universität wien

MASTERARBEIT / MASTER`S THESIS

Titel der Masterarbeit / Title of the Master`s Thesis

"Scrutinizing EU Long Distance Transportation Policy"

verfasst von / submitted by

Plamen Pachev, B.Sc

angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien, 2019 / Vienna, 2019

Studienkennzahl lt. Studienblatt /degree programme code as it appears on the student record sheet: A 066 913

Studienrichtung lt. Studienblatt /degree programme as it appears on the student record sheet: Volkswirtschaftslehre

Betreut von / Supervisor: ao. Univ.-Prof. Mag. Dr. Wolfgang Weigel

Contents

1 Abstract

The Treaty of Rome from 1957 laid down the constitutional foundations of the European Union (EU) in the format we know it today. More importantly, the Treaty also gave the legal legitimacy of the common transport policy of the Union. After 1991, this common transport policy started to take shape. A central target of the common transport policy on long distances is achieving balance in market shares between road and rail for transporting goods. For 2030, the aims are shifting 30% of the goods transported by road, to rail or waterborne transport (EC, 2011). By employing an argumentation from the field of Law & Economics, this Thesis evaluates qualitatively if this target is feasible to be achieved, given the political and legal framework conditions. In addition, a literature review on the dimensions of the external costs caused by road and rail freight transport is conducted, in order to determine whether it is feasible to promote rail as an alternative to road at all. By analysing key policy documents and legal acts, a conceptual model is developed. Then, the political and legal framework conditions are critically evaluated, to which extent they are active. Finally, by developing a small case study, a conclusion on whether the policy aims for 2030 are achievable, is developed.

2 Zusammenfassung (Abstract in German)

Der Vertrag von Rom aus dem Jahre 1957 hat die konstitutionelle Grundlagen der Europäischen Union gelegt. Die gemeinsame Transportpolitik war auch ein Teil dieser Grundlagen und existiert seit 1991. Ein wichtiger Punkt der Transportpolitik der EU, ist erreichen von einem Gleichgewicht beim Marktanteil von LKW und Zug bei der Beförderung von Gütern über lange Distanzen. Für 2030, das Ziel ist, dass 30% von allen Gütern mit dem Zug oder Schiff befördert sollen (EC, 2011). Diese Masterarbeit verwendet Argumentation aus dem Bereich „Ökonomische Analyse des Rechts“ und eruiert qualitativ, ob so eine Umwandlung im Güterverkehr für 2030 möglich ist. Dazu werden Schlüsselaspekte aus Grundsatzdokumenten sowie wichtige EU-Richtlinien und Verordnungen analysiert. Zusätzlich wird eine Literaturübersicht zum Thema externe Kosten: Straße gegen Schiene geführt, um festzustellen, ob es sich überhaupt lohnt, einen Umstieg von Straße auf Schiene zu fördern. Die Erkenntnisse aus den Grundsatzdokumenten wurden in einem konzeptionellen Gesamtmodel zusammengefasst und den Rahmenbedingungen (von wirtschaftspolitischer und gesetzlicher Natur) gegenübergestellt. Schlussendlich wurde eine kleine Fallstudie entwickelt, damit die Aussage getroffen werden kann, ob die Ziele für 2030 erreichbar sind oder nicht.

3 Introduction

Transport is a crucial part of the economy. Every day, thousands of tons of goods circulate throughout Europe, meeting the demands of consumers and producers. The last centuries marked significant improvements of all means of transportation- with the invention of the steam engine in the course of the Industrial Revolution, a new mean of transport, the train was born. Some decades later, the internal combustion engine was created, which led to the discovery of the truck. The Railways experienced their "golden years" in the 19th and first half of the 20th century but after that, their popularity in terms of mode choice for freight transportation declined (EC, 2001). In 2004 for instance, the market share of railways was as low as 10% which was a reduction of 2.1% compared with 1995 (EC, 2006). In the same time span, market share of road transport for freight increased from 42.1% to 44% (EC, 2006).

One of the reasons to be concerned about this development is the fact that increased usage of road transport may come with higher costs to society than rail. Especially with regards to environmental friendliness, road may perform worse than rail. Reduction of CO2 emissions is one of the main strategic goals of the EU in the long term, as President of the European Commission, Jean Claude Juncker, emphasized in his annual address "State of the Union" on the 13th of September 2017 that *".....I want Europe to be the leader when it comes to the fight against climate change"* (EC, 2017a, p.10). In addition, the Draft of the Commission Work Programme up to the end of 2018 foresees as Priority number 3 "a resilient energy union with a forward-looking climate policy" (EC, 2017a, p.27) and in particular, legislative proposals targeted at "common rules for combined transport of goods", "fuel-efficiency and CO2 standards for lorries, busses and coaches", and "an initiative to accelerate the delivery of the alternative fuels infrastructure" (EC, 2017a, p.27).

In order to achieve these targets, a common transport policy is needed. Such policy is indeed one of the cornerstones of the European Union. Title VI, Article 90 of the Consolidated Treaty on the Functioning of the European Union says that "The objectives of the Treaties shall, in matters governed by this Title, be pursued within the framework of a common transport policy" where "common rules applicable to international transport" are already summarized under point a) (Consolidated Version of the Treaty on the Functioning of the European Union, 2016, p.85).

After the institutional reforms that emerged from the Treaty of Maastricht, it became easier to find compromise on a ministerial level, but not only that, the EU was successful in initiating various market reforms throughout the Community. Telecommunication sector, for example, was liberalized. From telecommunications being in full state ownership and thus, not allowing any competition from outside, the Commission, with its Directives 88/301/EEC (Commission Directive 88/301/EEC, 1988, pp.73-77) from 1988 as well as 90/388/EEC (Commission Directive 90/388/EEC, 1990, pp.10-16) from 1990, rolled out legislative measures in order to allow operators from other countries to be able to offer services to end customers throughout the Union. This whole opening of the telecommunication markets was completed by 1998 (Gual & Waverman, 1998).

1990s marked then the beginning of the common transport policy in the Union- the next big market reform that took place under the favourable conditions of the institutional reset from the Maastricht Treaty. The first White Paper on Transport was published in 1992 and outlined the steps towards liberalization of rail sector (Fact Sheets on the European Union, 2018, para.6). Similar to telecommunications, rail undertakings were state owned companies, having both infrastructure (railways, stations, transhipment terminals etc.) and the rolling

stock in their possession and thus, deciding freely how to use it. In such configuration, it was completely in their right to refuse access to any foreign rail undertaking, wishing to use the infrastructure. This reform may look identical in legislative terms like the telecommunications one, however, there is one crucial difference between both. While in terms of communication services, the Commission was concerned by the fact that the state is not seen as an innovator when it comes to technical improvements and thus, consumers are left behind in benefiting from them, in the case of railways, the Commission was rather aware of the low level of competitiveness of railways against the road counterpart. It was the claim that being a monopoly, the state- owned railway undertakings could cause a deadweight loss to the customers. In addition, the environmental and social aspect was the other factor speaking in favour of trying to foster the level of competitiveness of this mode of transport.

Railways could exercise a positive effect in terms of reducing congestion due to the switch of freight tonnages from road to rail and this would imply less trucks on the highways which at the end, would lead to more space on the roads available. Trains do not emit directly CO2 emissions but rather, use either diesel fuel or electricity. As CO2 emissions are dependent on the freight tonnage and trains do carry more load than a single truck, when this load is divided by the total CO2 emissions caused by the diesel emissions or electricity production, it could well be the case that trains emit less CO2 emissions per unit of freight.

Also, the social costs of railways are assumed to be lower than those of the road counterpart. According to the Statistical Pocketbook for 2017, issued by DG Transport of the European Commission, in 2015, there were 748 fatalities linked to lorries less than 3.5 tons in the EU but only 27 railway passengers were killed in the same year (EC, 2017b). This constitutes a

difference amounting to 27 times in favour of the road mode. Last but not least, rail is perceived as less annoying in terms of noise.

The railway market was completely opened in 2007 (EC, 2006). In 2015, however, market share of railways was as low as 11.9%, compared with 49% for road (EC, 2017b). Moreover, in the time between 2008 and 2015, percentages for rail haven't changed dramatically and oscillated between 11% and 12% (EC, 2017b). Road remained stable at 49% (EC, 2017b) but one should notice that road freight markets in EU were not regulated to the extent rail freight markets were. Thus, it seems that the mere market liberalization didn't suffice to bring the desired change in market share for railways. The Commission nevertheless advocates for increased use of railways in its White Papers, published on 10-year intervals (EC, 2001, 2011). The current target is that by 2030, 30% of road freight should be transferred to rail or waterborne transport (EC, 2011)

From the issues outlined, the question of whether the current Commission's long-distance transport policy is effective in terms of achieving the goals set, emerges. This Thesis will investigate this question and its purpose is to give a qualitative estimation on whether the goals set in the long-distance transportation policy of the European Union, could be achieved by the set timeframe of 2030, by employing an argumentation from the field of Law and Economics. For this particular reason, I will compare rail vs road as the two most used means of freight transportation in the European Union. The reason I have chosen road vs. rail, is to be found in the geographical position of the EU- most of the Member States are located on one piece of land, without islands (except Malta) and seas in-between. Such setting allows building roads and railways relatively easy. Indeed, in the EU, there are 5075800 km of paved road and motorways and 334300 km railways, including electrified rail lines (EC, 2017b).

Together, they represent about 97% of the whole EU infrastructure.[1] Other infrastructure objects like pipelines are designed for special types of freight and thus, issues with representativeness could emerge. Since freight transported via road can be unloaded directly at the customer's destination and thus, a door-to-door delivery can be achieved, unloading of rail freight can be done only at terminals and then, further transport to the final destination is required. Only the largest industrial complexes have direct connection to rail infrastructure on the premises of their plants. In order to overcome this issue, I will observe rail freight transport primarily in the frame of an intermodal transportation scheme. Intermodal transport constitutes a combination of several means of transport and is envisioned to exploit advantages like lower costs, less CO2, or optimizing dock space (Freightquote by C.H. Robinson 2019, para.1-4). In the context of this Thesis, "intermodal" will mean that the larger part of the haulage is performed by train. To illustrate, freight from different origins is transported to a rail terminal, then the load is transhipped to a train. The long-distance transport is executed on rail until it reaches the destination terminal. From there, trucks take the train load on smaller portions and deliver it to the various end recipients.

This Thesis is organized as follows, in Chapter 4, I will outline the political background for the EU long distance transportation policy which is implied mainly by the White Papers from 1992, 2001, and 2011. White Paper is a strategic policy document by the European Commission where legislative or political intentions are outlined. Such papers are published by the different Directorates General, typically in 10-year intervals. Each succeeding White Paper also assesses the degree of achievements made on the targets set in the preceding one. In Chapter 5, I will then introduce the adopted legislation on liberalizing the rail freight

[1] This calculation was derived from the numbers, indicated in the Statistical Pocketbook of the European Commission from 2017

sector. Chapter 6 is dedicated to the overview of scientific studies on external and operating costs of road and rail freight. The intention behind this part is to clarify whether it is feasible to promote one or the other mean of transport at all. Chapter 7 will present the conceptual framework, compiled from Chapter 4 and evaluate the crucial legal and economic policy framework undertaken or fostered by the Commission, from the viewpoint of the Law and Economics discipline, whether active to the fullest extent. Chapter 8 will then conclude.

4 The Political Background

4.1 The White Papers from 1992 and 2001

The first White Paper on Transport that the Commission released, was the one from 1992, titled "The Future Development of the Common Transport Policy". I tried to find the original text in EURlex but I didn't manage. However, the absence of the original text is not hindering my research. Since this paper is the first one on transport, one should expect rather short content and few guidelines that set the stage for legislative initiatives in that field. According to one fact sheet on the European Union from 2018, the Paper called for opening of the transport markets inside EU in order to enlarge the Trans-European Transport Network (Fact Sheets on the European Union, 2018, para.6). It was moreover an indication of steps toward achieving "integrated intermodal approach based on the model of sustainable mobility" (Fact Sheets on the European Union, 2018, para.6).

The White Paper from 2001 titled "European Transport Policy for 2010: Time to Decide" is the first pivotal document when it comes to roll out of concrete measures addressing the transport challenges of the EU. The introductory part of the paper covers various policy guidelines, addressing issues that were on the Commission's agenda at that time (EC, 2001). Attention is required to policy guideline II- "Congestion: the effect of imbalance between modes" (EC, 2001, p.12). Here, the Commission stresses that congestion has turned to a major problem throughout the Union and has emerged to dimensions, large enough to threaten the whole competitiveness of the Union (EC, 2001). As reasons for this, missing connections in the infrastructure and lack of interoperability between transport means are mentioned (EC, 2001). The impact of congestion is quantified at 10% of the EU road network being suffering from congestion as well as 20% of the railways experiencing bottlenecks

(EC, 2001). Then, a special emphasis on congestion is put, estimating the costs of it to 0.5% of the Community GDP (EC, 2001). Forecasts for 2010 show that if nothing done, costs will double and amount to 1% of the EU GDP (EC, 2001).

As one of the reasons, the Commission (2001) points out that transport users are not charged adequately for the costs they cause. Furthermore, it reads that, the price structure "generally fails to reflect all the costs of infrastructure, congestion, environmental damage and accidents" (EC, 2001, p.13). The Commission (2001) will further address this claim at different passages throughout the paper and implies already in the beginning that the problem with congestion needs to be tackled by, among other means, shifting the modes of transport from road to rail. Policy guideline III pictures some aspects of the growth in transport in an enlarged European Union, particularly relating to the upcoming enlargement of the Union in 2004, where 10 new member states were admitted (EC, 2001). This extension of the Union will influence the transport policy of the Union and make it even more difficult to implement (EC, 2001).

Policy guideline IV is targeted at integration of transport in order to achieve sustainable development (EC, 2001). This issue was even brought to the attention of the Gothenburg European Council from 2001 (EC, 2001). Apart from future considerations regarding the European Union, employment, intra-European cooperation in defence and security, transatlantic relations, sustainable development was also part of the Council (European Council Council of the European Union, 2018, para.4). The Council then called for infrastructure investments in intermodal transport as a mean to integrate effectively the different modes of transport and exploit their economic advantages (European Council Council of the European Union, 2018, para.4). Here, the Heads of State and Government

recognize that integrating modes of transport successfully will reduce the CO2 emissions as well as oil dependency because in this way, more than one mode will be used and thus, different sources of energy will be used for the transport of goods over particular distance. To present a simple example- transport of one container from Vienna to Hamburg via road will need only gasoline. Instead, if the main haulage is performed by train and trucks are used only for bringing the load from the sender to the rail terminal in Vienna and then, taking the load from the terminal in Hamburg to the recipient, then, a smaller amount of gasoline will be needed. The main part of the energy demand will be electricity, and electricity can be produced from different sources- nuclear, oil, coal, wind, etc. Such modal shift could in fact reduce the CO2 emissions and the dependency on oil because oil is not the main mean of energy employed anymore. In Chapter 6, I will investigate the issue of whether trains that run on electricity are really more environmentally friendly than trucks driving on the motorway. Nevertheless, oil dependence is a big topic for the EU because at that time, it constituted 98% share in the energy mix of the Union (EC, 2001).

Policy guideline VI summarizes the aspects, on which the Commission will focus their efforts in order to achieve the goals set. From them, 60 specific measures to be taken at EU level are supposed to emerge that will be then translated into an action plan to be completed until 2010 (EC, 2001). The aspects are summarized in Table 1 below, with brief summary on what do they cover as well as an estimation on how relevant every single one for the Thesis is.

Table 1. Comparison of the aspects from the 2001 White Paper based on relevance for the Thesis. Compiled from EC (2001).

Aspect	Summary	Relevance for the Thesis
(1) "Revitalizing the railways" (EC, 2001, p.16)	A "strategic sector", on which the success in achieving the modal shift will depend (EC, 2001). Vital to introduce competition on tracks, according to the Commission (EC, 2001).	**Very high**, it will be compared with the road counterpart in terms of external costs minimization in part 4.
(2) "Improving quality in the road transport sector" (EC, 2001, p.17)	Competitive advantage against rail in terms of flexibility but very dense competition resulting in narrow margins and pressure on prices (EC, 2001).	**Not at all** since the Commission address here primarily the problem of the working conditions for truck drivers. These conditions are of a little importance for the Thesis.
(3) "Promoting transport by sea and inland waterway" (EC, 2001, p.17)	"underused", with a potential to reduce congestion as well as to compensate for the missing railway infrastructure, in areas where rivers are provided (EC, 2001). Here, the Commission elaborates their intention to create "Motorways of the Sea" which is one of the emphasis of this White Paper (EC, 2001).	**Not at all** since the Thesis concentrates on road vs. rail and how to reduce imbalances between these 2 modes of transport.
(4) "Striking a balance between growth in air transport and the environment" (EC, 2001, p.17)	Absence of "Single Sky" is addressed as well as over-fragmentation of air management systems (EC, 2001). Aims to indroduce community legislation on air traffic are presented (EC, 2001).	**Not at all** since the Thesis concentrates on road vs. rail.
(5) "Turning intermodality into reality" (EC, 2001, p.18)	"fundamental importance in developing competitive alternatives to road transport" (EC, 2001, p.18), according to the Commission. Calls for technical harmonization and interoperability (EC, 2001).	**Very high** because throughout the thesis, rail will be primarily observed in the frame of intermodality, in order to achieve comparison with road.
(6) "Building the trans-European transport network" (EC, 2001, p.18)	One of the priorities is removing bottlenecks in railway networks but also	**Moderate**. It is about infrastructure that is absolutely necessary in

	completing roads supposed to take enhanced traffic after the enlargement in 2004 (EC, 2001). Motorways of the sea, development of airport capacities, and linking of remote regions is also addressed (EC, 2001).	order the transport modes to function normally. However, the thesis is about examining why there are imbalances between road and rail and how they can be fixed, and infrastructure issues will be touched briefly upon.
Aspect	**Summary**	**Relevance for the Thesis**
(7) "Improving road safety" (EC, 2001, p.18)	Emphasis on the dimensions of road accidents and the resulting costs to the society (EC, 2001).	**Moderate** because it can rather be seen as an implication of shifting more freight to the rail and thus, removing trucks from the highways and at the end, reducing the potential to cause road accidents.

