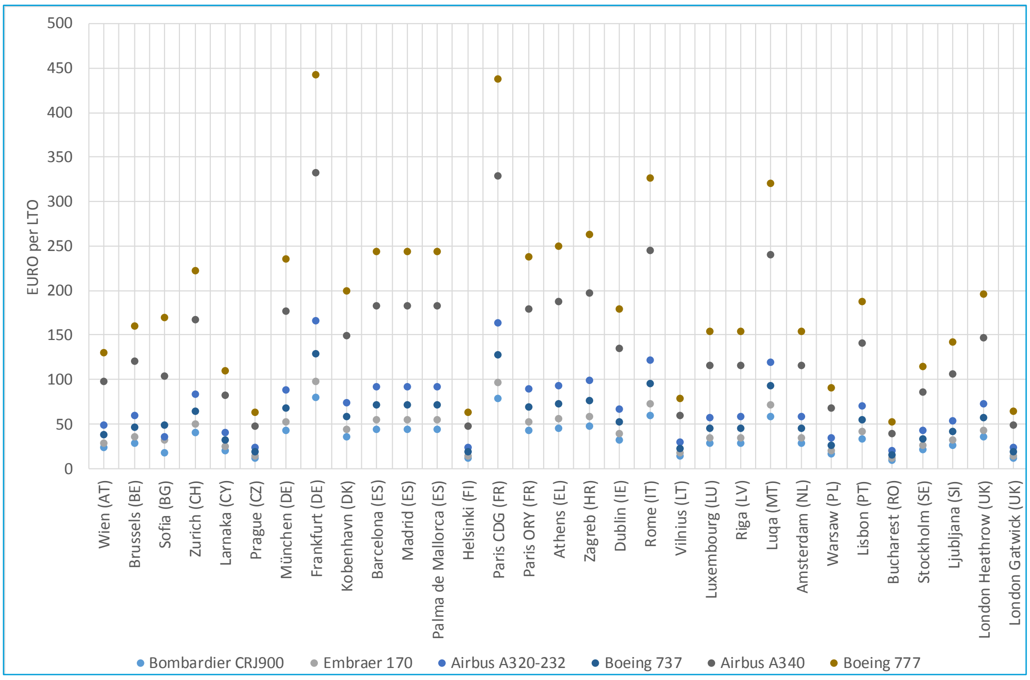
Figure 91 – Security charge level by aircraft type, daytime (€/LTO, PPP adjusted)



PRM charges

A charge for persons with reduced mobility is levied at several European airports. The charge is usually calculated based on the number of passengers and not differentiated. The variation of the level of charges between the airports is relatively low compared to other charges (see Figure 92).

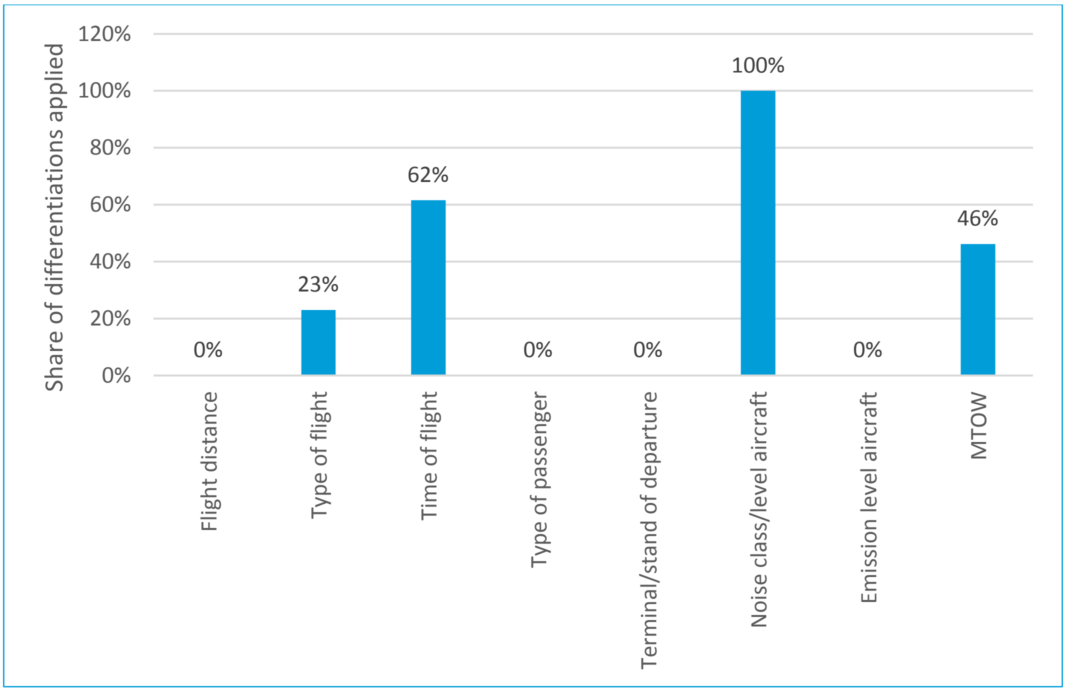
Figure 92 – PRM charge level by aircraft type, daytime (€/LTO, PPP adjusted)



Noise charges

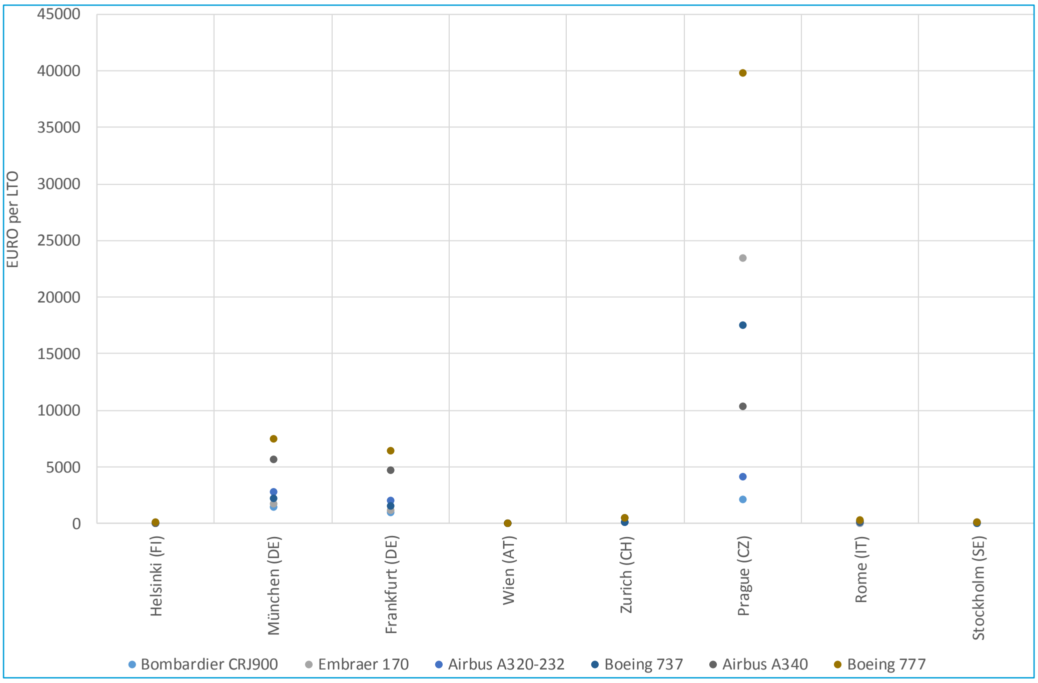
In Europe, noise charges are levied at 11 airports. However, the noise level of aircrafts is also relevant with regard to the LTO charge (see above). Noise charges are always differentiated to the noise class or level of the aircraft, and often also to the time of the flight and the MTOW of the aircraft (see Figure 93).

Figure 93 – Main differentiation of noise charges



Noise charge levels for different reference aircrafts are shown in Figure 94.

Figure 94 – Noise charge level by aircraft type, night-time (€/LTO, PPP adjusted)

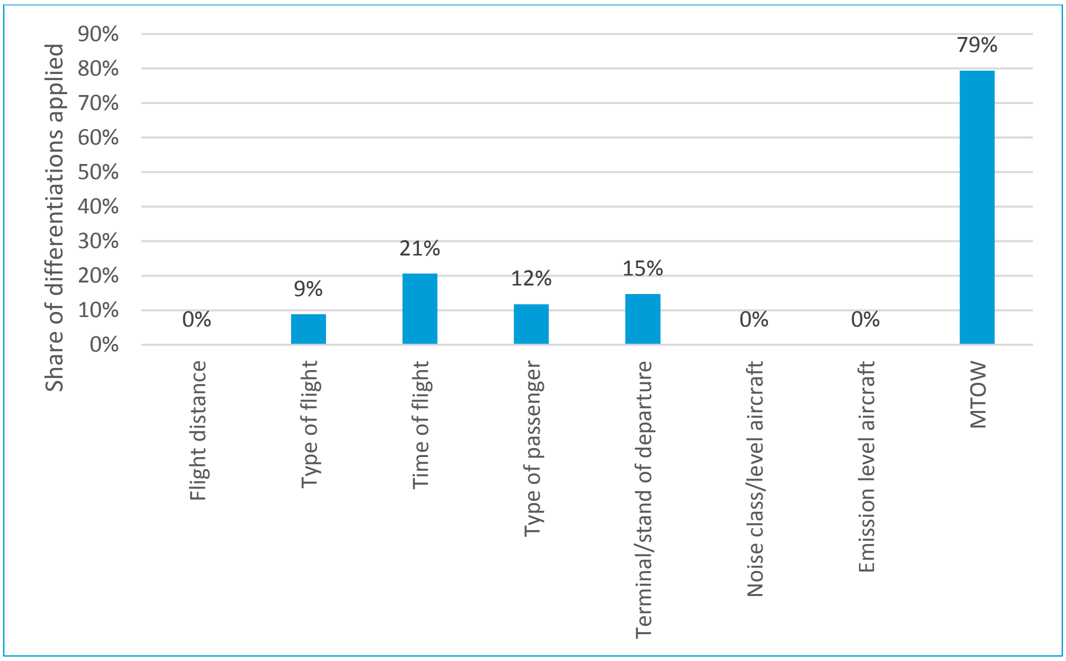


Other selected airport charges

Aircraft parking charges

Aircraft parking charges are applied in most of the airports considered. The charge is always differentiated by the MTOW. In some charging schemes also the type and time of flight, the type of passenger and the terminal or stand of departure are basis of a differentiation. The variation of the level of charges between the airports is relatively low compared to other charges.

Figure 95 – Main differentiations of aircraft parking charges



Airbridge charge

Airbridge charges are often differentiated by the type of flight (domestic, international) and the MTOW. Charges are often calculated based on the duration of the airbridge use. In Rome, the level of charges differs between peak and off-peak times. This charge is applied in the following airports: Lisbon, Praha, Dublin, Spanish airports, London Heathrow, Roma, Larnaka, Vilnius, Sofia, and Los Angeles. As data availability on airbridge charges is rather poor, we are not able to present reliable figures per airport. In general, the charge range from € 100 to € 600 per LTO

Infrastructure charges

Infrastructure charges are levied at several European airports, in Los Angeles as well as in Vancouver and Toronto. Further charges with respect to the use of special infrastructure are levied but the name of these charges varies. Hence, a comparison of the different levels of charges may not be reliable. In general, specific infrastructure charges range from € 33 to € 1,020 for reference aircraft A3 (Airbus A320).

Charges for air navigation services

The level of unit rates for the en route and terminal navigation charges are presented in Table 29. The unit rates are the unit prices to be paid for a certain quantity. En route charges are calculated for each charging zone flown through based on the unit rate of the specific charging zone, the distance and the aircraft weight factor according to the maximum take-off weight (MTOW) of the respective aircraft. Charges for terminal air navigation services are collected either by the airport or Eurocontrol on behalf of several Member States. Terminal navigation charges are calculated based on the unit rate of the respective country or airport and the maximum take-off weight (MTOW) or a weight factor.

Table 29 – Unit rates for en route charges and terminal navigation charges applicable to January 2016 (€ per unit rate, PPP adjusted)

Country	En route charges	Terminal navigation charges
Austria (AT)	67.78	200.45
Belgium (BE)	59.99	172.72
Bulgaria (BG)	47.57	444.41
Croatia (HR)	75.49	373.03
Cyprus (CY)	38.07	n.a.
Czech Republic (CZ)	65.92	384.97
Denmark (DK)	46.13	104.96
Estonia (EE)	n.a.	122.84
Finland (FI)	45.79	114.09
France (FR)	61.76	206.55
Germany (DE)	78.00	150.23
Greece (EL)	44.00	243.21
Hungary (HU)	59.66	538.21
Ireland (IE)	26.98	163.36
Italy (IT) (zone 1)	81.68	204.45
Italy (IT) (zone 2)	81.68	237.71
Latvia (LV)	40.56	349.58
Lithuania (LT)	73.34	306.94
Luxembourg (LU)	54.20	186.01
Malta (MT)	31.78	253.50
The Netherlands (NL)	60.48	145.60
Poland (PL)	60.93	196.50
Portugal (PT)	50.23	168.37
Romania (RO)	72.04	551.07
Slovakia (SK)	78.96	460.04
Slovenia (SI)	80.56	242.63
Spain (ES) – Continental	79.71	20.79
Spain (ES) – Canarias	64.90	20.79
Sweden (SE)	46.94	68.31
United Kingdom (UK)	73.34	14.40
Norway (NO)	27.76	129.92
Switzerland (CH)	68.12	201.44

7.3.4 ETS

Since 2012 aviation has been covered by the European Emission Trade System (EU ETS). Therefore, every emitted tonne of carbon dioxide must be offset through an emission right. The emission cap for the period 2013-2020 equals to 95% of the historical emissions. Airlines receive 82% of their emission right for free and 15% need to be acquired on the market (remaining 3% are special reserve). Originally all flights with start or landing within the European Economic Area (EEA) where included (full scope). In light of the adoption of a Resolution by the 2016 International Civil Aviation Organisation (ICAO) Assembly on a global emissions reduction measure, the EU has decided to maintain the geographic scope of the EU ETS limited to intra-EEA flights. The 2016 ICAO General Assembly Resolution sets out the objective and key design elements of the global scheme, as well as a roadmap for the completion of the work on implementing modalities. In June 2018, ICAO endorsed the Standard and Recommended Practises (SARP) detailing the Carbon Offsetting Scheme for International Aviation due to start for its voluntary phase in 2021. The Carbon Offsetting and Reduction Scheme for International Aviation, or CORSIA, aims to stabilise CO_2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020. As of 29 June 2018, 73 States, representing 75.96% of international aviation activity, intend to voluntarily participate in CORSIA from its outset. In accordance with the EU ETS Directive, the Commission will then assess the key features of CORSIA and consider ways to implement CORSIA in Union law, taking into account the Union economy-wide greenhouse gas emission reduction commitment for 2030.

