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Regulatory Strategic Adaptation: understanding the effects of deregulation in transportation systems based on empirical evidence

by Ioannis Koliousis, MSc, MEng

PhD Thesis

Submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Piraeus

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Στρατηγική Προσαρμογή στην Ρύθμιση: κατανόηση των επιπτώσεων της απορρύθμισης των συστημάτων μεταφορών με βάση εμπειρικά στοιχεία

του Ιωάννη Κολιούση

Διδακτορική Διατριβή

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ΕΣΠΑ 2007-2013 πρόγραμμα για την ανάπτυξη
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ABSTRACT

This thesis analyzes the impact of deregulation on the European transport companies and more broadly on the European transport industry. More specifically, the analysis addresses the impact of deregulation, both intra-sectoral and inter-sectoral, on the managerial efficiency of a panel of deregulated transport companies. Additionally, the thesis addresses the cross modal impact of deregulation by analyzing the effects of entry barriers' reduction and regulation intensity on transport systems. Furthermore, this thesis introduces a strategic tool to be used as a guideline for C-level decision making, not only in post-privatization industries but also after the introduction of a significant regulatory shock. It also suggests key policy making initiatives with respect to deregulation in the European transport industry. The empirical results of a vigorous transport industry-wide analysis confirm the expectation that in the short run, privatized companies will attempt to optimize their operational efficiency and profitability. However in the longer term, these companies appear to be risk averse and do not increase their capital expenditure; in other words, they don't invest more. Similarly, the empirical analysis on the transport output, post-deregulation, indicates that deregulatory initiatives may increase the total output of the transport sector, however in terms of cross modal effects, modes with stronger modal-share capture capability, increase their output to the detriment of other modes, as the relationship between the road transport deregulation and the short sea shipping output indicates. Based on empirical evidence, this study contributes to the Transport Systems Management literature by developing a strategic adaptation decision matrix, by assessing the impact of deregulation at the system of systems' level and by specifying policy recommendations that address the shortcomings of the deregulatory initiatives.

ΣΥΝΟΨΗ

Η παρούσα διατριβή αναλύει τις επιπτώσεις της απορρύθμισης στις ευρωπαϊκές εταιρείες μεταφορών και στον ευρωπαϊκό κλάδο των μεταφορών εν γένει. Πιο συγκεκριμένα, η ανάλυση πραγματεύεται τον αντίκτυπο της απορρύθμισης, τόσο εντός ενός τομέα όσο και δια-τομεακά στον κλάδο των μεταφορών, σχετικά με τη διοικητική αποτελεσματικότητα της απορυθμισμένης μεταφορικής εταιρείας. Επιπλέον, η διατριβή ασχολείται με τις δια-τομεακές επιπτώσεις της απορρύθμισης, αναλύοντας τα αποτελέσματα της μείωσης των περιορισμών εισόδου όσο και της έντασης της ρύθμισης στις μεταφορές. Επιπρόσθετα, η διατριβή αναπτύσσει και εισάγει ένα στρατηγικό εργαλείο, το οποίο μπορεί να χρησιμοποιηθεί ως οδηγός για λήψη αποφάσεων στο ανώτατο εταιρικό επίπεδο, όχι μόνο στις βιομηχανίες όπου ο Κύριος Πάροχος ιδιωτικοποιείται, αλλά και σε βιομηχανίες όπου ένα ισχυρό κανονιστικό σοκ έχει εισαχθεί. Επίσης, η διατριβή παρουσιάζει βασικές πτυχές χάραξης πολιτικής σε σχέση με την απορρύθμιση του ευρωπαϊκού κλάδου των μεταφορών. Τα αποτελέσματα της στατιστικής ανάλυσης, η οποία βασίστηκε σε εμπειρικά δεδομένα, επιβεβαιώνουν τις προσδοκίες σχετικά με τις στρατηγικές αποφάσεις. Πιο συγκεκριμένα, στη βραχυχρόνια περίοδο, οι ιδιωτικοποιημένες εταιρείες προσπαθούν να βελτιστοποιήσουν τη λειτουργική αποδοτικότητα και την κερδοφορία τους, ωστόσο, πιο μακροπρόθεσμα, δεν εμφανίζονται πρόθυμες να αναλάβουν ρίσκο αυξάνοντας τις κεφαλαιουχικές δαπάνες, με άλλα λόγια, δεν επενδύουν περισσότερο. Ομοίως, η εμπειρική ανάλυση σχετικά με το μεταφορικό έργο, μετά την απελευθέρωση, δείχνει ότι οι απορρυθμιστικές πρωτοβουλίες είναι δυνατόν να αυξήσουν τη συνολική παραγωγή του τομέα των μεταφορών, ωστόσο, σε επίπεδο δια-τομεακό, τα μέσα μεταφοράς που έχουν την μεγαλύτερη ικανότητα κατάκτησης μεριδίου αγοράς φαίνεται να αυξάνουν την παραγωγή τους εις βάρος των άλλων μέσων μεταφοράς, όπως η αιτιώδης συνάφεια μεταξύ της απορρύθμισης των οδικών μεταφορών και της παραγωγής του τομέα ναυτιλίας μικρών αποστάσεων εξόδου ναυτιλία παραστάσεις επιβεβαιώνει σε Ευρωπαϊκό επίπεδο. Με βάση τα εμπειρικά αποτελέσματα, η μελέτη αυτή συμβάλλει στη βιβλιογραφία της διοίκησης συστημάτων μεταφορών με την ανάπτυξη ενός εργαλείου στρατηγικών αποφάσεων

προσαρμογής στην απορρύθμιση, με την αξιολόγηση των επιπτώσεων της απελευθέρωσης στο επίπεδο των συστημάτων μεταφορών και με τον καθορισμό συστάσεων πολιτικής που στοχεύουν στην εξάλειψη τυχών αδυναμιών) των απορρυθμιστικών πρωτοβουλιών.

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EXECUTIVE SUMMARY

This thesis analyzes the impact deregulation brings on the European transport companies and on the European transport industry in general. More specifically, the analysis addresses the impact of deregulation, both intra-sectoral and inter-sectoral, on the managerial efficiency of the deregulated transport company. Additionally, the thesis addresses the cross modal impact of deregulation by analyzing the effects of entry barriers' reduction and regulation intensity on the transport product. This thesis introduces a strategic tool to be used as a guideline for C-level decision making, not only in post-privatization industries but also after a significant regulatory shock is introduced. It also presents key policy making initiatives with respect to deregulation in the European transport industry.

It is well known that the transport industry has experienced many changes over the past three decades. A wave of transformations in the legal framework took place, mainly due to the change of political objectives and of the political visions. Governments around the world started shifting legacy practices and decisions regarding market structure and adopted pro-market and pro-competition policies. In an effort to reduce restrictions, governments adopted deregulatory initiatives aiming to reduce administrative barriers, to allow more companies to enter the transport markets and to divest from monopolistic state-owned companies. The main argument was that more competition will improve the market status, will improve the corporate structure and will benefit the market and the society.

In the European Union, the main deregulatory activity started during the mid-1980s, and more precisely after the 1985 Judgement of the European Court of Justice which recognized the limitation of competition in EU. With this ruling, the European Commission was asked to act appropriately by adopting greater powers of interventions and of policy making with EU wide applicability in order to effectively introduce the European Single Market. Currently, the Transport Industry competitive status is vastly different to the status of the 1980s. The main objectives set have been achieved, including:

- Development of a competitive internal market for transport, through market opening and market liberalization,
- Facilitation of investment in prioritized transport infrastructure, and
- Reform of infrastructure pricing and taxation to encourage more efficient use of transport infrastructure.

The current policy document at the EU level, the 2011 White Paper on Transport, aims to further improve the Single European Transport Area and further complete the Internal Market for the transport of both goods and passengers. The core objective is to remove major barriers to transport operations and to promote safe, efficient and environmentally friendly transport services without affecting mobility. Additionally, the 2011 White Paper addresses horizontal issues including liberalization, state aid, control and competition rules, ownership, independent regulation, inter-, multi- and co-modality, as well as technical, safety and social issues. This is the first large scale policy intervention at the EU level to de- and re-regulate the entire transport sector in the European Union, in a comprehensive and centrally planned manner.

The main objectives of deregulation at the EU level is to increase efficiency in the transport sector improving not only the social welfare but also the fundamentals of the incumbents. However, although there is a lot of research focusing on the results on the social and on the public welfare level (that is on a macroeconomic level), there is little research focusing on key managerial drivers especially in the transport sector. Most of the studies on post-deregulation efficiency focus only on assessing the theoretical efficiency after the deregulation action was introduced and comparing it with the prior situation, or use a large, diverse sample of companies from different industries and with limited (if any) transport sectors coverage.

However, since efficient operations at the managerial level is a key determinant of not only stock value but more importantly of short and long term sustainability of a company, this thesis addresses specifically these issues. When the structure of a market changes through deregulation, the incumbents experience a significant shock and this has effects on the managerial decision making and ultimately on the financial and operational efficiency of the companies themselves. More precisely, this study investigates on a systematic way the empirical data after the introduction of

deregulation in the transport industry and confirms whether the theoretical expectations that deregulation is positive hold true for the deregulated company itself. More precisely, the research focuses on the following:

- Discusses current issues, at the European level, in the transport literature based on empirical observations instead of theoretical estimations,
- Discusses industry structure and deregulatory implications,
- Studies implications at the transport industry level, focusing on cross sector impacts instead of unidimensional impact within each individual sector
- Combines macroeconomic analysis with microeconomic impact, thus addressing specific managerial concerns.

This rigorous analysis on the firm level empirical evidence tries to understand the impact deregulation has on the managerial efficiency and ultimately on the decision making both at the sector as well as at the industry level and quantifies the relationship between deregulation and the effect on the privatized firms' operating efficiency, profitability and capital expenditure as measured by certain financial metrics. This study specifically challenges the following ideas:

- Deregulation in the form of privatization in a sector (sectoral level) has an effect on the operational efficiency, on the profitability and on the investment decisions (capital expenditure) of a firm,
- The intensity of competition in the transport industry at-large (industry level) as measured by OECD has an effect on the operational efficiency, on the profitability and on the capital expenditure of a firm,
- The deregulation of a specific sector and the abolishment of market entry limitations has any impact on another sector,
- The level of regulation of the transport industry has any impact on the transport industry output.

It has to be noted that this study, contrary to previous studies on this domain, argues about specific managerial indicators that are heavily used by mainstream financial analysts and which give a bird's eye view on the C-Level decision making. These indicators are very important for the financial sustainability of the company both in

the short run and also in the long run. Additionally, this study addresses specific cross modal effects of transport industry wide deregulation.

Based on the results and on a sample of more than 500 firm-year observations for the period 1998-2015 and more than 1,900 metric-year observations, this analysis empirically proves that transport companies post-privatization seem to use resources more effectively. More precisely, this analysis confirms that transport companies post privatization improve their profitability and their operational efficiency. Similarly, when deregulation is introduced across different transport sectors, the privatized firms seem to improve their operational efficiency and their profitability. This confirms the theory that a private owner puts effort to optimize the inputs whereas the state-owned companies have different strategic objectives. On the long run however, the results do not confirm the expectation that privatized transport companies increase their investment activity neither on the sectoral level nor on the industry level. This observation contradicts the experience from other sectors, for example the Telecoms Industry, where the privatized companies invest heavily to modernize their networks and to offer new innovative services for example Next Generation Networks, 4^{th} and 5^{th} Generation Mobile Networks, Fiber-to-the-home, etc. This finding may be attributed to the inherent characteristics of the transport sectors themselves, including the competition intensity in the transport industry, which is much greater, the commoditization of the transport "product", the scale of the capital investment and exogenous events like the fiscal crisis of 2007-2009 that has affected many investment plans.

In summary, these results suggest that the privatized firms tend to focus more on short term decision making, in order to improve their operational efficiency and their profitability, that is, to optimize the resource consumption. On the other hand, long term decision making, in terms of new investments, upgrading of infrastructure, new equipment, is put aside for the time being as the empirical evidence suggests. Based on the empirical analysis and on the statistical inferences, a strategic decision matrix was developed. This matrix encapsulates the decision making at the corporate level after deregulation on the sector and on the industry level. This 2x2 matrix (Figure 1)

offers a distinct view of the different decisions a company post privatization takes based on the decision horizon.

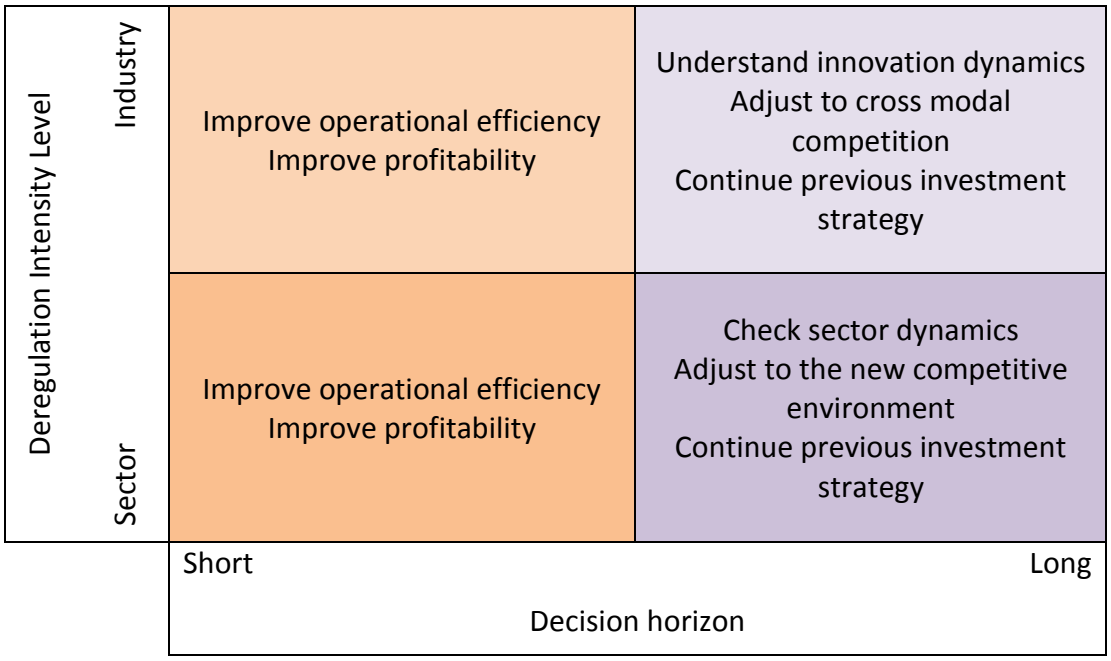

Figure 1 – Post Privatization Strategic Adaptation Matrix: Decision Making under market competition and uncertainty

More precisely, the following observations are drawn:

- ***Deregulation on the sector level***
    - In the short run, the company optimizes both operational efficiency and profitability,
    - In the long run the company investigates sector dynamics so as to understand its competitive position and attempts to adjust to the new competitive landscape that is created from the deregulation. The assets tend to remain the same, indicating that the investment plan doesn't change.
- ***Deregulation on the industry level***
    - Similarly to the above, on the short run, the privatized company tries to improve operational efficiency and gain as much revenue as possible

as well as to improve profitability in order to defend its market share and market position compared to industry wide cross-modal competition,

- On the long run, the company tries to understand the dynamics in the market so as to adjust its profitability to cross modal competition and also tries to adjust its capital expenditure to the industry wide post deregulation effects. Similarly to the short run decision making, the assets tend to remain the same, indicating that the investment plan doesn't change post deregulation.

This simple tool is very useful and can be used as a guideline for C-level decision making, not only in post-privatization industries but also after a significant regulatory shock is introduced through decreasing (or increasing) the intensity of rules in the legal framework. For example, similar to privatization are other deregulatory tools adopted by the government or the independent regulatory bodies like the abolishment of market entry barriers, imposing high (monopoly) rents to all market players (from the government), imposing vertical or horizontal separation based on anti-trust grounds, breaking up conferences (especially in the shipping sector) and generally inducing significant and intense competition on a sector. These deregulation initiatives could be considered to have an equal effect on the decision making profile of the deregulated company based on their intensity. Last but not least, it has to be noted that this tool and this methodology helps understand which companies will produce better financial results and how managerial decisions are steered in a competitive environment.

In addition to this analysis, further tests were undertaken to estimate the cross-modal effects of deregulation. The first of these tests included the analysis of the road transport deregulation on the volume of cargo transported through Short Sea Shipping services. The empirical analysis covered a sample of more than 220 country-year observations. The empirical results suggest that the road freight deregulation affects negatively the volume of goods transported via short sea shipping. A deregulated road market reduces on average the gross weight of goods transferred

through short sea shipping by almost 120,000 thousand tones, which represents 6.5% of gross weight of goods transferred in the EU-25 through short sea shipping in 2008.