Based on these policy guidelines, the remainder of the White Paper on transport from 2001 is concentrated on the concrete areas in which the Commission thinks it is necessary to take actions. For the Thesis the first, the second, and selected chapters from the third area are relevant.

Part 1: "Shifting the balance between modes of transport" (EC, 2001, p.23). Aspects (1), (2), (3) and (5)

Since aspects (1) and (5) are of a great importance for the Thesis, I will concentrate my analysis on them. In this part, the Commission has planned to take actions in two priority objectives: regulating competition between the different modes and connection of modes, in order intermodality to be achieved (EC, 2001). It is worth noticing that the number of pages on the first objective is 19 whereas on the second objective, only 9 pages are dedicated (EC, 2001). Moreover, on the issue of intermodality, emphasis on waterborne transport is placed, meaning that in this White Paper, the Commission prioritized short sea shipping and other port-based transportation to carry the bigger fraction of the transport over long distances (EC,

2001). Rail seems to be neglected which may negatively impact its future performance, compared to other means of transport.

a) Regulating competition between modes (EC, 2001).

The first issue that, according to the Commission, contributes to the increased competitiveness of the road sector, is the distorted regulatory framework for drivers of trucks and trains (EC, 2001). Before December 2000, there were no EU-wide regulations on the number of hours per week that the truck drivers may work (EC, 2001). This led to cases where truck drivers worked for 60 hours per week whereas their train counterparts were entitled to work on average between 22 and 30 hours per week (EC, 2001). Such imbalance distorts the competition because it makes road transport more accessible and thus, more demanded. Also, the potential for accidents on the road increases as truck drivers will be on average more tired than train drivers. This was fixed in 2000 where a cap of 48 hours weekly working time for truck drivers was introduced (EC, 2001).

"Revitalizing the railways" (EC, 2001, p.27) which is considered the second area of action in order the regulation on competition to be achieved, is by far the most comprehensive chapter. A reference to the USA is made where about 40% of the total freight is transported by rail (EC, 2001). The first major bottleneck identified by the Commission is the missing integration of rail transport into the internal market (EC, 2001). The networks are claimed to be "fragmented geographically" (EC, 2001, p.28), and this fragmentation is causing operating difficulties (EC, 2001). In order to overcome this, the Commission initiated gradual opening of the rail freight markets, starting in 1991 with a Directive requiring the railway undertakings to have separate accounts for the management of railway infrastructure and provision of transport services (EC, 2001). The concrete legislation will be discussed in the next chapter.

The Commission hoped that in changing the way railway companies are organized, transparent management will be achieved which at the end shall serve towards fair competition on tracks (EC, 2001). It is evident that opening of the rail freight market is the centrepiece of the Commission (2001)'s plans to revitalize the railways. It argues that arrival of new entrants, with experience in logistics and intermodal integration, will make the railway sector more competitive and encourage the state-owned railway undertakings to "restructure while also taking social issues and working conditions into account" (EC, 2001, p.28). In any case, the question on whether there will be new entrants at all, after allowing competition on rails, remains. Railways are one of the most capital-intensive sectors, requiring enormous investments that need time in order to bring returns. Bitzan (2003), for instance, came to the conclusion that railways are natural monopolies. His calculations showed that multiple firm operation on a single rail network is likely to increase costs (Bitzan, 2003).

The Commission also criticizes railway companies not separating infrastructure and transport operations on missing clear commercial mission, allowing them to distinguish between freight services and passenger services (EC, 2001). Some claims of malfunction are named. In Table 2, I will present them and assess whether they are justified by the mere fact that a railway operator operates both infrastructure and operations. I will also examine whether the claims are solvable through opening of the market and thus, allowing for competition on rails.

Table 2 Critical evaluation of the Commission`s claims against railway operators not separating between infrastructure and operations. Compiled from EC (2001)

Claim	Summary	Justified?	Solvable through market opening?
(1) "Companies can't count" (EC, 2001, p.29)	Railway operator cannot say, how many locomotives are currently operating. Also, exact location cannot be given (EC, 2001).	**Mostly yes**. Presence of bureaucracy in the railway company and concentrating too many responsibilities inside one unit can cause such distortions.	**Yes**. By allowing entrance of new operators with operational excellence and slim company structure, incumbents can be disciplined to operate better.
(2) "Trains don't run properly" (EC, 2001, p.29)	30-40 minutes are needed in order locomotives on a goods train to be replaced (EC, 2001).	**Depends** where change of locomotive is performed. If inside the same country, then, as with (1), the same argument applies. If change cross-border, then specificities of the infrastructure of the host country apply, and they are out of scope of the observed operator.	**Partly**, if we talk about routes inside one country. In this case, the personnel of the entrant may work more effective due to good company organization.
(3) „Missing information" (EC, 2001, p.29)	When crossing the border, the train is handed over to the operator from the other side of the border (EC, 2001). Various train information needs to be exchanged (EC, 2001). Digital information exchange is not developed thus information exchanged on paper- delivery may be slowed (EC, 2001).	**Partly**, since the railway operators are responsible for maintaining information about their own rolling stock. Not developed digital information exchange is, however, a collective problem, not of a single railway undertaking.	**No**, because in the current setting, no opportunities for effective international information exchange are provided. Only allowing for cross-border competition would not change anything.
(4) "Ghost trains" (EC, 2001, p.29)	Freight train stops to change locomotive but waits additionally	**Depends.** If we talk about a route inside one country, then yes and	**No.** Since infrastructure will remain in state hands, the issue

	for freeing of a train path (EC, 2001). Locomotive waits for a train and vice versa (EC, 2001). Lack of information on their arrival (EC, 2001).	organizational shortcomings of the incumbent are to blame. For international routes, however, not.	with the train paths will most likely not be solved. Same applies for locomotives waiting for a train and vice versa.
Claim	**Summary**	**Justified?**	**Solvable through market opening?**
(5) "One train- lots of drivers" (EC, 2001, p.29)	Different train crew requirements throughout the EU (EC, 2001).	**No**, because question of national legislation. The EU could have some instruments to influence that, but market opening is not the way.	**No**, because question of national legislation. The EU could have some instruments to influence that, but market opening is not the way.

From the analysis of the aforementioned claims, I arrive to the conclusion that claim (1) may fully be solved through opening of rail freight markets. Claim (2) may partly be solved. For all others, there have to be some accompanying measures by the Commission. When having a closer look on the remaining claims (3) – (5), I identify infrastructure and legislation issues as the common denominator that needs to be worked on, in order to solve the claims effectively. More concretely, there is a need for harmonization of information exchange (Claim (3)), more effective usage of the provided infrastructure (Claim (4)), and harmonization of legislation (Claim (5)).

The Commission addresses this issue with plans for "further package of measures to create a genuine internal rail market" (EC, 2001, p.30). Among the measures presented, one is of particular interest, namely an update of the Interoperability Directive (EC, 2001). Its aims are to harmonize technical requirements and usage provisions of all components of the railway networks (EC, 2001). Also, „a Community structure for safety and interoperability" is envisioned to be created (EC, 2001, p.30). The Commission even admits that

interoperability issues are to be tackled first (EC, 2001). An identified bottleneck of interoperability are locomotives and their technical specificities as there are different electrifications and signaling systems around the EU (EC, 2001). Safety systems, for example, differ a lot throughout the EU. Consider Figure 1.

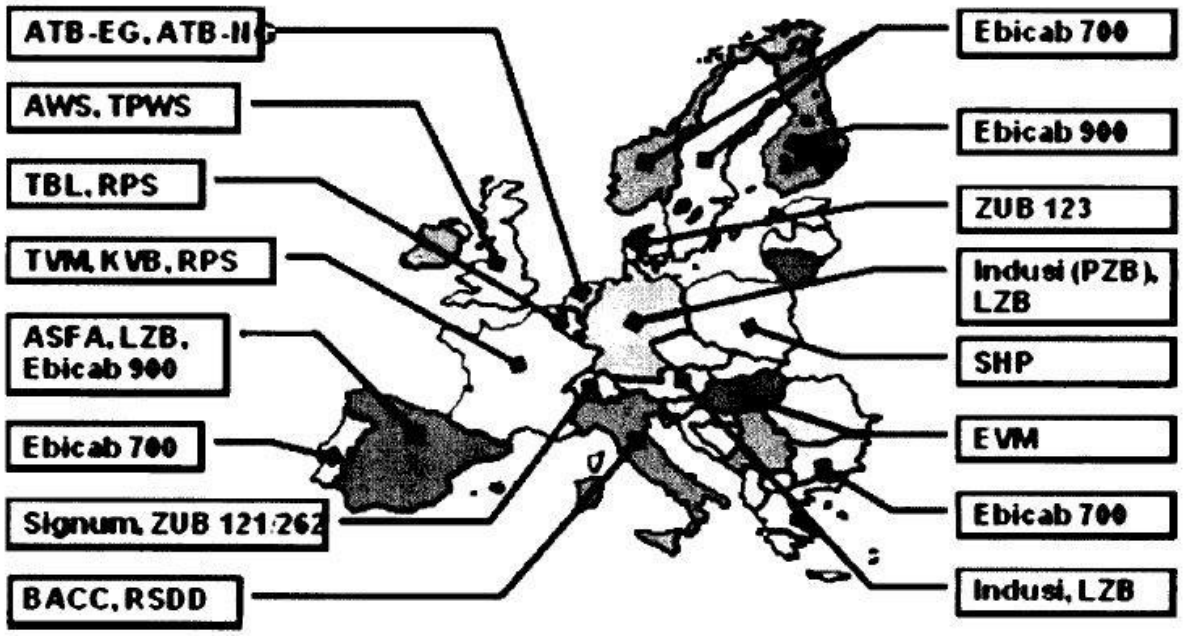

Figure 1. Comparison of safety systems throughout EU. Source: Ghijsen, Semeijn, Van Der Linden (2007)

As one can see, almost every EU Member State is having its own safety system for rail transport. Moreover, rail infrastructure of the Member States differ with respect to track conditions, gauge, type of current, and facilities (Ghijsen, Semeijn, Van Der Linden, 2007). All these differences constitute a challenge to harmonization and thus, achieving interoperability is crucial.

Road transport, on the other side, does not have these problems. Trucks are able to drive on the roads, they are equipped with own internal combustion engines, and fuel for these engines

is widely available. When crossing a border, no need for crew change or other components emerges, therefore, trucks do not need harmonization of information exchange or legislation. This provides them a competitive advantage in terms of flexibility, compared to trains. According to the Commission (2001), this has led to fractioned markets instead of a single network. The White Paper does not provide estimates on how much the technical harmonization will cost, only an educated guess of "tens of billions of euros" (EC, 2001, p.30). To conclude the interoperability part, the Commission (2001) has not planned explicitly to concentrate on interoperability but rather, sees interoperability as one of the measures to be taken. This may be of a further disadvantage for the railways because it seems there is an urgent need for harmonization. Having in mind the geographical structure of the European continent, long-distance freight transport, defined by the Commission as distance over 300km (EC, 2011), will be likely to cross borders. Cities like Hamburg, Vienna, Bratislava, Rotterdam, or Krakow are located near borders which makes international movements part of the daily trade life.

As mentioned in the introduction, rail is much safer than road and this is backed by the transport statistics (EC, 2017b). Therefore, I do not consider analyzing the part "guaranteeing rail safety" (EC, 2001, p.31). Instead, the next big measure the Commission (2001) plans to undertake in order to revitalize railways, is achieving the optimum use of provided infrastructure. Here, for the first time in the paper, it is stressed that "the rail market shows the biggest potential for growth over long distances" (EC, 2001, p.33). The identified infrastructure caveats that are hampering the development of the rail potential are removing of rail lines (600km per year) but extending highway network (1200km per year) in Europe (EC, 2001). Lack of interoperability is also emphasized here, with a historical remark that most of the railway infrastructure was built in the second half of the 19th century, reflecting

national or regional requirements (EC, 2001). At that time, the territory of the continent was dominated by few empires like British, German, or Austro-Hungarian, each of them playing on its own behalf. Since rail infrastructure is a strategic object, also designed to serve properly in case of war, there was no interest in harmonizing it.

As this infrastructure is still existing, harmonization is to be achieved. In order a Trans-European Rail Freight Network is to be established, train paths for freight (in a form of dedicated infrastructure or time slots) are to be established (EC, 2001). In this regard, the Commission has proposed some legislation, for example Directive 2001/12/EC that creates the first part of a Trans-European Rail Freight Network (TERFN) with a length of 50 000 km which is supposed to be the first step (EC, 2001). On this line, any licensed European rail company may use the network and compete with others (EC, 2001). Further plans envisaged the network to be extended to 150 000km by 2008 (EC, 2001). As of 2019, the Network encompasses 138 072km of rail lines (EC, 2019a, para.2).

b) "Linking up the modes of transport" (EC, 2001, p.41)

Here, the emphasis is placed on Intra-Community maritime transport and inland waterway transport whereas rail is barely mentioned (EC, 2001). Since waterways are outside the Thesis scope, this part will not be discussed.

Part 2: "Eliminating Bottlenecks"(EC, 2001, p.49). Aspects (5), (6), and (7)

In the context of traffic, bottlenecks can be defined as type of traffic jam where the participants are either stuck or slowed in a part of the way/road that is narrowed (vocabulary.com, n.d, para. 1). Examples are numerous and the reason was outlined in the

previous lines. For the Commission, "unblocking the major routes" (EC, 2001. p.51) and ensuring adequate funding for infrastructure projects are seen as a solution to this issue (EC, 2001). I will not observe the funding part because it is not a subject of the Thesis.

When it comes to unblocking of the major routes, one can see that there is an intention towards establishing multimodal corridors for prioritized freight movement (EC, 2001). This step is to a large extent taken from the USA where a complete rail network for freight movements is provided (EC, 2001). In Europe, on the contrary, it is often the case that passenger rail traffic is having a priority, which at the end causes the trains with goods to wait first for passenger trains- according to the Commission, this causes freight customers to prefer road because of the greater flexibility it offers (EC, 2001). In order to tackle this problem, the Commission is planning to encourage investments in gradual development of trans-European corridors where a priority to freight trains will be given (EC, 2001). Moreover, it is planned that in areas with intensive traffic, separate lines for freight and passengers should be built (EC, 2001). This is the guiding principle in the development of the network (EC, 2001). Concrete legislative measures, however, are not planned, according to this White Paper.

Part 3: "Placing users at the heart of the transport policy" (EC, 2001, p.65). Aspect (7)

This part covers mainly one aspect that is of a moderate importance for the Thesis. However, I would not neglect it because here, the Commission (2001) identifies a crucial shortcoming in charging road and rail for infrastructure use and reflects on it in the second chapter of this part. The claim is that inefficiencies have been caused by failure of confronting users with the full costs of their activities, thus causing demand to be "artificially high" (EC, 2001,

p.71). Users are treated in the same way, regardless of the infrastructure damage, bottlenecks, and pollution they cause (EC, 2001). Also here the Commission (2001) dedicated a considerable amount of content to this issue and aims to gradually replace existing transport system taxes with other instruments in order to integrate infrastructure costs with external costs.

The fundamental principle of infrastructure charging is that the charge required from the user should cover not only infrastructure costs, but also external costs like pollution, congestion, noise, accidents, etc (EC, 2001). Figure beneath shows an estimate from DG Transport on external and infrastructure costs of a heavy goods vehicle travelling 100km on a highway with little traffic.

External and infrastructure costs	Average range
Air pollution	2.3–15
Climate change	0.2–1.54
Infrastructure	2.1–3.3
Noise	0.7–4
Accidents	0.2–2.6
Congestion	2.7–9.3
Total	8–36

Figure 2. Average ranges for external and infrastructure costs. Source: EC (2001)

Average charges in form of tolls or usage stickers vary between 12 and 24 Euro throughout the Union (EC, 2001). As evident, the cost range is much broader than the range of usage charges which in fact means that numerous cases are possible where infrastructure charges do not reflect all the costs generated by heavy goods vehicles. This constellation raises the question whether the same applies to rail. In this White Paper, estimates for rail are not provided, therefore, in Chapter 7, I will investigate the charging issue between road and rail

by finding a common charging denominator, for example, weight. Since both means of transport differ throughout, I consider weight to be something that should be present in the charging scheme of rail and road due to the fact that pressure on the infrastructure is exercised by road and rail and thus, amortization on infrastructure is caused. When it comes to climate change, accidents, or noise, the comparison gets a bit tricky. From the 12-24 Euro average charges, around 8.3 Euro go for infrastructure which indicates that users are already overcharged for infrastructure usage but probably undercharged for the external costs they generate (EC, 2001).

The Commission recognizes the problem by noting that the structure of infrastructure taxes needs to be changed in order to reflect the external costs generated (EC, 2001). Legislative measures are planned to be presented in 2002, in form of Directive where the interoperability of toll systems on the trans-European road network shall be guaranteed (EC, 2001). For instance, Directive 2004/52/EC, adopted in 2004, tackles the interoperability of electronic toll systems within the community, and is still in force (Directive 2004/52/EC of the European Parliament and of the Council, 2004, pp.124-143).

In fact, aligning external costs to the road charges has been planned before this White Paper. The 1998 White Paper on Fair Payment for Infrastructure Use has proposed an integrated approach on Community level (EC, 1998). However, in the White Paper of 2001, the Commission admits that the approach is not complete (EC, 2001).

For the road sector, the aims by Commission's side are to consider more extensively the environmental costs heavy goods vehicles cause (EC, 2001). As of 2001, only partial success

has been achieved (EC, 2001). So far, the achievements are minimum charge for vehicles, maximum limits on highway network access rights as well as calculation of toll amounts (EC, 2001). The result from that is the so called "Europe of tolls" where private users pay each highway toll separately, "Europe of Eurovignettes" where the heavy goods vehicles pay an all-inclusive fee for the usage of the entire network annually, and Europe without charges (EC, 2001). Such situation is far from perfect, but at least, progress is made on the "Eurovignette" which can serve as a basis for further policy measures. As of 2001, the Eurovignette system is active in six Member States- Belgium, Netherlands, Luxembourg, Germany, Denmark, and Sweden, and charges trucks based on emissions, according to the EURO-classification and size of the vehicle, measured in number of axles (EC, 2001). It is a lump-sum charge varying from 750 to 1550 Euros per annum (EC, 2001). Although it constitutes an improvement, it is still far from sufficient because it is a fixed cost and thus, the truck driver can drive as much as he/she wishes, becoming at some point of time undercharged for the social costs he/she causes (EC, 2001). Rail, on the contrary, has managed to internalize the external costs by much larger extent (EC, 2001). Therefore, the Commission dedicates only few lines to this issue by noting only that noise-related charges have to be looked at, and if needed, introduced (EC, 2001). As of 2019, Belgium and Germany are not participating in the system anymore because they introduced the Toll Collect electronic system (DKV, 2015, para.6).