The following table shows the roughly estimated cost for a European Emission Allowance (EEA) per pkm based on the average price of an EEA in 2016 (5.20 Euro/tCO_2). However, recently the EEA allowance prices experienced an increase up to 20 Euro/tCO_2 meaning that these costs per pkm would be higher for future years.

Table 30 – Cost for an European Emission Allowance per passenger kilometre (€)

Aircraft type	Bombardier CRJ900	Embraer 170	Airbus A320	Boeing 737
Distance (km)	500	500	1,500	1,500
CO_2 emissions (g/vkm)	11,224	15,247	11,313	12,676
Cost per pkm (Eurocent/pkm)	0.07	0.09	0.04	0.06

7.4 Revenues from aviation taxes and charges

7.4.1 Total revenue

An overview of the total charge revenue in 2016 in the various airports is given in Table 31. For almost all taxes and charges the total revenue per airport are provided. All figures are PPP adjusted to allow comparison between airports (see also Section 1.3). For the airports in Spain (Madrid, Barcelona, Palma de Mallorca), Belgium (Brussels), Cyprus (Lanarka) and Croatia (Zagreb) revenues were not available or only on a national level. Therefore, for these airports total revenues were estimated based on the number passengers per year. Information on the level of revenues for passenger and freight transport was not available and are, therefore, estimated based on the number of passengers and tons of freight[56].

[56] Assuming that one passenger is equal to 100 kg of cargo.

Table 31 – Revenue from aviation charges in 2016 (million €, PPS adjusted)

Airport	Aviation taxes (estimations)	Airport charges	Total revenue		
			Total	Estimated revenue passenger transport	Estimated revenue freight transport
Vienna (AT)	85	323	408	364	44
Brussels (BE)	-	255	255	208	47
Sofia (BG)	-	678	678	645	33
Zagreb (HR)	N/A	55	55	53	2
Larnaka (CY)	-	96	96	96	0
Prague (CZ)	-	274	274	258	16
Copenhagen (DK)	-	276	276	247	29
Tallinn (EE)	-	18	18	17	1
Helsinki (FI)	-	118	118	108	10
Paris Charles de Gaulle and Orly (FR)	N/A	916	916	756	160
Frankfurt (DE)	304	713	1,017	755	262
Munich (DE)	211	679	890	890	0
Athens (EL)	-	336	336	322	14
Budapest (HU)	-	283	283	257	26
Dublin (IE)	-	247	247	236	11
Roma (IT)	-	648	648	624	24
Riga (LV)	-	40	40	39	1
Vilnius (LT)	-	23	23	22	1
Luxembourg (LU)[a]	-	43	43	12	31
Luga (MT)	-	69	69	67	2
Amsterdam (NL)	-	749	749	594	155
Warsaw (PL)	-	225	225	214	11
Lisbon (PT)	-	312	312	300	12
Bucharest (RO)	-	277	277	269	8
Bratislava (SK)	-	30	30	26	4
Ljubljana (SI)	-	24	24	21	3
Barcelona (ES)	-	517	517	501	16
Madrid (ES)	-	590	590	549	41
Palma de Mallorca (ES)	-	307	307	286	21
Stockholm (SE)	-	120	120	117	3
London Heathrow (UK)	1,019	2,025	3,044	2,529	515
London Gatwick (UK)	576	400	976	958	18
Oslo (NO)	32	143	175	166	9
Zurich (CH)	-	449	449	388	61
Toronto (CA)	-	513	513	464	49
Vancouver (CA)	-	163	163	145	18
Atlanta (US)	N/A	306	306	289	17
Los Angeles (US)	N/A	2,480	2,480	1,939	541
Tokyo Haneda (JP)	-	143	143	143	0

Data on income from aviation taxes are available for only selected countries and not for the airports individually. In Austria, the income from aviation taxation (*Flugabgabe*) amounts about 100 million Euro. In Germany, the income from aviation tax (*Luftverkehrsabgabe*)accounts for about 1 Billion Euro. The air passenger duty in the UK amounts for about 3,3 billion Euro. Finally, the income from the Norwegian aviation tax amounts € 100 million. These revenues are allocated to individual airports within the country based on the share each airport has in the total number of air passengers per country. The estimated revenues for the respective airports were included in the total revenue and average revenue reported for the airports, even though taxes are not collected by airports.

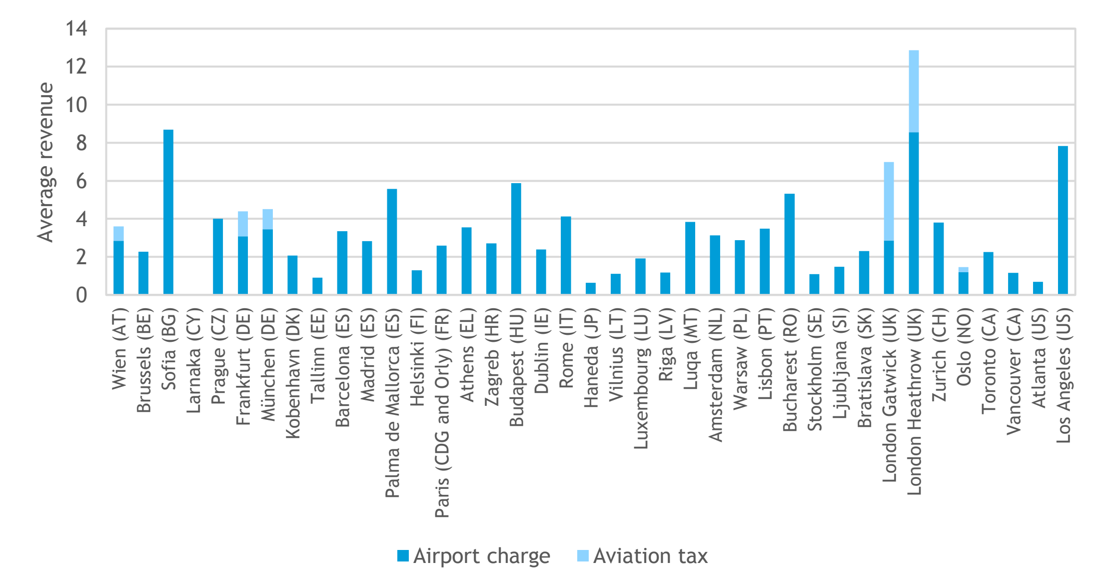
ETS revenue data is only available on country level and not for individual airports. For the year 2016 the countries integrated in the EU ETS concluded a volume of 5.998 million auctions/sales in the aviation sector. A breakdown of the revenues per country to the airport level is not possible in a reliable way, since several pieces of information are missing. Particularly, the share of intra-European CO_2 emissions (or pkm) would have to be known per country. For a bottom-up calculation, it would be necessary to know the share of the CO_2 emissions for which the airlines had to acquire EU ETS allowances on the airports analysed. However, it has to be stated that the absolute level of the EU ETS revenues is very small compared to all other taxes and charges. As discussed in Section 7.3.4, the average level of the EU ETS revenue has been around € 0.15 per passenger for European flights and close to zero for intercontinental flights (only with stopovers). Compared to the average level of airport charges and taxes (EU average: around € 13 per passenger), the EU ETS is therefore negligible.

Finally, data on tax revenues from fuel taxes is not available. However, as discussed in Section 7.3.1, fuel taxes are only applied for domestic flights (in a few non-EU28 countries). Compared to the revenues from aviation taxes and airport charges, these revenues are negligible.

7.4.2 Average revenue

The average revenue from aviation charges is presented in Figure 96. According to the data provided, the highest level of average revenue is about 13 times higher than the lowest average revenue.

Figure 96 – Average revenue from aviation charges (1,000 €/LTO, PPP adjusted)



Note: No data on number of LTO available for Larnaka (CY), data for Haneda (JP) not plausible and hence not presented. For Zagreb (HR), the French airports and the US airports, aviation taxes are missing due to a lack of data on total revenues for these taxes.

The high level of average revenues at London Heathrow and London Gatwick could be explained by the high level of airport charges – particularly the passenger charge – as well as the allocation of the estimated aviation tax revenues to these airports which are relatively high compared to other countries. The level of average revenue is high in Sofia (BG) compared to other airports due to a relatively high level of LTO and security charges. PPS adjustment may also be considered. The level of average revenue for Los Angeles is relatively high due to aviation taxes. Due to relatively low aviation charges (e.g. no security charge) and under consideration of PPS adjustment, the average revenue at Tallinn airport (EE) is relatively low. Average revenue at Atlanta is due to relatively low airport charges such as landing fees, etc.

7.4.3 Earmarking of revenue

Revenue from energy taxes are often earmarked (see Table 32).

Table 32 – Earmarking of revenues from fuel taxes for commercial domestic flights

Country	Country specific name	Earmarking	Further explanation on earmarked revenues
Norway (NO)	CO_2 tax on fuel	No	
Switzerland (CH)	Mineralölsteuer	Yes, 100%	The income from the tax is earmarked by law. The income from the fuel tax for air transport must be used to promote a high level of technical safety in air traffic and for contributions to environmental protection measures and security measures.
United Stated (US)	Jet fuel tax	Yes	No information available.
United States (US)	Leaking Underground Storage Tank fuel tax	Yes	No information available.
Canada (CA) – Toronto	Gasoline tax for aviation fuel	Yes	Since 2004, a portion of the gasoline tax is given to municipalities for public transit.
Canada (CA) – Vancouver	Jet fuel tax	No	
Japan (JP)	Aviation fuel tax	Yes, 22%	Revenues are applied to airport facilities. Therefore, tax revenue is distributed to prefectures and municipalities relevant for airports.

Data on earmarking of airport charges is only available for selected countries and airport charges. Based on the data available, we can conclude that airport charges in Belgium, Bulgaria, Italy, Luxembourg, Netherlands, Romania, Sweden, Norway, Switzerland and the US are earmarked. In most cases the full charge is earmarked. While most of the earmarked revenues have to be used for the respective services, revenues from a few charges are used for internalisation of external costs.
E.g. revenues from the noise charge at Zürich airport have to be allocated to the Airport of Zurich Noise Fund (AZNF) to finance in particular costs of noise abatement measures and compensations which benefits residents and formal expropriations. At Rome airport, 10 percent of the revenues from noise charges are earmarked to be used for the completion of monitoring systems, de-polluting measures and compensation to residents living in the vicinity of the airport. The revenues from the noise charge at Frankfurt airport are used to finance measures of the noise abatement programme.

8 Synthesis

8.1 Introduction

This chapter provide a brief synthesis of the results found in the previous chapters on taxes and charges levied on the various transport modes. In Section 8.2, we first compare the total revenues from taxes and charges for the various modes at the EU28 level. The same kind of comparison is provided in Section 8.3 for average revenues.

8.2 Total revenues

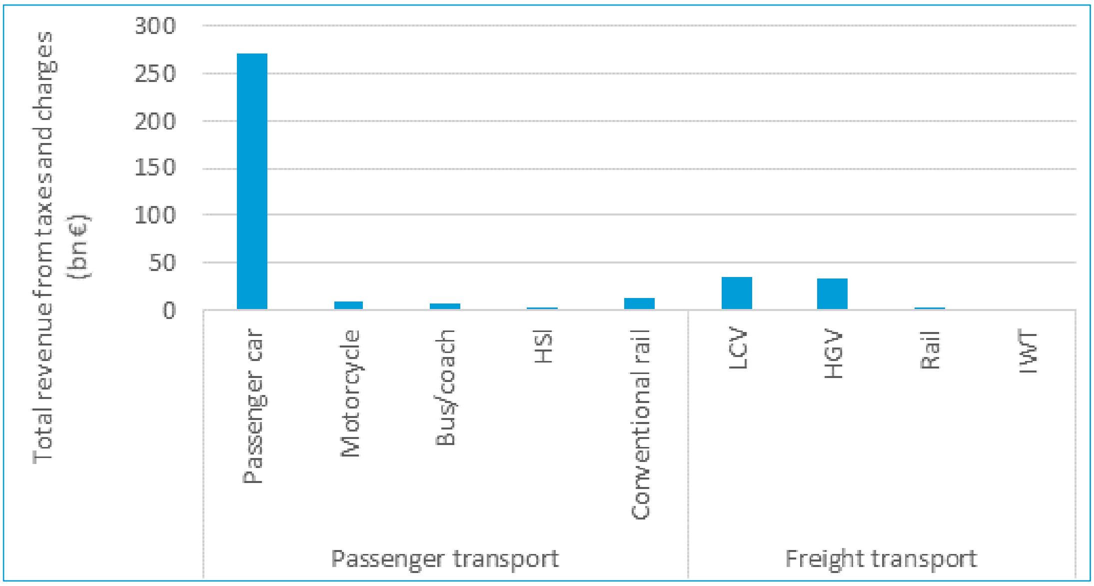
The total tax/charge revenues from road, rail and inland waterway transport in the EU28 amount to € 370 billion for 2016. This is about 2.5% of GDP in the EU28 in 2016. The revenues for aviation and maritime transport are only calculated for a set of selected airports and ports. For the selected 33 EU airports, the revenues are estimated at about 13.5 billion[57], while for the selected 31 EU ports[58] the revenues are (roughly) estimated at € 1.8 billion. However, based on this study, it is not possible to determine what the share of these revenues in the total tax/charge revenues of aviation and maritime transport in the EU28 is.

As is shown in Figure 97, passenger cars are responsible for the main share of the tax/charge revenues in the EU28, which can be explained by both the large share this vehicle category has in total transport performance and the relatively high tax/charge burden on these vehicles. The other road transport vehicles also contribute significantly to the total revenue, especially road freight transport. Revenues from HSL and regular passenger rail transport also contribute significantly to total revenue. The revenues from rail freight and IWT are very small compared to the revenues from the other modes.

[57] These revenues include the revenues from airport charges and part of the revenues from aviation taxes (the part that can be allocated to the airports considered (see Section 7.4.1 for more information).