Similarly, the causality between the index "volume of freight transport relative to GDP" and the OECD index on deregulation as well as other relevant control variables is analyzed. Based on a large sample of more than 350 country-year observations, the empirical results suggest that market deregulation leads to higher volume of cargoes transported to all three sectors studied (combined Road, Rail and Inland Waterways). This is a very interesting observation, confirming that industry wide deregulation (which is captured by the OECD Index which measures deregulation across many different sectors and industries) affects positively the volume of cargoes, without though rejecting the previous hypothesis. More precisely, this analysis confirms the impact of the deregulatory initiatives on the volume of cargoes at aggregate numbers, signifying the importance at the systemic level, but concurrently limiting the benefits to those modes that have stronger cargo (i.e. value) capturing capabilities.

The results of these two tests have two important implications on the formation of transport policy. First, regulatory reforms and the (direct and indirect) provision of stimuli to road freight transport companies have negative effects on short sea shipping. Hence, the effectiveness of the resources (e.g. financial contribution through the Marco Polo I and II programs and through the TEN-T funding scheme) already allocated to the short sea shipping sector are weakened. Secondly, environmental benefits can be gained if the policies towards the enhancement of short sea shipping are complemented by focusing on reducing road freight transport externalities, including reducing truck movements based on load factors / empty runs and decreasing the number of trucks in general. Additionally, it has to be noted that interestingly, although the industry wide deregulation improves the transport industry output, however, the modal share of the road sector increases due to market asymmetries and due to the inability of the other sectors to capture market share.

Last but certainly not least, this study contributes to the debate "Regulation, Deregulation, Re-regulation or Self-regulation?" clarifying certain implications that deregulatory tools have on the sectoral and on the industry level.

In summary, based on the empirical analysis, some key policy conclusions may be drawn, including:

- Deregulation is inevitably incomplete when exercised on complicated systems which include infrastructure, more than one modes of transport competing one-another and significant intra- and inter-market forces,
- Agility is essential and close monitoring of the post-deregulation market is needed, in order to ensure that no adverse effects will occur,
- An independent regulator or an independent regulatory agency covering the entire transport industry, instead of isolated Independent Regulatory Authorities should be developed. The main aim of the regulator is to provide a consistent and level playing field for all modes in addition to a combination of discretion with transparency. However, up until now, mode specific IRAs are the case, with many incidents of mutually exclusive objectives among the IRAs. The combination of regulatory functions in a single agency, ideally for all modes, should be sought after since fragmentation risks communication, objectives setting etc. A dedicated industry wide regulator may achieve more focus on critical issues, be more effective in mobilizing and in attempting to optimize the industry as a whole instead of individually optimizing each transport mode.
- The transport sector is inherently risky due to the large economies of scale and of scope. Especially, when planning and developing infrastructure, the decisions should not reflect short term decisions, fused by (strong) political pressures, but rather focus on long term objectives.
- Deregulation in one sector should also be bundled with efficiency improvements in other sectors, in order to avoid market (competitive) asymmetries. The example of road deregulation, when at the same time the SSS sector was heavily bureaucratic is a case in point where the Short Sea Shipping sector effectively lost cargo to the road sector.
- A robust framework that can cope with external ("unexpected") shocks should be developed and implemented. Deregulation is planned according to a business-as-usual scenario. The latest fiscal and economic crisis in Europe of

2007-2008 and elsewhere indicated that more robust planning should be adopted prior to deregulation. More precisely, long term decision making, especially in significant economic sectors, should be a key attribute, thus a combination of input optimization (in the short run) with long term capacity and sustainability planning is required. Black Swan events should be accounted for (e.g. the 2008 fiscal crisis effects on trade and eventually on the transport industry, the Eyjafjallajökull eruption and the effects on the airline industry, the Greek Crisis and the effect on network development) in a deregulation policy, so as to include pre-specified policy adjustments

LIST OF ABBREVIATIONS

Abbreviation	Description
ACEA	Association of European Car Manufacturers
AEA	Association of European Airlines
AIS	Automatic Identification System ASA Air Service Agreements
ATM	Aviation Traffic Management Systems
CAGR	Compounded Annual Growth Rate
CF	Cohesion Fund
COSS	Committee on Safe Seas
CTP	Common Transport Policy
DG	Directorate-General
DG MOVE	Directorate-General for Mobility and Transport
DG TREN	Directorate-General Energy and Transport
DSS	Decision Support System
EASA	European Aviation Safety Agency
EC	European Commission
ECSA	European Community Ship-owners' Association
EEA	European Environment Agency
EEC	European Economic Community
EIB	European Investment Bank
EMSA	European Maritime Safety Agency
ERA	European Railway Agency
ERDF	European Regional Development Fund
ERTMS	European Rail Traffic Management System
ESA	European Space Agency
ETCS	European Train Control System
EU	European Union
EU MS	European Union Member State
FMC	Federal Maritime Commission
FP	Framework Programme
FTL	Full Truck Load
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HGV	Heavy Good Vehicles
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
ICT	Information and Communication Technologies
IMO	International Maritime Organisation

IRA	Independent Regulatory Authority
ITF	International Transport Forum
ITS	Intelligent Transport System
IVVS	Intelligent Vehicles Safety Systems
LCC	Low Cost Carriers
LPI	Logistics Performance Index
LTL	Less than Truck Load
MoS	Motorways of the Seas
MS	Member State
OSRA	Ocean Shipping Reform Act
PP	Priority Projects
PSC	Public Service Contract
PSO	Public Service Obligation
RA	Regulatory Authority
RIS	River Information Service
SES	Single European Sky
SESAR	Single European Sky ATM Research
SME	Small Medium Enterprises
SOLAS	Safety of Life at Sea
SSN	SeaSafeNet
SSS	Short Sea Shipping
TEN-T	Trans-European Transport Networks
TEN-T EA	Trans-European Transport Network Executive Agency
UIRR	International Union of combined Road-Rail transport companies
VTMIS	Vessel Traffic Management Information System
YoY	Year over Year

TABLE OF CONTENTS

INDEX OF FIGURES

INDEX OF TABLES

INDEX OF MODELS

1 INTRODUCTION

1.1 Overview

Transport represents a significant part of the business and economic activities. The transport industry contributes more than €1.3 Trillion in the EU-28 GDP whereas the more than 1.1 Mio companies in the sector directly employ more than 10.5 Mio persons (European Union, 2015b) and accounts for more than 5% of the EU28 GDP in 2012. In the USA, the Transport industry accounts for 9.5% of the GDP in 2013 (Rodrigue, 2015). Similar percentages are observed in other economies, making this industry one of the most important.

The transport industry has experienced many changes over the past three decades as there was a wave of changes in the legal framework, mainly due to a change of political objectives and of visions. Governments around the world reconsidered legacy practices and decisions regarding the market structure and adopted pro-market and pro-competition policies, reducing administrative barriers, allowing more companies to enter the transport markets and divesting from monopolistic state-owned companies. Moreover, those governments set up independent authorities, assigning them the regulator's role, so as to offer a level playing for all market incumbents, without any exceptions or restrictions.

This course of actions was based on a widespread argumentation in favor of the deregulation of the markets, highlighting the positive effects on the market activity, on people and on the economy in general. This thesis focuses exactly on that, analyzing the specific impact deregulation had on the transport industry as a whole and at individual sectors. Using empirical data and a systematic approach, the impact on the business side of the deregulated and privatized companies will be assessed.

1.2 Generic characteristics of the Transport Industry

A number of attributes in the transport industry require the introduction of certain regulations in order to avoid market failures. However, these regulations over the course of years have become cumbersome for the industry. The most important

attribute of the industry is that it is a dual component product. More precisely, in order to execute a transport operation, one needs both the infrastructure to operate on and the vehicles to operate with. One of the most important characteristics is that the infrastructure is extensive and expensive with high fixed costs. Roads, ports, railway tracks, airports, inland waterway networks, pipelines and other terminal facilities require large amounts of capital to be build. These economies of density and/or of scale make it difficult to invest, and additionally, infrastructure comes in lumpy increments. These characteristics, especially those of the infrastructure side, produce either monopolies or at best oligopolies, although they can accommodate more than one users. Another important attribute is the marginal cost of the first user, which is significant and also sunk once the decision to invest is implemented.

Said that, competition is limited, although exceptions exist, like in markets with significant demand or when the markets are considered in greater geographical contexts. In certain cases, competition is not only limited due to economies of scale or scope, but also because of supply limitations, like in the cases of natural monopolies (e.g. river transport). The concern in the former case is that natural monopoly incumbents may abuse their position and try to gain abnormal profits from the market.

Transport being a network industry brings together geographically distant locations forming a complex system consisting of many stakeholders and many operators. Operating across different or multiple markets increases the economies of scope but also increase costs and risks in the supply chains. Nevertheless, to recoup, the government sets as an ultimate goal the improvement of the social welfare within a complex system characterized by huge fixed infrastructure costs and joint costs, by multiple users with different valuations and different objectives and ultimately by different costs.

1.3 Research Focus

As will be described in the following sections, there is a widespread belief that deregulation has increased efficiency in the transport sector improving not only the social welfare but also the fundamentals of the incumbents. However, although there

is a lot of research focusing on the results on the social and on the public welfare level, there is little research focusing on key managerial drivers especially in the transport sector. Most of the studies on post-deregulation efficiency focus only on assessing the theoretical efficiency after the deregulation was introduced and comparing it with the prior situation, or use a large diverse sample of companies, however, limited with respect to the transport industry itself.

However, efficient operations from the managerial perspective is a key determinant of not only stock value but more importantly of short and long term sustainability of a company, meaning not only that the business is profitable but that the business is a good investment too. Advancing this argument, if this company is a good investment, then more entrants will participate in the market, and this competition will improve the industry as a whole, essentially the main objective of deregulation.

The transport industry is an integral part of end-to-end modern supply chains, with significant impact on the country's GDP as well as on the level of employment and on the wider business environment. The imperfect efficiency has an impact on society, both economic, because they do not fully exploit the available production units (resources/input, etc), social, because of the adverse effects on the society, and environmental, since it does not exploit alternative and more environmentally friendly transport methods. In order to improve this efficiency, different regulatory models and structures have been implemented by the different states with the impact varying depending on the objectives, on the inherent systemic limitations and on the specific attributes.

Moreover, in recent years, there is an intense debate at European and global level concerning the regulation, the de-regulation or the re-regulation of the markets. This in addition to the economies of density, scale and scope of the transport industry as well as the market failures that were observed across different markets either in regulated or in deregulated markets, has intensified the debate. Therefore, a more insightful understanding of the deregulation effects is required.

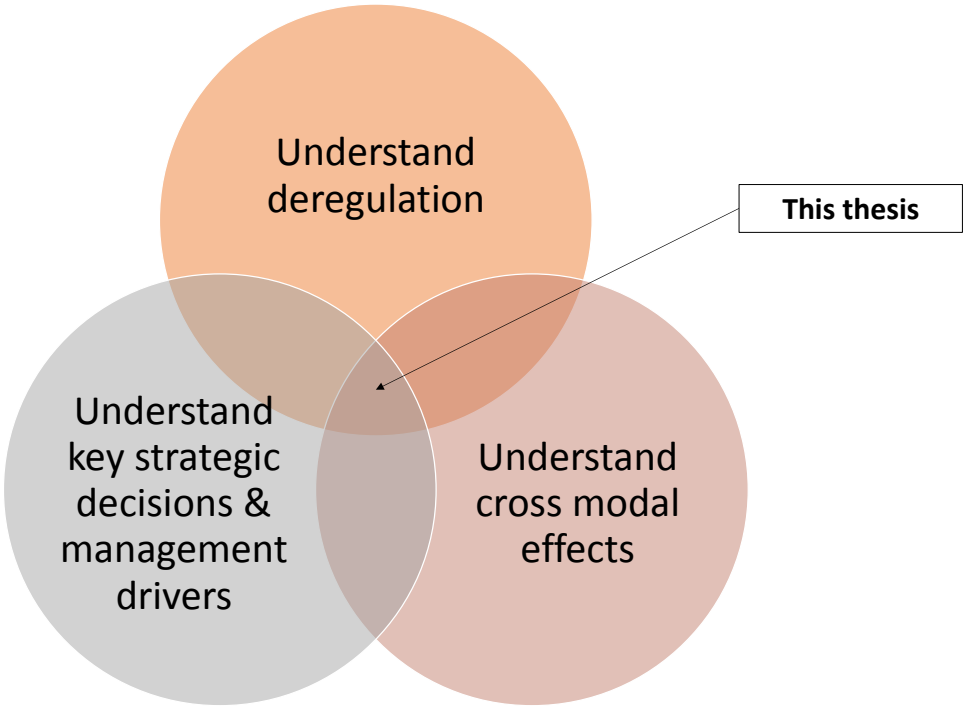

Figure 2 – The thesis' focus

To this extent, this thesis focuses (Figure 2) its research to a very specific concern and studies the impact of the deregulation, in other words changing the structure of a market, on the companies (incumbents) themselves as well as on the industry output. More precisely, this study will investigate on a systematic way the empirical data after the introduction of deregulation in the transport industry and study whether the theoretical expectations that deregulation is positive, also hold true for the deregulated company itself. The research focuses on the following:

- Answers current issues in the transport literature based on empirical observations instead of theoretical estimations, at the European level,
- Discusses industry structure and deregulatory implications,
- Studies implications at the transport industry level, focusing on cross sector impacts instead of unidimensional impact within each individual sector
- Combines macroeconomic analysis with microeconomic impact, thus addressing specific managerial concerns.

It is easily understood that this thesis focuses on the intersection of three different debates, that is, what is deregulation (extent, framework, market structures etc), what is the technical efficiency (the efficiency frontier where the deregulated firm can

reach) and what are the key strategic decisions a firm can adopt (from operational excellence on the managerial level to investment decisions).

In summary, this is a rigorous analysis on the firm level empirical evidence that tries to understand the impact deregulation have had on the economic aspects, on the managerial efficiency and ultimately on the decision making both at the sector as well as on the industry level. In addition, the analysis studies the empirical evidence to understand the effects of deregulation on the transport industry output as well as on the specific cross modal effects. This research, to the best of our knowledge is the first industry specific study at the European level, providing a bird's eye view on managerial decisions.

1.4 Research questions

Based on the previous introduction, the research questions this study sets aim to quantify the relationship between deregulation and the effect on the privatized firms' operating efficiency, profitability and capital expenditure as measured by certain financial metrics. The main arguments in favor of deregulation, is that deregulation has clear benefits both for the deregulated company and for the entire transport sector. This study focuses exactly on this premise, challenging whether:

- Deregulation in the form of privatization in a sector has any effect on the operational efficiency, on the profitability and on the investment decisions (capital expenditure) of a firm,
- The intensity of competition in the transport sectors at-large (i.e. transport industry) as measured by OECD has any effect on the operational efficiency, on the profitability and on the capital expenditure of a firm,
- The deregulation of a specific sector and the abolishment of market entry limitations has any impact on another sector,
- The level of regulatory intensity of the transport industry has any impact on the transport industry output.

In contrast to previous studies which focused on the consumer benefits and on the technical optimal efficiency, this study argues about specific managerial indicators that are heavily used by financial analysts. These indicators are very important for the

financial sustainability of the company both in the short run and also in the long run. The objectives set in most deregulatory policies focus on simple metrics like the number of new entrants, the changes of the tariffs/fares/rates, the change on the competitive landscape, the new services development, the changes on the quality of service, the reduction on or abolishment of monopoly rents paid and the consumer surplus. These metrics, although very important, fail to address business continuity at the company level. The financial world, the analysts, rely on "simpler" but more "robust" indicators and at the end of the day, the deregulated company will only sustain its operations if it uses efficiently its assets, it makes profits and it invests in its future. This is also considered to be the correct approach business-wise to correct a market failure without producing another market failure.

1.5 Methodology

The thesis uses a robust and proven methodology in order to understand, estimate and assess the impact deregulation brings to the transport industry. Figure 3 presents the methodology in a workflow manner in order to show the different activities that were undertaken and how these activities relate one another.