Concluding this subchapter, the areas of action that will be illuminated closely in Chapter 7, are "Shifting the balance between modes of transport" (EC, 2001, p.23) and "Eliminating bottlenecks" (EC, 2001, p.49). The reason is that these areas of action cover aspects that I considered of a high importance for the Thesis. In the following subchapter, I will examine

the aspects also from the 2011 White Paper and estimate whether they are consistent with the ones I selected here.

4.2 The White Paper from 2011

The last White Paper on transport, issued by the European Commission, dates from 2011. It is written as a roadmap "to a single European transport area" and is much shorter than the previous one from 2001. There are 4 parts of it- an introduction where the essential achievements of the common transport policy so far are outlined, relevant aspects where the Commission envisions to concentrate its efforts, outline of 4 areas of action, and a conclusion (EC, 2011).

In the following table, I will shortly outline the aspects and show, if there is an overlap with the 2001 White Paper aspects, I considered either as "very high" or "moderate".

Table 3. Outline of the 2011 White Paper aspects and comparison with those from the 2001 White Paper marked either of a "very high" or "moderate" importance. Compiled from EC (2011)

Aspect	Summary	Relevance for the Thesis	Overlap with aspects from the 2001 White Paper marked as "very high" or "moderate"?
(1) "A Single European transport area" (EC, 2011, p.10)	A "priority area", according to the Commission in order to achieve the single European railway (EC, 2011). Call for abolishment of "technical, administrative, and legal obstacles" which prevent effective international rail operations (EC, 2011).	**Very high** because it touches upon the fragmentation of the EU railway market.	**Yes**, both for the "very high" and "moderate" marked aspects.
(2) "Innovating for the future- technology and behavior" (EC, 2011, p.12)	Calls for strengthened transport research and innovation policy, in order to	**Moderate**, because the issue of interoperability is already addressed in aspect (1). Other	**Only** with 2 aspects marked as "moderate".

	reduce the oil dependence in the coming decades (EC, 2011). Standardisation and interoperability emphasized here as well (EC, 2011).	issues here are out of Thesis scope.	
Aspect	**Summary**	**Relevance for the Thesis**	**Overlap with aspects from the 2001 White Paper, marked as "very high" or "moderate"?**
(3) "Modern infrastructure, smart pricing and funding" (EC, 2011, p.14)	Emphasis of the need of Europe being united "also in terms of infrastructure" (EC, 2011, p.14). Mention of Trans-European Transport Network as well as calls for developing multimodal terminals at sea, ports, and near cities (EC, 2011). Call for transforming the road taxes according to the "polluter pays" principle (EC, 2011). Concern regarding "disparities in national road charging policies" (EC, 2011, p.16).	**Very high**, because road charging is one of the crucial policy measures that might explain the fragmented railway market.	**Indirectly** with all of them, except Aspect (7) Improving road safety
(4) The external dimension (EC, 2011, p.17)	Plan to promote the EU approach globally (EC, 2011).	**Not at all**, because it constitutes a mere diplomatic exercise.	**Yes**, both for the "very high" and "moderate" marked aspects.

From this aspect analysis, it becomes clear that the Commission is following a consistent policy in the transport sector. Moreover, those aspects identified of a „very high“ relevance for the Thesis do overlap with the aspects from the 2001 White Paper, identified of a „very high“ or „moderate“ importance. In Chapter 7, this fact will ease the analysis a lot because the distillation of relevant aspects will cover a timeline of nearly 2 decades which is in fact the whole timeframe of common European transport policy.

Already in the introduction of this paper, there are some lines that invoke skepticism regarding the ambitious targets set in the White Paper from 2001. The fact that the Paper starts with “European transport is at crossroads” (EC, 2011, p.4) and “old challenges remain but new have come” (EC, 2011, p.4), indicate shortcomings in the achievements so far. A special emphasis is to be put on the need for readdressing the way the internal market for transport is to be completed (EC, 2011). When we add also the reference to energy security, greenhouse gasses (GHG), need for infrastructure harmonization and investment, and congestion, it seems that issues previously addressed in the 2001 White Paper, are still on the table (EC, 2011). Achievements since 2001 are in the sphere of market opening for both freight and passenger transport, completion of the “Single European Sky”, increase of safety standards (passenger and freight), as well as first steps towards the Trans-European transport network. (EC, 2011).

However, these achievements seem to be only a small fraction of what is to be done in order to achieve the common European transport market. The Commission also recognizes it and concentrates on 3 action areas that form the vision for a competitive and sustainable transport system (EC, 2011).

a) "Growing transport and supporting mobility while reaching the 60% reduction target" (EC, 2011, p.6)- all aspects.

Here, the Commission envisions to combine greenhouse gasses (GHG) targets with more efficient means of transport (EC, 2011). The ultimate purpose is to reduce oil dependency of the transport sector which is by far the biggest consumer of oil and gas (EC, 2011). In the 2001 White Paper, intermodal transport was mentioned at several places but here, it starts already in the beginning (EC, 2011). Its advantages are to be found in the more effective infrastructure use as well as better resource utilization (EC, 2011). Here, the Commission breaks transport into 3 segments- short, medium, and long-distance transport (EC, 2011). This area of action is completely consistent with both areas of action identified as highly relevant under the 2001 White Paper because from one side, intermodality shifts the balance between modes of transport. From the other, reducing oil dependency to a larger extent will be only possible, if cross-border freight movements occur. For that reason, bottlenecks have to be eliminated.

b) "An efficient core network for multimodal intercity travel and transport" (EC, 2011, p.7)- aspects (1) and (2).

According to Commission's estimates, for short distances, the market will be rather dominated by trucks, but for longer distances, there is potential for road decarbonization and multimodality can be one of the means to achieve it (EC, 2011). Contrary to the 2001 White Paper, here, the Commission openly advocates freight multimodality as an alternative to truck transport (EC, 2011). In order to achieve that, capacity upgrades in the rail network will be needed as well as interoperability (EC, 2011). Here, it seems that not much have been done since the last White Paper. This area of action is consistent with both "Shifting the

balance between modes of transport" (EC, 2001, p.23) and "Eliminating bottlenecks" (EC, 2001, p.49) from the previous White Paper because both of them are mentioned here.

c) "A global level playing field for long-distance travel and intercontinental freight" (EC, 2011, p.8).

This area of action is not relevant for the thesis since it concerns maritime transport which is out of observation scope.

d) "Clean urban transport and commuting" (EC, 2011, p.8)- aspects (1), (2), and (3).

This area of action concentrates rather on passenger urban transport but some lines are also dedicated to freight transport, passing through cities (EC, 2011). The Commission (2011) points out particularly the shortcomings in efficiency of the so called "last mile freight transport". This can be understood as transport from the terminal to the end customer (Cerasis, 2018, para.2). This "last mile" is problematic because it carries up to 28% of the total transportation costs (Cerasis, 2018, para.1). Wygonik and Goodchild (2016) for example estimated that increased road density enhances the CO2 emissions generated through delivery from depot to final customer. The Commission seems to be aware of this fact and advocates use of "intelligent transport systems" as well as "low-emission urban trucks" (EC, 2011). Among others, the target is to reduce congestion (EC, 2011). This area of action is consistent with "Shifting the balance between modes of transport" (EC, 2001, p.23) because efficiency issues can only be resolved if there is an effective balance shift between the modes. If such balance shift happens, then there would be incentives for research and development in order to solve the "last mile problem".

Based on these action areas, the Commission (2011) formulates 10 goals in order competitive and efficient transport system, in line with the 60% GHG emission reduction target to be achieved. These goals are summarized under targets that are expected to be fulfilled if all the potted goals are done.

The 2011 White Paper is the first one that sets a target for optimizing the performance of multimodal logistic chains and using more energy-efficient modes (EC, 2011). There are two separate goals that, in essence, call to move 30% of road freight over 300km to rail or waterborne transport by 2030 and more than 50% by 2050 (EC, 2011). Helping measures for that should be the facilitation of "efficient and green" freight corridors as well as development of adequate infrastructure (EC, 2011). The other significant goal in order performance of multimodal logistics to be improved, is completion of fully interoperable Trans-European Train network by 2030 (EC, 2011). As helping goals, one can identify establishing a "framework for European multimodal transport information, management and payment system" as well as moving towards "user pays" and "polluter pays" (EC, 2011, p.9) which implies that users of the transport infrastructure should pay fully for the externalities they cause. The stance on interoperability will be illuminated in Chapter 7.

Both issues of interoperability as well as multimodality appear in the 2001 White Paper as well (EC, 2001, 2011). Multimodality was not much emphasized in the 2001 White Paper but in that one, it is much more strengthened (EC, 2011). This gives additional credibility of the selection of the multimodality aspect. Interoperability, on the other side is equally tackled in both White Papers (EC, 2001, 2011). It needs to be emphasized that the Commission (2001) pointed out that interoperability issues need to be "resolved first" before moving to other measures. The fact that there are still unsolved aspects of interoperability leads to the

assumption that moving from road to rail in the percentage the Commission (2011) envisions, will be hard.

Why the Commission defined distance over 300km as long, can be seen as arbitrary to some extent. One possible explanation could be the fact that in the cost structure of railways, the so called "initial-end operating costs" occupy a considerable part of their total operating costs. These costs cover all activities related to the freight handling upon departure and arrival (Ivanova, 2009). In the case of an intermodal configuration, the movement truck-rail terminal related to it, is also included in these costs (Ivanova, 2009). Such costs are fixed and must be paid, regardless of the distance covered (Ivanova, 2009). The trucking counterpart is also having such costs, however, the extent is smaller. It takes namely less effort to load a single truck than a train with 40 waggons for example. Therefore, from such cost perspective, it is feasible to transport goods via train over long distances, in order to distribute more evenly the "initial-end operational costs" through the distance covered (Ivanova, 2009).

On that occasion, it is worth to investigate, what are the literature findings and whether there is a "break-even" distance, that is, a distance, after when surpassed, makes one mean of transport more affordable than another one (Kim & Van Wee, 2011). As transport patterns throughout Europe, in terms of infrastructure, costs (internal and external), subsidies, etc are different, finding an unique break-even distance could prove difficult.

Sahin, Yilmaz, Ust, Guneri, Gulsun, Turan (2014) investigated break-even distance of road vs. intermodal transport for Turkey. For the intermodal configuration road-rail, break-even distance is 1200km and if we talk about rail transportation only, then, it becomes

economically feasible only after 380km (Sahin et al., 2014). Janic (2008), analysing freight inputs from different European countries, discovered the so called “economies of distance”, that is, with increasing door-to-door distance, the average internal costs increase more than proportionally. These economies are more distinct in the case of intermodal transportation than the road counterpart (Janic, 2008). Break-even distance seemingly also depends on the type of train involved in the intermodal haulage (Janic, 2008). There seem to be differences between conventional intermodal freight trains (CIFT) and long intermodal freight trains (LIFT) (Janic, 2008). The former are trains, consisting of 25-30 wagons, 20 meter each, running at a speed of maximum 120 km/h, with average speed being 40-50 km/h. (Janic, 2008). The latter trains are basically an extended version of CIFT, having 38-48 wagons but due to this size, such trains are able to have maximum operating speed of 90 km/h while the average speed is 45 km/h. (Janic, 2008). CIFT are more profitable than road transport if the distance exceeds 1100 km (Janic, 2008). LIFT, on the other side, can help significantly in reducing the break-even distance because when used, then, after 600-700 km, LIFT have lower operating costs (Janic, 2008). Since Chapter 6 is dedicated to the external costs of road vs. rail, I have included here only evidences on operating (internal) costs.

The aforementioned results can serve as a credibility source for Commission’s programme but still, in order all types of trains to be used extensively, haulage distance need to be over 1000 km which is not the case for the most transport operations throughout Europe. Nevertheless, the potential of LIFT can be exploited more heavily.

5 The Legislative Background

5.1 The First Railway Package

The First Railway Package is the first series of legislation acts by the Commission towards achieving a single European railway area. It consisted of 3 Directives, adopted in the time between nineties and the new Millennium (EC, 2019b, para.1-3): "Directive 91/440/EEC on the development of the Community's railways" (Council Directive 91/440/EEC, 1991, pp.25-28), "Directive 95/18/EC on the licensing of railway undertakings" (Council Directive 95/18/EC, 1995, pp.70-74), and "Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification" (Directive 2001/14/EC of the European Parliament and of the Council, 2001, pp.29-46). None of the three directives are in force as of 2018 because in 2012, a recast of these directives has been placed (Directive 2012/34/EC, 2012 of the European Parliament and of the Council, pp. 32-77). Broadly speaking, a recast is a procedure where a part of a legal document is altered whereas the part not altered is kept unamend (Client Earth, 2016, para.2). Besides amending, recast also allows including content from other legislative documents. In this way, a change of substance is possible.

Therefore, the first railway package is, as of 2018, a single "Directive 2012/34/EU on establishing a single European railway area" (Directive 2012/34/EU of the European Parliament and of the Council, 2012, pp.32-77). For the sake of simplicity, I will shortly outline only selected chapters from the Directive because there are many technicalities involved that do not really contribute to the scope of the Thesis.

Chapter I starts with “General Provisions” (Directive 2012/34/EU of the European Parliament and of the Council, 2012, pp.38-40) which is the typical approach in EU legislation. Article 1 lays down subject matter and scope, that is, aspects covering “the rules applicable to the management of railway infrastructure and to rail transport activities of the railway undertakings…” (I), “the criteria applicable to the issuing, renewal or amendment of licenses by a Member State…” (II), and “the principles and procedures applicable to the setting and collecting of infrastructure charges and allocation of infrastructure capacity…” (III) (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.38). For the scope of this Thesis, aspect (I) and partly (II) are appropriate for outlining. Aspect (III) surpasses the scope and thus, will not be considered.

Chapter II of the Directive is dedicated to the first aspect (Directive 2012/34/EU of the European Parliament and of the Council, 2012, pp.40-46). Here, Article 4 states that Member States are obliged to ensure that railway undertakings are independent from the state in terms of management, administration, internal control, accounting etc. (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.40). Also, the assets, budgets, and accounts shall be separate from those of the State (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.40). In order to avoid misinterpretation- making railway undertakings independent from State doesn’t mean railways have to be privatized. Instead, the management board can, for example be appointed by the State, but his or her actions shall not be influenced by the State. This is a compromise solution between privatizing and having the railways in full State authority. Bearing in mind the way railways are organized in the Member States as well as their importance to the State themselves, one can say that this solution is intended to satisfy everyone. In the succeeding article, railways of the Member States are requested to act in the spirit of the market by “providing efficient

and appropriate services at the lowest possible cost for the quality of the service required" (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.41). The aim is to achieve the efficiency that a company can have when operating in an oligopolistic market. Whether this efficiency will be achieved, depends on the incentives set, because it is likely that the situation will remain a monopoly due to the reasons I elaborated in the previous chapter.

These incentives can be found in Article 6 and 7 (Directive 2012/34/EU, 2012 of the European Parliament and of the Council, pp.41-42). Article 6 is about the obligation for Member States to create separate profit and loss accounts as well as to keep and publish balance sheets (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.41). These 2 actions shall hold for both infrastructure and passenger transportation (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.41). It shall also be prohibited that subsidies or other public fund transfers are moving from infrastructure to passenger or vice versa (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.41). This separation is supposed to be not only on paper but either in a form of divisions or separate entities, and it should serve towards providing access to railway infrastructure for companies that do not own it or do not themselves provide any rail transport services (Directive 2012/34/EU of the European Parliament and of the Council, 2012, pp.41-42). The main purpose of it is to provide open and non-discriminatory access to incumbents wishing to offer rail services on the territory of different Member States.

Section 4 of the Directive outlines both the conditions of access to railway infrastructure as well as the conditions of access to services (Directive 2012/34/EU of the European Parliament and of the Council, 2012, pp.43-45). Regarding freight, there are not many details

on it, contrary to passenger services. It says only that right to access of infrastructure shall be granted under "equitable non-discriminatory, and transparent conditions" (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.43). Types of rail freight services are not constrained, and access is supposed also to include accesses to ports (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.43). Such legal setting allows effectively for intermodal operations as well. When it comes to services, the same conditions as infrastructure apply, especially regarding the organization of the service facility which is supposed to be also independent from the governing body, "in organisational and decision-making terms" (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.44). Separation of accounts- balance sheet and profit and loss accounts also applies (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.44). Article 13 lays down conditions for refusal of request for operating foreign railway services which hold only if there are "viable alternatives" (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.44). This is supposed to prevent investments by the service operator in order to satisfy all requests (Directive 2012/34/EU of the European Parliament and of the Council, 2012, p.44).

Unfortunately, the body of research, aiming to investigate the impact of such reforms to the railway undertakings, is limited. Attention is required to C.A.Nash, Smith, van de Velde, Mizutani, and Uranishi (2014) whose study had a twofold aim- quantitative evaluation of the vertical separation impact on costs of railway undertakings and qualitative identification of some incentive misalignments that occurred in the aftermath of the adoption of the railway packages. The empirical findings testify that the effect of vertical separation varies with train density, that is, low levels of train density contribute to reduced costs after vertical separation but as soon as levels approach the average, little impact is observed (C.A.Nash et al., 2014).

Another interesting empirical finding is that as long as fraction of freight distributed through the network increases, then cost reductions from vertical separation disappear, and one possible explanation could be the increased coordination efforts, since there are expected to be more rail operators (C.A.Nash et al., 2014). Competition is found not to have any significant effect on costs (C.ANash et al., 2014). The authors also identified the fact that separation between service and infrastructure operation cause the separated entities to act in their own interest and thus, creating held-up investment opportunities in various technical assets, not developing networks in line with market requirements, or suboptimal combination of assets (rolling stock, track, personnel) (C.A.Nash et al., 2014). This enables excessive costs of production or externalities from efficiency savings from one's party actions and so incentives are misaligned, implying it in the costs (C.A.Nash et al., 2014).