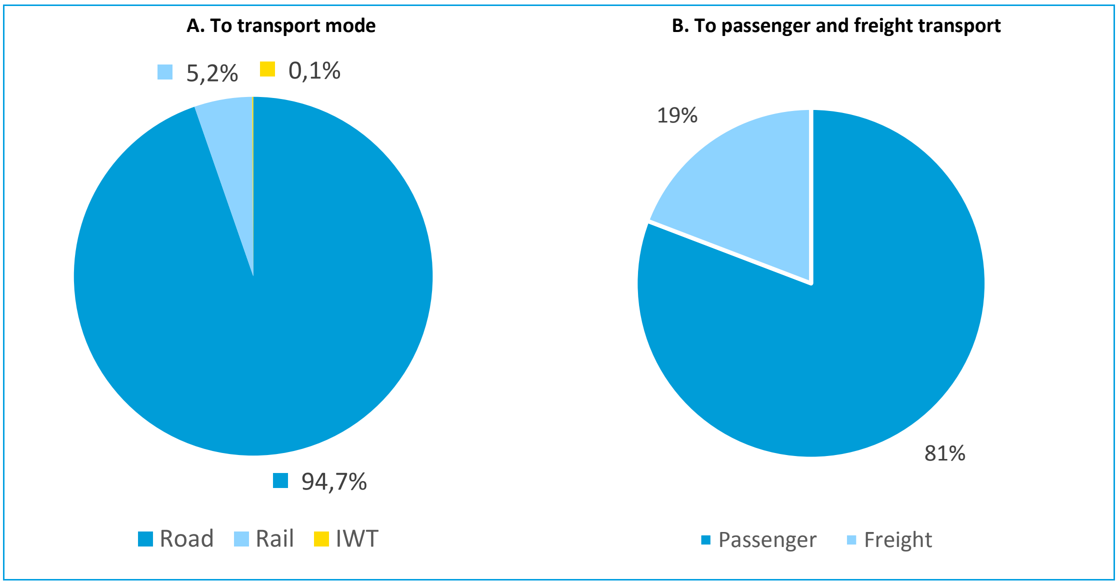
[58] In this study the set of selected ports contain 34 EU28 ports. However, for three of them (Limassol, Calais and Marsaxlokk) total revenues from transport taxes/charges could not be estimated.

Figure 97 – Total revenue taxes and charges for road, rail and inland waterway transport in the EU28 (billion €, PPS adjusted)



As is shown in Figure 98, road transport is responsible for the majority of the total tax/charge revenues: 95% of the total revenues (excluding aviation and maritime transport). Rail transport contributes about 5% to the total revenues, while IWT only contributes 0.1%. The figure also shows the contributions passenger and freight transport have in total tax/charge revenues (excluding aviation and maritime transport). About 80% of the total tax/charge revenues are collected from passenger transport, while 20% are coming from freight transport.

Figure 98 – Composition of total revenue taxes and charges in 2016 for road, rail and inland waterways transport in the EU28



The total tax/charge revenue per country are shown for road, rail and IWT in Table 33. This table also shows the share of these revenues in the national GDP. This share range from 1.6% in Poland to 4.6% in Slovenia.

Table 33 – Total tax/charge revenues for road, rail and inland navigation transport in 2016 (in billion €, PPS corrected)

Country	Road (bn €)	Rail (bn €)	IWT (bn €)	Total (bn €)	% of GDP
EU28	350.0	19.6	0.4	369.9	2.5%
Austria	9.7	0.4	0.0	10.2	3.1%
Belgium	8.9	0.6	0.0	9.6	2.5%
Bulgaria	3.4	0.1	0.0	3.5	3.5%
Croatia	3.1	0.1	0.0	3.1	4.3%
Cyprus	0.5			0.5	2.6%
Czech Republic	6.3	0.4	0.0	6.7	2.5%
Denmark	6.4	0.1		6.5	3.1%
Estonia	0.8	0.1		0.9	3.0%
Finland	4.6	0.0	0.0	4.6	2.7%
France	47.8	5.5	0.0	53.3	2.6%
Germany	58.7	5.4	0.2	64.3	2.2%
Greece	8.2	0.0		8.2	3.9%
Hungary	5.9	0.2	0.0	6.1	3.1%
Ireland	5.0	0.1		5.1	2.0%
Italy	55.6	1.1	0.0	56.7	3.3%
Latvia	0.9	0.2		1.2	3.1%
Lithuania	1.4	0.4		1.7	2.7%
Luxembourg	0.8	0.0	0.0	0.8	1.9%
Malta	0.3			0.3	2.3%
Netherlands	16.3	0.4	0.0	16.6	2.6%
Poland	10.8	1.0	0.0	11.9	1.6%
Portugal	8.2	0.1		8.4	3.6%
Romania	6.6	0.5	0.0	7.2	2.1%
Slovakia	2.8	0.2	0.0	3.0	2.5%
Slovenia	2.3	0.0		2.3	4.6%
Spain	26.1	0.7		26.8	2.2%
Sweden	6.2	0.2		6.3	1.8%
United Kingdom	42.1	1.9		44.1	2.1%
Norway	4.4	0.0		4.5	2.0%
Switzerland	5.6	0.9	0.0	6.5	1.6%

8.3 Average revenues

The average revenues from taxes and charges for road and rail passenger transport are compared in Figure 99.[59] The average revenues are highest for diesel passenger trains, followed by passenger cars and motorcycles.

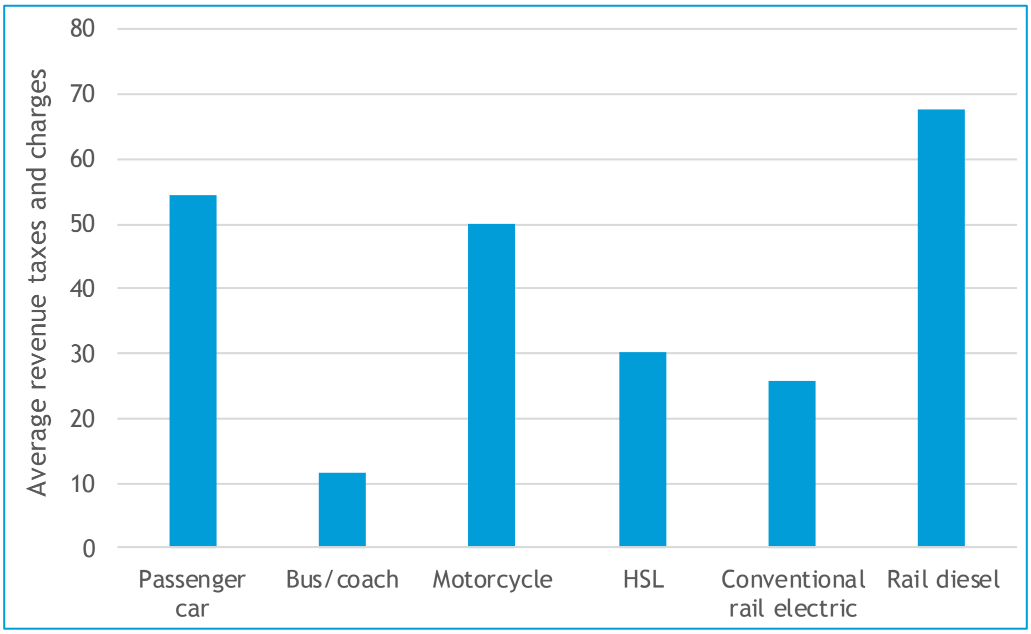
The high revenues from passenger cars and motorcycles is partly explained by the lower occupancy rates of these vehicles. Occupancy rates of passenger cars and motorcycles are considerably lower than occupancy rates of buses and coaches.

[59] The average revenues per country (or airport) are presented in the Excel file 'Average tax and charge rates per vehicle type'.

As for passenger trains, occupancy rates for diesel passenger trains are in general lower than for regular electric trains. As a results average revenues are higher than regular trains. Furthermore, diesel taxes are – on average – higher than electricity taxes in the EU28. Most countries have higher charges for use of the HSL network. The average revenues of HSL trains therefore exceed the average revenues of conventional electric passenger trains.

For aviation, no average revenues from taxes and charges at the EU28 level are estimated in this study.

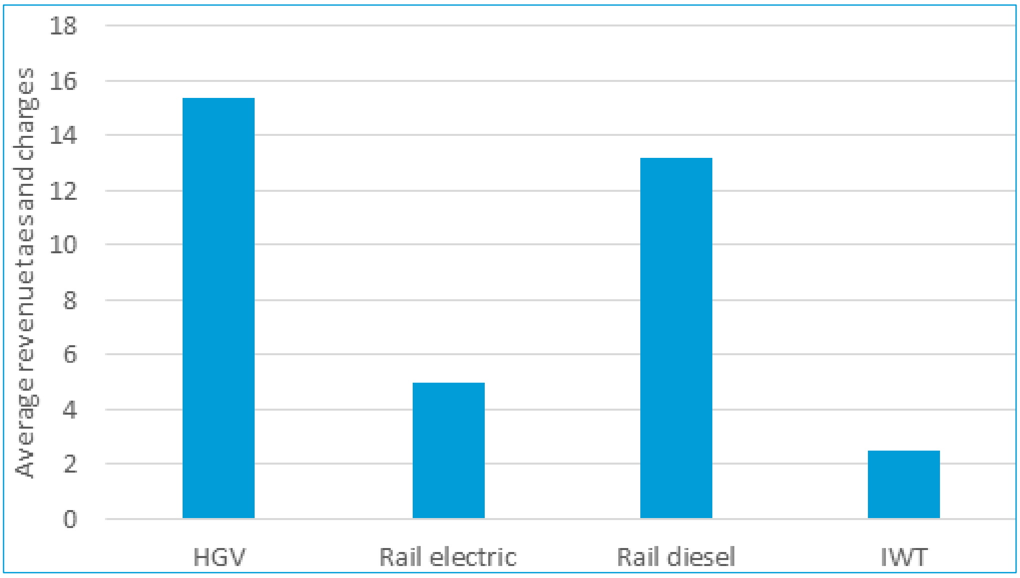
Figure 99 – Average revenues taxes and charges in 2016 for road and rail passenger transport in the EU28 (€/1,000 pkm, PPS adjusted)



The average revenues from taxes and charges for road, rail and inland navigation freight transport in the EU28 are displayed in Figure 100.[60] The highest revenues are found for road transport, followed by rail transport and IWT. For maritime transport, no average revenues (in € per 1,000 tkm) could be estimated for the selected ports. Average revenues from diesel freight trains exceed electric freight trains mainly due to lower load factors. Revenues from IWT are lowest, among other things, due to the exemption of IWT from fuel taxes in most countries.

[60] The average revenues per country are presented in the Excel file ‘Average tax and charge rates per vehicle type’.

Figure 100 – Average revenues taxes and charges in 2016 for road, rail and IWT freight transport in the EU28 (€/1,000 tkm, PPS adjusted)



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A Reference vehicles

A.1 Introduction

In this section we discuss the technical and operational characteristics of the reference vehicles defined for this study. This is done for road transport (Section A.2), rail transport (Section A.3), IWT (Section A.4), maritime transport (Section A.5) and aviation (Section A.6).

A.2 Road transport

The road reference vehicles and their technical and operational characteristics are defined in Table 34 to Table 42. Every reference vehicle has its own unique ID, which will help to find all relevant information on the tax/charge levels for the reference vehicle in the Excel database of this report.

Table 34 – Technical and operational characteristics reference passenger cars[1]

Characteristics	Petrol				Diesel				LPG	CNG	Full electric	PHEV (petrol)	Source
	High fuel-efficiency 2016 car	Low fuel-efficiency 2016 car	High fuel-efficiency 2000 car	Low fuel-efficiency 2000 car	High fuel-efficiency 2016 car	Low fuel-efficiency 2016 car	High fuel-efficiency 2000 car	Low fuel-efficiency 2000 car					
Reference vehicle ID	***PC1[2]***	***PC2***	***PC3***	***PC4***	***PC5***	***PC6***	***PC7***	***PC8***	***PC9***	***PC10***	***PC11***	***PC12***	
Engine size (cc)	999	1,984	1,390	2,324	1,598	1,968	1,896	1,896	1,395	1,395	n/a	1,395	EEA (2016a), assumptions for 2000 cars
Engine power (kW)	85	228	55	110	81	135	74	96	103	81	85	110	EEA (2016a), assumptions for 2000 cars
Weight (kg)	1,254	1,356	1,137	1,265	1,280	1,394	1,159	1,275	1,446	1,395	1,585	1,599	EEA (2016a), assumptions for 2000 cars
Maximum allowable weight (kg)	3,500	3,500	3500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	European Commission (EC, 2001)
Emission class	Euro 6	Euro 6	Euro 3	Euro 3	Euro 6	Euro 6	Euro 3	Euro 3	Euro 6	Euro 6	Euro 6	Euro 6	Assumption
CO_2 emissions Type approval values (g/km)	99	180	161	233	89	119	135	176	119	96	0	39	Assumption based on EEA (2016a) and EEA (2015)
Type approval fuel consumption average (l/100 km)	4.3	7.8	6.9	10	3.4	4.5	5.3	6.6	7.3	3.4 kg/100km	11,4 kWh/100 km	1.5	Assumption based on EEA (2016a)
Number of seats	5	5	5	5	5	5	5	5	5	5	5	5	Assumption
Purchase price (without taxes, €)	16,200	28,000	14,900	25,000	17,000	26,000	15,500	24,000	21,000	22,000	36,000	32,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

1 As reference passenger car a medium-sized car is chosen. As a consequence all reference passenger cars have a similar mass. Notice that the mass is highly correlated with the vehicle's size, which is the main determinant of the vehicle's utility. Therefore, by keeping the mass of the vehicle constant over the reference passenger cars, we are able to compare external costs, taxes and charges for cars with a similar utility in Task C.

2 All passenger car except PC3, PC4, PC7 and PC8 are based on 2016 editions of the Volkswagen Golf, which is the most sold passenger car in Europe. No 2016 LPG edition is available of the Volkswagen Golf, therefore a comparable passenger car is selected (Opel Astra).