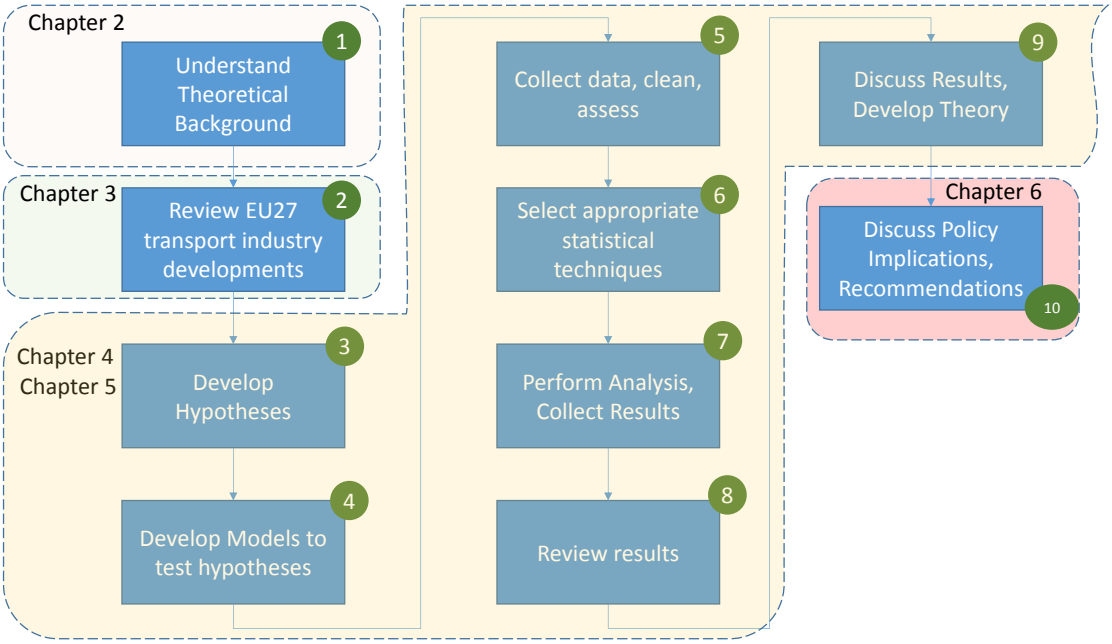

Figure 3 – Thesis' Methodology (high level)

Regarding the technical tools (steps 3 to 8), this study uses empirical data and observations in a systematic way in order to analyze and assess the impact of

deregulation on the deregulated company as well as understand the wider industry effects. Based on publicly available data, a sample of the major deregulated transport companies in the EU-27 member states was selected. The selection was based on various criteria, including:

- The company operating in a specific transport industry sector based on its SIC classification (primarily from the following: marine cargo handling and ports, airports, road concessions, freight transportation, trucking, postal and courier services, rail, marine transportation and ferry transportation),
- The deregulatory shock (privatization transaction) took place after 1985,
- Financial data for the sampled company were available.

The sample included 44 major companies (monopoly incumbents) in 16 EU countries for the period 1998-2015. Additionally, metrics focusing on the operational efficiency, on the profitability and on the capital investment intensity (Net Income Margin, Return on Assets, Asset Turnover, and CAPEX to Assets) were collected and prepared based on the publicly available balance sheets and financial information.

In order to analyze the raw data of the sample (totaling to more than 1900 company-year-metric observations) various models were developed and were tested using linear regressions. These regressions will confirm or reject the hypotheses that will be set and consequently will back up or reject the research questions.

Additionally, two more case studies will be analyzed, again using empirical data. The first study will focus on the effects the deregulation of the road freight sector had on the short sea shipping sector. To perform the analysis, publicly available data were collected, and more precisely data on the GDP and on the ton-kilometers transported via SSS based services and were compared with deregulated availability of trucks. Using linear regressions, the hypotheses will be tested. Similarly, the second case study focuses on the impact regulatory intensity, as measured by the OECD ETCR index, has on the transport industry output at the European level. Again, using linear regression models, the analysis will test this hypothesis. Last but not least, the results are discussed and some key policy recommendations, based on the implications identified, are drawn.

1.6 Research Contribution and motivation

The regulatory environment has changed in the past 30 years and efficiency has improved as a result. In some places, inefficiencies in transport and trade logistics persist in the form of market failures, poor service and high prices, while in others deregulation has led to more efficient transport and logistics services. Rational reform of legal and institutional frameworks is important for the industry. The regulatory environment must adapt to the global economy and to the industry. This is the core motivation of this study, to understand the effects deregulation has on the firm level in the transport sector as well as to understand the cross modal effects of deregulation.

International experience confirms the benefits of strong competition. Many countries have introduced substantial reforms to their transport markets by essentially deregulating the industry. There are numerous studies that have focused on the effects of deregulation primarily theoretical but also empirical. This thesis contributes to the rich body of literature in the following ways:

- Uses a large time scale for the privatized firms, allowing for a comprehensive view of how deregulation has affected the entire industry, as opposed to fragmented study periods or fragmented studies,
- Uses the most recent data (post-2000), which include major changes at the industry level, post deregulation,
- Studies both effects within one sector of the industry as well as effects at the industry level, providing a better overview of the system-wide effects,
- Is a rigorous analysis on the firm level empirical evidence, being the first to study the managerial implications of deregulation on the transport industry, complementing the traditional theoretical uni-sectoral studies and empirical cross-industry studies failing to focus on the transport industry.

1.7 Thesis Overview

The thesis is divided in the following Chapters:

Chapter 2, "LITERATURE REVIEW": this section presents the relevant Literature Review, as well as the most important definitions that will be used. Additionally, the objectives for Government Intervention are discussed along with the regulatory tools that the state has in its disposal to implement a regulation or deregulation. The rationale and the arguments for regulating an environment are also discussed and the section concludes with the effects as depicted by relevant studies in the field.

Chapter 3, "THE EU TRANSPORT SECTOR", discusses the macroeconomic transport environment and sets the macroscopic scene for the analysis. Additionally, the state of play of deregulation in EU is also discussed and more precisely, the current regulatory level in terms of the most important deregulatory interventions for each transport sector in EU is described. The sectors described are the most important transport sectors at the EU level, including Aviation, Railways, Road freight, Road passenger (non-urban) and Urban public transport, Inland waterways, Short sea shipping and intermodal transport.

Chapter 4, "ESTIMATING THE IMPACT OF DEREGULATION ON THE EFFICIENCY", is the analytical part of this thesis. The chapter describes some background information and relevant research on this specific topic, the development of the dataset and its characteristics and sets the hypotheses that test the research questions. Additionally, the sections describe the analytical methodology used and the empirical results obtained from the regression models. Furthermore, the chapter discusses some important conclusions derived from the analysis and contributes to the research and business literature, including the development of a business decision making matrix.

Chapter 5, "ESTIMATING SYSTEM WIDE EFFECTS OF SECTORIAL DEREGULATION", is the second part of the analysis, focusing on two case studies, namely the SSS case study and the Regulatory Intensity analysis. The chapter describes the relevant to this specific topic literature review and also the empirical methodology and the hypotheses to be tested. Additionally, the development of the two datasets is also described in this chapter which concludes with discussing the results and the policy implications.

The final chapter, ***Chapter 6, "CONCLUSIONS",*** provides an overview of the analysis and discusses in detail the results from the analysis as well as the policy implications

from these results. Finally, this chapter concludes with recommending future research on this specific topic.

Last but not least, the ***Appendix in page 225*** (and onwards) provides useful details of the models, the analytical methods and the results obtained. Additionally, the Appendix provides the raw data that were used in order to test them but also in hopes of further extending this research.

2 LITERATURE REVIEW

2.1 Introduction and Definitions

The ideal transportation system is designed to be efficient, to be solid and to be financially stable. However, inherent complexities, limitations and network abnormalities induce inefficiencies in the system, thus regulations are called for in order to correct market failures including externalities (e.g. health, safety, and environmental risks), asymmetric information, market power and long term system viability. On the other hand, although regulation may solve social problems, it may cause additional problems, including compliance costs, inhibition of innovation, technology adoption, ancillary risks, and rent-seeking. To achieve an ideal equilibrium between those two, governments adopt certain regulatory policies aiming at reducing adverse effects among competing carriers or improving viability in the long term. In order for those policies to effective, these ought to be neutral, in terms of incumbents' preference and also produce benefits that can be reallocated to the market. For example, regulatory bodies should not provide unfair advantages to carrier(s) or to an industry as a whole by granting special privileges, freedoms or promotions, user charges, subsidies, taxes or economic regulation(s) in any other way.

There are many definitions on what regulation is, however, Stigler (Stigler, 1971) states that "[…] Regulation may be actively sought by an industry, or it may be thrust upon it, […] (which) is instituted primarily for the protection and benefit of the public at large or some large subclass of the public, […] or is essentially a political process defying rational explanation". Although this is not the most complete or exact or widely adopted definition of regulation, however, it successfully encompasses all of the debate on which most of the relevant discussions are based. This follows mainstream definitions, including Waterson's "[regulation is defined as] control of an industrial activity by government, in the sense of actions, such as restrictions on firms entering the industry, constraints on firms actually in the industry, or both" (Waterson, 1988).

A contrario, deregulation is considered to be the elimination of government imposed controls that govern the operation of markets or industries[1], particularly barriers to entry. For the transport sector, the market deregulation is mainly reached through:

- Allowing more companies to operate one route or one geographic area or one trade,
- Introducing substantial fines for price fixing cartels or predatory pricing or unlawful market practices,
- Allowing more contestability among market incumbents, without introducing too many disincentives, thus indirectly supporting and/or allowing for long-term investment.

In a perfect market, the allocation of resources, goods, prices and level of service are all set by competition and no regulation is needed since no imperfections (in the market) exist. Nevertheless, when imperfections arise, the government imposes requirements on (mainly) private firms and individuals in order to achieve some preset objectives. These objectives include better and cheaper services and goods, protection of incumbents from "unfair" (and /or fair) competition, environmental and sustainability objectives, safer workplaces, products and practices, etc. Failure to meet regulations can result in fines, orders to cease doing certain activities, or, in some cases, even criminal penalties.

Litan (Litan, 2015) identifies three types of regulation:

- ***"Economic regulation"***: the set of rules that limit who can enter a business (entry controls, ownership structure and capacity restrictions) and what prices the incumbents may ask (price controls). These regulations are imposed on various sectors or industries, for example on taxis as well as on other

[1] Although "market" and "industry" are essentially different terms, this thesis uses them interchangeably, since any regulation affects both

professionals (entry controls), or on airlines, trucking companies, and railroads (price controls).

- ***"Social regulation"***: the set of rules governing how any business or individual carries out its activities, aiming to correct "market failures". A classic example is the externalities which are sometimes overlooked by the market players.
- ***"Information Regulation"***: the set of rules imposed on companies in order to provide sufficient information for consumers, regulators or workers to make informed choices.

This identification follows the definition OECD gives in each engagement (OECD, 1997), which categorizes the regulations in three broad categories, namely:

- ***Economic***, which intervene directly in market decisions such as pricing, competition, market entry or exit.
- ***Social***, that aim to protect public interests including health, safety, the environment, and social cohesion, and
- ***Administrative***, which include all the government imposed formalities.

Based on the available literature review and on the experience, the most important regulations, pertinent to the transport sector can be described in Figure 4.

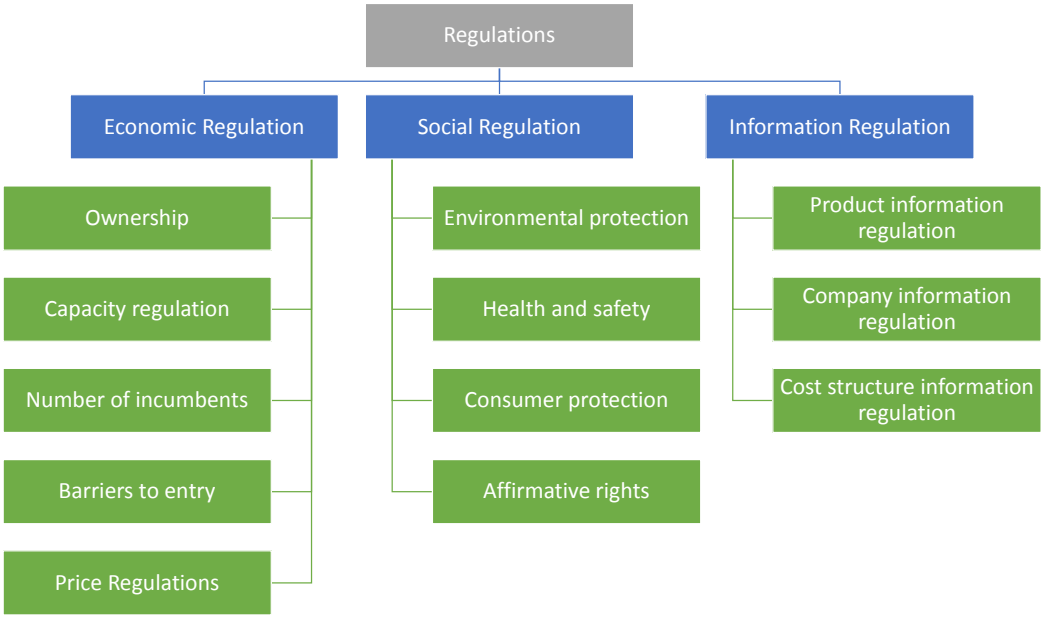

Figure 4 – Basic breakdown of regulations for the transport industry based on OECD

Economic research has focused on regulation with a high degree of consensus among academics on several propositions, including specific regulatory propositions as well as broader industry justifications. For example, price controls are nowadays confined to (natural) monopolies or duopolies. Similarly, entry controls are only imposed on those markets where low quality should not be tolerated. Furthermore, social regulations are imposed mainly through environmental performance standards. This leaves room for interpretation to the policy makers, since the level of restrictions may affect the costs and the benefits of regulation.

With regards to regulating transportation services and transportation capacity, we can identify all three types of regulation. More precisely, economic, social and information regulations are often used by regulators to accomplish their objectives. For example, the transport economics domain studies issues of economic regulation of the supply of transport and more precisely whether transport services and networks should be provided by the public sector or by the private sector or by both. The essential attributes of the transport networks and services enable any combination of regulated/deregulated and public/private provision. For example, bus services in many EU capitals are provided by both the public (core metropolitan areas where regulation is very strict) as well as by private establishments (in agglomerated urban sprawled areas in a fiercely deregulated economic environment). This will be further discussed in the following sections.

2.2 Objectives for Government Intervention

The Government has many different objectives, sometimes even mutually exclusive or collectively conflicting, to intervene in the markets. All of them based on the specific needs, on the type of regulation as well as on the type of user/consumer/producer group affected each time. Governments usually establish regulation in order to improve sector or industry performance relative to an ideal standard. Nevertheless, the exact meaning of “improving sectorial or industry performance” is subject to considerable debate, since the government may be addressing commitment issues, achieving long term efficiency or long term sustainability or favoring particular types of customers or suppliers. Generally speaking, from a normative perspective,

regulation may be desirable if the welfare objectives of the government are different from the business objectives of the operator(s), the operator(s) has(ve) an information advantage over the government and lastly the production or service provision produce externalities that are not otherwise addressed. These objectives are briefly described in the following paragraphs.

2.2.1 Social welfare (maximization) objectives

The main argument in favor of regulation is the maximization of social welfare by resolving market failure(s). The most often observed failure is when one or more incumbents gain market power, thus creating monopolies, cartels, or other forms of collusion. These developments may limit the benefits that are observed in competitive markets and free trade, including further developing natural monopolies, a condition which is inherent in transportation networks deployment and in developing transportation infrastructure.

Another argument is reducing externalities, for example, in the context of transport congestion, of adverse effects on the environment from building a network or operating a rolling stock, of consumption of energy and emissions etc. These are also called negative externalities. Similarly, there is the case where in the presence of positive externalities, the government also intervenes in order to reap benefits (for the society) from the Network Effects especially when the speeding up of the economic growth will improve the societal benefits and the public (and private) utility. Last but not least, market failures take other forms, which lead to interventions like the provision of PSO (Public Service Obligation) goods, the offering of transportation in distant areas, defense issues, public goods, fixing information asymmetries, etc.

2.2.2 Macro-economic objectives

Macroeconomic objectives are a very common argument especially in favor of governmental intervention in the transportation sector, since the transportation product has very strong multiplier effects for an economy. Macroeconomic objectives come in many forms, for example efforts to control inflation (including price stabilization), efforts to minimize the effects of economic cycles (e.g. maintain

employment during recession, efforts to control high value, ultra-worth assets, promoting/demoting exports or imports, etc), efforts to boost a specific sector or industry uptake, efforts to foster innovation, efforts to reduce information assymetries, to name but a few.

2.2.3 Socio-economic objectives

The Government promotes a range of socio-economic objectives, for example income or wealth (re)distribution, efforts to provide a basic standard of services to all citizens, (for example "Mobility-for-All" programs, etc), efforts to promote public safety and security, efforts to promote certain sectors of the economy, or even efforts to promote individual sectors or firms (Industrial Policies). Additionally, the reduction of the negative externalities is also attributed in this category.

2.2.4 Other objectives

This last category includes all the unclassified objectives a Government may have. This category includes efforts to promote national interests, efforts to promote national prestige, or even efforts to promote specific interest groups.

2.3 Regulation: Rationale & Arguments

Regulation is a way for the Government to reallocate resources and redistribute income based on a more "fair" basis and for a production outcome yielded by the market. To this extent, the transportation sector has been heavily regulated until recently all over the world. As discussed above in §2.2 "Objectives for Government Intervention" (pp 45) we can identify two main theories why economic regulations are imposed: (a) consumer protection and (b) industry protection. Although there are different rationales in each case, these two are the most prevalent and are discussed below.