5.2 The Second Railway Package

The Second Railway Package has been adopted in 2004 and included various directives that underwent a recast throughout the years (EC, 2019c, para.1-2). A particular attention is to be paid to Directive 2001/14/EC which is currently amended and consolidated into Directive 2004/49/EC (Directive 2004/49/EC of the European Parliament and of the Council, 2004, pp.44-113). Nevertheless, I deem important to outline the key features of Directive 2001/14/EC because it is about allocation of railway infrastructure capacity, but the document also sets the agenda towards levying charges for the use of railway infrastructure (Directive 2001/14/EC of the European Parliament and of the Council, 2001, pp.29-46).

In Article 5 of the Directive, again the non-discriminatory principle in granting infrastructure usage rights is emphasized (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34). Also, the minimum access package is determined, that is, the set of infrastructure objects that are to be granted for usage to the requesting side (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34). Rejection of access requests is allowed only under certain conditions, similar to Chapter 5.1 of this Thesis (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34). Article 6 is interesting because it tries to prepare the infrastructure managers for the new market environment by obliging them to lay down conditions in order to ensure that their accounts will be balanced (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34). It goes even further by allowing Member States to cut funding to infrastructure managers for routes where rail is able to compete with other modes of transport (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34).

Principles of charging for infrastructure are outlined in Article 7 and the important aspects are as follows (Directive 2001/14/EC of the European Parliament and of the Council, 2001, pp.34-35):

- The costs caused by operating rail services shall be covered (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34).
- It is possible that charges reflect scarcity in capacity on a certain segment of a train route during congestion (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.34).
- Environmental effects caused by train operations can be reflected in the calculation of infrastructure charges, but this shall only be allowed if also competing modes of transport are charged in the same way (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.35).

As one can see, Parliament and Council recognize the fact that external costs shall also be covered in the calculation of usage charges, especially when it comes to environment (Directive 2001/14/EC of the European Parliament and of the Council, 2001, pp.34-35). It is also important to emphasize that in this Directive, the Commission recognizes the fact that railway undertaking are natural monopolies and thus, forbids trade of infrastructure capacity (Directive 2001/14/EC of the European Parliament and of the Council, 2001, p.36).

Part of the Second Railway Package is also the creation of a European Railway Agency, performed through Regulation 881/2004 (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, pp.1-43). This Regulation is repealed by Regulation 2016/796 (Regulation (EU) 2016/796 of the European Parliament and of the Council, 2016, p.43) but again, I deem appropriate to outline the initial regulation. This European Railway

Agency is supposed to be in charge of the actual implementation of the Community legislation (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, p.9). In particular, the main mandate of this agency is to drive forward the interoperability of railway systems as well as to develop a common approach to safety on European level (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, p.9). The Agency, however, is not entitled to create legally binding acts but rather recommendations and opinions to the Commission (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, p.10). Consultation with social partners and rail freight customers and passengers, are foreseen (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, pp.12-13). With regards to common safety methods (CSM) and common safety targets (CST) that are to be drawn up by the agency, every one of them is supposed to be accompanied by a cost-benefit analysis upon submitting (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, pp.13-14). Reporting on the safety performance is to be borne every 2 years and made public (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, p.15). The succeeding chapters of Regulation 881/2004 cover in more details interoperability, maintenance of vehicles, railway staff, etc. (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, pp.15-43) This regulation is a cornerstone in achieving the technical harmonization that could prove crucial for allowing a common European Railway Network, free of boundaries.

5.3 The Third Railway Package

This package was adopted in October 2007 and, as the other two packages, consisted of various directives and regulations (EC, 2019d, para.2). For the Thesis, only Directive 2007/59/EC is of relevance since it covers rail freight transport (Directive 2007/59/EC of the European Parliament and of the Council, 2007, pp.51-78). All other documents are targeted at passenger transport and that is outside Thesis scope.

Directive 2007/59/EC undertakes steps towards unifying certification of train drivers (Directive 2007/59/EC of the European Parliament and of the Council, 2007, pp.51-78). After the creation of the European Railway Agency that is tasked to contribute to the technical interoperability (Regulation (EC) No 881/2004 of the European Parliament and of the Council, 2004, pp.18-22), in order cross-border movements to be made possible, on the side of the drivers, there should also be some unifications to be performed because otherwise, bottlenecks in terms of inability to drive the trains could occur. In order this to be avoided, Directive 2007/59/EC lays down the necessary conditions (Directive 2007/59/EC of the European Parliament and of the Council, 2007, pp.56-57) for train drivers to obtain a license for driving on particular infrastructures (Directive 2007/59/EC of the European Parliament and of the Council, 2007, p.56) that shall be valid throughout the Union (Directive 2007/59/EC of the European Parliament and of the Council, 2007, p.56). Such conditions are covered in Chapter III and include minimum age, linguistic knowledge, and professional qualifications (Directive 2007/59/EC of the European Parliament and of the Council, 2007, pp.56-57). The basic requirements are about primary/secondary education, basic training, physical and psychological fitness as well as general professional competence that is to be checked via relevant examination (Directive 2007/59/EC of the European Parliament and of

the Council, 2007, p.57). All these shall ensure that European train drivers are treated equally, in order to navigate in the new environment.

6 The External Costs Dimension- Road vs. Rail

6.1 CO2 Emissions

The question, which mode of transport emits more CO2 emissions, is legitimate for several reasons- first, these emissions are easy to measure and second, they constitute the most visible external cost because emitting CO2 in the air causes environmental disbalances. Transport, being dependent to a large extent on fossil fuels, is emitting more GHG, compared to manufacturing industries, commerce, or agriculture (EC, 2018). Consider the figure below.

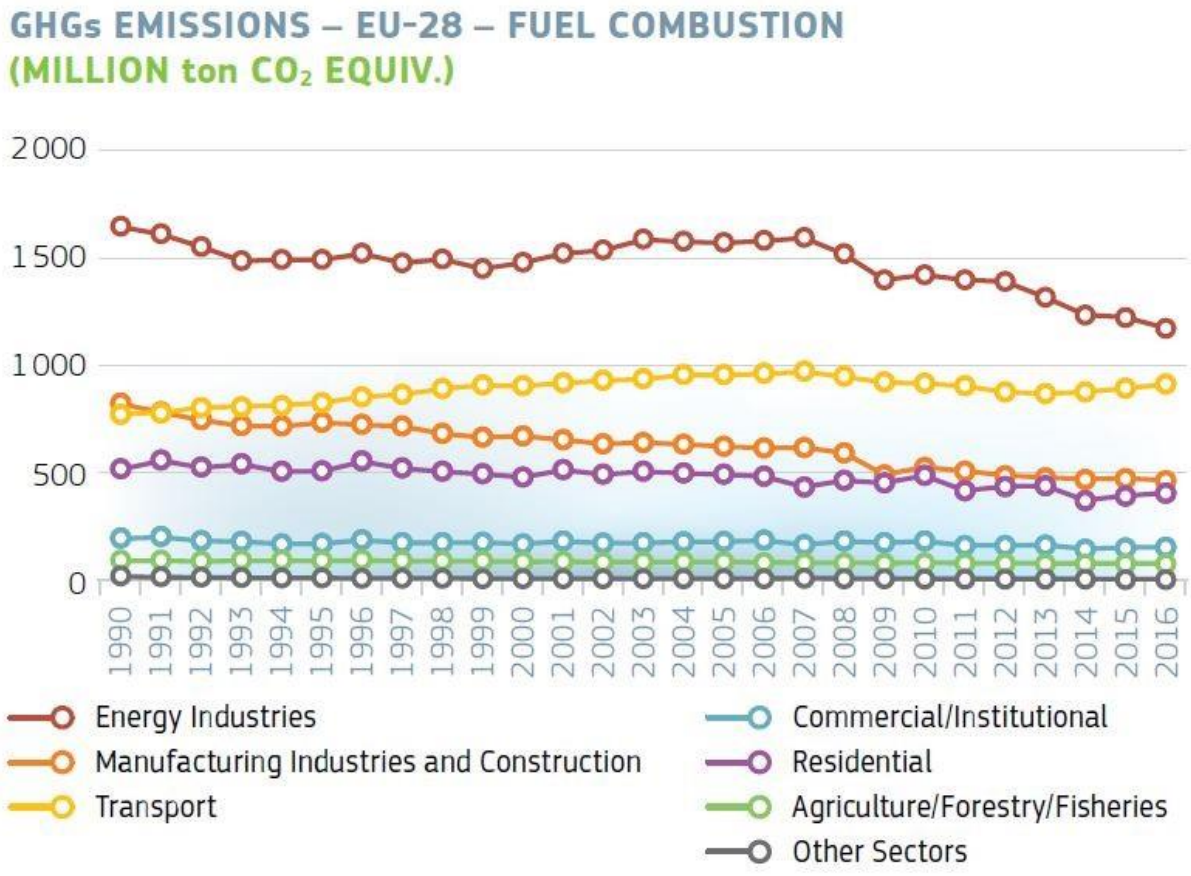

Figure 3. Comparison of CO2 emissions in the EU. Source: EC (2018)

As evident from figure 3, transport is indeed likely to cause environmental disbalances. This raises the issue that a potential shift of goods transport from road to rail may contribute to lowering the GHG emissions. This subchapter will examine several key articles on this aspect and state whether rail really emits less CO2 emissions than road.

Earlier studies examined the CO2 emissions in the context of door-to-door transport for truck-only configurations and terminal-to-terminal transport for intermodal systems (Kim & Van Wee, 2008). Such examination does not deliver the full picture of the CO2 emissions because in the case of an intermodal system, there is a need to further transport the loads from terminals where trains disembark, to the destination of the recipient. For the loading procedure of the trains to embark, the same procedure holds. This also causes CO2 emissions, especially bearing in mind that terminal-destination and origin-terminal transport is performed by trucks (Kim & Van Wee, 2008). In order to exemplify, consider the following figure.

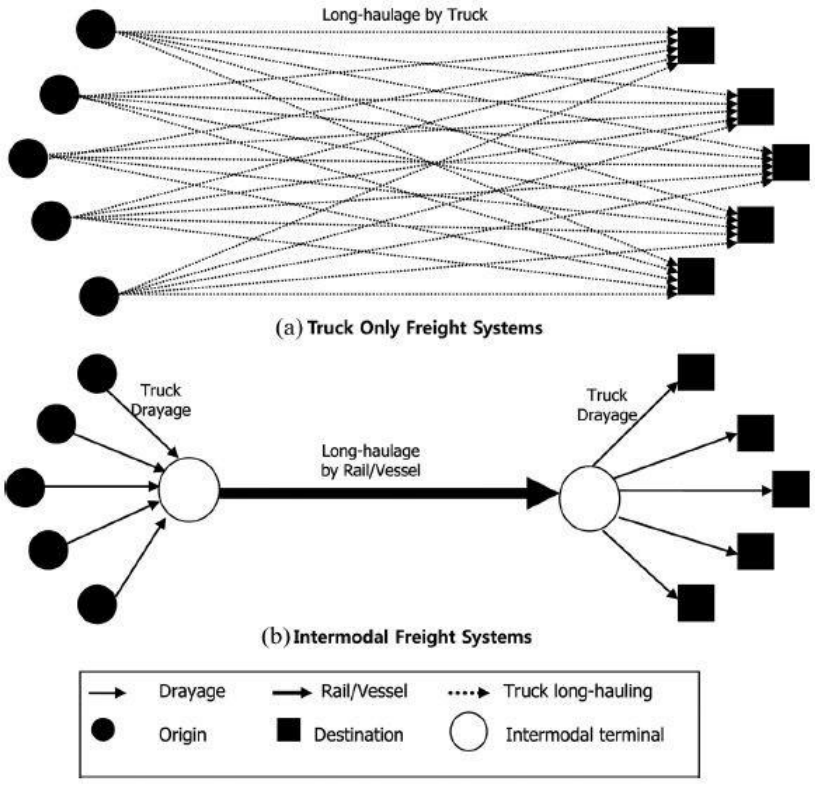

Figure 4. Graphical representation of intermodal vs. truck-only configuration. Source: Kim & Van Wee (2014)

Another issue that remained scarcely considered according to Kim & Van Wee (2014) is the fact that terminal operations also cause CO2 emissions, for example when electric cranes, forklifts, reach stackers and lighting are in operation. Since trains do not emit directly CO2 but rather, the way of production of the electricity in terms of sources used- coal, nuclear power, oil/gas, renewables, etc do, consideration of different production scenarios need to be applied (Kim & Van Wee, 2014).

There are different methodologies for calculating transport emissions and energy consumption. Methodology for Calculating Transport Emissions and Energy Consumption (MEET) from 1999 can consider production emissions of fuel as well as partial consideration of the sources of production of electricity (Kim & Van Wee, 2014). However, combination of freight modes is not applicable (Kim & Van Wee, 2014). In 2000, the European Commission proposed another model, called Real Cost Reduction of Door-to-Door Intermodal Transport (RECORDIT) (EC, 2019e, para.1). It is based on MEET but is now able to compare emissions of whole transport systems (Kim & Van Wee, 2014). The model is again not perfect since it estimates full costs where external costs are internalized in monetary terms (Kim & Van Wee, 2014). With internalization of external costs, it is meant that the transport providers do pay 100% for all external costs they cause. So far, however, the reality is different because, as discussed in Chapter 4, external costs transport modes cause, are not completely internalized. Nevertheless, RECORDIT can give an accurate measure on what happens with the costs if the Commission achieves all its plan to a full extent.

Kim and Van Wee (2008, 2009, 2014) devoted a considerable amount of research to the emissions of CO2 coming from intermodal and road-only freight transport. Their paper from

2009 compared the emissions coming from trucks, diesel and electric trains as well as factors that influence them (Kim & Van Wee, 2009). They used the Life-Cycle assessment (LCA) in order to make comparisons at system level possible (Kim & Van Wee, 2009). This method of assessment is appropriate for the comparison rail vs road because electric trains do not emit directly CO2 but rather, use already produced electricity from different sources (Kim & Van Wee, 2009). The LCA model considers this issue (Kim & Van Wee, 2009). For trucks, the authors considered hot and cold emissions (Kim & Van Wee, 2009). The latter are the emissions that are dispensed immediately after the engine is turned on and the former are the emissions afterwards (Kim & Van Wee, 2009). For diesel powered trains, in addition to their movement-related consumption, rolling stock properties like weight, stop spacing, and speed are taken into consideration (Kim & Van Wee, 2009). The third transport mean used in the study are electric powered trains which do not emit CO2 emissions at all but rather, the emissions used in the electricity production need to be considered (Kim & Van Wee, 2009). The pollution potential from the different sources is as follows: coal-fired power stations (959.2 g/kWh), oil-fired power stations (818.6 g/kWh), combined cycle gas turbines (447.5 g/kWh), and nuclear power stations (4 g/kWh) (Kim & Van Wee, 2009). The electricity consumed for loading/unloading and lighting at intermodal terminals is also considered (Kim & Van Wee, 2009). Here, the consumption factor is 5.33 kWh/20 foot equivalent unit (TEU) (Kim & Van Wee, 2009). The scenario used in the study is moving of 1000 TEU containers at a given constant speed (Kim & Van Wee, 2009). The results are summarized in the figures beneath.

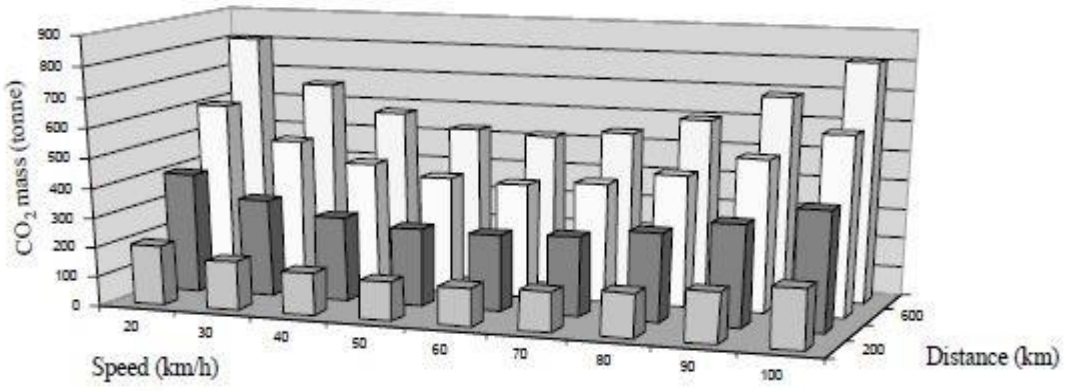

Figure 5. Emissions from truck-only movement. Source: Kim & Van Wee (2009)

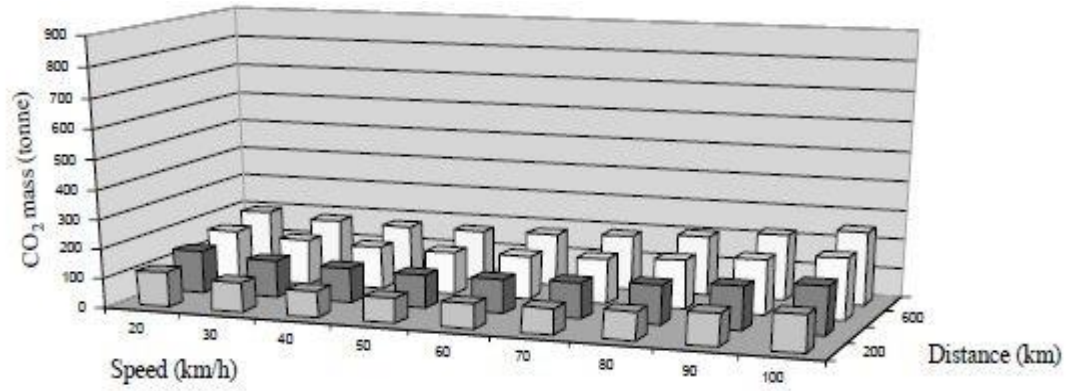

Figure 6. Emissions from diesel powered trains. Source: Kim & Van Wee (2009)

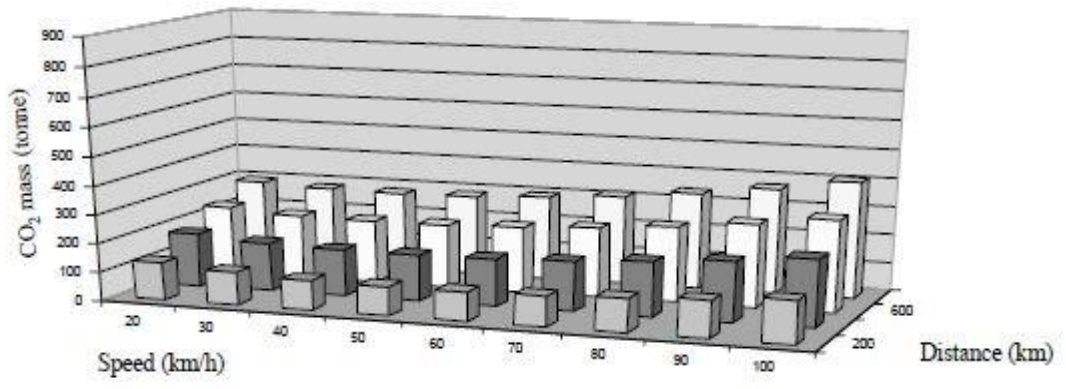

Figure 7. Emissions from electric trains. Source: Kim & Van Wee (2009)

What one can conclude from these results is that intermodal systems, where the main part of the haulage is performed by either diesel or electric trains, emit substantially less CO2 than truck only haulage (Kim & Van Wee, 2009). In addition, the emissions increase in the case of diesel or electric trains is much lower when increasing the speed than with truck only haulage (Kim & Van Wee, 2009). This indicates that train-based systems are less sensitive to speed (Kim & Van Wee, 2009). The electricity produced for the electric powered trains reflects the typical EU-energy mix which is 35% nuclear, 30% coal/oil, 14.5% hydro, and 9% gas (Kim & Van Wee, 2009). Some other production scenarios are also considered by the authors and the results are as follows (bar labels on the next page).