Table 35 – Technical and operational characteristics reference powered two-wheelers

Characteristics	Petrol			Electric	Source
	High fuel-efficiency	Low fuel-efficiency	Moped		
Reference vehicle ID	*MC1*[1]	*MC2*[2]	*MC3*[3]	*MC4*[4]	
Engine size (cc)	660 (4 cylinder)	1,170 (2 cylinder)	49 (1 cylinder)		Manufacturer website
Engine power (kW)	55	92	2.3	45	Manufacturer website
Weight (kg)	164	244	95	185	Manufacturer website
Emission class	Euro 3	Euro 3	n/a	n/a	Assumption
Type approval CO_2 emissions average (g/km)	100	128	46	0	Manufacturer website
Type approval fuel consumption average (l/100 km)	4.2	5.5	2	5 kWh/100 km	Manufacturer website
Purchase price (without taxes, €)	5,300	16,500	2,000	12,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

[1] Based on the Yamaha MT-07 (second-best sold motorcycle in Europe).

[2] Based on the BMW R1200GS (most sold motorcycle in Europe)

[3] Based on the Yamaha Neo's 4.

[4] Based on the Zero S.

Table 36 – Technical and operational characteristics reference busses[1]

Characteristics	Diesel		CNG	Full electric	Source
	High fuel-efficiency	Low fuel-efficiency			
Reference vehicle ID	***B1***	***B2***	***B3***	***B4***	
Engine size (cc)	10.5	10.8	10.5	N/A	Assumption based on TNO (2015)
Engine power (kW)	235	228	228	210	Assumption based on TNO (2015)
Weight (kg)	18,000	18,000	18,000	18,000	Assumption based on TNO (2015)
Length (metres)	13.7	13.7	13.7	13.7	Assumption
Number of axles	2	2	2	2	Assumption based on TNO (2015)
Emission class[2]	Euro 3/6	Euro 3/6	Euro 6	n/a	Assumption based on TNO (2015)
Operational life (years)	14	14	14	14	TML (2016)
Occupancy rate average (persons/bus)	20	20	20	20	TML (2016)
Number of seats	30	30	30	30	Assumption
Real World CO_2 emissions average (g/km)	954	1155	1007	0	Assumption based on TNO (2015) and TNO (2016b)
Real World fuel consumption average (l/100 km)	36	44	45 kg	0	Assumption based on TNO (2015)
Purchase price Dutch €	230,000	225,000	250,000	425,000	CE Delft (2018)

1 Based on the Man Lion citybus and the VDL citea electric bus. The difference in fuel consumption is based on Ricardo (2017) and is due to the application of fuel consumption reduction technologies.

2 The vehicle characteristics of an Euro 3 and an Euro 6 bus are assumed to be similar in order to be able to provide better comparisons in Task C (e.g. how do taxes for an Euro 3 bus differ from taxes for an Euro 6 bus). Although there may be some differences in vehicle characteristics between a Euro 3 and Euro 6 bus, these differences are probably small. Therefore, it is realistic to have the same vehicle characteristics for both types of busses.

Table 37 – Technical and operational characteristics reference coaches

Characteristics	Diesel		Source
	High fuel-efficiency	Low fuel-efficiency	
Reference vehicle ID	***C1***	***C2***	
Engine size (cc)	8,000	10,677	Assumption based on CE Delft (2017)
Engine power (kW)	280	315	Assumption based on CE Delft (2017)
Weight (kg)	13,500	13,500	CE Delft et al. (2017)
Number of axles	3	3	CE Delft et al. (2017)
Emission class[2]	Euro 3/6	Euro 3/6	Assumption
Operational life (years)	14	14	TML (2016)
Occupancy rate average (persons/bus)	30	30	Steer Davies Gleave (2009)
Number of Seats	50	50	Assumption
Real World CO_2 emissions average (g/km)	583	742	Assumption based on CE Delft (2017)
Real World fuel consumption average (l/100 km)	22	28	Assumption based on CE Delft (2017)
Purchase price Dutch (€)	260,000	255,000	Assumption based on CE Delft (2017)

1 Based on the Mercedes Benz Tourismo. The difference in fuel consumption is based on Ricardo (2017) and is due to the application of fuel consumption reduction technologies.

2 The vehicle characteristics of an Euro 3 and an Euro 6 coach are assumed to be similar in order to be able to provide better comparisons in Task C (e.g. how do taxes for an Euro 3 coach differ from taxes for an Euro 6 coach). Although there may be some differences in vehicle characteristics between a Euro 3 and Euro 6 coach, these differences are probably small. Therefore, it is realistic to have the same vehicle characteristics for both types of coaches.

Table 38 – Technical and operational characteristics reference LCVs

Characteristics	Petrol				Diesel				Full electric	Source
	High fuel-efficiency 2016 van	Low fuel-efficiency 2016 van	High fuel-efficiency 2000 van	Low fuel-efficiency 2000 van	High fuel-efficiency 2016 van	Low fuel-efficiency 2016 van	High fuel-efficiency 2000 van	Low fuel-efficiency 2000 van		
Reference vehicle ID	***V1[1]***	***V2[2]***	***V3[1]***	***V4[1]***	***V5[1]***	***V6[1]***	***V7[1]***	***V8[1]***	***V9[2]***	
Engine size (cc)	1,560	1,595	1,796	2,295	1,496	1,499	1,753	2,402	n/a	EEA (2016b)
Engine power (kW)	70	110	85	107	55	88	66	66	80	EEA (2016b)
Weight (kg)	1,240	1,535	1,395	1,395	1,469	1,618	1,460	1,713	1,555	EEA (2016b)
Maximum allowable weight (kg)	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	(EC, 2001)
Maximum loading capacity (kg)	1,920	1,920	2,000	2,000	1,950	2,000	1,920	2,000	2,170	EEA (2016b)
Euro class	Euro 6	Euro 6	Euro 3	Euro 3	Euro 6	Euro 6	Euro 3	Euro 3	n/a	Assumption
Type approval CO_2 emissions average (g/km)	105	179	198	262	104	133	172	225	0	EEA (2016b) & EEA (2015)
Type approval fuel consumption average (l/100 km)	4.5	7.7	8.5	11.3	3.9	5.0	6.5	8.5	16.5 (kWh/100 km)	EEA (2016) & EEA (2015)
Purchase price (without taxes, €)	16,000	14,500	14,500	13,500	15,000	18,000	14,000	16,500	22,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

[1] Based on the Ford Transit (most sold van in 2016).

[2] Based on the Nissan e-NV200 (most sold full electric van in 2016).

Table 39 – Technical and operational characteristics reference small trucks (3.5-7.5t)[1]

Characteristics	Diesel		Source
	High fuel-efficiency	Low fuel-efficiency	
Reference vehicle ID	***ST1***	***ST2***	
Engine size (cc)	3l	3l	Assumption based on Ricardo (2017)
Engine power (kW/ HP)	132	132	Assumption based on Ricardo (2017)
Weight (kg)	2,900	2,900	Assumption based on Ricardo (2017)
Gross vehicle weight (kg)	7,000	7,000	European Commission (EC, 2001)
Maximum loading capacity (kg)	4,100	4,100	Assumption based on Ricardo (2017)
Number of axles	2	2	Assumption based on Ricardo (2017)
Axle configuration	Single	Single	Assumption based on Ricardo (2017)
Presence of air suspension	Yes	Yes	Assumption
Euro class[2]	Euro 3/6	Euro 3/6	Assumption
Loading factor	35.3%	35.3%	Ricardo (2017)
Average fuel consumption (l/100 km)	14	17	Assumption based on Ricardo (2017)
Real-world CO_2 emissions average (g/km)	370	450	Assumption based on Ricardo (2017)
Purchase price (without taxes, €)	30,000	25,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

1 Based on a New Iveco Daily van 4100. The difference in fuel consumption is based on Ricardo (2017) and is due to the application of fuel consumption reduction technologies.

2 The vehicle characteristics of an Euro 3 and an Euro 6 truck are assumed to be similar in order to be able to provide better comparisons in the parallel study on the state-of-play of internalisation in the European transport sector (e.g. how do taxes for an Euro 3 truck differ from taxes for an Euro 6 truck). Although there may be some differences in vehicle characteristics between a Euro 3 and Euro 6 truck, these differences are probably small. Therefore, it is realistic to have the same vehicle characteristics for both types of trucks.

Table 40 – Technical and operational characteristics reference medium trucks (7.5-16t)[1]

Characteristics	Diesel		Source
	High fuel-efficiency	Low fuel-efficiency	
Reference vehicle ID	***MT1***	***MT2***	
Engine size (cc)	7l	7l	Assumption based on Ricardo (2017)
Engine power (kW/HP)	203	203	Assumption based on Ricardo (2017)
Weight (kg)	7,750	7,750	Assumption based on Ricardo (2017)
Gross vehicle weight (kg)	11,900	11,900	Assumption based on Ricardo (2017)
Maximum loading capacity (kg)	4,150	4,150	Assumption based on Ricardo (2017)
Number of axles	2	2	Assumption based on Ricardo (2017)
Axle configuration	Single	Single	
Presence of air suspension	Yes	Yes	Assumption
Euro class[2]	Euro 3/6	Euro 3/6	Assumption
Loading factor	72%	72%	Ricardo (2017)
Average fuel consumption (l/100 km)	22.5	27	Assumption based on Ricardo (2017)
Real-world CO_2 emissions average (g/km)	596	716	Assumption based on Ricardo (2017)
Purchase price (without taxes, €)	60,000	54,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

1 Based on a Mercedes Benz Atego. The difference in fuel consumption is based on Ricardo (2017) and is due to the application of fuel consumption reduction technologies.

2 See comment below Table 39.

Table 41 – Technical and operational characteristics reference large trucks (16–32t)[1]

Characteristics	Diesel		Source
	High fuel-efficiency	Low fuel-efficiency	
Reference vehicle ID	***LT1***	***LT2***	
Engine size (cc)	7.7 l	7.7 l	Assumption based on TNO (2016a)
Engine power (kW/HP)	250	250	Assumption based on TNO (2016a)
Weight (kg)	7,000	7,000	Assumption based on TNO (2016a)
Gross vehicle weight (kg)	25,000	25,000	Assumption based on TNO (2016a)
Maximum loading capacity (kg)	18,000	18,000	Assumption based on TNO (2016a)
Number of axles	3	3	Assumption based on TNO (2016a)
Axle configuration	Tandem	Tandem	Assumption based on CE Delft et al. (2014)
Presence of air suspension	Yes	Yes	Assumption based on Ricardo (2017)
Euro class[2]	Euro 3/6	Euro 3/6	Assumption based on Ricardo (2017)
Loading factor	72%	72%	Assumption
Average fuel consumption (l/100 km)	27	33	Assumption based on Ricardo (2017)
Real-world CO_2 emissions average (g/km)	716	875	Assumption based on Ricardo (2017)
Purchase price (without taxes, €)	77,000	70,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

1 Based on a Volvo FE. The difference in fuel consumption is based on Ricardo (2017) and is due to the application of fuel consumption reduction technologies.

2 See comment below Table 39.

Table 42 – Technical and operational characteristics reference heavy truck trailer (+32t)[1]

Characteristics	Diesel		LNG	Source
	High fuel-efficiency	Low fuel-efficiency		
Reference vehicle ID	***TT1[1]***	***TT2[2]***	***TT3[3]***	
Engine size (cc)	12.8l	12.4 l	9.3 l	Ricardo (2017)
Engine power (kW/HP)	336	328	340	Ricardo (2017)
Weight (kg)	7,480 (tractor) + 5,820 (aero trailer)	7,460 (tractor) + 7,500 (trailer)	7,200 (tractor) + 7,500 (trailer)	Ricardo (2017), manufacturer websites
Gross vehicle weight (kg)	40,000	40,000	40,000	European commission (EC, 2001)
Maximum loading capacity (kg)	26,700	25,040	19,000	Ricardo (2017)
Dead weight trailer (kg)	5,820	7,500	7,500	Ricardo (2017)
Number of axles	5	5	5	Ricardo (2017)
Axle configuration	Tridem	Tridem	Tridem	Ricardo (2017)
Presence of air suspension	Yes	Yes	Yes	Assumption
Euro class[4]	Euro 3/6	Euro 3/6	Euro 3/6	Assumption
Loading factor (kg)	76%	76%	76%	Ricardo (2017)
Average fuel consumption (l/100 km)	32	39	24 kg/100 km	Ricardo (2017) and TNO (2016b)
Real-world CO_2 emissions average (g/km)	848	1033	900	Ricardo (2017) and FS (2014)
Purchase price (without taxes, €)	130,000	125,000	160,000	These are Dutch prices. These prices are transferred to national prices by using the Personal Transport equipment (PTE) price level indicator from Eurostat. This approach is in line with CE Delft et al. (2017).

1 Based on a Mercedes Benz Actros (with tear-drop aerodynamic trailer).

2 Based on a MAN TGX Tractor (with manual gearbox and standard trailer).

3 Based on a Scania G340.

4 See comment below Table 39.

A.3 Rail transport

The reference trains and their technical and operational characteristics are defined in Table 43 and Table 44. Every reference train has its own unique ID, which will help to find all relevant information on the tax/charge levels for the reference vehicle in the Excel Database of this report.

Table 43 – Technical and operational characteristics reference passenger trains

Characteristics	High speed	Intercity		Regional		Source
		Electric	Diesel	Electric	Diesel	
Reference vehicle ID	***PT1***	***PT2***	***PT3***	***PT4***	***PT5***	
Presence of tilting technology	Yes	Yes	Yes	No	No	www.railway-technology.com
Train length (metres)	200	200	200	110	110	High speed: UIC, Siemens (2017a) Intercity: CE Delft (2017); Fornelli (2013) Regional trains: Estimations made based on Table of Train Weights (2013); Heros (undated, a); Heros (undated, b)
Train weight (tonnes)	450	450	450	250	250	High speed: SCNF Intercity/regional trains: Table of Train Weights (2013)
Maximum axle weight (tonnes)	17.7	n/a	n/a	n/a	n/a	UIC
Axle load (tonnes)	17.5	21.5	21.5	15	15	High speed: Siemens (2017a, 2017b) Intercity: CE Delft (2017) Regional train: Fornelli (2013)
Maximum speed (km/h)	320	160	160	140	140	High speed: NCRRP (2015); SNCF Intercity and regional: Fornelli (2013)
Number of seats[a]	500	500	500	350	350	Fornelli A. (2013); NCRRP (2015);Railway Technology (undated); Siemens (2017a); Talgo (2017); Trenitalia (2017)
Number of passengers per train	330	180	180	105	105	High speed: based on an EU average occupancy rate of 66% (estimated based on UIC (2013); Ortega (2013); EEA (2016b); Doomernik (2014) and Dinu (2016); Italo (2016). Intercity: based on average occupancy rate of 36% (estimated based on CE Delft (2014) and Hayashi Y. Et al. (2015)) Regional train: based on average occupancy rate of 30% (based on (CE Delft, 2014) and (UITP, 2016)
Energy consumption (kWh/vkm if electric or l/km if diesel)	20	15	4	12.5	3	CE Delft (2014) ; Bosquet et al. (2013); NCRRP (2015); Lukaszewicz and Andersson (2009)
Emission classes (for air pollutant emissions)	n/a	n/a	Low if equipped with EGR/SRC/ high if not equipped with EGR/SRC[b]	n/a	Low if equipped with EGR/SRC/ high if not equipped with EGR/SRC	Norris and Ntziachristos (2009)
Operational life (years)	35	35	30	35	30	Based on TML (2016); Italo (2016); Rogers et al. (2014); ERA (2018)
Annual mileage (km)	450,000	180,000	180,000	120,000	120,000	Based on TML (2016) and Italo (2016). Expert judgement of researchers.
Lifetime mileage (km)	14,625,000	5,850,000	4,950,000	3,900,000	3,300,000	Calculated by multiplying annual mileage by operational lifetime. For the last 5 years of lifetime, it is assumed that annual mileage is 50% lower.