2.3.1 Consumer Protection

Posner (Posner, 1974) describes the public interest theory, advocating that regulation is used to protect the public against the market failures and most commonly, against

the adverse effects of monopoly. This type of regulation maximizes social welfare by correcting market failure, for example, regulating monopolies to produce the level of output that maximizes social welfare, instead of maximizing the monopolistic optimal output. Additionally, fixing externalities is also attributed to consumer protection.

2.3.2 Industry Protection

2.3.2.1 Main Arguments

Across the public interest theory, the industry protection theory is the main argument in favor of regulations on the supply side. Regulatory capture is promoted by politically effective groups in order to protect the sector or the industry. Industry incumbents ask for regulations mainly because it is expected to generate economic rents, capitalizing on the influence they have based on their financial interests relative to the interests consumers may have. Stigler (Stigler, 1971) discusses that producers "capture" regulatory agencies in order to get protection from "*public interest*", transferring value and benefits to the producers, benefits that the producers could not obtain in more competitive markets. To this extent, there is a tendency for incumbents to ask for stricter regulation especially through lobbying. This is a common feature for incumbents and is used so as to obtain greater market power (entry restrictions, higher operational / compliance costs, etc). Two distinct cases of industry protection are discussed in the following section, namely first stage protection and intense competition amendment.

2.3.2.2 First Stage (Infant Stage) Industry protection

The protection of an industry in its early stages (infant industry) is also an argument in favor of economic regulation typically used in those cases where potentially large external benefits from the growth of an industry are expected, or in the expectation for other important non-economic benefits. For example, the introduction of sustainable energy production facilities in EU came with heavy entry regulations as well as significant subsidies, grants and tariff exemptions. Similarly, in the shipping sector, the use of technologies like cold-ironing, scrubbers and LNG fuels has come with economic regulation through grants (e.g. upgrade of vessel machines) and through geographical based capacity and output restrictions (SECA Zones).

2.3.2.3 Intense Competition Remedy (Intra & Extra market players)

Although strengthening competition in a market is the main reason for deregulation, intense, beyond a certain point, competition is not always good and may affect negatively long term stability and sustainability in the market. Intense or "cut-throat" competition ultimately leads to anti-competitive business practices which subsequently constraint competition in a market in the long run. In this case, long term cost retrieval is not achieved (for example asset depreciation and capital expenditure reclaims) since in most of the cases, the pricing wars (predatory pricing) do not allow to cover production costs over extended periods. Additionally, the case of price instability regulation in intensely competitive markets is argued as a method that stabilizes output prices. For example in the transport industry, this is most often seen in shipping conferences, where the government allows the development of transport cartels as a way to discourage new entrants and consequently stabilize market prices. Furthermore, in heavily congested road networks, the hidden congestion costs that increase and destabilize the "price" paid or incurred by the users is also argued in favor of regulation. Therefore, regulation from the government is asked as is the case with congestion pricing in Metropolitan areas (e.g. London, UK), entry restrictions (car entry restrictive policies in Athens, GR) subsidies to other modes, etc. in order to reduce the competition's adverse effects. Similarly, with regards to large scale infrastructure, as with road networks, the infrastructure tends more often to be publicly owned so as to provide a level playing field for all incumbents.

Furthermore, irrational pricing may be also practiced in the short run through anti-competitive practices, especially in sectors where intense competition prevails. For example, regulatory rate-setting practices may lead to partial cost recovery thus indirectly leading to operational problems (e.g. the local government imposing low fare policies to deregulated bus companies, leading to excess financial losses). Similarly, predatory pricing, common in markets with few incumbents, leads to low profit margins thus to financial losses in the long term. The case of the airline industry is a case in point, since this competition led to many companies to bankruptcy (for example the first wave of low cost carriers in the USA have – most of them – filed Chapter 11 claims).

2.4 Review of Relevant Economic Principles of Transport Systems

Although the different transport sectors are diverse in many respects, they all share one fundamental element: they are all essentially network industries. The common properties include (Sambrakos, 2001):

- Complex technical, economic and political sub-systems with many hierarchical levels,
- Economies of scale and of scope,
- Externalities in production and in consumption,
- Provision of public interest services.

The regulatory challenges involved are significant and usually regulation poses a multi-objective multi-variable decision making problem, especially when the different hierarchical levels of transportation service provisions are considered in a system-of-systems context (Emile Quinet, 2004):

i. The infrastructure level, including the roads, the railways, the ports, the terminal facilities, the airports, etc.,
ii. The infostructure level, including the information technology and information sharing systems that improve utilization, safety and security of the available infrastructure (for example VTMIS, ERTMS - signaling systems for railways, air traffic control, urban traffic management),
iii. The service provision level (including all forms and all actors of transport service provision like road transport companies, rail operators, short sea shipping).

Based on the above consideration, the main regulatory concern is at which integration (vertical/horizontal) level the provision of the transport service should be undertaken by a single or by more undertakings. Considerations about the ability of the transport industry to offer the services at a low price but at the same time at a good quality, or the market on the other hand getting the required services reflect the main regulatory limitations.

Additional regulatory considerations based on the specific principles of the transport systems include:

- The level of entry and exit costs (sunk costs) at the individual and at the systemic level,
- The extent of economies of scale and scope,
- The importance of services of general interest,
- The externalities (with particular reference to elements such as environment, congestion and accidents),
- The transport chain elements being essential and/or critical to the system.

Regarding the entry and exit costs, which are key drivers of the transport industry structure, it has to be noted that they may significantly influence the competitive pressure that incumbents face from potential entrants. For example, the road freight and the inland waterways sectors (at the service provision level) had low entry and usually no exit costs (although the limited transport product quickly made these entry costs sunk, affecting the entrance of newcomers in the small and medium sized business). Thus, the markets have been served by many undertakings. Contrary to this, the high entry costs (for example compliance fees and investment expenses) in other sectors, like the railway or aviation sectors, reduced the commercial appetite of new market entrants.

Similarly, the economies of scale and scope seem to have a reinforcing relationship with optimal industry structure. For example, significant economies of scale dominate companies with large fixed costs (too many trucks/railcars, etc), whereas economies of scope dominate synergistic service provision approaches (one truck/railcar servicing all market segments i.e. both retail and wholesale). The downside is that economies of scale/scope strengthen monopolistic approaches including monopolistic rents. With significant economies of scale and scope there is always a tendency towards natural monopoly.

Public interest services is another concern, since the main objective, especially in the passenger markets, is not to leave un-served or not to leave significantly underserved the public. One solution for intervention is the public service obligations (PSOs) which include financial support to the service provider. Additionally, the externalities produced by the transport sector are also the regulatory focus, since the provision of transport services may adversely affect the general public, or the environment.

Last but not least, the theory of essential infrastructure (as will be presented below) is a matter of focus for the regulatory intervention, since their lack or their sub-optimal use may affect the entire transport chain.

2.5 Regulatory Tools

2.5.1 Overview

Regulatory tools range in scope, in scale (intensity and/or severity) and in coverage from simple instruments such as counseling and information awareness to more advanced and/or restrictive tools including ownership and operational engagement in undertakings in certain industries. The most common instruments of intervention include the following categories:

- Information awareness: the government attempts to affect user choice through soft measures including, speeches, conferences, information sharing, advisory, consulting bodies, studies/research etc. The main aim is to influence using little or no direct expenditure or regulatory action. The use of increasing information awareness is sometimes referred to as *moral suasion*. Other tools include promotion of research and partial funding, organization of academic or professional conferences on a given topic, the establishment of advisory and consulting bodies that can offer guidance and assistance to the different user groups, and last bit not least the reorganization of existing agencies.
- Government expenditures: the most common form of government intervention is direct spending for a specific issue to promote the regulatory objectives and ensure the production of services or goods that are socially beneficial or have a desired impact. These tools include direct spending financial facilities, grants and subsidies often combined with provision of public assets.
- Rules and Regulations: Governments impose certain regulations for economic, social or other purposes. For example, in the transportation sector, entry limitations lead to concentration and monopolistic contexts (for instance the railroads infrastructure, the airline sector, etc). In this case, the Government lets the private establishment offer the services / goods while imposing some

form of regulation(s). In order for the Governments to enforce regulation, specified bodies that have been granted additional powers of imposing fines and penalties stipulate the standards, the rules and the guidelines.

- Government ownership and/or control of enterprises: the most powerful tool of regulation is the direct ownership of a company. The provision of a service or production of goods through a public agency or state-owned enterprise may allow for setting more efficient prices or more fair prices, especially in cases where production is subject to strong economies of scale, or where regulation is difficult.

2.5.2 Regulatory Tools used in the Transport Sector

The main regulatory tools used in the transport sector fall in the following categories:

- Price regulation (minimum / maximum rate, rate structure, rate duration),
- Rate-of-return regulation,
- Quality of the transport service provision regulations,
- Entry and/or exit restrictions,
- Antitrust regulations including mergers and acquisition,
- Financial and accounting practices regulations,
- Safety standards (minimum safety regulations),
- Other regulations.

The most common of them are briefly discussed in the following paragraphs.

2.5.2.1 Price Regulation

Price regulation is the establishment of a maximum limit or a minimum or both on the prices firms ask for their offerings. Price regulations are mainly used to constrain market power of monopolistic / oligopolistic incumbents, thus regulators enforce either price-cap or revenue-cap regulations. At the same time, the minimum limit provides for a base level for all incumbents assuring at least recovering some of the costs associated with service provision. Price-cap regulations limit price changes, for example based on the consumer price index or some other index, controlling irrational price variations, while producers are indirectly incentivized to reduce their

costs. Before economy wide deregulation, incumbents were asking permission from the regulatory overview agency (or the state) for any price changes. Currently, at the EU level transport industry, there is no such application, however the regulatory agencies (for example Competition Authorities in EU) have the right to inquire further for any price change as well as for the price on its own merits. Regarding the revenue capping practices, although somehow unusual, the most common form was backward rent asking from incumbents either through taxes or through operating permits or other similar forms aiming to reduce the (abnormal) monopolistic rents.

2.5.2.2 Rate of Return Regulation

A more fair regulatory practice (compared to Price Regulation) is the rate-of-return regulation. Regulatory authorities use a rate-based regulation in order for the carrier to make up a "fair" profit based on the investment. This practice has more sustainable long-term effects, since capital expenditure is (usually) recovered and additionally myopic short term price policies are disregarded. A recent example is the tolling regulation in the EU core road network as well as the slot pricing in the rail infrastructure in EU. In those cases, the EU MS have been regulating the rate of return for these systems.

2.5.2.3 Quality of the Transport Service Provision Regulation

Quality regulation has many attributes, from the very basic capacity planning, type of car/vessel/aircraft used, age of the car/vessel/aircraft, frequency of the service, connectivity with other modes or within mode (intra- and intermodal competition), resource allocation etc. The most common regulation of this type are the Public Transport Concessions in most deregulated metropolitan areas as well as the Port Concessions (and more broadly speaking, infrastructure concessions) being deregulated and transferred to private owners with specific obligations on how to run the services and strictly defining the services including the frequencies.

2.5.2.4 Entry and Exit Regulation

Entry and exit regulations has been the most common regulatory tool used worldwide and has been heavily used in the transport industry. Entry was restricted to a specific number of companies and new entrants would have to acquire a permit from market

incumbents. Similarly, exit from a regulated market would mean significant non-recoverable costs or would even not be allowed. A case in point is the road freight transport sector in EU as well as the trucking industry in the US and the airline sector on a global scale among others. Prior to deregulation, entry was very difficult since a permit (license) was required for airline carriers and for truck owners to operate. The permit would usually restrict carriers to certain commodities or classes of service or routes or even slots. Since deregulation, entry on specific routes was much more open, however, even currently, legacy limitations may exist (e.g. a carrier must not decline any request otherwise the company may be considered to be unfit or may default from the regulatory context). Likewise, exit was in most of the cases impossible either due to high costs or high penalties or even due to legal restrictions. For example in the bundled route assignments, where one route was uneconomical to be operated and the other was profitable, the assignee was not possible to abandon the uneconomical route. This led to heavy cross-subsidization among profitable / nonprofitable operations, which is now a non-accepted practice (for example in EU, the DG Competition has ruled against it in quite many occasions).

2.6 Effects of Regulation and of Deregulation

2.6.1 Introduction

There are numerous studies that have focused on the effects of regulation both theoretical and empirical. Most of the studies have focused primarily on the economic effects on the economy, the welfare and ultimately the wider public, that is, the groups that the regulations were first and foremost intended for. The following is a non-exhaustive overview of the relevant academic discussion on regulation.

Morrison and Winston (Morrison & Winston, 1989) argue that entry regulations in the airline industry reduces unnecessary competition. More precisely, they found that a 16% cost increase should be attributed to entry regulations including crown ownership of carriers (ownership of carriers by the government). They argue that entry regulations transfer rents to the organized input suppliers (aircraft manufacturers, labor unions, etc), and additionally, services are unresponsive to customer needs leading to great inefficiencies. Similarly, Douglas and Miller (Douglas

& Miller, 1974) discussed about price regulations and how they lead to quality competitions, again in the airline industry. Based on this work, they also discussed about the domestic airline system being much less flexible and more inefficient.

Winston (Winston, 1985) discusses that exit regulation creates excess capacity in the rail industry that produces inefficiencies, and more precisely discuss that "[…] Railroads were discouraged from abandoning routes by a lengthy and costly application procedure […] leading to two billion dollar welfare losses in 1963 dollars". Additionally exit regulation leads to cross-subsidization from profitable to unprofitable routes, thus the society loses more welfare under cross-subsidization compared to direct subsidy.

With regards to the Rate-of-Return regulations, Averch and Johnson (Averch & Johnson, 1962) advocate that this is a fairer basis for economic regulation. When companies' profits are based on the capital (at a certain percentage) this induces incumbents and new entrants to over-invest in order to increase profits especially in the long run. Excessive capital accumulation in those cases where the government has adopted the rate of return regulation, also called "gold plating", guide regulatory decisions based on a fair rate of return on the capital employed (that is the accounting / financial value of the assets). This in turn incentivizes firms to increase the value of the assets by investing more on capital input relative to other input (labor), leading to improved technologies employed and in some degree to innovation.

At this point, it has to be noted that these arguments apply where market failure is observed. If there is no market failure, in principle, there is no economic need for any economic regulation. For example studies have shown the impact of regulation on the airline industry, on the road transport (highway trucking), intercity bus and taxicab industries to name but a few. Empirical evidence (which is discussed in the next section) suggests that where there is no economic regulation, the market seems to work more competitively and to produce better outputs (the theory of contestable markets is also discussed in §2.6.3, pp.61). Therefore, it is easily understood that economic regulation is a cause of market failure, contrary to protecting the market, the incumbents and the public good as originally intended.

Criticism against regulation emerged as early as in the 1940s and 1950s with a growing number of literature criticizing regulatory intervention. The main focus has been the cost regulation and whether deregulating a market could bring more benefits compared to the costs of regulating the market. Based on these arguments, a strong deregulation wave was experienced around the world, for example the deregulation of the airline industry in the late 70s in the USA as well as the railroad and the trucking sectors' deregulation during the 80s. However, these deregulation initiatives were all aimed at reforming economic regulation, including constrains in pricing, entry and exit decisions and rate-of-return regulations. All other regulatory forms were not changed, for example safety, environmental, and antitrust regulation. This form of partial deregulation was again a product of both the academic thinking of this period (Winston, 1993) as well as real market needs especially in terms of safety and long term sustainability.

2.6.2 Impact of Regulation on the Transport Sector

As said before, there is a large literature on regulation, barriers to entry, growth potential and efficiency. The following section discusses the academic research so far on the regulatory reforms and more precisely the (potential) implications to the transport sector. It is an attempt to describe the current academic thinking relative to the effects on the input side (employment, capital, innovation/technology, etc) as well as analyze the effects on the transport sector peculiarities.

Research suggests that the impact of deregulation on the employment constraints has been positive and further on, deregulation fosters growth by affecting employment, productivity, investment, innovation and new business development. More precisely, Kugler and Pica (Kugler & Pica, 2005) have studied the impact of introducing dismissal costs, accession regulations and other relevant regulatory interventions. Their results from an Italian Social Security employer-employee panel has indicated that although this reform reduced firms' entry rates, it increased very much the exit rate, thus flattening employment policies over the economic cycle, reducing accession to the market and ultimately discouraging potential entrants. Considering that most companies in the transportation sector are Micro and Small companies, this affects

new business development and constraints employment opportunities, oftentimes leading to sole proprietorship companies and hidden employment.

With regards to the productivity growth, Nicoletti and Scarpetta (Scarpetta & Nicoletti, 2003) look at differences in the scope and depth of pro-competitive, pro-business regulatory reforms. Their research indicates that despite extensive deregulation and privatization in the OECD area, the cross-country variation of regulatory interventions has increased equally with the increasing dispersion in growth. They developed a multifactor productivity model and tested it against empirical data investigating the regulation-growth link. The authors found that reforms promoting private governance and competition (where these were deemed sustainable) tended to boost productivity. Additionally, within the manufacturing sector, the expected benefits from lowering the entry barriers are greater the further a given country is from the technology leader. Thus, by limiting entry barriers, regulation may boost the adoption of new technologies, increase completion, induce technology spillovers, or the entry of new high-technology firms. The benefits from deregulation and from privatization were found to be positive in terms of productivity growth in all panel sectors.