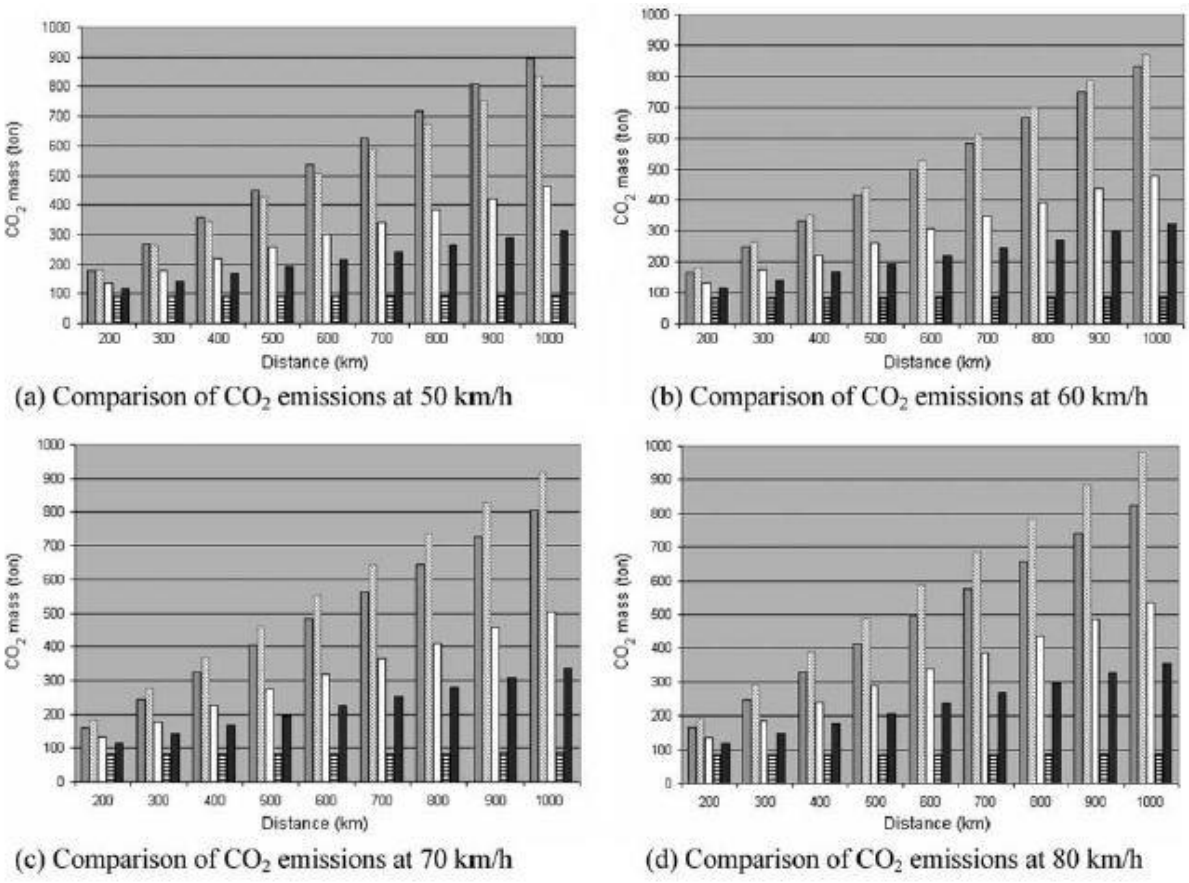

Figure 8. Comparison of CO2 emissions between truck-only and intermodal configuration, at different speeds and different electricity production scenarios. Source: Kim & Van Wee (2009)

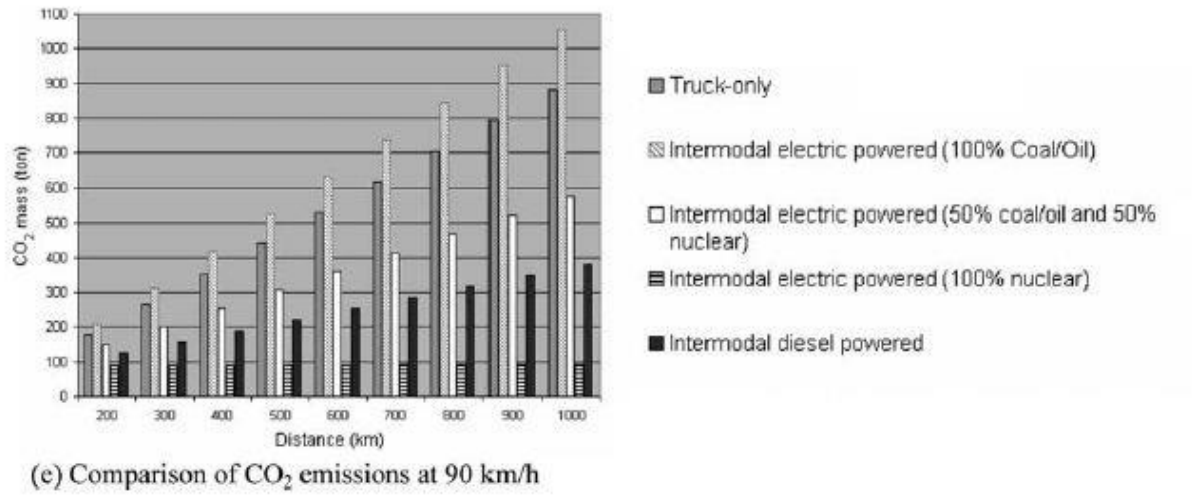

Figure 9. Comparison of CO2 emissions between truck-only and intermodal configuration, at different speeds and different electricity production scenarios, with bar labels. Source: Kim & Van Wee (2009)

As one can see, intermodal electric powered with 100% nuclear is the most environmentally friendly mean of transportation, followed by intermodal diesel powered (Kim & Van Wee, 2009). When the electricity is generated through coal and oil at 100%, however, CO2 emissions are even higher in comparison with truck-only systems (Kim & Van Wee, 2009). This study offers interesting insights in the question on which mode of transport is more environmental friendly. In the following lines, I will introduce one concrete application of this model on the Western-Eastern Europe corridor, that is, the distance between Rotterdam, the Netherlands and Gdansk, Poland (Kim & Van Wee, 2008).

Kim and Van Wee (2008) investigated how much CO2 will be emitted by moving 1000 containers from 50km distance around Rotterdam to 50km distance around Gdansk by using again the LCA model. For truck-only transportation, 1000 truck trips will be needed whereas for the intermodal transportation, 28 trips will be needed, by assuming that trains carry 3 20-foot containers per wagon, having a loading factor of 75% and total of 25 wagons (Kim & Van Wee, 2008). Again, several electricity production scenarios are considered, summarized in Figure 10.

	Freight Systems	Electricity Scenarios
Alt 1	Truck-only system (TO)	
Alt 2	Diesel powered train intermodal systems (DI)	
Alt 3	Electric powered train intermodal systems (EI 1 to 4)	EI-1: EU average: 35 % nuclear, 30 % coal/oil, 14.5 % hydro, and 9 % gas) (*28*)
Alt 4		EI-2: 100% coal/oil
Alt 5		EI-3: 100% nuclear
Alt 6		EI-4: 50% coal/oil, 50% nuclear

Figure 10. Production scenarios for the application of the model. Source: Kim & Van Wee (2008)

The results are as follows:

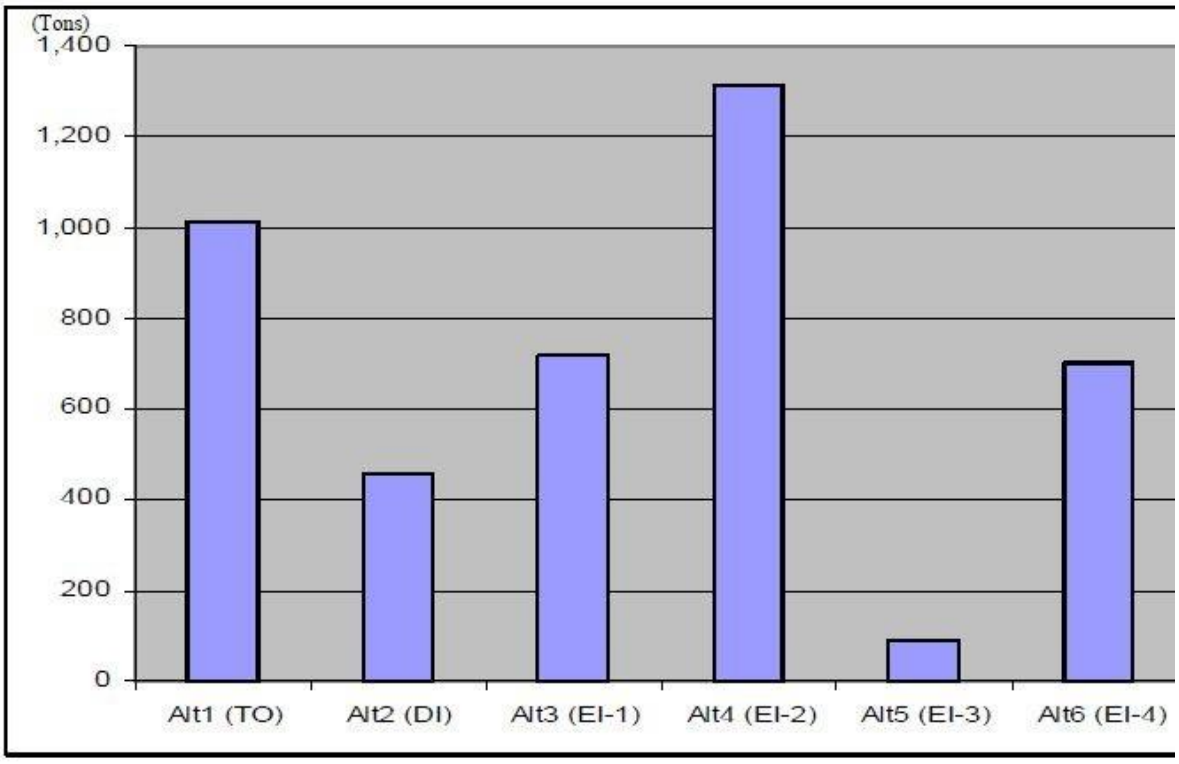

Figure 11. CO2 emissions, according to the different alternatives and electricity production scenarios. Source: Kim & Van Wee (2008)

As evident from the figure above, intermodal transport does not necessarily emit less CO2 than truck-only transport (Kim & Van Wee, 2008). If the electricity source is coal/oil, then truck is the more environmentally friendly option (Kim & Van Wee, 2008). Diesel-powered trains, despite emitting CO2 directly, perform better than all other alternatives, except nuclear power (Kim & Van Wee, 2008). An extension of the study showed that if drayage distance (distance between terminal and origin) increases to 70km, intermodal short sea shipping systems emit less CO2 than all other means, except intermodal train-based systems with nuclear power being the source of electricity (Kim & Van Wee, 2014). This might indicate that the trucks used for drayage have very CO2 intensive engines. Kreutzberger Macharis, Vereecken, Woxenius (2003) confirmed it one summary paper where in the observed case, trucks used for pre-and post-haulage emitted 48 litres/100km, compared with 35 litres/100km when driving on long distance. Many EU countries, however, are undertaking measures in order to abandon nuclear power as energy source due to its unsustainability in terms of nuclear waste and the limited possibilities in disposing it. Therefore, it is questionable whether promoting usage of nuclear energy for generating electricity in order to reduce the CO2 emissions from transport will be politically acceptable in the near future. Kreutzberger et.al (2003) for example, noted that all studies that examined CO2 emissions coming from rail vs. road before 2003, excluded the examination of environmental disadvantages that occur from the production of nuclear energy.

Janic & Vleugel (2012) developed a model for estimating savings in externalities that could be achieved when trucks are substituted with trains. Applying the model to a particular case where a distance between Netherlands and Greece/Turkey is considered, it was estimated that on a weekly basis, freight trains would emit 667 tons of CO2 per week, compared with 1031 tons of CO2 per week or in other words, rail emits only 66.7% of the truck CO2 emissions

(Janic & Vleugel, 2012). Here, one should note that with respect to trains, terminal to terminal journey is considered (Janic & Vleugel, 2012).

Bouchery and Fransoo (2015) went even further in estimating not just the shift from road to rail, but the particular shift from road to intermodal. By using a Manhattan distance simulation, they arrived at several interesting insights: first, maximizing modal shift do not contribute to achieving the minimum of CO2 emissions (Bouchery & Fransoo, 2015). With maximizing modal shift, it is meant that a bigger distance is covered by intermodal transportation (Bouchery & Fransoo, 2015). Instead, after reaching particular distance, CO2 emissions start to increase again (Bouchery & Fransoo, 2015). It appears there is a so called "CO2 optimal point". Moreover, if the transhipment terminal is located further away from the origin where the goods are transhipped, then this seems to have a positive impact on the carbon emissions (Bouchery & Fransoo, 2015). The paper also arrives at the conclusion that intermodal transportation can be feasible for short and medium distances if volume transported is big and origin/destination drayage distances are low (Bouchery & Fransoo, 2015). This is in contradiction of Janic (2008) findings from Chapter 4 but it is worth to mention that his investigations did not include volume of transported goods (Janic, 2008). Moreover, since the results of both studies are based on a simulation where the scope can be altered arbitrarily, statements about the reality are difficult to make. Especially interesting is the "CO2 optimal point" which would be difficult to estimate in the reality because it depends on the distance that was investigated in perfect conditions.

6.2 Accidents

Accidents are another visible external cost but there are certain quantification problems. Whereas the official statistics can capture number of injured or death, quantifying the expression of these circumstances in financial terms is difficult and sometimes arbitrary. Vickrey (1968) devoted a seminal paper to the issue of automobile accidents, tort law, and externalities. The relevant questions he pointed out are on how to charge behaviour that leads to injuries for the other people involved in driving as well as to what extent the charges paid should go directly to the injured (Vickrey, 1968). One of the conclusions was that actions possibly causing injuries on the road, should be abandoned (Vickrey, 1968). One may interpret this suggestion as shifting freight from road to rail because if less trucks are driving, respectively, the potential for accidents is lower.

The literature shows several findings on quantifying accidents. Forkenbrock (2001), for example, used estimates developed by the Federal Highway Administration from 1991 and updated them to 1994 dollars. For that respective year, there were in total 951 fatalities and 9669 personal injuries, caused by Class I freight trains (Forkenbrock, 2001). Monetary expression of the accidents amounts to $ 2 761 497 000 for the fatal injuries and $ 543 930 000 for the personal injuries (Forkenbrock, 2001). Breaking these costs down to ton-mile yields 0.17 cents for various train types whereas trucks cause 0.59 cents of external costs per ton-mile (Forkenbrock, 2001).

Ricci & Black (2005) applied the damage cost approach, which is the base of RECORDIT, to the frequency of incidents on 3 major routes: Genova-Preston, Athens-Gothenburg, and Barcelona-Warsaw. The share of accidents' contribution to the external costs is as follows.