[a] It is worth observing that for high speed trains and, in principle for intercity trains, passengers travel seated. On the other hand, regional trains have room to accommodate both seated and standing passengers.

[b] EGR means Exhaust Gas Recirculation and means SRC Selective Catalytic Reduction. Technical control technologies are available and tend to be gradually developing for railway engines to meet the mandatory emissions standards of EC Directive 2004/26/EC, which distinguishes between engines used in rail-cars and locomotives. It also provides phased limits for NOx, PM, CO and hydrocarbons, known as Stage IIIB (i.e., from 1.1.2012).

Table 44 – Technical and operational characteristics reference freight trains

Characteristics	Electric				Diesel				Source
	Long container	Long bulk	Short container	Short bulk	Long container	Long bulk	Short container	Short bulk	
Reference vehicle ID	***FT1***	***FT2***	***FT3***	***FT4***	***FT5***	***FT6***	***FT7***	***FT8***	
Train length (metres)	620	438	420	304	620	438	420	304	Estimated based on locomotive and wagon length from Siemens (2008) and Pulfer et al. (2014)
Train weight (tonnes)	720	708	510	510	710	698	500	500	Estimated based on locomotive and wagon weight from Siemens (2008)
Number of axles	120	100	80	68	120	100	80	68	Four axles per wagon are assumed (WBN (2017); DB Cargo (2017))
Axle load (tonnes)	12.7	17.4	12.7	17.4	12.7	17.4	12.7	17.4	The axle load has been obtained as the total load of a wagon divided by the number of axles per wagon. For container wagons the weight on the axles consists of the weight of the wagon itself (i.e., the tare), plus the average load per wagon and plus the tare of the average number of containers per wagon. For bulk wagons the weight on the axles consists of the weight of the wagon itself (i.e., the tare) plus the average load per wagon. Data has been obtained elaborating on wagons carrying different commodities: metal, mineral oil, chemical, agriculture, coal and paper/cellulose. Data from ICC (2017).
Number of wagons	30	25	20	17	30	25	20	17	UIRR (2017); Pulfer et al. (2014)
Maximum speed (km/h)	120	120	120	120	120	120	120	120	Siemens (2008)
Loading capacity (TEU for container train/tonnes for bulk train)	90	1,500	60	1,020	90	1,500	60	1,020	For container trains the loading capacity is obtained as the number of wagons by the number of TEU per wagon, which has been assumed equal to 3 TEU per wagon. For bulk trains the loading capacity is obtained as the number of wagons by the maximum weight per wagon (assumed to be 60 tonnes).
Loading factor (%)	70%	50%	70%	50%	70%	50%	70%	50%	UIRR (2017); Woodburn A. (2011); Ricci and Black (2005)
Load per wagon (tonnes)	27	45	27	45	27	45	27	45	Elaborations on WBN (2017)
Actual weight (total train tare + load) (tonnes)	1,677	1,833	1,197	1,275	1,667	1,823	1,187	1,265	The total weight of the train assumes the weight of the locomotive, the total tare of the wagons, the tare of the containers (where necessary) and the load carried by the number of wagons of the train.
Energy consumption (kWh/vkm if electric or l/vkm if diesel)	19.33	20.03	16.86	17.30	522	541	456	468	CE Delft et al. (2017)

Characteristics	Electric				Diesel				Source
	Long container	Long bulk	Short container	Short bulk	Long container	Long bulk	Short container	Short bulk	
Reference vehicle ID	***FT1***	***FT2***	***FT3***	***FT4***	***FT5***	***FT6***	***FT7***	***FT8***	
Emission classes (air pollutant emissions)	n/a	n/a	n/a	n/a	Low if equipped with EGR/SRC/ high if not equipped with EGR/SRC	Low if equipped with EGR/SRC/ high if not equipped with EGR/SRC	Low if equipped with EGR/SRC/ high if not equipped with EGR/SRC	Low if equipped with EGR/SRC/ high if not equipped with EGR/SRC	Norris and Ntziachristos (2009)
Noise class	- Low - Stationary ≤ 63 dB - Pass-by ≤85 dB - High - Stationary >63 dB - Pass-by[a] >85 dB				- Low - Stationary ≤68 dB - Pass-by ≤85 dB - High - Stationary >68 dB - Pass-by[a] >85 dB				Lutzenberger et al. (2013); UIC (2016)
Operational life locomotive(years)	30	30	30	30	25	25	25	25	TML (2016)
Annual mileage locomotive (km)	220,000	220,000	220,000	220,000	200,000	200,000	200,000	200,000	UIRR (2017)
Lifetime mileage locomotive(mln km)	6	6	6	6	5	5	5	5	Calculated by multiplying annual mileage by operational lifetime

[a] At 80 km/h.

A.4 IWT

The reference IWT vessels defined for this study are presented in Table 45. For these reference vessels all relevant operational and technical parameters required to calculate the tax and charge levels are given. Furthermore, the unique ID for each reference vessel is presented, which can be used to find all specific tax/charge levels in the Excel database of this study.

Table 45 – Technical and operational characteristics reference IWT vessels

Characteristics	CEMT II (bulk)	CEMT II (container)	CEMT IV (bulk)	CEMT Va (bulk)	CEMT Va (container)	Pushed convoy 11,000 tonnes (bulk)	Source
Reference vehicle ID	***IV1***	***IV2***	***IV3***	***IV4***	***IV5***	***IV6***	
Energy type	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	IVR
Number of engines	1	1	1	1	1	2	IVR
Length vessel (metres)	55	55	85	110	110	185	RWS (2011)/IVR
Breadth vessel (metres)	6.6	6.6	9.50	11.40	11.40	22	RWS (2011)/IVR
Actual draft (metres)	2.5	2.5	2.8	4.6	4.1	4.0	CE Delft (2016)
Energy consumption (l/100 km)	409	409	607	1,109	1,109	2,970	EMMOSS/Planco calculation
Deadweight tonnage	600 tonnes	600 tonnes/ 20 TEU	1,500 tonnes	3,000 tonnes	1,980 tonnes/ 208 TEU	11,000 tonnes	CE Delft (2016)/IVR
Loading capacity (tonnes/TEU)	570 tonnes	20 TEU/ 670 tonnes	1,425 tonnes	2,850 tonnes	1,881 tonnes/ 208 TEU	11,000 tonnes	CE Delft (2016)/IVR
Load factor (%)	56%	75%	56%	56%	75%	48%	CE Delft (2016)
Actual load (tonnes/TEU)	320 tonnes	15 TEU	798 tonnes	1,596 tonnes	156 TEU	5,280 tonnes	Based on loading capacity and loading factor.
Operational lifetime (years)	50	50	50	50	50	50	TML (2016)
Annual mileage (years)	19,000	19,000	32,667	25,200	25,200	47,600	TML (2016)/Planco Calculation
Lifetime mileage (years)	950,000	950,000	1,633,333	1,260,000	1,260,000	2,380,000	Based on operational lifetime and annual mileage
Type of cargo	Metal ore	Consumer goods	Metal ore	Metal ore	Consumer goods	Metal ore	Assumption
Bilge water (m^3 per year)	9	9	9	9	9	9	CE Delft et al. (2017)
Other oily and greasy ship waste(kg/year)	45	45	45	45	45	45	CE Delft et al. (2017)
Domestic waste (kg/year)	390	390	390	585	585	1170	CE Delft et al. (2017)
Number of calls per year at a specific port	76	76	66	97	120	105	Planco calculation
Availability of CCR4 certificate	No	No	Yes	Yes	Yes	Yes	Assumption
Availability of Green award	No	No	Yes	Yes	Yes	Yes	Assumption
Emission level	CCR-1/CCR-2	CCR-1/CCR-2	CCR-1/CCR-2	CCR-1/CCR-2	CCR-1/CCR-2	CCR-1/CCR-2	Assumption

A.5 Maritime transport

The reference maritime vessels defined for this study are presented in Table 46. One passenger reference vessel and four freight vessels (two container and two bulk vessels) are distinguished. Furthermore, for each reference vessel the operational and technical characteristics required to calculate the tax/charge levels are given. Finally, the unique ID of each reference vessel is presented, which can be used to identify all detailed results in the Excel database of this study.

Table 46 – Technical and operational characteristics reference maritime vessels

Characteristics	Ferry (RoPax)	Small container vessel	Large container vessel	Small bulk vessel	Large bulk vessel	Source
Reference vehicle ID	*MV1*	*MV2*	*MV3*	*MV4*	*MV5*	
Number of (main) engines	2	1	1	1	1	Clarkson Research; Services Limited (CRSL)
Length vessel (metres)	199	222	366	170	300	CRSL
Breadth vessel (metres)	27	30	48	28	50	CRSL
Summer draft (metres)	6.4	12,0	15,5	10	18.10	CRSL
Actual draft (metres)	6.1	10,3	11,9	7.3	17.6	FleetMon
Energy consumption (tons per day)	86	89	250	26	64	CRSL
Deadweight tonnage	7,500	39,750	142,200	30,000	206,000	CRSL
Loading capacity (tonnes/TEU/lanemtr[1])	120 cars, 660 passengers 2,600 lanemtr	2,824	13,200	29,000	203,000	CRSL
Load factor (%)	50/80	80	80	50	50	Own estimates
Actual load (tonnes/TEU)	60 cars, 330 metres	2,200 TEU	10,500 TEU	15,000 dwt	103,000 dwt	Based on loading capacity and loading factor
Gross tonnage	25,500	28,500	142,295	18,000	104,700	CRSL
Nett tonnage	11,565	14,200	60,480	11,100	66,443	CRSL
Operational lifetime (years)	35	24	25	29	25	Based on demolition age, CRSL
Annual mileage (years)	146,000	70,000	92,000	65,000	74,000	Own calculations
Lifetime mileage (years)	5,100,000	1,680,000	2,300,000	1,800,000	1,850,000	Based on operational lifetime and annual mileage
Type of cargo	Consumer goods passenger	Consumer goods	Consumer goods	Grain	Metal ores, coal	Assumption
Sludge/waste production (kg per litre fuel)	n/a	2% of fuel consumption	2% of fuel consumption	2% of fuel consumption	2% of fuel consumption	Assumption
Number of calls per year at a specific port	156	26	5	15	5	MDS Transmodal, Bulker in trip charter
Nature of port visit	Loading/unloading	Loading/unloading	Loading/unloading	Unloading	Unloading	
Method of payment port dues	Automated payment	Automated payment	Automated payment	Automated payment	Automated payment	Assumption
Use of OPS (on-shore power supply)	No	Yes	No	No	No	Environmental-shipindex.org
Presence of CCR4 certificate	No	No	No	No	No	Assumption
Presence of Green award	No	No	No	No	No	Greenaward.org: Only 258 ships worldwide
Presence of Environmental management system certificate	Exhaust Scrubber-SO_x	No	No	No	No	CRSL
ESI (environmental shipping index)	n/a	11.3	24.5	27.3	0.0	Environmental Ship Index.org 6,900 ships worldwide
Clean shipping index	No	No	No	No	No	Cleanshippingindex.com
Blue angel	No	No	No	No	No	Only five ships worldwide
Emission level	Tier 1/Tier 2	Tier 1/Tier 2	Tier 1/Tier 2	Tier 1/Tier 2	Tier 1/Tier 2	Assumption

[1] Lane metre is a common indicator of ferry capacity. It refers to a strip of deck of 2 metres wide.

A.6 Aviation

The reference aircrafts used in this study are presented in Table 47. The operational and technical characteristics required to calculate the relevant tax and charge levels are presented in this table as well. Finally, the unique ID of each reference aircraft is presented, which can be used to identify all detailed results in the Excel Database of this study.

Table 47 – Technical and operational characteristics reference aircrafts

Characteristics	Bombardier CRJ900	Embraer 170 (ERJ-170-100)	Airbus A320-232	Boeing 737-700	Airbus A340-300	Boeing 777-300 ER	Source
Reference vehicle ID	***A1***	***A2***	***A3***	***A4***	***A5***	***A6***	
Type of flight	Short haul	Short haul	Medium haul	Medium haul	Long haul	Long haul	
Number of engines	2	2	2	2	4	2	CE Delft et al. (2012), several sources
Engine type	CF34-8C5	CF34-8E5	V2527-A5	CFM56-7B22	CFM56-5C2	GE90-115BL	EASA Noise Level EPNdB/Bombardier
MTOW (kg)	36514	37500	73500	77564	260000	351533	EASA Noise Level EPNdB/Bombardier
Noise class	Low Cumulative Margin to Ch. 4 (EPNdB): 17.5	High Cumulative Margin to Ch. 4 (EPNdB):13.8	Low Cumulative Margin to Ch. 4 (EPNdB):19.9	High Cumulative Margin to Ch. 4 (EPNdB): 14.2	Low Cumulative Margin to Ch. 4 (EPNdB): 21.9	High Cumulative Margin to Ch. 4 (EPNdB): 16	EASA Noise Level EPNdB/Bombardier
Noise production (dB) => Cumulative Noise Level (EPNdB)	263,8	267,9	268,9	275,3	287,9	292	EASA Noise Level EPNdB/Bombardier
Fuel consumption (kg/LTO/engine)	240	241	437	390	466	1546	ICAO emissions database
Fuel consumption (kg/min/engine)	7,3	7,3	13,3	11,9	14,2	47,0	ICAO emissions database
CO_2 emissions (kg/LTO/engine)	749	752	1.363	1.217	1.454	4.824	BAFU (Emission factor)
Fuel/Pax	7,1	8,5	6,3	7,2	6,7	8,3	
Emission class	Low	High	Low	High	Low	High	
Number of seats (dual class)	81	66	165	126	335	396	Several sources
Number of seats (max. capacity)	90	78	189	149	375	550	Several sources
Passenger load factor (%)	78,80%	78,80%	78,80%	78,80%	78,80%	78,80%	IATA (2016)
Number of passengers	67	57	139	108	280	373	Based on the data in the three rows above
Scheduled ground time (min.)	48	48	48	48	84	84	Aviation stack exchange

B Estimation of total tax/charge revenue

B.1 Introduction

Most of the data used in this report have been collected from international or national data sources. However, for some countries/transport modes data on tax/charge revenues in 2016 was not available. More specific, two types of data were sometimes missing:
- total revenue of a specific tax/charge in 2016;
- revenue of a specific tax/charge per vehicle category.