With regards to investing in capital stock, Alesina et. al. (Alesina, Ardagna, Nicoletti, & Schiantarelli, 2005) have studied regulation on several sectors from OECD countries and have found that regulatory reform of product markets, especially in terms of reducing economic regulation, is positively associated with an increase in investment. More precisely, entry liberalization and privatization were both found to have a substantial effect on investment.

Furthermore, Aghion et. al. (Aghion, Blundell, Griffith, Howitt, & Prantl, 2009) have studied the new firm entry effects on innovation incentives and on productivity growth in incumbent firms. Their study suggests that incumbents in technologically advanced industries react positively to foreign firm entry which contrasts the case in lagging industries. Their analysis is based on a Schumpeterian growth model where they studied new firm entry with respect to a multi-sector model, thus showing that the threat of technologically advanced firms that may enter a market proliferates

innovation incentives especially in sectors close to the technological frontier. This encourages innovation and innovation adoption by incumbents.

This evidence shows that deregulation has positive effects across industries and help them use inputs in a better, more efficient and more sustainable manner. Furthermore, the following discussion focuses solely on the transport sector, discussing effects of (de)regulation on different transport industries.

Mizutani and Uranishi (Mizutani & Uranishi, 2013) analyzed the structural separation policies in the railway sector in EU and in East Asian countries with regards to vertical (operation-infrastructure) and horizontal (passenger-freight service) separation. Using econometric methods they analyzed the total cost function of 30 railway organizations from 1994 to 2007 and showed that horizontal separation reduces railway cost. With regards to vertical separation, effects change according to the density of a railway organization and of the rail network. Similarly, Mizutani et al (Mizutani, Smith, Nash, & Uranishi, 2014) examined, using econometric methods, the cost impacts of three different approaches to structuring railway systems. More precisely, they studied vertical separation, vertical integration and the intermediate holding company models and found that the optimal railway structure depends on the intensity and type of traffic running on the network, suggesting that on cost grounds, countries should be free to regulate and select either the vertical integration model, the holding company model or vertical separation model.

Furthermore, Growitsch and Wetzel (Growitsch & Wetzel, 2009) conducted a pan-European efficiency analysis and investigated the performance of European railways in terms of vertical integration effectiveness. They analyzed whether integrated railways realize economies of scope producing more efficiently railway services. Like most of their peers, the analysis has a theoretical background, using the theory of data envelopment analysis, developing a super-efficiency bootstrapping model which relates the efficiency for integrated production to a reference set consisting of separated firms which use a different production technology. This analysis follows a previous work from Wetzel (Wetzel, 2008) which used stochastic frontier analysis to prove that regulatory reforms have both positive and negative results depending each time on the different business environment factors used. This selection substantially

changes parameter estimates (coefficients), thus leading to biased estimation results when extrapolated in national or international level. Similarly, Cantos et al (Cantos, Manuel Pastor, & Serrano, 2012) use different theoretical approaches to estimate efficiency levels, using a sample of 23 European (national) rail systems for a period from 2001 to 2008. Based on this panel, they analyzed the impact of various reforms on inefficiency levels and found that the rankings obtained were similar, indicating that the best way to achieve increased efficiency is to combine vertical and horizontal reforms in the rail industry.

With regards to the shipping industry, Austria (Austria, 2003) describes the shipping industry as a highly contestable market, with minimal governmental intervention in terms of economic regulations. However, in lieu of the intense competition and regular market failures, there is a tendency to regulate liner shipping so as to produce stability in the market. All relevant sub-industries are highly vulnerable to both price and capacity fluctuations, leading to intense competition among incumbents. This, in turn, leads to concentration producing oligopolistic markets and ultimately monopolies as weak firms are driven out of the market (the case of insular ferry network servicing in Greece, Scotland and France are very distinct cases for this matter). The low marginal costs in this industry induce high volatility on the fares, especially when the incumbents try to operate near capacity, so as to reduce the average cost and prove themselves winners out of this competition race. This makes the industry unprofitable for all operators and eventually the market becomes a monopolistic one. This is especially true in markets where the shipping companies have set up extended networks which have overcapacity compared to market demand. In this case, the government intervenes proactively to stabilize the prices at a “fair” level, either by regulating prices themselves or by regulating rate-of-return.

Furthermore, governments also intervene with posterior regulation, and more precisely in those cases where an oligopoly or a monopoly have already been introduced. Although there is a debate on whether shipping has economies of scale, setting up a “complete” network represents a significant barrier to entry. According to Dick (Dick, 1987) shipping doesn’t present higher economies of scale (when for example the ships get larger or merrier), since although larger vessels have lower costs

per ton compared to smaller ships, any cost advantage of larger vessels is offset by higher cargo-handling rates (the larger ship spends more time in the port) and less frequent service provision because of their slower turnaround. Nevertheless, the modern logistics networks require significant investment not only in ships but also in auxiliary services, network development and other relevant investment in indirect activities, necessitating a scale operation to make the operation sustainable.

Additionally, Austria also discusses rate discounting, particularly on freight rates, a common practice in the shipping industry. Government regulations are also necessary to stabilize the market and also sustain long term viability, since paid rates differ significantly with the preset (and announced) rates, stemming from the bargaining power between shippers and shipping operators. Although discounts have various forms, this tends to favor specific user groups on the detriment of other groups as well as affecting negatively the sustainability of the market. The Adriatic Sea Ferry connection in the EU is a rather useful example; the price wars among the carriers led to significant price discounting to certain user groups, which in turn led several shipping companies out of the market due to significant financial losses.

2.6.3 Influences that changed the philosophy of regulation in the transport industry

In a policy brief, Watson (Watson, 2013) discusses the factors that may trigger changes in regulation. These factors include new ideas, economic and technological changes, shifts in the power of interest groups and incentives affecting legislators and regulators. More precisely, the main catalysts for change in the regulatory framework in the transport domain include:

- ***Changes in ideas***: Economic ideology after the 1970s and the 1980s has significantly shifted towards more competitive based systems, with minimal distortion from government intervention, ownership separation and ultimately simpler and more transparent systems. Although many think that deregulation started during the Thatcher or the Reagan administrations, it was actually initiated during the Carter Administration (in the USA) and during the Adenauer administration in Germany, as a fiscal control mechanism during the

1970s. However, the ideological change in the transport sector in EU started in the late 1980s and is still an ongoing process.

- ***Changes in the economic habitat***: the economic and business environments play an important role in the deregulation efforts. The rapid change in the money markets and in the cost structures as well as the restrictions in public spending and public macroeconomic deficit have played an important role in deregulating the various sectors.
- ***Changes in the technology and innovation***: technology and innovations have played an important role in shifting regulatory mentality, since the state owned companies were risk averse and did neither easily nor quickly enough adopt new technologies, both in terms of equipment and productive machinery as well as in terms of developing and offering new services and/or new products in the market.
- ***Changes in the effectiveness of interest groups***: the influence of interest groups has always played its role, thus when certain groups emerged and previous groups lost effectiveness, a shift in the deregulation has been observed.
- ***Changes in the incentives***: a primary regulatory tool is the incentivization of certain activities. With the removal of such incentives, many changes are introduced in the market and thus the need for regulation is also shifting.
- ***Changes in the internal dynamics of regulatory and/or governmental agencies***: this is similar to the above-mentioned interest group effectiveness, since the lead role in this case is orchestrated by the different governmental structures and the way they can propose and succeed in introducing regulatory actions. Similarly, in the place of interest groups and lobbying mechanisms, new agencies are introduced which strive for deregulatory initiatives to legacy practices

Especially for the transport industry, it should be noted that the change in the economy as well as the shift of the political ideas were the main reasons that affected the adoption of more pro-market and pro-competition initiatives. Furthermore, when specific regulatory authorities were set up, these where favoring industry-wide

deregulation so as to create a more level playing field and to further promote modal competition.

2.6.4 The theory of Contestable Markets and implications to the transport sector

Further to the previous discussion, it should be noted that the limited number of incumbents in an industry doesn't necessarily lead to market conditions that deviate from the ideal of competitive markets. Baumol et.al. (Baumol, Panzar, & Willig, 1982) indicate that markets may function competitively, even when only a few producers / providers exist, under certain conditions, reaching efficient equilibria without regulation. This theory was originally advocated by Harold Demsetz (Demsetz, 1968) and the conditions that should be in place so as the market structure and the market dynamics would resemble those of a perfectly competitive market include:

- Equal access by all incumbents to scale economies and technology, including access to competitive levels of unit costs and/or of product quality,
- Unrestricted entry and exit without entry and exit costs (including sunk costs from operating),
- Stable prices with no variability especially from entry / exit of competitors.

The idea behind this theory is that potential competition can replace actual competition. Therefore, even a single firm (monopoly) will behave like a competitive firm if the market conditions are the same for all market players (even potential entrants) and by all means, there is free entry and free exit from this market.

Contestable markets theory provides a reasoning supporting deregulation of transportation markets, and more precisely the vertical separation, even if no entrants initially joins the market. Empirical evidence has shown that if the conditions are equal to all incumbents, then it is no longer necessary to attract actual competition in a market since potential competition adjusts the market dynamics. This in turn might require new and strict regulations to be implemented. For example, there is no need to regulate a market with low sunk costs, or an industry with free entry. Nevertheless, theory adversaries suggest that the transport industry doesn't follow the contestable market principles. An early study from the airline industry (Bailey, 1981) showed that

transport markets (sub-sectors) may be partially contestable and actual competition is more effective than potential competition.

2.7 The context of regulations for the transport sector

2.7.1 Overview

According to the International Transport Forum (International Transport Forum, 2011), there is a wide choice of potential regulatory interventions, ranging from open market to government-led ownership, from private contracts to concession contracts, from discretionary regulation to public enterprises. In each case, the performance of each intervention is significantly affected by either the institutional or the market environment or both. With regards to the transport sector, the reluctance to leave governance to markets themselves, the adoption by governments of an operational role and the direct public ownership and control, have resulted in many governments adopting intermediate and/or hybrid solutions. For example, newly developed and appointed, Independent Regulatory Authorities are set up[2], have the regulatory oversight over the privatized companies or the State-owned companies who have a commercial objective and impose the policy objectives. As said above, the regulator protects users' interests by removing market failures and by protecting the public goods as well as the government backed infrastructure and assets.

It has to be noted that the governments are steadily adopting pro-market industry frameworks, however the transport industry is a very peculiar business environment and as such a number of issues have to be carefully addressed. This section discusses

[22] For example in EU, for each transport mode, a regulatory body is to be established in every Member State, with different objectives and powers; in the rail sector, the main task of the Regulatory Body is to ensure a fair and non-discriminatory access to the rail network and services, having its legal basis for the creation and competence of the Regulatory Body in Article 10.7 of the Directive 2001/12/EC (European Commission, 2001a) and in Articles 30 and 31 of Directive 2001/14/EC (European Commission, 2001f).

the framework of the transport industry and some specific concerns pertaining the transport sectors.

2.7.2 Transport Systems and regulatory concerns

A number of transport systems attributes are key decision drivers in selecting the regulation mix for a specific sector or even industry wide. The most important attribute is the extensive, capital intensive infrastructure. The transport network involves significant investment which is also lumpy since, in layman's terms, each increment has to be entirely built so as to accommodate the users. This implies that the marginal cost is very high for the first entrants and very low for the last users of the lumpy increment. Turning this argument around, the average total costs are inversely proportional to the number of users. Thus pricing of infrastructure and of service provision is adversarial in essence, especially when considering natural monopolies.

Another attribute is the ease in creating monopolies. This may come in different forms, but the most common is the (expected) advantage a company gets from market dominance whereas less common is the advantage the incumbent(s) acquires from the network layout. The denser the transport network, the higher the economies of density. It has to be noted though that these economies are based on specific market and business characteristics and differ from both economies of scale and of scope[3] (Caves, Christensen, & Tretheway, 1984) thus this attribute is less often observed.

Another regulatory concern in the transport systems are the joint costs. The infrastructure is used by a wide variety of users with different price elasticities and different payability profiles. The time criticality is of importance as well as similar quality factors. However, the regulator has to provide a level playing field for all users.

[3] Caves et.al. (Caves, Christensen, & Tretheway, 1984) give a very successful example on this issue: the difference in costs between trunk and local routes. The former is the classic economies of density whereas the latter is the typical economies of scale.

Although discriminatory pricing could increase the Total Revenues of the system, it often brings adverse effects. For example, PSO services and near PSO services could be a place to exercise market dominance as in the cases of peak usage in transport systems. The bottom line suggestion is that discriminatory pricing can't differ considerably compared to mean prices.

Another concern in the transport sector is indirectly created by the above issues. The correct managerial accounting principles by definition can't be precise in any transport sector and in the transport industry in general. There are so many accounting drivers that is endogenously difficult to calculate (and agree upon) a single cost metric in an entire transport network. Thus, the systems usually work either with approximations or with simplifications. However, as it is understood, this may create cross modal competition asymmetries in the system. Furthermore, this has implications to PSO offerings, since the subsidies are very difficult to be appropriated to specific segments, arcs, nodes or even areas of an entire system.

Furthermore, an additional issue in transport economics that directly affects the regulation is the cross subsidization at the firm, route or service level. Especially in companies that take advantage of economies of density or of scale, this is a very typical observation. The EU is very keen to resolve these issues and this is a typical matter for EU's DG Competition.

With regards to the demand profile, the variability in terms of spatial, duration, time and volume is very important in pricing and ultimately regulating the transport industry. These trends are also complemented by directional imbalances, producing adverse effects on the provision of the services. These trends produce significant imbalances that in some cases may be irrecoverable and regulation might be required in order to level off these adverse effects and produce a stable economic environment in the transport industry.

Last but not least, it should be noted that technology adoption is also a crucial issue, in terms of new technical and managerial technologies that may be implemented in the transport industry. New technologies may certainly help an incumbent but they can also undermine the incumbent's existence. The current strategic approach is to adopt new technologies as a driver for competitive advantage. Nevertheless, in certain

cases technology might produce competition asymmetries, thus, the regulator should step in and amend market failures. Similarly, the regulator should also assume initiatives and boost technological adoption especially when the incumbents refuse to embrace necessary new technologies. In this case, the regulator should impose such rules so as to induce technological adoption.

All of these concerns discussed above produce market asymmetries and ultimately market failures, even in the presence of regulation from the state. However, as can be easily understood, this debate focuses on the many attributes and the trade-offs that have to be satisfied in order to succeed in regulating (or deregulating) the transport industry.

2.7.3 Governance structures for the transport sector and regulatory context

Following the previous discussion, the transport sector is a very diverse sector with many different attributes and operational peculiarities that need to be carefully assessed before any regulatory enforcement takes place. The governance structures should be fit-for-purpose for the specific context they are aiming at, otherwise the effects from regulation may be significantly constrained. In markets with significant number of incumbents, Commercial Law and private contracts are sufficient to govern relationships among private suppliers of transport services. For more complex relationships, especially in oligopolistic or monopolistic contexts, public intervention is necessary. Ports and airports, infrastructure and natural monopolies especially, require the governmental intervention through regulation, in order to offer a level playing field for all market players as well as to all users by reducing the market power they have.

An example of the previous argument is the case of airports. Starkie (Starkie, 2008) analyzed the power certain UK airports had and showed that for non-hub airports served by low cost carriers, the cost structures and competitive conditions lead to more intense competition, so no need for regulation was required. Starkie advocates that in such cases, the enforcement of regulation might induce inefficiencies to the system. Based on this premise, the UK Government has privatized BAA Plc, a company transformed from the former British Airports Authority and taking over the airports

around London, Edinburgh and Glasgow. The Regulatory Body required BAA Plc to divest some of its airports (for example the Gatwick Airport in 2010) aiming at introducing more competition, thus replacing regulation of airside charges. Furthermore, most of the UK's regional airports have been deregulated, encouraging competition among incumbents, thus reducing the costs of regulation by introducing deregulation. In this case, the new need is for the Regulatory Authority (RA) to be able to exercise appropriate powers on the incumbents, as well as the capability to monitor the activities in depth so as to adopt and impose specific remedies. For example, the RA should be able to review arrangements (commercial and other), understand and assess system wide efficiencies, etc.

In the same context, international airline routes were benefited from deregulation of market entry limitations based on Oum's et.al. (Oum, Fu, & Zhang, 2009) estimations, who attributed a third of the growth of revenue passenger-kilometers to the Open Skies initiative and forecasted a 15% growth (a figure roughly around US$20 billion) for international aviation as a result of deregulation and of liberalization. The same principle is also applicable to ports, since geographic proximity induces route based competition among the different ports. This principle has to be carefully considered when examining competition issues even inside port complexes, e.g. in the case of vertical integration of terminals, of shipping lines using different quays and of logistics companies renting quay or warehouse space. A case in point of this peculiarity are the northern EU seaports (Rotterdam, Le Havre and Hamburg among others) where the port owns only the infrastructure (with different ownership models, e.g. central government ownership vs local authority ownership, etc.) and the operators of each terminal or facility compete individually for market share. Nevertheless, perfect competition can't be found when considering the entire transport chain. Even in this case, rail or road infrastructure is owned by a single entity (public or private entity) which may directly or indirectly hamper competition of the entire supply chain. Thus, access to end-to-end transport chain services should be free or at least grant the same rights to all market players. In this respect, RAs usually encourage cooperation among transport chain players or exercise mild regulatory powers to achieve a level playing field for all players.