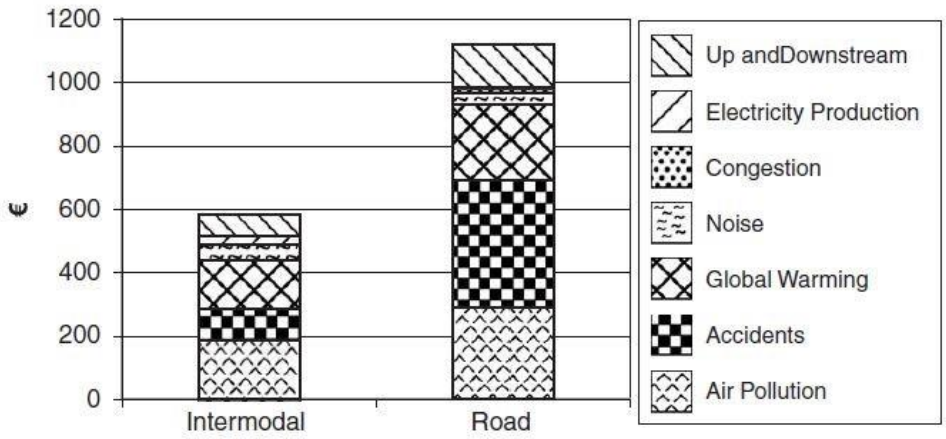

Figure 12. Shares of various types of external costs on the route Athens-Gothenburg. Source: Ricci & Black (2005)

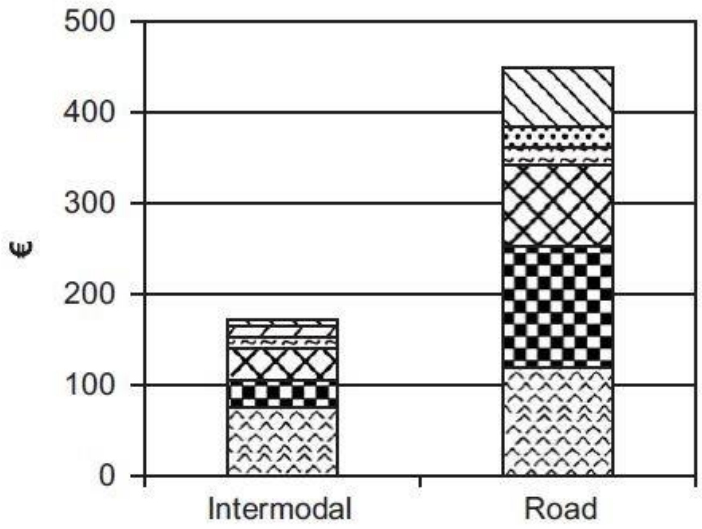

Figure 13. Share of various types of external costs on the route Barcelona- Warsaw. Source: Ricci & Black (2005)

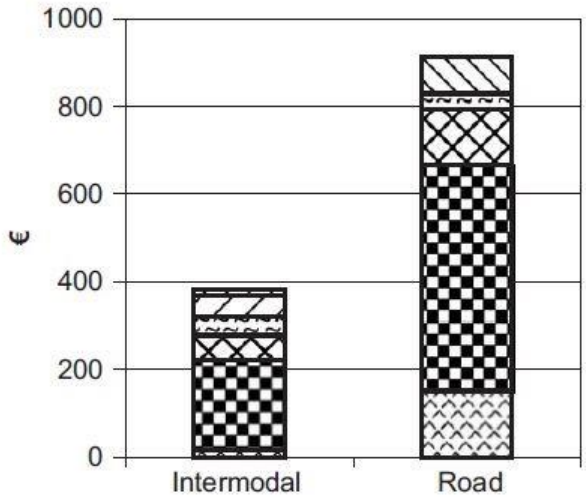

Figure 14. Share of various types of external costs on the route Genova- Preston. Source: Ricci & Black (2005)

As one can see, on every examined route, accidents as part of the external costs are lower when it comes to intermodal mean of transport (Ricci & Black, 2005).

The mathematical model from Janic & Vleugel (2012) which estimated the impact of modal shift, delivers a different picture. Surprisingly, if freight is shifted from road to rail, then, an increase of the accidents from 0.144 events/week to 0.198 events/week is expected to occur (Janic and Vleugel 2012). Nevertheless, external costs in terms of average unit costs are in favour of rail- 0.19 € cents/v-km for rail vs. 0.30 € cents/v-km for trucks (Janic & Vleugel 2012).

Perez-Martinez & Vassallo-Magro (2013) developed a framework for analysing external costs and applied it to the Spanish case. As part of their research, monetary values of accidents were also estimated and summarized in Figure 15.

Accident type	Cost per person[a] (€2000)	Number of people[b]	Amount (million €)	Tonne-kilometres[c] (millions)	Cost per tonne-kilometre (€cts2000)
Road					
Fatality	1,122,000	138	154.8	–	0.09
Severe injury	138,900	480	66.7	–	0.03
Slight injury	10,500	1456	15.3	–	0.01
Total	–	2074	236.8	233,219	0.13
Rail					
Fatality	1,122,000	3	3.4	–	0.04
Severe injury	138,900	0	0.0	–	0.00
Slight injury	10,500	1	0.0	–	0.00
Total	–	4	3.4	11,641	0.04

Figure 15. Quantification of accident types. Source: Perez-Martines & Vassallo-Magro (2013)

The values from the "cost per person" column are estimated on the principle of the willingness to pay for avoiding casualties with factor price being set to 2000 euro (Perez-Martinez & Vassallo-Magro, 2013). Details about number of people as well as the ton-kilometres are obtained from the respective Spanish transport authorities (Perez-Martinez &

Vassallo-Magro, 2013). As one can see, rail performs much better than road with regard to external costs (Perez-Martinez & Vassallo-Magro, 2013).

6.3 Congestion

Congestion is defined as the result from the occurrence of too many vehicles for the road space provided (Robinson, 1984). In fact, congestion can happen not only on the road but also on the rails or at the airport for example. Since there are not many scientific evidences about congestion on rails, I will consider congestion as an external cost only in the frame of the classical road congestion. This type of external cost is a bit special because it has the potential to create more emissions and higher probability of accidents although if accident happens during congestion, then speed will be on average lower and therefore, casualties will be reduced (Kreutzberger et al., 2003). Monetary estimation is here very context dependent- the effects of an additional vehicle on the road depend on existing traffic intensity, average speed, traffic situation, infrastructure surroundings, etc (Kreutzberger et al., 2003). Respectively, not many scientific outputs exist.

The calculation of the marginal costs from congestion is usually performed by using a bottom-up approach, that is, starting from the data collected at the level of each corridor and segment observed (in terms of length and duration) (Ricci & Black, 2005). Then, monetization by applying values of time on national level is applied (Ricci & Black, 2005). This monetization can be understood as loss of time for other transport users that suffer from the congestion caused by an additional truck (Ricci & Black, 2005). The problem here is that extrapolation is impossible, due to the fact that frequency and magnitude of congestion is directly and exclusively related to the features of the specific road segment observed and thus, a high variability of the cost values occurs (Ricci & Black, 2005). In this way, no pattern can be established in order to relate one road fraction to the other (Ricci & Black, 2005).

Janic & Vleugel (2012), in developing their mathematical model, aimed to estimate the savings of moving freight from road to rail, assumed that freight trains are scheduled within the available time slots along a given corridor. In this manner, freight trains do not cause delays to existing passenger trains and/or freight train services, thus, if operating under regular conditions, trains could be considered free of delays (Janic & Vleugel, 2012). This assumption, however, is generous because in such way, the trains (passenger and/or freight) are assumed to be free of any technical mistakes. As seen in Chapter 4, potential for technical shortcomings, especially during international haulages is provided and thus, I would conclude that in this case, the authors made that assumption for the sake of simplicity because as Ricci & Black (2005) pointed out, generalizations for congestion are close to impossible, and in fact, the model of Janic & Vleugel (2012) is supposed to provide some.

6.4 Noise

The implication of noise as an external cost is that on the roads, trucks involved in the traffic, generate noise that, if exceeding some tolerable limits, causes annoyance (Janic, 2007). If noise continues to persist over time, then, decrease in productivity and negative health effects can be observed (Janic, 2007). According to some estimates, around 20% of the EU population- around 80 million people, suffer from increased noise levels which cause annoyance, disturb sleep, or commit adverse health effects (Nijland & Van Wee, 2005). It is customary to argue that road traffic is the main source of noise. The figure below gives an indicative impression on some everyday situations and their noise implications in decibels (dB(A)).

dB(A)		Typical situation
10	Just audible	falling leaf
30	Very quiet	library
40	Quiet	quiet neighbourhood
50		light car traffic at 30 m
70	Interfering with speech	traffic on a motorway
80	Annoying	heavy traffic at 15 m
90	Very annoying, hearing damage after 8 h	bulldozer at 15 m
110	Extremely loud	rock concert

Figure 16. Everyday situations and their noise equivalent. Source: Nijland & Van Wee (2005)

As evident, “traffic on a motorway” and “heavy traffic at 15 m” is considered annoying and even close to hearing damage (Nijland & Van Wee, 2005). In some EU Member States, a considerable percent of the population is exposed to road traffic noise which is considered annoying (Nijland & Van Wee, 2005). Consider the following figure.

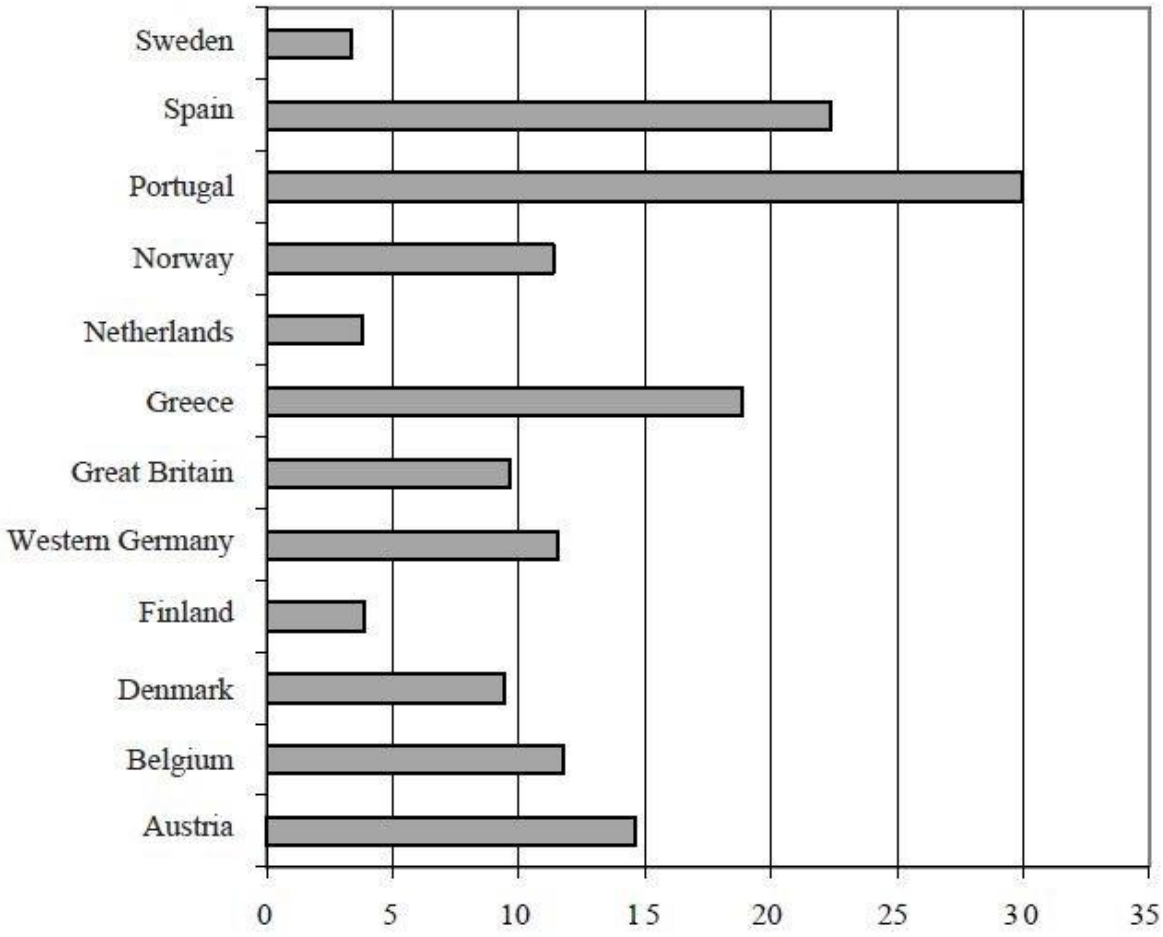

Figure 17. Percentage of population exposed to noise from heavy road traffic. Source: Nijland & Van Wee (2005)

As evident from the figure above, the noise problematic is relevant because it affects citizens in a direct way. There are, however, many methodological differences among Member States in calculating noise (Nijland & Van Wee, 2005). Nijland & Van Wee (2005) addressed this problem and tried to check whether data on noise from different Member States can be compared. In general, there are two distinct noise standards- noise emissions or noise exposure (Nijland & Van Wee, 2005). At European level, usually noise standards are considered whereas at national level, it is the noise exposure which is calculated through the relevant national authorities (Nijland & Van Wee, 2005). By such usage of different national methods, one may expect that different noise exposure values will be calculated (Nijland & Van Wee, 2005). Nijland and Van Wee (2005) point out 2 reasons for that: (1) real existing differences due to varying conditions, vehicle types or (rail)roads in the observed countries

or (2) differences in parameters used. The calculation differences on the second issue can reach 10 dB(A), in extreme cases even 15 dB(A) (Nijland & Van Wee, 2005). The Commission is, nevertheless, aware of this fact and has undertaken some measures in order to achieve comparability (Nijland & Van Wee, 2005). Examples are Directive 2002/49/EC relating to the assessment and management of environmental noise (Nijland & Van Wee, 2005). The Directive did set up a common noise calculation formula and is successfully implemented throughout the Union (Directive 2002/49/EC of the European Parliament and of the Council, 2002, pp.12-25). Studies, calculating noise according to that formula, however, are not known to me so far.

A considerable body of literature estimated the impact of road noise on house prices. By using hedonic techniques, Button (1990) estimated that for selected US states, exposure to increased levels of noise caused by road traffic, can decrease the house price by up to 0.88% per unit change of leq. Leq is the measure of a continuous sound equivalent in dBAs to a fluctuating sound of the same energy happening over a given period of time (Button, 1990). For Switzerland for instance, the value is even bigger and amounts to 1.26% (Button, 1990). Andersson, Jonsson, and Ögren (2010) examined the impact of rail vs road noise on Swedish house prices and concluded that road noise contributes much larger to the decrease of the house prices than rail noise. If a property is located in an area with noise level equal or more than 50 dB, then 1 dB increase of road noise is expected to lower the price with 1.2%, whereas the same increase of the railway noise is expected to contribute to the decrease of the price with only 0.4% (Andersson et al., 2010). When it comes to properties in an area with noise level equal or larger than 55 dB, then the decibel increase lowers the price with 1.7% for road and 0.7% for rail noise (Andersson et al., 2010).

Also according to Forkenbrock (2001), rail is perceived less annoying than road. However, it is admitted that it is not certain, which factors contribute to the annoyance and to what extent (Forkenbrock, 2001). Similar to congestion, noise varies considerably with time and location and therefore, extrapolation on country level is difficult to be made (Ricci and Black, 2005). Nevertheless, cost drivers like vehicle technology, population density or average climatic conditions could be used for generalization (Ricci and Black, 2005). Janic and Vleugel (2012) estimated that noise for freight trains and trucks is in terms of dBA almost identical and therefore, modal shift would not contribute that much to noise reduction.

7 Putting it Altogether- Assessment of Legal and Economic Policy Measures Targeted at Achieving the Balance in Competitiveness Between Road and Rail

As stated in the introduction, the main problem identified in this Thesis, are the imbalances in competitiveness between road and rail. As of 2015, market share of railways in the freight segment was only 11.9%, compared to 49% of the road counterpart (EC, 2017b). The target for 2030 is to move 30% of road freight to rail or waterborne transport (EC, 2011). From the analysis performed so far, I will formulate the preliminary hypothesis that such shift will be hard to achieve inasmuch it would entail, as Chapter 6 showed, the contribution of rail to reduction of some external costs which is also in line with the growing environmental concerns worldwide. The analysis of the 2001 and 2011 White Papers on Transport reveal that 2 aspects do overlap in both documents- "Turning intermodality into reality" and "Revitalizing the railways". Therefore, I will take these 2 aspects as the base of the conceptual model for the Thesis. In order these 2 aspects to be realized, there should be an appropriate legal and economic policy framework. From the analysis of both White Papers, I selected the three Railway Packages, the Directive on Interoperability as well as charging for infrastructure use as appropriate to be considered from the point of view of Law & Economics. The underlying premise is that, if the legal and economic policy framework is provided, then, intermodality and revitalization of railways would be possible to be achieved. Then, the stakeholders involved would be able to take actions towards changing balance between modes of transport and eliminating bottlenecks and ultimately, imbalances in competition between road and rail could be eliminated. It is important to mention that all 3 parts from this legal and economic policy framework should be simultaneously working. They were mentioned at several places in the White Papers discussed, thus, some credibility could be attached to them. Consider the figure beneath for a more visual representation.