In this Annex, we discuss in detail how these missing data, where relevant, have been estimated. This is done for road transport (Section B.2), rail transport (Section B.3), IWT (Section B.4), maritime transport (Section B.5) and aviation (Section B.6).

B.2 Road transport

Total revenue

For some taxes/charges and/or some countries data on total tax/charge revenues was missing. In these cases, estimation approaches were applied (see Table 48).

Table 48 – Approaches used to estimate total road tax/charge revenues

Tax/charge	Estimation approach
Fuel tax	Total fuel tax revenue have been estimated by multiplying the amount of petrol and diesel consumed per country (based on COPERT data) with the corresponding excise duties.
Purchase/registration tax	Total revenue was estimated by multiplying the average tax rate per vehicle category per country with the 2016 sales volumes (from ACEA, EEA and/or Eurostat) of the various vehicle categories.
Ownership/circulation tax	Total revenue was estimated by multiplying the various vehicle categories by use of the size of the various fleets in 2016 (based on Eurostat data) with by the average tax rates per vehicle category per country.

Revenue per vehicle category

For some of the countries/instruments considered, no data on the allocation of total revenue to the various vehicle categories was available. In these cases, this allocation is done based on relevant allocation keys. This is explained in detail per tax/charge in Table 49.

Table 49 – Approaches used to allocate total road tax/charge revenues to various vehicle categories

Tax/charge	Estimation approach
Fuel tax	Total fuel tax revenue have been allocated to the various vehicle categories based on the shares the various vehicle categories have in total petrol/diesel/LPG/CNG consumption. These shares are based on COPERT data. Fuel excise refund schemes for HGVs in some EU Member States (e.g. France) are taken into account.
Purchase/registration tax	Total revenue was allocated to the various vehicle categories by use us 2016 sales volumes (from ACEA, EEA and/or Eurostat) weighted by the average tax rate per vehicle category per country.
Ownership/circulation tax	Total revenue was allocated to the various vehicle categories by use of the size of the various fleets in 2016 (based on Eurostat data) weighted by the average tax rates per vehicle category per country.
Toll	Total revenue was allocated to the various vehicle categories based on the number of vehicle-kilometres of these categories on tolled roads (based on ASECAP data weighted by average to toll rates per vehicle category per country.
Vignette	Total revenue was allocated to the various vehicle categories based on the size of the various fleets in 2016 (based on Eurostat data) weighted by the average vignette price.
VAT on fuel tax and electricity tax	Calculated based on the total revenue from fuel and electricity taxes per vehicle category and relevant VAT rates in the various countries.
VAT on purchase/registration tax	Calculated based on the total revenue from purchase/registration tax per vehicle category and relevant VAT rates in the various countries.

B.3 Rail transport

Total revenue

To determine the total revenue from rail transport taxes and charges, sometimes estimation approaches were used (as data was not available from any official source). The approaches applied are presented in Table 50.

Table 50 – Approaches used to allocate total rail tax/charge revenues to various vehicle categories

Tax/charge	Estimation approach
Fuel tax	The total revenue has been estimated from the unit fuel excise duty at country level (i.e., €/litre) and total fuel consumed. In turn, the total fuel consumed has been estimated by dividing the transport performance of the diesel trains by the average consumption of the reference trains assumed (i.e., litre per train-km).
Electricity tax	The total revenue has been calculated from unit electricity tax at country level (i.e., €/litre) and total electricity consumed. In turn, the total electricity consumed has been estimated dividing the transport performance of the electric trains by the average consumption of reference vehicles assumed (i.e., kWh per train-km).

Tax/charge	Estimation approach
Access charge	For the countries where the total revenue of infrastructure access charges was missing, it has been estimated by multiplying the unit infrastructure access charge of a type of train (i.e., € per train-km) by its transport performance measured in terms of train-km. This approach has been used across all train categories to estimate the total revenue.
Charges on specific parts of the infrastructure	The total revenues come from the annual reports of the concessionaires in charge of Øresund bridge and Channel Tunnel fixed links. They have been equally allocated to the neighbouring countries.
ETS	Based on the power consumption (KWh per train-km) and yearly train-km, yearly power consumption of the electric reference vehicles has been calculated. Based on national electricity factors, the CO_2 emissions have been estimated from electricity production for electric vehicles. By multiplying the CO_2 emissions with the average 2016 ETS price the yearly ETS cost for each vehicle type has been calculated.

Revenue per vehicle category

For some of the countries/instruments considered, no data on the allocation of total revenue to the various train categories were available. In these cases, this allocation is done based on relevant allocation keys. This is explained in detail per tax/charge in Table 51.

Table 51 – Approaches used to allocate total rail tax/charge revenues to various vehicle categories

Tax/charge	Estimation approach
Fuel tax	The total revenue from diesel excise duty has been allocated based on the on the train-km of passenger and freight diesel trains weighted by average fuel consumption per train-km of these trains.
Electricity tax	The total revenue from electricity tax has been allocated based on the on the train-km of high speed and conventional electric passenger trains and freight electric trains, weighted by the electricity consumption per train-km of these trains.
Access charge	The total revenue from infrastructure access charge has been allocated based on the train-km of the train categories covered in this study, weighted by the average charge level for these train types.
Charges on specific parts of the infrastructure	The total revenue from charges on specific parts of the infrastructure has been allocated based on the on the train-km of high speed and conventional electric passenger trains and freight electric trains., again weighted by charge levels per train type.

B.4 IWT

For IWT, most data on total tax/charge revenues are taken from official sources. However, the revenues from port charges (at a national level) are not always available from national accounts. In these cases, the total port charge revenues in 2016 are estimated by multiplying the average port charge per tonne (based on data for a selected number of ports) with the number of transported tonnes in the country.

The totals of the fuel tax revenues were also not available from official sources and hence are estimated with the help of the CO_2 emission data for the relevant countries based on the fuel bunkered in the countries. On the basis of these CO_2 emissions, the amount of fuel bunkered is estimated and then multiplied with the tax rates.

B.5 Maritime transport

As mentioned in Section 6.4.1, for some ports only data on total port revenues was available. In order to estimate the total revenues of port charges for these ports, we assumed (based on an ESPO (2011)) that 65% of the total port revenues accounted for port charges.

B.6 Aviation

For the Spanish airports, the average revenue per passenger reported by the airport operator and the number of passengers per year for the specific airport were used to estimate total revenues. For the other airports, the average revenue per passenger for all considered airports and the total number passengers per year were taken to estimate total revenue.

C Detailed results earmarking road transport

A detailed overview of the extent by which the various types of road transport taxes and charges are earmarked is given in Table 52. These shares are based on a study of (national) documents and personal contact with policymakers in the various countries.

Table 52 – Share of tax/charge revenue that is earmarked for infrastructure expenditures (per tax/charge and per country)

Member State	Fuel tax	Electricity tax	Registration tax	Ownership tax	Tolls	Vignettes
Austria	0%	0%	0%	0%	100%	100%
Belgium	0%	0%	0%	79%	0%	0%
Bulgaria	0%	0%	100%	0%	0%	0%
Croatia	0%	0%	0%	21%	30%	0%
Cyprus	0%	0%	0%	100%	0%	0%
Czech Republic	9%	0%	100%	100%	100%	100%
Denmark	0%	0%	0%	0%	0%	100%
Estonia	0%	0%	0%	0%	0%	0%
Finland	0%	0%	0%	2%	0%	0%
France	38%	1%	0%	6%	100%	0%
Germany	0%	0%	0%	0%	100%	0%
Greece	0%	0%	0%	31%	0%	0%
Hungary	0%	0%	0%	100%	100%	100%
Ireland	0%	0%	0%	40%	50%	0%
Italy	0%	0%	0%	45%	89%	0%
Latvia	80%	0%	100%	0%	0%	0%
Lithuania	65%	0%	100%	0%	0%	100%
Luxembourg	8%	0%	40%	0%	0%	0%
Malta	0%	0%	0%	0%	0%	0%
Netherlands	0%	0%	0%	0%	0%	0%
Poland	0%	0%	0%	0%	100%	0%
Portugal	22%	0%	0%	37%	100%	0%
Romania	0%	100%	0%	100%	0%	100%
Slovakia	0%	0%	0%	100%	0%	0%
Slovenia	0%	100%	0%	11%	100%	100%
Spain	0%	0%	0%	26%	100%	0%
Sweden	0%	0%	0%	0%	0%	0%
United Kingdom	0%	0%	0%	0%	0%	0%
Norway	0%	0%	0%	0%	100%	0%
Switzerland	70%	100%	100%	0%	100%	100%
Canada – British Columbia	0%	0%	0%	0%	0%	0%
Canada – Alberta	0%	0%	0%	0%	0%	0%
US – California	0%	0%	100%	0%	0%	0%
US – Missouri	0%	75%	75%	10%	0%	0%
Japan	0%	0%	0%	0%	100%	0%

D Tax/charge revenues allocated to motorways

D.1 Introduction

In this Annex we present the total and average revenue of road transport taxes and charges that can be allocated to kilometres driven on motorways. Therefore, we first briefly describe the methodology used to estimate these revenues (see Annex D.2). In Annex D.3 we present the total revenues that can be allocated to motorways, while in Annex D.4 the average revenues are presented.

D.2 Methodology to allocate tax/charge revenues to motorway kilometres

The methodology to allocate the total revenues from the various types of taxes and charges to motorway kilometres is described in Table 53. As some taxes/charges (e.g. road tolls) are mainly applied on motorways we can simply assume that total revenues can be allocated to motorway kilometres. However, for other taxes (e.g. fixed vehicle taxes) more sophisticated allocation methodologies are required.

Table 53 – Methodology to allocate total revenues to motorways

Tax/charge	Methodology
Fuel tax	First, a bottom-up approach is applied to estimate the total amount of transport fuels used for kilometres driven on motorways and on the entire road network is made. This is based on data on total CO_2 emissions (from the Handbook on external costs of transport). The share of fuel used on motorways in total fuel consumptions is used to estimate the share of total fuel tax revenues (per vehicle category) that can be allocated to motorway kilometres.
Purchase/registration tax	Total tax revenues per vehicle category are allocated to motorways based on the share of motorway kilometres of that vehicle category in the total number of vehicle-kilometres of that vehicle category.
Ownership/circulation tax	Same methodology as for purchase/registration tax.
Road tolls	It is assumed that all road toll revenues can be allocated to motorways (as tolls are mainly applied on motorways). There are a few countries (e.g. Norway) where road tolls are not (or to a limited extent) are charged on motorways. For these countries, no revenues are allocated to motorways.
Vignettes	As for road toll revenues, it is assumed that vignette revenues can be allocated to motorways.
Insurance taxes	Total tax revenues per vehicle category are allocated to motorways based on the share of accidents on motorways in the total number of accidents of that vehicle category.
VAT on transport taxes	The same approach as used for tax/charge over which the VAT is levied.

The methodology to estimate the average revenues for motorways is explained in Table 54.
As discussed in Section 3.4.2, average revenues cannot be simply calculated by dividing total revenues by the total transport performance (because of differences in scope between tax/charge and transport performance data) and therefore alternative methodologies have to be applied.

Table 54 – Methodology to estimate average revenues for motorways

Tax/charge	Methodology
Fuel tax	Average fuel consumption figures (in l/vkm) are estimated for motorways (based on COPERT), which are multiplied with the relevant fuel tax rates.
Purchase/registration tax	Average revenues for motorways are equal to average revenues for the entire road network.
Ownership/circulation tax	Average revenues for motorways are equal to average revenues for the entire road network.
Road tolls	Total revenues are divided by the vehicle-kilometres made on the tolled road network. These data is taken from the ASECAP country reports, which present he vehicle-kilometres as reported by the national road toll operators.
Vignettes	Total revenues are divided by motorway kilometres, based on total transport performance data from Eurostat (entire road network) and the shares of motorways in these performance data from COPERT.
Insurance taxes	Average revenues for motorways are equal to average revenues for the entire road network.
VAT on transport taxes	The same approach as used for tax/charge over which the VAT is levied.

D.3 Total revenues allocated to motorways

The total revenues of road taxes/charges that can be allocated to motorways is presented in Table 55.