In any case, the bottom line of the previous discussion is the race-for-space that is adjusted by self-regulation in the market. ITF (International Transport Forum, 2011), advocates in favor of efficient access to and investment in essential facilities[4] considering the constrained space availability in ports. Contrary to the previously mentioned self-regulated bilateral (commercial) agreements, this context requires the active intervention by an RA. The RA would identify those segments of the transport chain where non-competitive conditions arise and intervene in order to reduce the adverse effects and produce a level playing field for everyone. These government interventions mainly include (International Transport Forum, 2011):

- No intervention, in those cases where the costs and risks of intervention are greater compared to the potential benefits. Nevertheless, the RA retains close oversight onto the market,
- Discretionary regulation, by an RA,
- Public procurement contracts and concessions,
- Public ownership and management, which is the stricter regulation available, necessary in those cases where market failure has very high costs.

It has to be noted that public procurement contracts and concessions are appropriate where market competition exists, that is competition for the concession agreement itself, however they don't work as good with bilateral commercial negotiations or with intense (fierce) competition. With respect to the public ownership and management, this measure is more suitable in markets where insufficient competition, able to serve public interest appropriately, exists. On the other hand, discretionary regulation, although advocated by many, is usually enforced based on ideological grounds rather than clear economic and business grounds. Gomez-Ibanez (Gomez-Ibanez, 2003)

[4] Facilities (infrastructure or equipment) are considered "essential" (Knieps, 2006) if the following rules apply: (a) indispensable for reaching customers and/or enabling competitors to do business, (b) not present anywhere else on the market, (c) such that they cannot objectively be rebuilt at a reasonable cost.

identifies a presumption in literature that "the ultimate goal in infrastructure regulation may be to dispense not just with public provision but, where possible, with public regulation as well", a performance criterion based on business grounds rather than an ideological criterion.

One of the key problems of contracts is that they are not as flexible as needed. In cases with significant fluctuations (e.g. the price of fuel, economic turmoil, etc) these contracts can't easily change and as a result, they can't capture well neither the upside nor the downside. Especially for the transport sector, this volatility is an inherent vulnerability, for example in those cases where the sunk costs are extremely high and network competition is difficult. Discretionary regulation on the other hand is a better choice due to its flexibility to unexpected changes. The problem with discretionary regulation is whether the RA has the capability to monitor closely and whether the Central Government has the willingness to enforce RA's rules in case the incumbent don't comply with them. Public ownership is a solution giving enough flexibility to the state, however it is less efficient in terms of time and of cost. Based on Guash et.al. (Guash, Laffont, & Straub, 2003), a strong, independent regulator, especially in the case of privatization of previously state-owned assets, leads to significantly fewer instances of ex-post contract renegotiation. Finally, it should be noted that discrete regulation is less flexible since it is observed that it has information collection and information sharing problems.

2.7.4 The Transport Industry as a theater for multi-form competition based regulations

Although the most common regulations in the transport industry include regulatory tools like price fixing, price monitoring, and price standardization, as well as heavy (cross-) subsidies and market entry restrictions, there are other indirect ways that have been used to induce competition in the industry. These alternatives to traditional regulation include the following policies:

- ***Intermodal Competition***: competition between modes may be as strong or as effective as intra-modal competition, even in the cases of natural monopolies.

- ***Spatial Competition***: similar to the previous case, spatial competition is also considered effective. Firms, operators, terminals, facilities and even unimodal networks face competition from neighboring markets. This is actually the case for port or airport competition: for example Luton Airport markets itself as a low cost alternative to other London airports, or similarly the competition among Hamburg, Rotterdam and Le Havre ports for pretty much the same hinterland. Although a natural monopoly, none of these terminals increases lightheartedly and without reason the asking rates.
- ***Contestability***: in markets with unrestricted entry but high fixed costs or with significant competitive advantage due to economies of scale or density, the theory suggests (Baumol, Panzar, & Willig, 1982) that incumbents will not exercise their monopolistic or duopolistic powers. The main argument is that this strategy will produce abnormal monopoly rents which will attract other competitors to join the market. Although there is a number of assumptions in this theory (replicability of the business, operational model, revenue sharing, etc) the business practice has confirmed this theory.
- ***Demsetz Competition***: another form of competition is Competitive Contracting or Demsetz competition (Demsetz, 1968). Organizing auctions for tendering or franchising certain rights and regularly re-auctioning these rights is effective in terms of sustaining a competitive landscape in the market. Demsetz competition is a very common practice in the provision of urban bus services and in the rail services, and the premise is that regular re-auctioning may result in the elimination of monopoly rents by driving price down to average cost.

2.8 Regulatory policy making in the European Transport Industry

2.8.1 Introduction

This section will describe the regulatory policy of the European Transport Sector at the highest administrative level, introducing the most important policy milestones in (de)regulating the European transport industry. The EU has made significant efforts to abolish certain rules (especially on the economics aspects) as well as to introduce other regulations (on the social aspects). Adapting Finger's et.al. (Finger, Bert, &

Kupfer, 2015) two-period assessment and based on the political developments, it can be safely deduced that the modern European transport policy has three main periods:

- The early period, from the early 1950s till mid-1980s,
- The period from the mid-1980s / early 1990s till 2001, and
- The mature period from 2001 till today

During the early period, transport policy and regulation were mainly within the competence of Member States. The policy initiatives were closely connected with the national priorities each time. Following the general trend of the network industries, up to the 1980s most transport operators were publicly owned, thus being either local, or regional or even national monopolies and following public service oriented policies.

The second period, from the mid-1980s / early 1990s till early 2000s, is characterized by network industries undergoing rapid technological change and by pro-competition neo-liberal ideas being introduced in the market(s). The European Union gradually acquired powers in matters of infrastructure as well as in matters of transport service provision. The most significant regulatory initiative was the creation of a Single European Market, which started around mid-1980s.

The third period, from 2001 till today, is characterized by intense efforts to centrally control regulatory efforts so as to develop a true Single Market for the entire EU. The EC has developed rigorous processes that measure the effects and echo the needs of the local and national markets and are producing regulatory legislation at the EU level which is then transposed to the National Legislation of each MS. Furthermore, EC aims to further induce competition in the transport industry through market opening and liberalization and to encourage more efficient use of transport infrastructure and modes.

2.8.2 Early Years

The early years of EU Transport Regulation involved initiatives that were constrained and fragmented. The major change came with the Treaty of Rome of 1957, which established the European Economic Community and identified transport as one of the Community's main common policies. The main objective was the unification of the

European Economic Area in terms of free movement of people, of capital, of goods and of services. Nevertheless, the Rome Treaty left the transport policy and its enforcement with the Member States[5], leading to significant inconsistencies among the different states[6].

Unification initiatives were mainly market led, with industry groups proposing European wide policy regulations and measures. For example, the Community European Railways (CER) proposed the development of an international, interoperable rail network for high-speeds. However, an EU wide policy making that a reality came out during the mid-1980s, when the European Court of Justice ruled a Judgment (European Parliament v Council of the European Communities: Capacity of the European Parliament to bring an action for annulment, 1985) recognized this limitation and asked the European Commission to act swiftly by adopting greater powers of interventions and of policy making with EU wide applicability.

In 1986, the Single European Act (European Commission, 1987a) was adopted, becoming the first policy act that attempted regulating the European transport sector[7]. This Policy removed certain physical and political barriers, reduced technical constraints, created common financing and fiscal principles in transport and in infrastructure. The next regulatory milestone was the 1988 Funding Plan (European

[5] According to Finger et.al. (Finger, Bert, & Kupfer, EU transport policy, 2015), Title IV of the Treaty of Rome (Art. 61 and Arts. 74-84) significantly limited the European Union's policy development in the transport sector. Actually, the first policy regulation with (truly) EU wide applicability came with the 2011 White Paper on Transport, with the TEN-T Network Development (European Commission, 2013a) and with the Urban Mobility Package (European Commission, 2013e). For more information please refer to Annex III – Timeline of the European Union Treaties, pp100.

[6] Inconsistencies where found from key points, from trivial points e.g. what is considered a main port or which corridor consists of which road/rail connections to more sensitive issues like cabotage rules for road transport or for shipping operations.

[7] The Single European Act - SEA of 1987 actually regulated prices for the transport of coal and steel and similar strategic commodities, however is considered the first tangible attempt by EC to regulate on an EU wide basis as well as removing entry barriers into several markets.

Commission, 1988), where the EC supported a limited number of transport related projects through the European Regional Development Fund (ERDF) and through the European Investment Bank (EIB). Still though, the policy was largely fragmented and ambiguous in terms of coherency.

2.8.3 Post 1990s: Coherent Transport Regulation at the EU Level

In the second period, marked by the Maastricht Treaty of 1992, transport becomes a main element in the development of the Single European Market. The Maastricht Treaty sets up the political, institutional and budgetary foundations for a coherent, centrally planned transport policy with EU wide applicability. The Maastricht Treaty introduced the concept of Trans-European Networks, the first EU wide detailed plan for creating European transport, energy and telecommunication infrastructures, funded (primarily and/or co-funded) by the European Community. The Trans-European Networks for Transport (TEN-T) were first introduced in 1996 (European Parliament and the Council, 1996), a set of 30 Priority Axes and other horizontal priorities in order to ensure the cohesion, interconnection and interoperability of the trans-European transport network and in order to ensure equal access to the network. The Maastricht Treaty was complemented by the White Paper of Transport of 1992 (European Communities, 1992) with which the EU proposes the establishment and the development of a Trans-European Transport Network, based on a system of open and competitive markets, promoting inter-connections and inter-operability of national networks and promoting equal access thereto (European Communities, 1992). The follow up of this White Paper was the Action Program of 1995 (European Commission, 1995a), which specified the infrastructure policies emphasizing social cohesion, sustainability, intermodality, safety, quality, and accession countries. These principles were added to the single market, open and equality principles of the Trans-European Networks. The Common Transport Policy plan aimed at unifying the diverse European regions into a single market.

2.8.4 Current Period (2001 onwards): enhanced EU wide regulation

The Common Transport Policy of 1995 was further developed in the late 1990s and a lot of consultations and negotiations led to the 2001 White Paper (European Commission, 2001e), a key policy intervention where the Commission proposes 60 measures that are deemed necessary to develop a modern, unified and balanced European transport system. This document is the first that puts attention on the modal shift, attempting to shift demand to more sustainable modes of transport using different regulatory tools, including creating more competition and reducing costs (especially through reducing bottlenecks in the supply chains, reducing administrative red tape and minimizing barriers to entry). Additionally, it should be noted that the 2001 White Paper is the first Policy Document from the EC that explicitly discusses about regulated competition and reducing the limitations, constraints and market failure so as to develop a level playing field across all transport modes.

The 2009 Review of the Common Transport Policy (Steer, Davies, Gleave, 2009) assessed that the major objectives were met. These objectives included:

- Development of a competitive internal market for transport, through market opening and liberalization,
- Facilitation of investment in prioritized transport infrastructure, and
- Reform of infrastructure pricing and taxation to encourage more efficient use of transport infrastructure.

More precisely, the Steer Davis Gleeve report assesses that, based on the analysis undertaken, substantial progress was made towards creating a competitive internal market for transport services[8]. Liberalizing the transport market and the market

[8] Actually, the Steer Davis Report confirms the results of the 2006 mid-term review (European Commission, 2006) of the 2001 White Paper. This review put an increased emphasis on intelligent transport systems as well as on affirmative actions towards balancing the modal selection where possible.

opening were very successful in the air sector, and the company evaluates as equally successful the market opening in the rail sector, although the rail market was slower in adopting the policies and the relevant Directives. The rest of the transport sectors are lagging behind and it was deemed that further reforms were required in order to fully implement market liberalization. The report concludes that one of the major lessons learnt is that opening a market can't be based solely on introduction of (new) legislation. For example, the railway sector's initial attempts to deregulate the market (vertical and/or horizontal separation) had little impact on the market.

Moreover, in 2007, the Lisbon Treaty amended the Rome (1957) and the Maastricht (1992) Treaties and listed Transport as one of the sectors (industries) of shared competence among the European Union and the EU Member States. Furthermore, the Freight Transport and Logistics Plan of 2007 (European Commission, 2007) adopts a series of actions that promote the freight transport logistics, increase the competitiveness of the rail freight sector as well as of the port sector and of the maritime freight transport sector and last but not least elevate the importance of the Motorways of the Sea concept at an EU wide level. The main idea again is the introduction of fair competition among modes and among incumbents / users, thus the EC adopts many different regulatory tools, including funding and financial support, especially for maritime related operations (ports, shipping, intermodality, etc).

The "Greening Transport Package" (European Commission, 2008) is the first major intervention explicitly addressing sustainability issues and adopting regulatory tools to balance market failures but also to promote specific policy objectives. The high level objectives are to achieve savings of 6-8% of CO_2 emissions, NO_x emissions and Sulphur emissions each year from heavy goods vehicles (HGVs) and to reduce by 50% noise from rail freight trains. The regulatory interventions suggested through this communication include:

- Restrictions of trucks on roads based on emissions, congestion and noise,
- Restrictions and funding for cleaner trucks,
- Restrictions and funding for technical upgrade of rail freight wagons (fitting of new technology brakes),

- Internalization of the transport costs, so that the costs include the societal costs.

Especially for the latter tools, this Package was the first major policy document, where the EC specifically addresses internalization of costs and introduces innovative schemes, for example the Euro-Vignette scheme that has been successfully applied in Austria and Italy.

In the 2009 Communication from the EC on the Future of Transport (European Commission , 2009) the EC puts forward the following objectives:

- To provide safe, secure and comfortable transport systems,
- To maintain and develop a fully integrated network,
- To be more environmentally sustainable,
- To develop and use advanced technological solutions,
- To offer quality public services and quality jobs,
- To be more efficient by smart pricing, and
- To improve accessibility through sound land-planning and location decisions

In coping with these objectives, the regulatory tools that EC plans to use include:

- Upgrading and expanding the infrastructure to create a single, integrated transport network,
- Introducing alternative pricing systems with incentives for users, planners and investors, while providing the resources for sustainable transport,
- Completing the internal market and promoting competition, without compromising safety, security standards, working conditions or customer rights,
- Promoting technological development and the switch to low-carbon transport with a clear legal and regulatory framework, standards and funding for demonstration projects and R&D,
- Raising public and employee awareness/involvement in transport policy development.

Similarly, with regards to the maritime strategy, the EC in the 2009 Communication (European Commission, 2009b) sets the strategic goals for the sector, including the

reduction of the costs, i.e. providing cost-efficient maritime transport services. Additionally, the EC aims to further increase the long-term competitiveness of the EU shipping sector, enhancing its capacity to generate value and employment as well as supporting the entire cluster of maritime industries. Considering these objectives, the EC proposed the adoption of specific (de)regulatory tools, including reducing barriers to entry, reviewing cost structures for natural monopolies, opening of the market and achieving equal access for all users.

The policy objective of the European Union is the creation of a Single European Transport Area and the completion of the Internal Market for the transport of both goods and of passengers. The objective is to remove major barriers to transport operations and to promote safe, efficient and environmentally friendly transport services without affecting mobility. These goals were outlined in the 2011 White Paper (European Commission, 2011b) which specifically aims to:

- Abolish conventionally-fueled cars in cities,
- Increase to 40% the usage of sustainable low carbon fuels in aviation and to reduce by 40% shipping emissions
- Shift at least 50% of medium distance intercity passenger and freight journeys from road to rail and waterborne transport
- Reduce by 60% cut in transport emissions by the middle of the century.

It has to be noted that all of these goals are to be achieved by 2050.

This 2011 White Paper covers the transport sectors of aviation, railways, road transport (both freight and passenger), urban (public) transport, inland waterways and maritime / short sea shipping. Additionally, the 2011 White Paper addresses horizontal issues including liberalization, state aid, control and competition rules, ownership, independent regulation, inter-, multi- and co-modality, as well as technical, safety and social issues. With this Policy Intervention, the European Commission for the first time, attempts to de- and re-regulate the entire transport sector in the European Union, in a comprehensive and centrally planned manner. Although during the past 20 years, all transport sectors and all EU member States have adopted various regulatory decisions, with the most common being the liberalization

of the road, rail and air sectors (Finger & Holvad, 2013), differences among countries and sectors were very common due to the vast differences of these sectors in each country. The EC adopted specific legislation which aimed for an EU wide regulation and at the same time promoted fair and effective competition. For the EU Member States, their role has been to deregulate and liberalize monopolies (from the supply side) as well as to apply the general competition law, especially on the network industries and to reduce direct and indirect subsidies and state aid. The process of separation has been ongoing since the previous period (Early years of Regulatory transport policy making), however after 2001 and especially after 2011, the unbundling of infrastructure (natural monopoly) from operations (potential free market) becomes a major objective for the EC. At the same time, Regulatory Authorities, independent in nature, are set up, since vertical (and horizontal) separation does not guarantee fair competition.