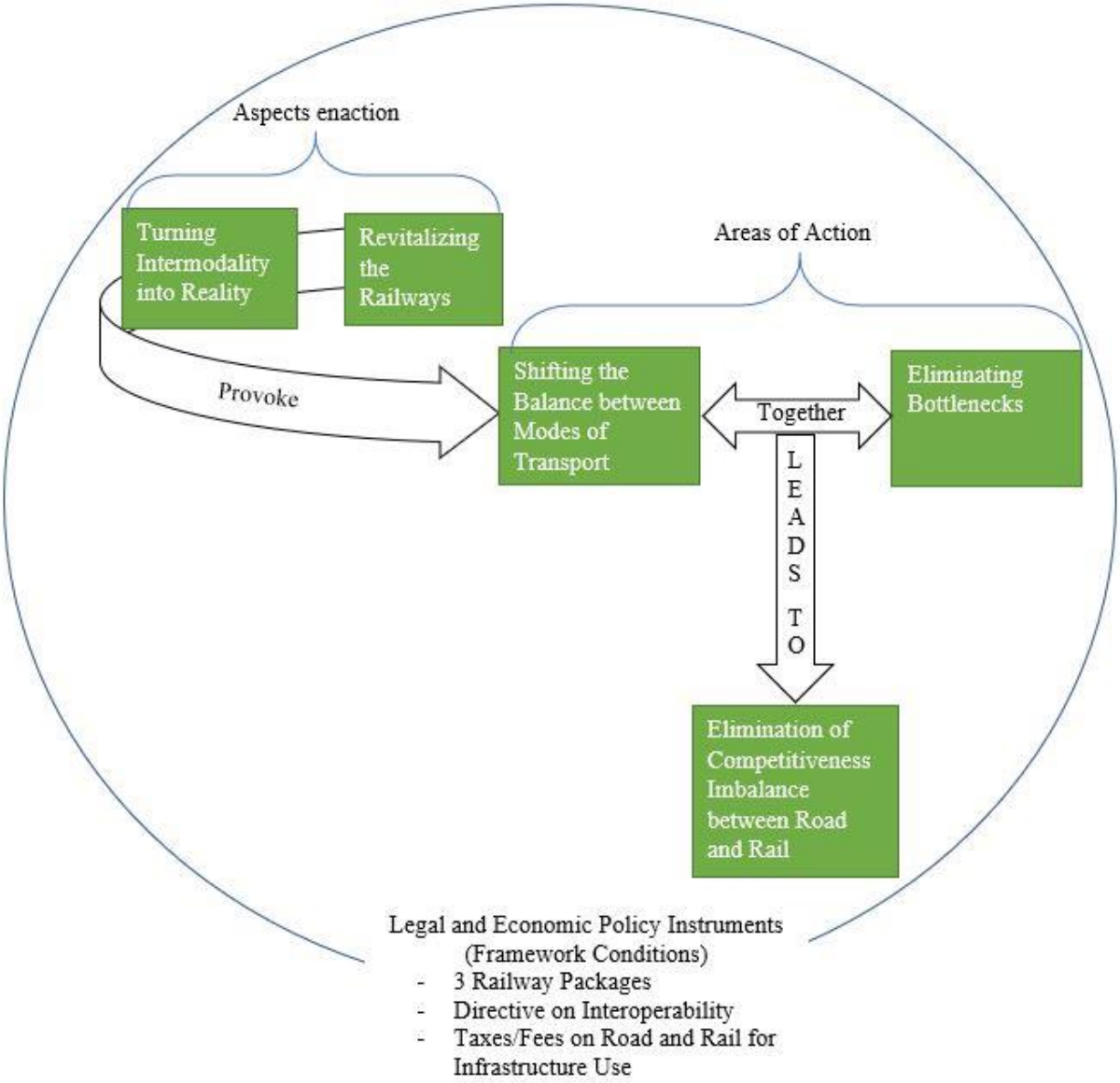

Figure 18. Conceptual model for the Thesis. Source: own drawings and EC (2001, 2011)

a) 3 Railway Packages

This instrument was the first to be initiated by the Commission and as of 2019, the 3 packages are in force. Chapter 5 provided an overview on them. Therefore, a complete legal framework for enabling competition on tracks is provided. As mentioned earlier in this Thesis, however, railways are natural monopolies (Bitzan, 2003), therefore, market entry of new competitors could be problematic. Crozet (2017) investigated this issue, in one of the few such papers.

To begin with, an overview comparing the legal liberalization and first new entrant for selected countries is useful. Consider the figure below.

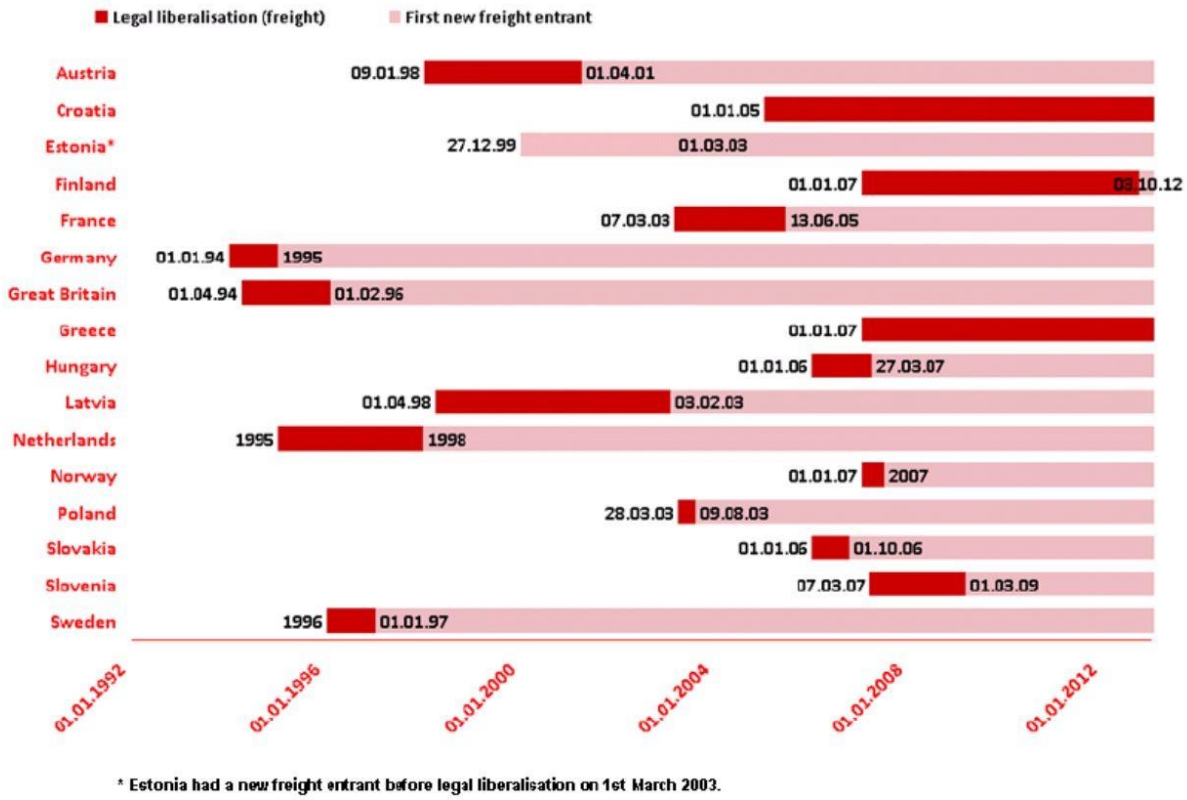

Figure 19. Liberalisation of rail freight markets and first market entries throughout EU. Source: Crozet (2017)

As one can see from the figure, in many countries, rail liberalization didn´t result in an immediate stream of new entrants (Crozet, 2017). In many countries, it took years until the first competitors enter the market and, in some countries, no competitor entry took place at all (Crozet, 2017). Even more, after liberalization, the market concentration continued to exist (Crozet, 2017). In Great Britain for instance, the value of the Herfindahl-Hirschman Index (HHI), a typical measure for market concentration, was 7450 in 1997 whereas in 2012, it was 3000 (Grozet, 2017). Germany had HHI index of 6300 while those of France exceeded 5000 (Grozet, 2017). HHI index of over 1000 means a strong market concentration (Crozet, 2017). Crozet (2017) asked the question whether unconcentrated market makes sense in this case and points to the premise that in order a rail operator to develop single-wagonload transport or powerful corridors for container transport, then a market share of more than 10% would

be inevitable because otherwise, the increasing returns would not be able to be enjoyed. Even if we neglect the market concentration issues, opening of the freight railway market seems to generate problems that are to be tackled through other channels. Crozet (2017) mentioned the common practice in Europe that if there are infrastructural or organizational bottlenecks in scheduling timeslots for movement, then, passenger trains are having priority thus, leaving freight trains waiting. Another problem might arise from the requirement that infrastructure and operations have to be separated institutionally by law, or at least in accounting terms, as outlined in Chapter 5. If the infrastructure manager gets then integrated in a holding company, this might result in privileged treatment of the other subsidiaries inside the holding and discrimination against other competitors (Crozet, 2017).

However, if interoperability is achieved to the fullest, market concentration would be not that important since then, the market power could spread evenly through the continent and not concentrate within the boundaries of a single country. Directive 2007/59/EC does allow that train drivers with a license issued in one EU country, use that license throughout the whole Union (Directive 2007/59/EC of the European Parliament and of the Council, 2007, pp.51-78).

b) Directive on Interoperability

In the broad sense, interoperability means that a freight train could freely cross any border inside EU and not face issues like changing the locomotive, personnel, or adjusting the electrical systems of the train, in order to be compatible with those of the recipient country. The Commission recognized the problem already in its 2011 White Paper and respectively, proposed a relevant Directive. The current Directive 2016/797 is a recast of Directive

2008/57/EC. That was necessary because too many amendments were submitted to it and thus, a recast was needed, for the sake of clarity (Directive (EU) 2016/797 of the European Parliament and of the Council, 2016, p.44). Already in the perambulatory clauses (PC), one can spot the shortcomings of the previous Directive, like PC 9 saying that "Major differences exist between national regulations, internal rules and technical specifications applicable to rail systems, subsystems and components, since they incorporate techniques that are specific to the national industries and lay down specific dimensions and devices as well as special characteristics" (Directive (EU) 2016/797 of the European Parliament and of the Council, 2016, p.45). Furthermore, PC 12 states that "The development of technical specifications for interoperability (TSIs) has shown the need to clarify the relationship between the essential requirements and TSIs on the one hand and the European standards and other documents of a normative nature on the other…." (Directive (EU) 2016/797 of the European Parliament and of the Council, 2016, p.45). PC 17 emphasizes then "In the development of new TSIs, the aim should always be to ensure compatibility with the existing subsystems…." (Directive (EU) 2016/797 of the European Parliament and of the Council, 2016, p.46). Last but not least, PC 20 says that „...the scope of TSIs should be extended to cover the vehicles and networks not included in the trans-European rail system." (Directive (EU) 2016/797 of the European Parliament and of the Council, 2016, p.46). Most probably, the Directive here means the Trans-European Rail Freight Transport Network (TERFN), as outlined in Chapter 4.

Without going into the legal details of the Directive, already from the mentioned perambulatory clauses, it becomes evident that the previous Directive has served its purpose to a very limited extent and thus, a recast has proven to be necessary. This strengthens the preliminary hypothesis I formulated in the beginning of the Chapter that a 30% freight shift from road to rail until 2030 (EC, 2011) will be hard to achieve.

Walker, Baarse, van Velzen, Jaervi (2009) analysed the state of the implementation of the Interoperability Directive before the recast. They didn´t narrow interoperability only to the technical aspects but also considered other aspects like corporate interoperability, juridical interoperability, or cultural interoperability (Walker et al., 2009). Corporate interoperability means when different organizations are willing and cooperating, in order to provide transport services (Walker et al., 2009). Juridical interoperability is then provided when legislation on all levels is harmonized and thus, affect the transportation as well (Walker et al., 2009). Cultural interoperability is observed when all cultural aspects are embraced and do not prevent the provision of seamless transport (Walker et al., 2009). This point seems to be overlooked in the literature because in the course of my research, this paper is the first one that mentions it. In the study outlined here, a range of 11 countries, stretching from south to the north of Europe, was investigated, and the assessment was based on Commission requirements as well as other requirements to achieve seamless rail freight transport (Walker et al., 2009). The Commission requirements included not only the TSIs but also things like legal/institutional framework, accessibility procedures, or market conditions for new entrants (Walker et al., 2009). The other requirements concentrated on network links, terminals, border crossing, and rolling stock (Walker et al., 2009). In addition, implementation conditions like political stability, institutions, etc. were assessed (Walker et al., 2009). The scores of the observed countries are as follows.

Requirement Category	Adequate (7-9)	Less Adequate (5, 6)	Not Adequate (3, 4)	Severe Limitations (1, 2)	Total
Legal/institutional framework	6	4	1	0	11
Interoperability and accessibility procedures	5	4	1	1	11
Market opening and market conditions	2	5	3	1	11
Network links	2	9	0	0	11
Terminals/transfer points	4	5	1	1	11
Border crossings	4	6	1	0	11
Rolling stock	3	7	1	0	11
Technical interoperability according to TSIs	0	0	5	6	11
Average no. of countries (excl. TSIs)	3.7	5.7	1.2	0.4	11

Figure 20. Implementation results on interoperability. Source: Walker et al. (2009)

	Ability				Interest		
Implement. Condition Category	Adequate	Less adequate	Not Adequate	Severe Limitations	Favourable	Neutral	Unfavourable
Political/legal	5	5	1	0	2	7	2
Administrative	4	6	1	0	2	8	1
Social/cultural	na	na	na	na	1	5	5
Technical	2	8	1	0	0	10	1
Financial perspective	3	3	2	3	1	8	2
Market perspective	5	5	1	0	0	9	2
Institutional & Organizational	4	4	2	1	3	7	1
Average	3.8	5.2	1.3	0.7	1.3	7.7	2.0

Figure 21. Implementation results on the additional implementation conditions. Source: Walker et al. (2009)

Then, a statistical analysis on the relationship between requirements and implementation conditions was carried out (Walker et al., 2009). A total of 148 significant and meaningful relationships was found, of which 85 were between the other requirements and the implementation conditions (Walker et al., 2009). This means that most of the scores presented above, were able to be explained via relationships between requirements and implementation conditions. Even though, the TSIs were formally enforced, some other institutional and policy issues prevented achieving interoperability (Walker et al., 2009). As of 2019, there is no follow-up to this study. Moreover, the website of the project, from which a big fraction of

the initial data was extracted, is not available anymore. Therefore, I will conclude that there are still issues with the interoperability in the railway sector across the EU.

c) Taxes/Fees on Road and Rail for Infrastructure Use

The underlying premise behind these taxes is that the payment of them should finance the amortisation costs of the infrastructure being used as well as to finance the further construction of roads, rail lines or other significant infrastructure objects. In the last years, there have been some claims to introduce payment for the external costs the means of freight transport cause, especially the truck counterpart. The Commission recognized the problem and introduced some Directives on that issue. In this Thesis, I will not discuss them because they are not central to the already discussed White Papers and will also unnecessarily blow up the volume. In the comparison road vs. rail, it is much more important to investigate the common patterns that could be central (e.g. weight) of infrastructure charging in the EU and see whether road and rail pay the same share. Another reason for concentrating only on one aspect of infrastructure charging, is the fact that, in technical terms, trucks differ from trains and so, there could be things that are charged only at the train counterpart but not at the trucking one. In the example of weight, however, it is feasible to assume that it will be the central charging criteria for trucks and trains because both means of transport exercise pressure on the infrastructure and thus, lead to its amortization.

To my surprise, there are not many studies that compare truck tolling schemes in the EU. McKinnon (2006) reviewed the German, Austrian, Swiss, and British tolling schemes and their impact on logistics systems, shortly after introduction. Nevertheless, absence of more scientific research on tolling schemes would not hamper my research. Germany, Austria, Switzerland, and Great Britain are located within mainland Europe, 30% of truck traffic in

Switzerland is foreign registered, whereas in Germany, this fraction is 35% (McKinnon, 2006). This fact should give some representativeness of the results. In 2006, the German and Swiss tolling scheme was based on gross weight class, depending on axle number and emission category of the vehicle (McKinnon, 2006). In Austria, truck tolling was based solely on gross weight, according to number of axles (McKinnon, 2006). The British tolling scheme was planned to differentiate tolls based not only on weight and emission standard but also on vehicle type, road type, and time of the day (McKinnon, 2006).

As of 2019, the state of toll schemes in these countries is the following.

Austria´s toll taxes depend on number of axles, EURO emission class, and time of the day (day or night) (AsFINAG, 2019). It is levied for trucks over 3.5 tonnes and per kilometre (AsFINAG, 2019). On several sections, there are surcharges which are justified by the increased potential for externalities (AsFINAG, 2019). The surcharges are expressed in 25% increase of the fare (AsFINAG, 2019).

Germany´s toll taxes depend also on axle number, but a bit diversified, compared to Austria (Toll Collect, 2019). EURO emission class is considered, and there are 4 weight/axle categories in total: 7.5-11.99t, 12-18t, >18t up to 3 axles, and >18t, with 4 or more axles (Toll Collect, 2019). According to the weight category, different charge is applied (Toll Collect, 2019). In addition, there is a fixed charge for noise pollution that is equal for every toll category (Toll Collect, 2019). The toll is charged per kilometre (Toll Collect, 2019).

Switzerland´s toll taxes interpret truck weight in tonne-kilometres and distinguish primarily between EURO emission classes, but clustered in 3 main categories (Eidgenössische

Zollverwaltung, 2017). Extra charges for rigs are foreseen and they depend on their individual weight, which is then added to that of the truck (Eidgenössische Zollverwaltung, 2017). Also here, the toll is charged per kilometre (Eidgenössische Zollverwaltung, 2017).

Toll taxes in Great Britain are a bit different. First, trucks over 12t are eligible (HGV levy, n.d). Second, the toll charge is time-based (HGV levy, n.d). Third, weight comes into consideration not only via number of axles but also via maximum operating weight (HGV levy, n.d). EURO emission class is considered as well (HGV levy, n.d). These factors are applied at the different toll roads, bridges and tunnels, in order the individual toll to be calculated (GOV.UK, n.d). Every road, bridge, and tunnel has its own methodologic which I will not illuminate here in order not to blow up the Thesis volume. Nevertheless, it is worth throwing some thoughts on differentiating user fees based on roads, tunnels, or bridges. The underlying premise is to achieve full price discrimination which in this case would mean that every user pays exactly for the caused share of external costs. As already mentioned, Austria applies such approach on several sections by charging increased fees (AsFINAG, 2019). However, the UK seems to have varying charging patterns. Theoretically, this approach is legitimate, but it is connected with high transaction costs. For instance, before launching, responsible authorities need to research the traffic stream, make predictions how the stream might develop, pay for the creation of the necessary IT infrastructure which again, will be more expensive than in the case of Austria because it will likely consider different scenarios, etc. That means that already at the level of search and information costs, there will be cost increases, compared to a lighter price discrimination. Then, when it comes to bargaining costs, the authority would need to hold consultations with all possible interest groups and convince them to pay the envisioned share. Since the charge will be varying according to road, bridge, or tunnel, the complexity of the negotiations will be respectively high and

accordingly, the costs. Last, when it comes to making sure that the terms of the contract won`t be breached, the authority could have problems in making sure everybody pays accordingly, when there are so many different charging patterns for different infrastructures. In the case of Austria for instance, the control can be performed by checking whether there is a "GO-Maut" device and whether properly connected. However, when charging for different infrastructures, it is likely to expect that a device like "GO-Maut" will not be feasible. Thus, the increased transaction costs will likely constitute an obstacle to the enforcement of so differentiated user fees on EU level.

From this truck toll analysis, it becomes clear that indeed, different factors are involved in the truck toll calculation. Common denominator for all observed countries, are the EURO emission standards and weight of the truck. It appears, however, that weight is considered differently in the different countries. I can distinguish 3 patterns: axle only (Austria), semi-mixed (Germany and Great Britain), and tonne-kilometre (Switzerland).