Table 55 – Total revenues allocated to motorways in 2016 (billion €, PPS corrected)

Member State	Fuel excise duty and electricity tax	Registration tax	Ownership tax	Tolls and vignettes	Insurance tax	VAT on taxes/ charges	Total revenue
EU28	44.21	4.19	11.31	29.11	4.98	8.68	102.48
EU27	38.94	4.19	10.11	28.80	4.65	7.75	94.45
Austria	1.33	0.13	0.69	0.66	0.11	0.42	3.33
Belgium	1.47	0.11	0.47	0.19	0.29	0.23	2.76
Bulgaria	0.38	-	0.04	0.35	-	0.04	0.82
Croatia	0.53	0.07	0.03	0.85	0.04	0.09	1.62
Cyprus	0.06	-	0.02	-	-	0.01	0.09
Czech Republic	0.68	-	0.06	0.64	0.01	0.09	1.47
Denmark	0.32	0.37	0.19	0.04	0.03	0.14	1.09
Estonia	0.07	-	-	-	-	0.01	0.08
Finland	0.28	0.12	0.13	-	0.04	0.06	0.63
France	5.23	0.42	0.17	8.10	0.91	0.79	15.61
Germany	9.99	-	2.62	1.46	1.25	2.05	17.37
Greece	0.70	0.03	0.24	0.91	0.11	0.29	2.28
Hungary	0.50	0.02	0.06	0.40	0.03	0.13	1.14
Ireland	0.45	0.15	0.21	0.27	0.02	0.13	1.24
Italy	6.89	0.41	1.62	9.08	0.96	1.21	20.17
Latvia	-	-	-	-	-	-	-
Lithuania	0.27	-	0.04	0.07	-	0.03	0.41
Luxembourg	0.23	-	0.02	0.01	-	0.02	0.28
Malta	-	-	-	-	-	-	-
Netherlands	2.74	0.58	2.05	0.14	0.36	0.57	6.43
Poland	0.24	0.01	0.02	0.25	-	0.03	0.54

Member State	Fuel excise duty and electricity tax	Registration tax	Ownership tax	Tolls and vignettes	Insurance tax	VAT on taxes/ charges	Total revenue
Portugal	1.18	0.25	0.23	2.52	0.14	0.21	4.53
Romania	0.77	0.04	0.12	0.44	0.02	0.09	1.49
Slovakia	0.26	0.02	0.04	0.18	0.01	0.05	0.56
Slovenia	0.42	0.01	0.06	0.41	0.02	0.10	1.03
Spain	3.97	1.45	0.95	1.82	0.31	0.98	9.48
Sweden	0.49	-	0.16	0.07	0.03	0.09	0.85
United Kingdom	4.78	-	1.04	0.23	0.29	0.83	7.17
Norway	0.19	0.18	0.11	-	-	0.03	0.51
Switzerland	0.84	0.07	0.38	0.39	-	0.10	1.78
Canada – Alberta	0.02	-	0.01	-	0.01	-	0.03
Canada – British Columbia	0.02	-	-	-	0.03	-	0.05
United States – California	2.42	-	1.00	-	0.14	-	3.57
United States – Missouri	0.18	-	0.07	-	0.03	0.01	0.29
Japan	9.43	0.33	7.37	54.83	-	1.08	73.05

Note: There are no motorways in Latvia and Malta.

D.4 Average revenues allocated to motorways

The average tax/charge revenues for motorways are shown for the various vehicle categories in Figure 101 to Figure 105.

Figure 101 – Average revenue from taxes and charges for passenger cars in 2016 for motorways (€/1,000 pkm, PPS adjusted)

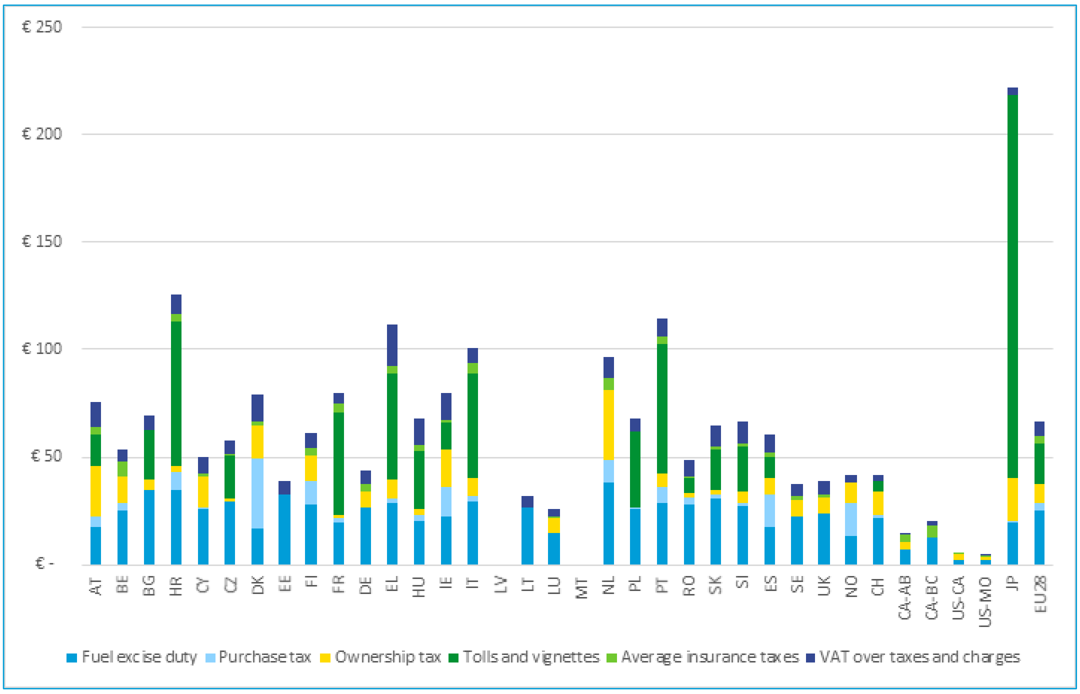


Figure 102 – Average revenue from taxes and charges for motorcycles in 2016 for motorways (€/1,000 pkm, PPS adjusted)

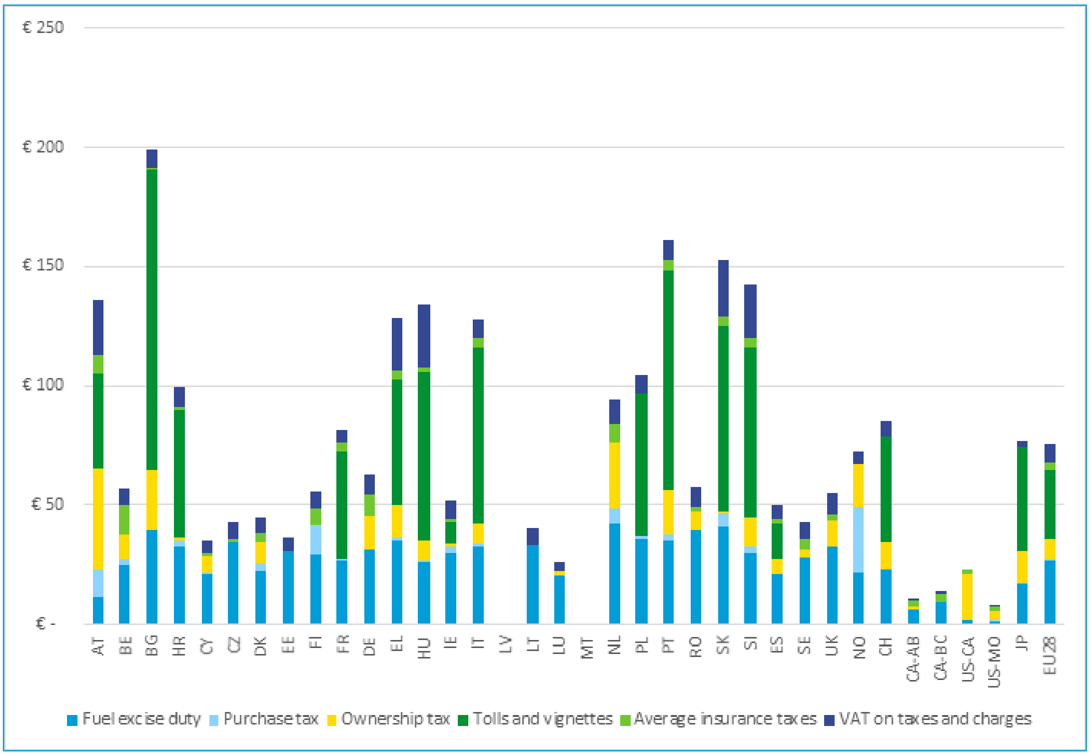


Figure 103 – Average revenue from taxes and charges for buses and coaches in 2016 for motorways (€/1,000 pkm, PPS adjusted)

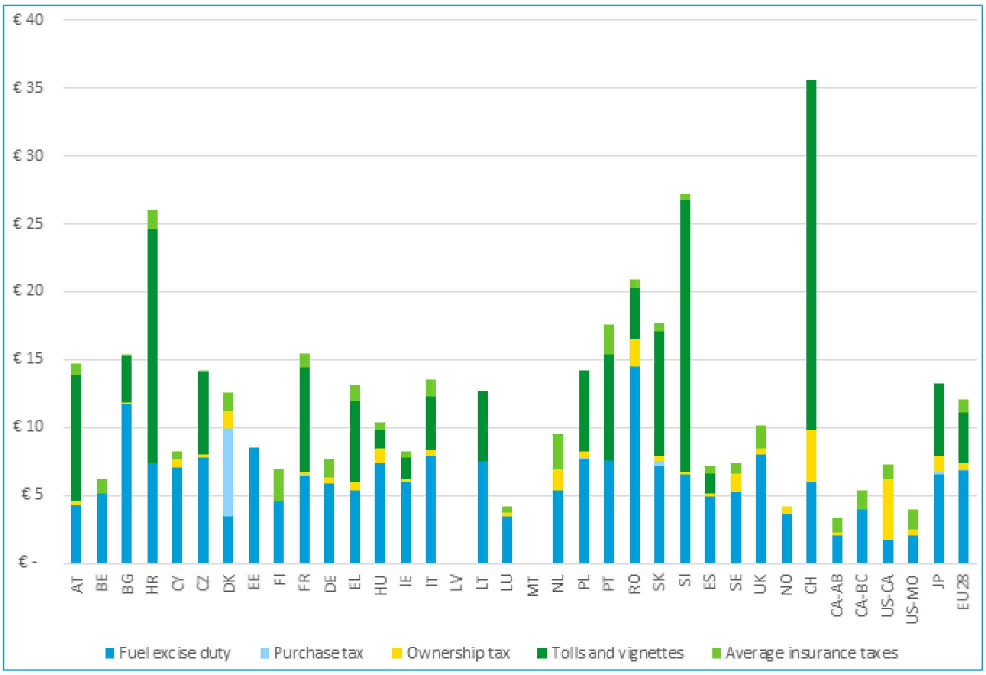


Figure 104 – Average revenue from taxes and charges for vans in 2016 for motorways (€/1,000 vkm, PPS adjusted)

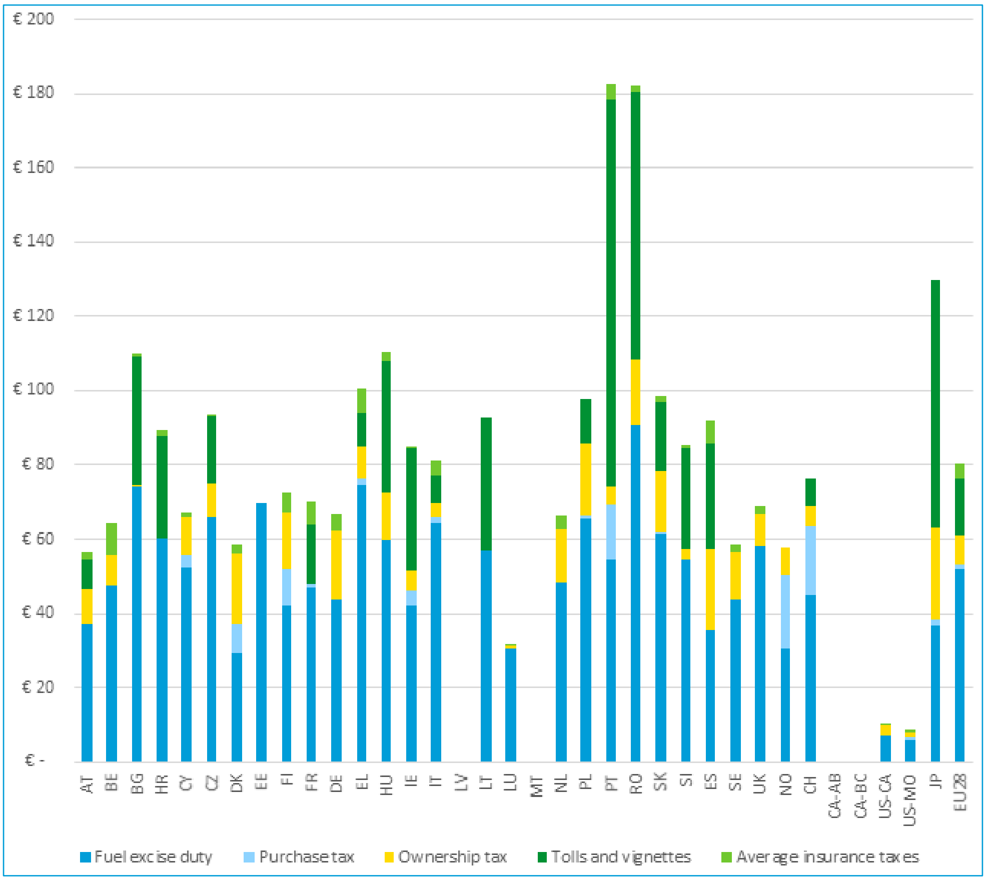
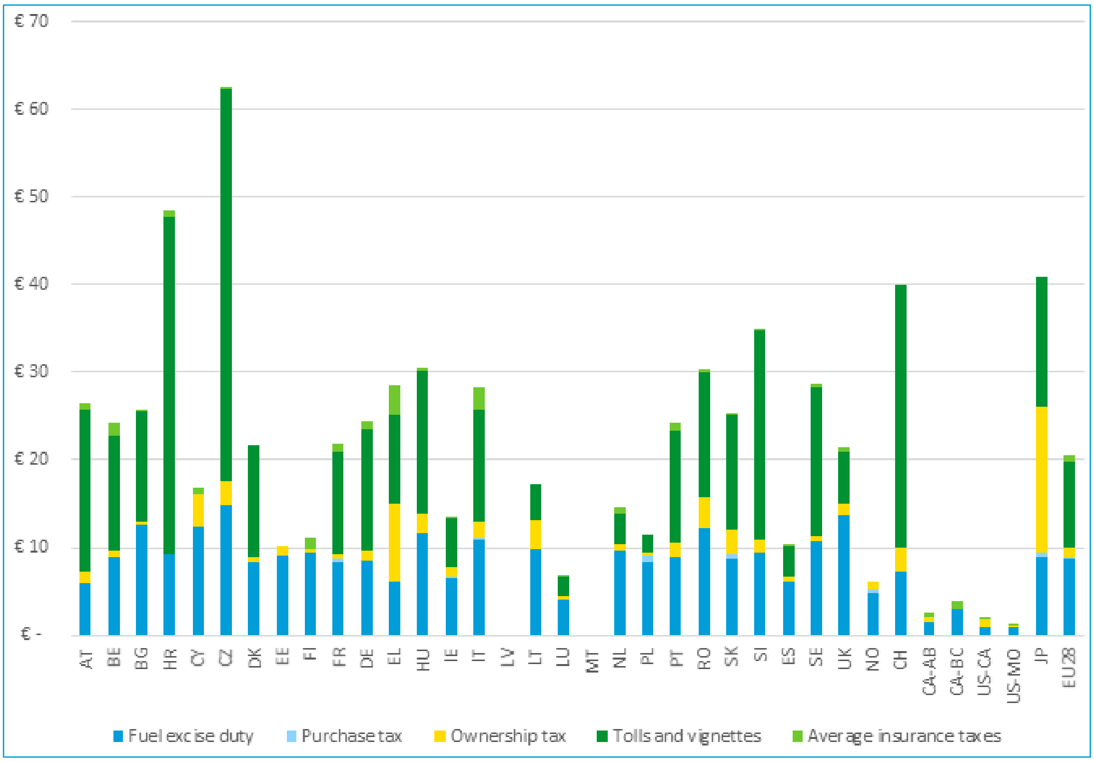


Figure 105 – Average revenue from taxes and charges for HGVs in 2016 for motorways (€/1,000 tkm, PPS adjusted)



E Tax/charge revenue not adjusted for PPS

E.1 Introduction

In the main report, the total revenues of transport taxes and charges corrected for differences in purchase power (by applying a PPS correction) are presented. In this Annex, we present the figures not adjusted for PPS.