Another deregulation initiative with EU wide applicability, that was further promoted this period, is the reduction of "cabotaged" services (exclusion of an operator from a MS "A" to provide services to MS "B" for route from MS"C" to MS"D"). This initiative started in 1997 with the airline industry, however, for the rail and road sectors it was as late as 2001 that this deregulation commenced effect, with a long way still to go. For example, in the rail sector, the First Railway Package of 2001[9] liberalized the market, although this process has been very slow and very cumbersome ever since, leading to a Fourth Package on 2013.

Similarly, road transport is fairly liberalized, again with a lot of difficulties during this process. Inter-urban road passenger transport has only recently been open to competition, with Road Freight Transport being deregulated since 2001 and with cabotage being abolished in 2013. The objectives that EC has for the road transport sector aimed at modernizing, simplifying and streamlining rules in order to improve

[9] The first Railway Package consists of three Directives, namely (European Commission, 2001g), (European Commission, 2001c) and (European Commission, 2001d)

the overall efficiency and to ensure fair competition in EU. With regards to the urban public transport, EC has been pushing compulsory competitive tendering as a form of liberalization. The inland waterways, short sea shipping and maritime sectors are liberalized throughout Europe with competition being significantly increased. Nevertheless, inconsistencies are observed, including administrative barriers, port related barriers, indirect cabotage enforcement and fleet management / seamen distribution (selection) issues. EC has made specific proposals (European Commission, 2013c) for market access to port services in order to further induce competition in the sector.

The TEN-T is a specific case on its own merits, since this is actually the first large scale regulatory intervention from the EC. At the beginning of the 1990s, the then 12 Member States set up an infrastructure policy at the Community level. The objective was to support the development internal market through continuous and efficient transport, energy and telecommunications networks. The first TEN-T Guidelines were adopted in 1996 (European Commission, 1996) by the European Parliament and the Council, establishing the TEN-T master plan with the main objective that of connecting dispersed and fragmented national networks of all transport modes. The EC adopted an active policy intervention by regulating the European transport sector, through directly supporting one mode over the others based on the generic EU rules for the granting of Community financial aid in the field of trans-European networks (European Commission, 1995b). These principles determined each proposed projects' eligibility for EC/EU funding, directly through EU funds but also through the Cohesion Fund and the ERDF. In 2004 the TEN-T guidelines were revised (European Commission, 2004a) introducing the framework for funding the Motorways of the Sea.

As of 2013, a new plan has been laid down, more ambitious in terms of scope (EU-27 and beyond) and in terms of increasing the competition of the European transport sector. Additionally, as of December 2013, the EC has set up a specific fund, specifically devoted to funding directly such projects. The Connecting Europe Facility (European

Commission, 2013a) became the main regulatory tool[10] specifically aimed at promoting specific modes either through economic or through social but also through information regulation. It has to be noted that the EC goes the extra mile by building a truly European Transport Network, the Core Network (European Commission, 2014b), thus promoting core nodes and core routes that have the necessary capacity to cope with an increasing demand, instead of inducing adverse effects in the supplementary network.

As of January 2014, the European Union has a new transport infrastructure policy that connects the continent between East and West, North and South. This policy aims to close the gaps between Member States' transport networks, remove bottlenecks that still hamper the smooth functioning of the internal market and overcome technical barriers such as incompatible standards for railway traffic. It promotes and strengthens seamless transport chains for passenger and freight, while keeping up with future technological trends. This policy is vital for Europe to re-boost its economy and to generate new jobs. The €26 billion budget up until 2020, in combination with funds from other EU sources and the EIB, should significantly stimulate investments and ensure a successful implementation of the new infrastructure policy.

A specific subset of the TEN-T initiative is the Priority Axis 21, the Motorways of the Sea (MoS), which introduces intermodal maritime-based logistics chains bringing significant structural changes. The EC favors for the first time non road based transport chains based on the White Paper of 2001.

Last but not least, the TEN-T initiative has identified 329 key seaports to participate in the unified European port network, boosting growth, improving competitiveness and further strengthening the European Single Market. The EC will use the Connecting Europe Facility to support transport infrastructures, including ports and port-hinterland connections abiding with the transparency and competition rules.

[10] Additional regulatory interventions include Regulation 1315/2013 (European Commission, 2013d) regarding EU Funding regulation, as amended by Regulation 473/2014 (European Commission, 2014a).

Especially for the former issue, the competition legal framework is very strict in terms of financing port infrastructure and state aid is carefully monitored so as not to hamper intra-modal and cross-modal competition.

2.9 Review of paradigmatic transport industry deregulation cases

2.9.1 The ocean shipping deregulation in USA: the case of OSRA

2.9.1.1 Introduction of the US Shipping Policy and background

The US Ocean Liner Shipping industry has been regulated by the US Government since its early stages. The most important attribute of the US policy, specifically stipulated in the Shipping Act of 1984, is the exemption from antitrust provisions for price-fixing cartels of ocean carriers. This exemption aimed at protecting the industry from market failure as well as other relevant industry dysfunctions, and the political will to maintain merchant marine for US trade as well as to maintain a capable fleet in case of national emergency (Sagers, 2006). Additionally, the Shipping Act of 1984 (Federal Maritime Commission, 2001) has assigned the regulation of the international liner industry to a quasi-independent Regulatory Agency, the Federal Maritime Commission - FMC. FMC oversees the market and enforces the regulations to both domestic and internationally based shippers, ocean common carriers, NVOCCs and ocean freight forwarders, shippers' associations, marine terminal operators.

Currently, the Shipping Act of 1984 has been amended by the Ocean Shipping Reform Act (OSRA) of 1998. The main change that was introduced was the adoption of the independent service contracting, the terms of which may be kept confidential. This deregulated the price fixing provisions of the Shipping Act of 1984.

2.9.1.2 Effects of OSRA 1998

The liner shipping industry was considered to be protected from market forces through specific anti-trust regulations. For example, the liner conference concept is essentially a case of building a cartel in terms of capacity provision and price fixing. However, as said before, market failures have led to accepting this practice, i.e. shipping lines with a business interest in a specific route cooperate to provide a regular service. Prior to the OSRA, all stakeholders (carriers, shippers, freight forwarders, etc)

had direct access to the contract rates and to the specific terms and conditions and used these as benchmarks for their own negotiations. The announcement of the contract terms, led to the "me-too" strategies by the potential customers, and on the other hand, shipping lines were very reluctant to get into a negotiation like this (unless absolutely necessary). Said that and although the market was governed by price fixing, the transparency of information significantly constrained any commercial benefits of contract specialization for both carriers and shippers and the fear of new entrants governed rates closer to competitive markets (market contestability).

The OSRA provisioned pro-competition amendments compared to the 1984 Shipping Act. More precisely, the shift from publication of rates to confidential rates led to more individually negotiated service contracts. Thus, conferences' power to impose rates agreed at the conference level to the customers is significantly limited. This has induced container freight rate competition, leading to significant rate differentials on the Transatlantic and Transpacific routes (Wang, 2013). Greater competition, capacity and demand volume disparity have suppressed downwards the rates on the direction with excess capacity (backhaul) and have driven upwards rates on the direction with ample capacity (head-haul). Lloyd's Shipping Economist (Lloyd's Shipping Economist, 1999) has identified these this process, which is based on the trade imbalances, advocating that booking low-paying cargo is in any case better than receiving no revenues for empty container movements.

Wang (Wang, 2013) has studied the rate differences between head haul and backhaul routes and found that the market structure of both Transatlantic and Transpacific lanes were competitive after the OSRA deregulation. OSRA 1998 has substantially affected the market structure of Transatlantic and Transpacific routes forcing the carriers to operate more competitively.

Furthermore, Wang (Wang, 2013) used classical economic tools to analyze market competition and more precisely used econometric analysis to apply Adam Smith's condition of joint product. The empirical evidence confirms Smith's condition showing that post-OSRA application, the US container liner market becomes competitive. This leads to major structural changes in the U.S liner shipping industry, both in terms of newcomers as well as in terms of Potential Industry Profits. Nevertheless, the article

recognized the limitations especially stipulated in the shipping industry (being a globalized market) in lieu of the effects of the European shipping laws. Additionally, the article understood the limitations of the analysis in terms of the effects of OSRA on the quality of services, on the fatigue of seafarers, on the work conditions, and on the risk of accidents to name but a few characteristics.

2.9.2 The Case of Trucking deregulation in the USA

2.9.2.1 Introduction

The US Government has been regulating the interstate road freight transport prices and competition since the creation of the Interstate Commerce Commission (ICC) back in 1887. Additionally, ICC regulated market entry in 1935, through the Motor Carrier Act of 1935, which required new road freight transport companies' owners to seek a "certificate of public convenience and necessity". For incumbents, this was a straightforward, yet bureaucratic, process; for new entrants, the process was very restrictive and selective. Furthermore, the regulation included filing in all rates with the ICC, where anyone (including competitors) was allowed to inspect them. This regulation also stipulated that in case of dispute by any other carrier, the ICC would normally suspend the rates and carry out an investigation.

From the 1940s until the 1980s, new or expanded services were almost impossible to be granted since it was not possible to reach unanimity in any route, with the incumbents having implicitly or explicitly reserve or first-speech rights. In addition to that, the market became even more cumbersome in 1948, when the Congress (Moore, 2015) authorized road freight companies' owners to fix rates (price fixing scheme) similarly to the Ocean Shipping Sector practices[11]. These market entry regulations created a strong legal barrier in the market, where practically the only available entrance was by purchasing transport permits from incumbents. This permit would be

[11] The Reed-Bulwinkle Act exempted carriers from the antitrust laws (Moore, 2015).

priced in the range of US$ 200.000 for certain routes. ICC's regulations reduced significantly competition and made road freight transport inefficient and expensive.

2.9.2.2 Regulatory Framework and Costs

According to Moore (Moore, 2015) road transport regulations increased costs and rates significantly, and diminished service quality. In order to compare the difference, products exempt from regulations moved at significantly lower freight rates (discounts from 20 up to even 50%) as well as up to 75% lower rates when compared to more flexible regulations in West Germany, in Great Britain, in Belgium or the Netherlands for the same period.

Attempts to deregulate the market started in 1962, during J.F. Kennedy's presidency. However, it was in November 1975 when President Ford asked specific legislations that reduce regulation in the road transport market. These efforts led to the Carter administration enacting the Motor Carrier Act of 1980 (MCA-1980) (Moore, 2015) which significantly reduced the ICC's authorities. MCA-1980 partially deregulated the road freight industry, which in combination with a modern framework for ICC, substantially reduced entry barriers to the market as well as market failures. The MCA facilitated permit issuance[12] and eliminated most restrictions relevant to carrying commodities, on the routes and on the geographical scope. After the MCA 1980 application, the ICC would only intervene to unreasonable price variances with price changes at the range of 15% being quite "reasonable".

2.9.2.3 The Success of Deregulation

Based on various analyses as reported by Moore (Moore, 2015), deregulation was successful. In terms of rates, between 1977 and 1982, rates for Full-Truckloads fell about 25%. Even for Less-than-Truckload rates, the reduction was up to 20%. Revenues per truckload-ton fell 22% in the period from 1979 to 1986, whereas 77% of surveyed shippers responded positively in terms of quality improvements. This

[12] The so called Certificate of Public Convenience and Necessity

scheme strengthened negotiations between shippers and road transport companies' owners which in turn led to new price schemes, simplified rate structures, new service options and to new routes being served. Furthermore, service provision to small communities improved and complaints by shippers have declined by about 90%. With regards to employment, deregulation helped nonunion workers get jobs in the industry and wages fell by 50% compared to unionized wage structures before deregulation.

Business development was also positively affected, since the number of new firms increased significantly. By the 1990s, the total number of licensed carriers increased twofold, to about 40,000, and nationwide carriers were about 5.000. It goes without saying that the face value of the operating permits dropped to almost no value. Intermodal operations have also increased in terms of volume by 70% in the period from 1981 to 1986. Additionally, the Motor Carrier Act of 1980 in combination with the Straggers Act helped build efficient road-rail operations (Moore, 2015).

In summary, the benefits from deregulating the road transport industry led to a significant decrease of the rates as well as to a significant decrease in the costs of holding inventories. Besides that, on-time delivery and flexible service provisions were improved leading to a leaner supply chain (based on just-in-time principles) for shippers.

2.9.3 The case of the North American (Mexico – USA – Canada) road transport sector

The North America road transport industry (Mexico and USA) was largely controlled by a small number of family owned companies. The road transport service provision was regarded as a public service, thus governments enforced entry barriers, restrictions on marketing efforts and special regulations on loading/unloading activities. Based on World Bank's analysis (World Bank, 2000), before Mexico's transport sector was deregulated, short-distance tariffs were 20-40% higher, compared to routes of similar characteristics in the USA market, whereas annual monopoly rents were estimated at US$ 532 million (US$ 3,500 per truck). The 1989

deregulation abolished the entry restrictions as were tariff restrictions. The impact of the deregulation included the following:

- Monopoly rents were eliminated with a gain of US$ 600 million p.a. from offering more efficient road transport services as well as services of improved quality,
- The number of trucks increased by 21%,
- The average tariff decreased by 25%,
- The turnover in the sector increased since many companies contracted out their private fleets.

Similarly, the USA road transport sector deregulation was also positive. World Bank (World Bank, 2000) reports that trucking deregulation in the form of entry restrictions and operational restrictions resulted in costs savings of US$ 300 - 500 million. The Canada road transport deregulation had only marginal positive impact since regulatory constraints were already softer. Additionally, Winston (Winston, 1998) reported on the effects of deregulation on the LTL and FTL for-hire sectors which (deregulation) seemed to have improved the efficiency (due to the intense competition) which in turn led to 25% savings compared to privately owned fleets. Nevertheless, a lot of problems arose, especially in the first years of deregulatory intervention, with many incumbents being reluctant in accepting the changes. The dynamics of competition led to a decrease in the number of Class I (over $10 million in revenues) LTL carriers from about 600 in 1976 to around 50 in 1995 (Morrison & Winston, 1999) whereas FTL incumbents increased since deregulation from 20,000 small TL (Class III) carriers in 1980 to nearly 55,000 in 1995.

2.9.4 The Chilean road transport deregulation experience

The road transport sector in Chile was deregulated during the 1970's as a response to the Chilean national economic crisis. Up to then, the Chilean freight transport sector was heavily regulated through government-approved local trucking associations, capacity restrictions and tariff controls (World Bank, 2000). Similarly, in the passenger transport sector, bus route licenses were issued after a lengthy procedure (time and administrative wise) obligatory union membership even at the companies' level,

capacity restrictions in terms of changing routes or service areas and governmental control of fares. Additionally, the import of trucks and buses was also restricted in an attempt to support local vehicle manufacturing.

The 1975 road freight deregulation initiatives led to abolishing tariff regulations and facilitated the unrestricted entry into the market. Tariffs were agreed on a competitive basis, without any prior setting framework, and pretty much the Chilean government abolished all economic restrictions in the market. This led to a significant increase in the number of truck operators, increased foreign direct investment in the Chilean transport market. However the 1982 economic crisis led to a significant decrease of the tariffs which in turn led the government to intervene again in the market. Nevertheless, the long term effects of deregulation remain positive (World Bank, 2000) since small operators have organized themselves into road transport companies, the extent and quality of services have improved and in general the sector remains profitable.

The inter-urban passenger sub-sector was deregulated in 1977 abolishing tariff regulations and unrestricting market entry. After the first years of implementation, the fares fell back to pre-deregulation levels due to the increased number of market entrants. A market consolidation led to a transformation from small companies to large corporations that could offer improved services in terms of quality and number.

The Chilean road transport sector deregulation includes the following lessons learned:

- Non-urban and road freight sectors improved their efficiency by removing government access restrictions, increasing the services offered and removing price regulations,
- Consolidation will follow deregulation that will transform small companies into strong corporations,
- The road freight consolidation helped the transformed companies achieve more contracts and private fleets were also contracted out.

In summary, the deregulation efforts seemed quite positive in the long run for the market, despite the deep crisis that hit the Chilean economy in 1982.

2.9.5 The UK Experience of road transport deregulation

In the EU, among the first countries to encourage open market and deregulation was the UK. The government intervention was mainly focused on social regulation, whereas economic has been limited. Strict quality controls for entry into the road transport business, commercial standards based operations and overviewing bodies have set a level playing field for all interested to enter the market. The impact from transport industry deregulation include (World Bank, 2000):

- Minor instability due to financial problems is observed, especially with the new-comers,
- The government established regulatory bodies and overviewing agencies that monitored the market abuse,
- There is no abnormal volatility in the tariffs,
- Lower costs have been observed in the road passenger sector with fares reductions of up to 40% (the highest reduction observed in the non-urban buses sector),
- The level of service and quality of vehicle have increased substantially.