C.Nash (2005) provided some insights on the structure of rail infrastructure charges in Europe. The conclusion was that most of the countries charge train operators per kilometre, differentiating by speed, weight, type of traction, and axleload of the train (C.Nash, 2005). Some countries include the gross-tonne kilometre in the calculation (C.Nash, 2005). There are also differences in the calculation of gross tonne kilometre: for example, in Bulgaria, gross-tonne kilometre simply considers the gross weight of the train and then, multiplies it with the travelled distance in kilometres (I.Yanakiev, personal communication, 25 March 2019). Other countries employ engineering formulas which include factors like unit type, axle load, speed, or unsprung mass (C.Nash, 2005). Despite that, there have been some proposals for additional charges- Slovenia, for example, has proposed an additional charge

for use of lines outside the normal operation hours (C.Nash, 2005). Germany, on the other side, distinguishes between different path classes (C.Nash, 2005). Great Britain introduced a congestion charge per train-km and Germany fines operators who want to cancel an already placed path order (C.Nash, 2005).

From that analysis, it seems that indeed, weight is a common denominator in the calculation methodology of charges for infrastructure use of both means of transport. With regard to the trucking tolls, there seem to be differences in weight estimation. Same holds for the rail counterpart, although to a smaller extent. Nevertheless, given the scope of the Thesis, I will conclude that on the aspect of weight, imbalances in infrastructure charging are rather negligible.

From the 3 framework conditions discussed, one is a regulation in the classic sense (Directive on Interoperability), one is a legal act aimed at deregulating certain market (the 3 Railway Packages), and one is a pure economic policy instrument (Taxes/Fees on Road and Rail for Infrastructure Use). As stated in the beginning of the Chapter, according to the conceptual model, all 3 framework conditions shall be fully and simultaneously in effect. This is true for the 3 Railway Packages as well as for the Taxes/Fees on Road and Rail for Infrastructure Use. When it comes to the Directive on Interoperability, it seems that its full effect is not provided.

Based on this result, a conclusion, based on a small case study on whether White Paper targets for 2030 are achievable is developed, and is as follows.

A customer of a freight company wants to move given number of containers from point A to point B, with point B being in a different EU country. On the way from point A to point B, there are 2 options for transportation- either entirely by trucks or by intermodal transport, consisting of trucks and train, with train travelling the bigger amount of the distance. Given the fact that the Directive on Interoperability is not fully effective, when the train from the intermodal configuration crosses borders, additional waiting time occurs. Assume that the delay caused by the train part is considerable and results in some opportunity costs for the customer. Therefore, in order to avoid the opportunity costs or at least to minimize the probability for these costs to occur, the customer would rather choose to move the containers via truck.

This case study shows that trucking and intermodal transport are substitution goods for the customer. It is feasible to assume that because for every economic agent, the underlying logic of deciding is based either on maximizing profit or minimizing costs. Here, the latter is relevant. Therefore, by deciding for the trucking mean of transport, the substitution effect is enacted. The possibly higher external costs caused by the trucks are not included in the preference of the customer and so, the substitution effect cannot capture them. Thus, exploiting one of the main advantages of transport via train would not be achieved.

If one assumes that every economic agent in the EU who is in need of freight transportation, has the preference of moving freight as cost effectively and quickly as possible, then, given the above case study and its economic justification, it is feasible to assume that trucking will be preferred to intermodal transport with rail. Therefore, one can conclude that market share of trucking as mean of freight transport will most probably remain stable or rise and this of train, decline. On the other side, according to the Commission, train's market share is

supposed to rise as per the 2011 White Paper. Given all the conclusions of this chapter and the background information from the previous chapters, rise in the market share of train as mean of freight transport, is not feasible to be expected. Thus, the target of having 30% of road freight over 300km transferred to rail until 2030 (EC, 2011), is not realistic, given the framework conditions outlined.

8 Conclusion

The European Union was formally established via the Treaty of Rome from 1957 but it wasn`t until 1991 when the common transport policy started to take shape. More than 20 years later, there are advancements- in many countries, road freight users are now obliged to pay a fairer share of the external costs they cause. Rail drivers may obtain a license which is valid in the whole Union, by obeying clear rules that are unified throughout the Union. Also, a Trans-European Rail Freight Network is now existing. Railway undertakings are incentivized to act in a market conform way, by being obliged to separate between operations and infrastructure, and increased cooperation led to better safety standards. What remains to be finished, is to achieve full interoperability of railways throughout EU. It seems that there is a long way to go and one should reaffirm that the ultimate target of the Treaty of Rome is nothing less than an “Ever Closer Union”. Maybe when an “Ever Closer Union” is finally there, the EU will overcome the interoperability obstacle but in the current setting, without a deep integration, the EU common transport policy will remain an unfinished symphony.

9 References

Andersson, H., Jonsson, L., Ögren, M. (2010). Property Prices and Exposure to Multiple Noise Sources: Hedonic Regression with Road and Railway Noise. *Environmental and Resource Economics*, 45(1), 73-89. doi: 10.1007/s10640-009-9306-4

AsFINAG. (2019). *GO-Maut für Fahrzeuge über 3,5 Tonnen*. Retrieved from https://www.asfinag.at/maut-vignette/maut-fuer-lkw-und-bus/

Bitzan, J.D. (2003). Railroad Costs and Competition The Implications of Introducing Competition to Railroad Networks. *Journal of Transport Economics and Policy*, 37(2), 201-225. Retrieved from http://www.jtep.org/

Bouchery, Y., Fransoo, J. (2015). Cost, carbon emissions and modal shift in intermodal network design decisions. *Int. J. Production Economics*, 164, 388-399. doi: 10.1016/j.ijpe.2014.11.017

Button, K. (1990). Environmental Externalities and Transport Policy. *Oxford Review of Economic Policy*, 6(2), 61-75

Cerasis. (2018). *What is Last Mile Logistics & Why Are More Shippers Looking at This Transportation Function?* Retrieved from https://cerasis.com/last-mile-logistics/

Client Earth. (2016). *What is the EU recast procedure and why it is used?* Retrieved from https://www.clientearth.org/eu-recast-procedure-used/

Crozet, Y. (2017). Rail freight development in Europe: how to deal with a doubly-imperfect competition? *Transportation Research Procedia*, 25, 425-442. doi: 10.1016/j.trpro.2017.05.420

DKV. (2015). *Eurovignettes: a summary of all facts.* Retrieved from http://www.dkv-benelux.com/eurovignettes-a-summary-of-all-facts/

Eidgenössische Zollverwaltung. (2017). *LSVA- Allgemeines / Tarife*. Retrieved from https://www.ezv.admin.ch/ezv/de/home/information-firmen/transport--reisedokument--strassenabgaben/schwerverkehrsabgaben--lsva-und-psva-/lsva---allgemeines---tarife.html

European Commission. (1998). *Fair payment for infrastructure use. A phased approach to a common infrastructure charging framework in the EU. White Paper*. Office for Official Publications of the European Communities, Luxembourg. Retrieved from https://publications.europa.eu/en/home

European Commission. (2001). *White Paper European transport policy for 2010: time to decide.* Office for Official Publications of the European Communities, Luxembourg. Retrieved from https://publications.europa.eu/en/home

European Commission. (2006). *Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the implementation of the first railway package {SEC(2006) 530}.* Publications Office of the European Union. Retrieved from https://publications.europa.eu/en/home

European Commission. (2011). *White paper on transport. Roadmap to a single European transport area: towards a competitive and resource efficient transport system.* Publications

Office of the European Union, Luxembourg. Retrieved from https://publications.europa.eu/en/home

European Commission. (2017a). *State of the Union 2017 by Jean-Claude Juncker, President of the European Commission 13 September 2017*. Publications Office of the European Union, Luxembourg. Retrieved from https://ec.europa.eu/commission/priorities/state-union-speeches/state-union-2017_en

European Commission. (2017b). *Statistical pocketbook EU Transport in figures.* Publications Office of the European Union, Luxembourg. Retrieved from https://publications.europa.eu/en/home

European Commission. (2018). *EU Energy in figures statistical pocketbook 2018.* Publications Office of the European Union, Luxembourg. Retrieved from https://publications.europa.eu/en/home

European Commission. (2019a). *Mobility and Transport Infrastructure- TEN-T – Connecting Europe Maps.* Retrieved from https://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/maps_fr

European Commission. (2019b). *Mobility and Transport rail first railway package of 2001.* Retrieved from https://ec.europa.eu/transport/modes/rail/packages/2001_en

European Commission. (2019c). *Mobility and Transport rail second railway package of 2004.* Retrieved from https://ec.europa.eu/transport/modes/rail/packages/2004_en

European Commission. (2019d). Mobility and Transport rail third railway package of 2007. Retrieved from https://ec.europa.eu/transport/modes/rail/packages/2007_en

European Commission. (2019e). *Trimis- Transport Research and Innovation Monitoring and Information System RECORDIT.* Retrieved from https://trimis.ec.europa.eu/project/real-cost-reduction-door-door-intermodal-transport

European Council Council of the European Union. (2018). *European Council conclusions (1993-2003) European Council- Göteborg, 15-16 June 2001*. Retrieved from https://www.consilium.europa.eu/media/20983/00200-r1en1.pdf

Fact Sheets on the European Union. (2018). *Common transport policy: overview.* Retrieved from http://www.europarl.europa.eu/factsheets/en/sheet/123/common-transport-policy-overview

Forkenbrock, D.J. (2001). Comparison of external costs of rail and truck freight transportation. *Transportation Research Part A*, 35(4), 321-337. doi: 10.1016/S0965-8564(99)00061-0

Freightquote by C.H. Robinson. (2019). *What is intermodal transportation?* Retrieved from https://www.freightquote.com/define/what-is-intermodal-transportation

Ghijsen, P.W., Semeijn, J., Van Der Linden, H. (2007). Rail Freight in Europe: Different Perspectives on Achieving Higher Service Levels. Transportation Journal, 46(4), 42-57. Retrieved from http://www.psupress.org/Journals/jnls_transportation_journal.html

GOV.UK. (n.d). *Toll road charges*. Retrieved from https://www.gov.uk/uk-toll-roads

Gual, J., Waverman, L. (1998). The Liberalisation of Telecommunications in the EU: Managing the Transition. *Business Strategy Review*, 9 (3), 67-71. doi: 10.1111/1467-8616.00076

HGV levy. (n.d). *Terms and conditions*. Retrieved from https://www.hgvlevy.service.gov.uk/fopslivepws/pwslive/f?p=SSRV_SEC:300::INITIALISE:NO:300:P300_PTT_CODE:TSANDCS

Ivanova, D. (2009). *Разходи и себестойност на превозите в транспорта. Фактори и резерви за намаляване на разходите.* Retrieved from http://www.referati.org/razhodi-i-sebestoinost-na-prevozite-v-transporta-faktori-i-rezervi-za-namalqvane-na-razhodite/30718/ref/p2

Janic, M. (2007). Modelling the full costs of an intermodal and road freight transport network. *Transportation Research Part D*, 12, 33-44. doi: 10.1016/j.trd.2006.10.004

Janic, M. (2008). An assessment of the performance of the European long intermodal freight trains (LIFTS). *Transportation Research Part A*, 42(10), 1326-1339. doi: 10.1016/j.tra.2008.06.008

Janic, M., Vleugel, J. (2012). Estimating potential reductions in externalities from rail-road substitution in Trans-European freight transport corridors. *Transportation Research Part D*, 17, 154-160. doi: 10.1016/j.trd.2011.09.015

Kim, N.S., Van Wee, B. (2008). *Assessment of CO2 emissions for intermodal freight transport systems and truck-only system: a case study of the Western-Eastern Europe corridor*. Retrieved from https://www.researchgate.net/profile/Nam_Seok_Kim/publication/265280413_ASSESSMENT_OF_CO_2_EMISSIONS_FOR_INTERMODAL_FREIGHT_TRANSPORT_SYSTEMS_AND_TRUCK-ONLY_SYSTEM_A_CASE_STUDY_OF_THE_WESTERN-EASTERN_EUROPE_CORRIDOR/links/55863d9508ae7bc2f44bf3c2/ASSESSMENT-OF-CO-2-EMISSIONS-FOR-INTERMODAL-FREIGHT-TRANSPORT-SYSTEMS-AND-TRUCK-ONLY-SYSTEM-A-CASE-STUDY-OF-THE-WESTERN-EASTERN-EUROPE-CORRIDOR.pdf

Kim, N.S., Van Wee, B. (2011). The relative importance of factors that influence the break-even distance of intermodal freight transport systems. *Journal of transport geography*, 19(4), 859-875. doi: 10.1016/j.jtrangeo.2010.11.001

Kim, S.K., Van Wee, B. (2009). Assessment of CO2 emissions for truck-only and rail-based intermodal freight systems in Europe. *Transportation Planning and Technology*, 32(4), 313-333. doi: 10.1080/03081060903119584

Kim, S.K., Van Wee, B. (2014). Toward a Better Methodology for Assessing CO2 Emissions for Intermodal and and Truck-only Freight Systems: A European Case Study. *International Journal of Sustainable Transportation*, 8(3), 177-201. doi: 10.1080/15568318.2011.633689

Kreutzberger, E., Macharis, C., Vereecken, L., Woxenius, J. (2003). *Is intermodal freight transport more environmentally friendly than all-road freight transport? A review*. Retrieved from https://fek.handels.gu.se/digitalAssets/1344/1344833_2003_nectar_umea_kr_ma_ve_wo.pdf

McKinnon, A.C. (2006). A review of European truck tolling schemes and assessment of their possible impact on logistics systems. *International Journal of Logistics: Research and Applications,* 9(3), 191-205. doi: 10.1080/13675560600859110

Nash, C. (2005). Rail infrastructure charges in Europe. *Journal of Transport Economics and Policy,* 39(3), 259-278. Retrieved from http://www.jtep.org/

Nash, C.A., Smith, A.S.J., Van de Velde, D., Mizutani, F., Uranishi, S. (2014). Structural reforms in the railways: Incentive misalignment and cost implications. *Research in Transportation Economics*, 48, 16-23. doi: 10.1016/j.retrec.2014.09.027

Nijland, H.A., Van Wee, G.P. (2005). Traffic Noise in Europe: A Comparison of Calculation Methods, Noise Indices and Noise Standards for Road and Railroad Traffic in Europe. *Transport Reviews*, 25(5), 591-612. doi: 10.1080/01441640500115850

Perez-Martines, P.J., Vassallo-Magro, J.M. (2013). Changes in the external costs of freight surface transport in Spain. *Research in Transportation Economics*, 42(1), 61-76. doi: 10.1016/j.retrec.2012.11.006

Ricci, A., Black, I. (2005). The Social Costs of Intermodal Freight Transport. *Research in Transportation Economics*, 14, 245-285. doi: 10.1016/S0739-8859(05)14009-8

Robinson, R. (1984). Problems in the urban environment: traffic congestion and its effects. *Wollongong studies in geography, 14*. Retrieved from https://ro.uow.edu.au/wollgeo/

Sahin, B., Yilmaz, H., Ust, Y., Guneri, A.F., Gulsun, B., Turan, E. (2014). An Approach for Economic Analysis of Intermodal Transportation. *The Scientific World Journal, 2014*. doi: 10.1155/2014/630320

Toll Collect. (2019). *Tariftabellen*. Retrieved from https://www.toll-collect.de/de/toll_collect/bezahlen/maut_tarife/maut_tarife.html

Vickrey, W. (1968). Automobile Accidents, Tort Law, Externalities, And Insurance. An Economist's Critique. *Law and Contemporary problems*, 33(3), 464-487. doi: 10.2307/1190938

Vocabulary.com. (n.d). *bottleneck*. Retrieved from https://www.vocabulary.com/dictionary/bottleneck

Walker, E.W., Baarse, G., van Velzen, A., Jaervi, T. (2009). Assessing the Variation in Rail Interoperability in 11 European Countries, and Barriers to its Improvement. *European Journal of Transport and Infrastructure Research*, 9(1), 4-30. Retrieved from https://www.tudelft.nl/en/tpm/about-the faculty/departments/engineering-systems-and-services/research/ejtir/

Wygonik, E., Goodchild, A.V. (2018). Urban form and last-mile goods movement: Factors affecting vehicle miles travelled and emissions. *Transportation Research Part D*, 61, 217-229. doi: 10.1016/j.trd.2016.09.015

10 Legal References

Commission Directive of 16 May 1988 on competition in the markets in telecommunications terminal equipment (88/301/EEC). (1988). Official Journal of the European Communities, No L131, 73-77

Commission Directive of 28 June 1990 on competition in the markets for telecommunications services (90/388/EEC). (1990). Official Journal of the European Communities, No L192, 10-16

Consolidated Version of the Treaty on the Functioning of the European Union. (2016). Official Journal of the European Union, C202, 1-388

Council Directive of 29 July 1991 on the development of the Community`s railways (91/440/EEC). (1991). Official Journal of the European Communities, No L237, 25-28

Council Directive 95/18/EC of 19 June 1995 on the licensing of railway undertakings. (1995). Official Journal of the European Communities, No L143, 70-74

Directive 2001/14/EC of the European Parliament and of the Council of 26 February 2001 on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification. (2001). Official Journal of the European Communities, L75, 29-46

Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. (2002). Official Journal of the European Communities, L189, 12-25

Directive 2004/49/EC of the European Parliament and of the Council of 29 April 2004 on safety on the Community`s railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive). (2004). Official Journal of the European Union, L164, 44-113

Directive 2004/52/EC of the European Parliament and of the Council on the interoperability of electronic road toll systems in the Community. (2004). Official Journal of the European Union, L166, 124-143

Directive 2007/59/EC of the European Parliament and of the Council of 23 October 2007 on the certification of train drivers operating locomotives and trains on the railway system in the Community. (2007). Official Journal of the European Union, L315, 51-78

Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area (recast). (2012). Official Journal of the European Union, L343, 32-77

Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union. (2016). Official Journal of the European Union, L138, 44-101

Regulation (EC) No 881/2004 of the European Parliament and of the Council of 29 April 2004 establishing a European Railway Agency (Agency Regulation). (2004). Official Journal of the European Union, L164, 1-43

Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016 on the European Union Agency for Railway and repealing Regulation (EC) No 881/2004. (2016). Official Journal of the European Union, L138, 1-43