E.2 Road transport

The road tax and charge revenues unadjusted for PPS are presented in Table 56.

Table 56 – Total revenue from road taxes and charges in 2016 (billion €, not PPS adjusted)

Member State	Fuel excise duty and electricity tax	Registration tax	Ownership tax	Tolls and vignettes	Insurance tax	VAT on taxes/ charges	Total revenue
EU28	195.70	16.61	44.02	31.42	20.25	41.39	349.39
EU27	162.02	16.61	37.31	30.74	18.63	35.33	300.65
Austria	4.26	0.42	2.26	1.95	0.34	1.35	10.59
Belgium	5.16	0.39	1.61	0.75	0.98	0.88	9.77
Bulgaria	1.15*	-	0.14	0.17	0.01	0.17	1.63
Croatia	1.08	0.13	0.06	0.34	0.07	0.26	1.95
Cyprus	0.30	0.01	0.10	-	0.01*	0.05	0.47
Czech Republic	2.91	-	0.22	0.54	0.07*	0.37	4.12
Denmark	2.55	2.62	1.42	0.65	0.21	1.16	8.61
Estonia	0.51	-	0.01	-	-	0.08	0.59
Finland	2.70	0.96	1.08	-	0.39	0.52	5.65
France	28.52	2.19	0.86	9.83	4.74	6.25	52.39
Germany	36.94	-	8.95	4.63	4.30	7.41	62.23
Greece	3.66	0.19	1.11	0.50	0.55*	0.80	6.82
Hungary	1.98	0.08	0.24	0.66	0.10	0.38	3.44
Ireland	2.48	0.84	1.12	0.22	0.08*	0.78	5.52
Italy	29.60	1.69	6.81	5.94	3.88	6.63	54.54
Latvia	0.47	0.01	0.08	0.02	-	0.06	0.64
Lithuania	0.66	-	0.06	0.04	-	0.09	0.85
Luxembourg	0.83	-	0.07	0.01	0.01	0.07	0.99
Malta	0.11*	0.04	0.05	-	0.02	0.01	0.24
Netherlands	8.09	1.55	5.58	0.19	0.97	1.67	18.04
Poland	4.71	0.19	0.24	0.22	-	0.67	6.04
Portugal	3.25	0.69	0.55	0.98	0.43*	0.77	6.66
Romania	2.31*	0.16	0.25	0.26	0.14*	0.32	3.44
Slovakia	1.19	0.06*	0.14	0.26	0.08*	0.17	1.90
Slovenia	1.08	0.03	0.15	0.36	0.04	0.19	1.85
Spain	10.56	4.36	2.72	1.83	0.91	3.25	23.63

Member State	Fuel excise duty and electricity tax	Registration tax	Ownership tax	Tolls and vignettes	Insurance tax	VAT on taxes/ charges	Total revenue
Sweden	4.98	-	1.41	0.37	0.30	0.97	8.03
United Kingdom	33.68	-	6.71	0.68	1.62*	6.06	48.74
Norway	2.06	1.82	1.07	1.06	-	0.55	6.56
Switzerland	4.22	0.33	1.73	1.83	-	0.47	8.57
Canada – British Columbia	0.90	-	0.33	-	0.37	0.05	1.65
Canada – Alberta	0.23	-	-	-	0.34	0.06	0.62
US – California	7.69	-	3.30	0.28	0.38	-	11.65
US – Missouri	0.60	----	0.15	-	0.05	0.03	0.83
Japan	29.82	0.89	20.12	17.04	-	4.62	72.49

E.3 Rail transport

The rail tax and charge revenues unadjusted for PPS are presented in Table 57.

Table 57 – Total revenue from rail taxes and charges (million €, not PPS adjusted)

Member State	Electricity tax	Fuel excise duty	Rail access charges	Charges on specific parts of the infrastructure	ETS	Total revenue
EU28	276.69	2,010.74	16,924.51	360.74	67.66	19,640.35
EU27	276.69	1,284.54	15,630.81	215.74	63.72	17,471.50
Austria	29.95	37.72	392.21	-	1.86	461.75
Belgium	-	-	702.00	-	1.79	703.79
Bulgaria	0.44	7.21	28.41	-	0.85	36.91
Croatia	0.08	15.27	16.00	-	0.19	31.54
Cyprus	-	-	0.00	-	0.00	0.00
Czech Republic	-	105.96	151.66	-	2.56	260.18
Denmark	0.23	11.07	34.01	33.37	0.49	79.17
Estonia	0.02	18.85	30.29	-	0.01	49.17
Finland	-	8.16	40.40	4.00	0.65	53.22
France	4.30	63.97	5,778.00	145.00	5.50	5,996.78
Germany	195.15	561.68	5,072.04	-	24.30	5,853.17
Greece	0.03	13.69	17.93	-	0.05	31.70
Hungary	0.88	-	127.36	-	1.14	129.38
Ireland	-	5.52	68.45	-	0.04	74.01
Italy	-	43.01	1,061.71	-	5.51	1,110.22
Latvia	-	77.44	61.88	-	0.01	139.33
Lithuania	0.00	55.26	163.90	-	0.00	219.16
Luxembourg	0.04	0.62	15.73	-	0.08	16.46
Malta	-	-	0.00	-	0.00	0.00
Netherlands	5.39	33.28	353.21	-	2.44	394.32
Poland	12.75	44.31	491.91	-	7.06	556.03
Portugal	-	9.74	68.38	-	0.70	78.81
Romania	0.39	55.26	196.59	-	1.18	253.42

Member State	Electricity tax	Fuel excise duty	Rail access charges	Charges on specific parts of the infrastructure	ETS	Total revenue
Slovakia	-	24.01	82.85	-	0.51	107.37
Slovenia	0.00	6.04	8.62	-	0.33	14.99
Spain	27.04	86.46	490.98	-	4.98	609.46
Sweden	-	-	176.29	33.37	1.50	211.15
United Kingdom	-	726.20	1,293.70	145.00	3.94	2,168.84
Norway	-	-	37.24	-	0.38	37.62
Switzerland	-	2.57	1,335.07	-	-	1,337.64
Canada – British Columbia	-	9.74	-	-	-	9.74
Canada – Alberta	-	16.98	-	-	-	16.98
US – California	-	1.84	-	-	-	1.84
US – Missouri	-	-	-	-	-	0.00
Japan	35.12	162.23	-	-	-	197.35

E.4 IWT

The IWT tax and charge revenues unadjusted for PPS are presented in Table 58.

Table 58 – Total revenue from IWT taxes and charges (million €, not PPS adjusted)

Member State	Fuel taxes	Port charges	Fairway dues	Dues for locks and bridges	Water pollution charges	Total revenue
EU28	3.3	305.4	59.1	1.0	10.9	379.7
Austria	-	3.3	-	-	-	3.3
Belgium	-	14.4	5.4	1.0	1.6	22.3
Bulgaria	1.3	15.1	-	-	0.7	17.0
Croatia	-	0.2	N/A	-	-	0.2
Czech Republic	-	3.3	-	-	-	3.3
Finland	-	1.0	-	-	-	1.0
France	-	6.9	N/A	-	0.02	6.9
Germany	-	193.2	48.3	-	5.2	246.7
Hungary	1.3	0.9	-	-	N/A	2.1
Italy	0.2	N/A	-	-	N/A	0.2
Lithuania	N/A	N/A	-	-	-	N/A
Luxembourg	-	0.4	N/A	-	0.01	0.4
Netherlands	-	28.0	-	-	3.5	31.5
Poland	-	22.7	N/A	N/A	-	22.8
Romania	-	14.6	5.4	-	-	20.02
Slovakia	0.5	1.5	N/A	-	N/A	1.9
Switzerland	-	4.1	-	-	0.3	4.4
US – Missouri	N/A	0.0	-	-	-	N/A

E.5 Maritime transport

The maritime transport tax and charge revenues unadjusted for PPS are presented in Table 59.

Table 59 – Total revenue from maritime taxes and charges (million €, not PPS adjusted)

Port	Fuel taxes	Port charges	Fairway dues	Total revenue
Antwerp (BE)	-	174.0	-	174.0
Varna (BG)	-	18.0	-	18.0
Limassol (CY)	-	N/A	-	N/A
Hamburg (DE)	-	52.3	-	52.3
Bremerhaven (DE)	-	17.7	-	17.7
Travemünde (DE)	-	N/A	-	N/A
Aarhus (DK)	-	22.2	-	22.2
Helsingør (DK)	-	23.9	-	23.9
Tallinn (EE)	-	75.0	14.2	89.2
Algeciras (ES)	-	48.5	-	48.5
Valencia (ES)	-	77.2	-	77.2
Barcelona (ES)	-	74.5	-	74.5
Bilbao (ES)	-	41.9	-	41.9
Helsinki (FI)	-	58.3	12.4	70.7
Marseille (FR)	-	83.5	-	83.5
Le Havre (FR)	-	118.2	-	118.2
Calais (FR)	-	N/A	-	N/A
Pireaus (GR)	-	67.3	-	67.3
Rijeka (HR)	-	14.4	-	14.4
Split (HR)	-	3.8	-	3.8
Dublin (IR)	-	45.6	-	45.6
Trieste (IT)	-	14.8	-	14.8
Genova (IT)	-	31.9	-	31.9
Venice (IT)	-	18.5	-	18.5
Klaipeda (LT)	-	34.0	-	34.0
Riga (LV)	-	32.5	-	32.5
Marsaxxlokk (MT)	-	N/A	-	N/A
Rotterdam (NL)	-	295.0	-	295.0
Oslo (NO)	-	13.8	--	13.8
Gdansk (PL)	-	21.3	-	21.3
Sines (PT)	-	17.3	-	17.3
Constanta (RO)	-	31.3	-	31.3
Gothenburg (SE)	-	17.8	20.9	38.7
Koper (SK)	-	29.6	-	29.6
Felixstowe (UK)	-	28.8	-	28.8
Vancouver (CA)	-	27.0	-	27.0
Montreal (CA)	-	36.7	-	36.0
Los Angeles (US)	-	327	-	327.0
Savannah (US)	-	N/A	-	N/A
Tokyo (JP)	-	N/A	-	N/A

E.6 Aviation

The aviation tax and charge revenues unadjusted for PPS are presented in Table 60.

Table 60 – Total revenue from aviation taxes and charges (million €, not PPS adjusted)

Airport	Aviation taxes (estimations)	Airport charges	Total revenue		
			Total	Estimated revenue passenger transport	Estimated revenue freight transport
Vienna (AT)	93	351	444	396	48
Brussels (BE)	-	278	278	227	51
Sofia (BG)	-	323	323	308	16
Zagreb (HR)	N/A	35	35	34	1
Larnaka (CY)	-	85	85	85	0
Prague (CZ)	-	179	179	169	10
Copenhagen (DK)	-	370	370	331	40
Tallinn (EE)	-	14	14	13	1
Helsinki (FI)	-	145	145	132	13
Paris Charles de Gaulle and Orly (FR)	N/A	1,003	1,003	828	175
Frankfurt (DE)	322	756	1,078	800	278
Munich (DE)	224	720	944	944	0
Athens (EL)	-	276	276	264	12
Budapest (HU)	-	167	167	152	15
Dublin (IE)	-	273	273	260	13
Roma (IT)	-	636	636	613	23
Riga (LV)	-	27	27	26	1
Vilnius (LT)	-	14	14	14	0
Luxembourg (LU)	-	52	52	14	38
Luga (MT)	-	56	56	54	2
Amsterdam (NL)	-	831	831	659	172
Warsaw (PL)	-	125	125	119	6
Lisbon (PT)	-	248	248	239	10
Bucharest (RO)	-	141	141	137	4
Bratislava (SK)	-	20	20	17	2
Ljubljana (SI)	-	20	20	17	2
Barcelona (ES)	-	465	465	452	14
Madrid (ES)	-	531	531	494	37
Palma de Mallorca (ES)	-	277	277	257	19
Stockholm (SE)	-	157	157	152	5
London Heathrow (UK)	1,185	2,356	3,541	2,942	599
London Gatwick (UK)	670	465	1135	1115	20
Oslo (NO)	47	212	259	246	13
Zurich (CH)	-	689	689	596	93
Toronto (CA)	-	596	596	538	57
Vancouver (CA)	-	189	189	168	21
Atlanta (US)	N/A	376	376	355	21
Los Angeles (US)	N/A	3,045	3,045	2,380	665
Tokyo Haneda (JP)	N/A	163	163	163	0

F Content Excel Database

All data on transport taxes and charges collected for this study is available in an Excel Database. This database contains for each tax/charge applied in each country/airport/port two types of information:

General information on the tax/charge scheme

The following information is available for all tax/charge schemes:
- type of tax/charge;
- country-specific name of the tax/charge;
- country where the tax/charge is applied;
- transport mode for which the tax/charge is applied;
- vehicle types or fuel types for which the tax/charge is applied;
- brief description of the scheme;
- responsible authority;
- overview of parameters to which the tax/charge is differentiated;
- total revenue of the tax/charge in 2016 (if available even allocated to fuel or vehicle type);
- whether the tax/charge is earmarked and to what extent;
- destination of the earmarked revenues;
- any other relevant issues;
- data sources used.

Tax/charge levels for the reference vehicles considered

For each tax/charge, the charge levels for the relevant reference vehicles (as defined in Annex A) is shown.

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