Nevertheless, the deregulation has led in many occasions to establishing monopolistic contexts after a free market failed to cater revenues for all entrants (an illustrative example is the case of scheduled coaching business). Additionally, in this sector, the market dynamics led fares to return, in real terms, to those levels before deregulation.

Last but not least, it should be noted that creating a level playing field across all modes, increased the competition not only among the incumbents of the same mode but also and most importantly among different modes (rail versus road, sea versus air, etc). This in turn increased the quality of service, since the cross modal competition seems to have found a tariff equilibrium and now compete on other service and qualitative attributes.

2.9.6 The EU Road Freight Deregulation

The most significant deregulation initiative in the EU Road Freight Transport sector came in with the abolishment of the Cabotage restrictions. Since 1998/1999 a fully

deregulated international road transport market started being implemented within the EU. With the 2004 accession of Malta, Cyprus and Slovenia, the companies registered in these countries had unrestricted access to the EU market. However, road freight transport companies registered in Poland, Slovakia, Czech Republic, Hungary, Estonia, Latvia and Lithuania (the rest of the 2004 accession countries), only cross-trade was allowed and cabotage rules were enforced. In 2007, the accession of Bulgaria and Romania was also followed by cabotage restrictions. Although cabotage is gradually being abolished, still, the domestic EU market at a national level is reserved for same country resident operators with only exception the operation of 3 consecutive operations within 7 calendar days. As said above (§2.8.4, "Current Period (2001 onwards): enhanced EU wide regulation" pp75), currently, the ways in which a transport company can offer services in the European Union include:

- Intra EU (international), excluding purely domestic operations:
    - Bilateral operations between two countries performed by a transport company registered[13] in either country of departure or destination, which is freely done,
    - Cross-trade operations between two countries performed by a transport company registered in a third country. This can be done under an EC authorization or an ECMT permit
    - Cabotage operations performed by transport companies with trucks registered in a third country, which is done on a temporary basis (with the definition of temporary still under consideration).
- Domestic transport is executed exclusively by companies registered in the specific country.

[13] Company registration implies truck registration.

The deregulation initiatives in the sector are considered to have contributed to a significantly increased competition among international road transport operators (Schramm, 2012). More precisely, Schramm, explains that the development of Bilateral, Cabotage and Cross-trade Operations have increased ever since. After the EU enlargement of 2004, bilateral transport raised (in tkm) by 14.9%, cabotage by 9.3% and cross-trade even by 58.1% within three years until 2007. Even during the EU economic crisis years of 2008-2009-2010, the dynamic growth of cabotage was 42.8% and cross-trade was 84.5% from 2004 to 2010. In terms of split between domestic and international intra EU tkm transported, the growth from 3.7% to 6.5% in road freight based cross-trade and from 0.9% to 1.2% in cabotage with a declining bilateral transport share from 25.9% to 25.0% show the dynamics of these forms of international road freight transport.

Apart from these figures, road transport deregulation is also considered to have adverse effects on the managerial level for the transport companies. Some observations include (Schramm, 2012):

- Relocation, Flags and Crews of Convenience Issues, where several forms of cross-country practices in this context have been observed. In order to capture profit based on deregulation asymmetries, a fully or partial relocation of company operations has been attempted. From moving the headquarters address (PO BOX / Letterhead companies, e.g. the Willi Betz Case (Willi Betz vs the German Government, 2008)) to actually moving the headquarters and the operations to destinations within the EU with better tax or social charges structures. This practice includes "Flags of convenience" (FOC) countries where the trucks are registered and/or "Crews of convenience" (COC) countries as low-wage, low-tax countries from where truck drivers are hired.
- Subcontracting to FOC or COC countries, where the principal company is set in a cabotage restricted country, however the true operation is done through 3rd countries' truck fleets.
- Artificially increasing capacity through contracting, renting or buying trailers and semi-trailers that are registered in FOC countries. These trailers are still

pulled by national registered tractors, which practice indirectly reduces total taxable income and vehicle taxes.

A lot of adverse effects were produced in deregulating road transport, mainly due to significant asymmetries in the deregulation process as well as asymmetries across EU MS, business practices and social benefit practices. Thus, this sector is not fully deregulated yet and a lot of case specific and country specific regulations still apply. Furthermore, the EC is closely monitoring this sector in order to apply EU wide regulations that will enable a level playing field (in terms of employment standards, financial and tax standards, security and safety standards and lastly environmental standards).

Nevertheless it has to be noted that the High Level Group assigned to identify key obstacles arising from the road freight market opening (i.e. the Bayliss Report, (Bayliss, 2012)) recognized the following issues:

- Driver shortages would significantly limit the benefits from market deregulation,
- Enforcement Practices have to be identical across all countries in order to monitor and impose the rules and the regulations; there is no need to adopt strict rules if they are not to be fully and utterly enforced,
- The special case of employment and social security issue should also be addressed, since social dumping practices have been creating adverse competition to those incumbents that follow the business ethics,
- Cabotage Practices need to be reconsidered in order to provide a level playing field, both intramodal as well as intermodal, and finally,
- Lack of innovations and applications of good practices in the sector should be further addressed and companies should be encouraged to adopt more innovative methods both business and technical wise.

2.9.7 The UK Rail sector privatization

The UK Government started restructuring and privatizing the British Rail in the early 1990s. The approach included breaking up the company through separating infrastructure from operations and privatizing all of the new companies. This didn't come easy and a lot of debate and strong opinions were raised. Even currently, the

system seems to not having found a stable state yet, with many safety issues being raised and many managerial failures appearing on the headlines regularly. Nevertheless, passenger and freight traffic have grown ever since the privatization of the UK rail system.

Rail privatization in the U.K. had its origins in the financial difficulties the rail entity had as well as in the unobserved growth rates compared to economic growth. The first restructuring of the British Rail came with Lord Beeching's 1963 report "The Reshaping of British Railways" which proposed the closure of unprofitable rail lines and the reduction of the network from 29,117 km in 1962 to 18,889 km in 1970 (UK Department for Transport , 2015). The Beeching reforms (or "The Beeching Axe" as was popularized during this period) had some effect in reducing expenses. This initiative has been followed by numerous similar actions, however the original financial problems still persisted due to resistance from labor and due to political reasons stemming from underpopulated areas, which were fearful of losing service. In order to separate profitable operations from unprofitable ones, the 1968 Transport Act first addressed the issue of Public Service Obligation contracts, were the government could remunerate the Rail Company for undertaking loss making operations. This PSO alternative helped reduce the tensions from the small communities significantly. Additionally, it should be mentioned that before deregulation and privatization, the company used an outdated organizational chart and the innovation adoption was very limited.

The privatization tipping point were the rail accidents at Clapham, Purley and Bellgrove in 1988 and 1989 (World Bank, 2004) respectively which asked for deep restructuring in the sector. The main objective of the government was to follow the EU vision and to introduce competition, innovation and flexibility in the UK rail industry. The Government considered several broad options:

- Selling British Rail as a single unit in a single package,
- Breaking up British Rail into Regionally integrated units along the pre -existing lines,
- Breaking up British Rail into the various integrated Sectoral units with controlled network access as needed,

- Separating infrastructure from all operations and privatizing all parts separately.

Each option had difficulties (costs of separation, targeting of subsidies, assigning rights, investment planning, system coordination etc). The option that was selected was the separation of infrastructure from operations due to the higher competition this would induce on the network as a system-of-systems when at the same time this would contain the necessary economies of scale in network planning and management and would minimize coordination problems and disruption problems. Additionally, the UK government's experience in utilities using this approach was also proved beneficial to the implementation. British Rail privatization consisted mainly in creating independent rail companies that would compete on rail access, thus inducing Demsetz competition on the network. More precisely, a group of operating franchises (collectively called the Train Operating Companies—TOCs) that would lease their rolling stock from a set of independent rolling stock leasing companies (ROSCOS) and would operate trains over separately managed infrastructure (owned by Railtrack Plc.). In addition, the UK government developed two new regulators complementing the already established safety regulator that already existed. One regulator was assigned the overview of designing, awarding and funding the passenger franchises (the so called Office of Passenger Rail Franchising) and another was assigned the overview of the performance and access prices of the infrastructure operator(s) (the so called Office of the Rail Regulator). The concessions awarded (about 25 passenger concessions) had a duration from 5 to 15 years and the awarding basis was the amount of requested financial contribution from the government. In order to understand the change, it is notable to point out that one concession proposal offered payments from the first year onwards, whereas most of the concession proposals offered payments at some point well before the end of the duration (with some financial contribution from the government in the beginning) and another set of financially unstable concessions required government support throughout the period. Nevertheless, the breakthrough in this process was that the government had structured the access charges in a clear and robust manner, something that enabled a better understanding of the business case by the potential entrants (proposal submitters). Similarly, the

freight business was also broken down to two concessions and each was assigned to private undertakings.

With regards to the infrastructure, the assets were transferred to a newly established company, called Railtrack Plc. Railtrack both owned and maintained the tracks and the other fixed assets and facilities. An independent regulator was established, which monitored closely the activities. Railtrack was originally expected to remain state owned, however in 1995 (World Bank, 2004) the UK Government decided to privatize the entire system in a single lot (that is, full privatization of the entire Railtrack Plc company which actually took place in 1996). It has to be noted that the duration of the concessions was such, in order to create and sustain competition in the market induced by the frequent competitive bidding processes.

Furthermore, the rolling stock that British Rail owned, was allocated to three companies (the companies were called **RO**lling **S**tock **CO**mpany - ROSCOS) which were then assigned to lease the equipment (wagons, coaches and passenger locomotives) to the operating companies, since the short duration of the concession was considered to be too short for the operating company to buy its own equipment. The final rail-related functions, assets and operations of the old British Rail were privatized to different private sector companies. The total profit for the UK Government for the sale of the entire British Rail's assets was about £4.5 billion.

The lessons learned from this privatization include the following (World Bank, 2004):

- The initial inexperience of the private operators was replaced by higher specialization leading to a growth in passenger-kms of about 41% and growth of passenger trips of about 37.8% in the period 1994 – 2004,
- The average passenger revenue per passenger-km fell by 3% over the same period (in constant prices),
- Similarly, the safety records were disappointing (especially worsened due to the Hatfield accident) and in part this disappointment was also attributed to Railtrack Plc which accumulated a lot of operational issues,
- Freight traffic in ton-kms has also grown by about 45% (1994-2004), although freight tonnage has declined, suggesting that short-haul high-volume operations

belong to the past and this business is replaced by container long haul loads as the current status quo in the UK rail sector,

- The case of Roscos was also problematic due to the inefficiencies observed in their operations as well as the limited capital expenditures and capital reinvestment.

Currently, there is a debate in the UK with regards to the restructuring of the rail system, however the debate is focusing not on the ownership (public vs private) but on the bundling of different services, on the responsibility of each Regulatory Authority as well as on the financing sources of each operation and of each new project.

3 THE EU TRANSPORT SECTOR

3.1 Introduction

The European Transport Sector was first regulated after the First World War, when many companies were nationalized. However, the big wave of nationalization that followed the Second World War was even stronger, affecting all network industries in Europe. All major and many minor network industries were either transformed to or dominated by vertically integrated, stated-owned monopolistic companies. The National Government in each country was heavily investing in each monopolistic company and all utilities and all networks were viewed as an operational branch of the government. The destruction of the networks during the 2nd World War forced the government to not only invest but also to specifically instruct these companies to provide universal services, to sell services at low prices (even below cost in certain cases), to increase employment, to invest in infrastructure and generally to absorb any market failures. Although the Government was the main (or the only in several occasions) shareholder, in parallel, the same Government was also the regulator (and even the arbitrator), setting standards together in the quality and in the price, even if this dual character induced problems in the industry and in the services provided.

The European Commission started promoting a gradual deregulation process as early as in the mid-1980s, mainly in terms of economic deregulation. The EC aimed at improving the efficiency and service quality of the network industry, fixing market failures. A number of directives helped set up a common regulatory framework for all EU Member States[14]. The approach adopted by the EC, aimed at distinguishing the two important elements of the transport chain, the infrastructure and the rolling stock (operations), by completely deregulating the economic restrictions on the operations level (e.g. rolling stock, service provision, retail, etc) but leaving a significant degree of

[14] This section complements the main policy documents presented in §2.8 "Regulatory policy making in the European Transport " pp61 in terms of mode specific regulations.

freedom to the national governments with respect to the networks' ownership. This is the reason, many privatized transport network companies in the EU are still partially or majority owned, either by state or by local governments. Nevertheless, the main objective is to shift to partial ownership models with the rest of the shares to be "free floating" in a Stock Exchange(s) or to be privately owned or any other intermediary status. However, even in the cases of the government owning a golden share, especially in transport (operating) companies, there is a requirement set by EU which requires from the national governments to set a market overseeing body (i.e. a Regulatory Authority) in parallel with the complete abolishment of entry barriers.

The extent of effective liberalization as well as the effective timing of deregulation varies considerably among EU MS and across industries within each MS. Nevertheless, in theory, the process and the actions of deregulation officially started in 1987 with the publication of the Green Paper "Towards a Dynamic Economy: Development of the Common Market for Telecommunication services and equipment" (European Commission, 1987b) which was complemented by the creation of independent Regulatory Authorities through the Directive 90/388 (European Commission, 1990a). This was followed by the establishment of the internal energy market for both electricity and natural gas in the EU in 1988. In order to understand the delay in the implementation, deregulation in some specific sectors started taking place effectively as late as in 1996. The transport sector was among those delayed sectors with respect to the deregulation efforts and the implementation across the different sectors of this industry.

The airline industry, the inland waterways, the rail, the road transport (passenger and freight), the urban public transport, the short sea shipping and the intermodal logistics sectors have experienced substantial changes over the last three decades in their regulatory frameworks. Since the first EC White Paper in Transport in 1992, important reforms have been introduced in the transport sector both on the MS level but more importantly on the EU level. The structural transformation from state ownership to private ownership was the main policy and the main objective.

During this period, unbundling and vertical/horizontal disintegration policies were widely adopted. More autonomous commercial entities based on private sector

involvement took over either transport infrastructure or operations and competition by and large was intensified. For example, the monopoly of the flag carriers in the airline industry was broken, incumbents' dominant position was severely challenged and new services were offered. Even in the infrastructure domain, the situation with respect to competition either remained stable, with the Government retaining its position but offering a clear and level playing field for all, or competition was induced through tendering and concessionary processes attracting the interest of many privately owned companies.

3.2 Background to regulatory reform for the European transport sector

For the past 30 years, EU has adopted very ambitious goals in terms of strengthening the internal market and fostering competition as a tool to boost economic growth. The adoption of the pro-competitive, pro-market policies was mainly based on reducing the economic regulations and more specifically on liberalizing the transport industry as a whole and also on a sectorial basis. The different transport sectors, be it airlines, railways, road, urban and non-urban public transport, inland waterways and short sea shipping have been liberalized by privatizing the state owned incumbents and by allowing new market entrants to develop and provide services, thus opening the markets to competitive forces, as well as by reducing or abolishing any monopolistic rents.

The regulatory reforms in the transport industry have followed the changes in other network industries in Europe. A number of common elements across network industries' deregulation included:

- Vertical (operational) separation of infrastructure and of downstream services,
- Equal access to the infrastructure based on rules and conditions,
- Interconnection of the networks at the European level, ensuring interoperability,
- Phase based deregulation,
- Ensuring the public interest, without leaving the consumers with no service, or leaving them with below quality standards services,
- Introducing or inducing competition at least at the service provision level.

In deregulating the network industries and especially in deregulating the transport market, the main objectives of the European Commission, included to:

- Increase the consumer welfare,
- Eliminate the financial losses of the incumbents,
- Introduce a level playing field across all modes for all market players and abolish modal distortion,
- Identify the true market failure(s) and eliminate them,
- Identify the essential facilities and develop specific consumer protective regulations,
- Increase competition and free and equal access for all to the networks, without abusing dominant position(s), especially in monopolistic bottlenecks,
- Introduce clear costing models for network access.

Deregulation of the transport industry in Europe has followed a wave of initiatives similar to the one followed in other industrialized economies around the world. In all of these cases, the main deregulation initiatives included:

- Liberalization from entry/exit barriers,
- Ownership transfer,
- Vertical and horizontal separation and service provision unbundling,
- Introduction of Independent Regulatory Authorities,
- Shift in the policy focus from unimodal to multimodal and modal-agnostic,
- Introduction of new Pan European transport governance structures and shift from national-oriented views.

The following figure (Figure 5) presents an overview of the most important EU transport industry regulations prior to 1985. Although it is not exhaustive, it gives an overview of the main economic regulations and is indicative of the restrictive business environment within which the companies had to operate.

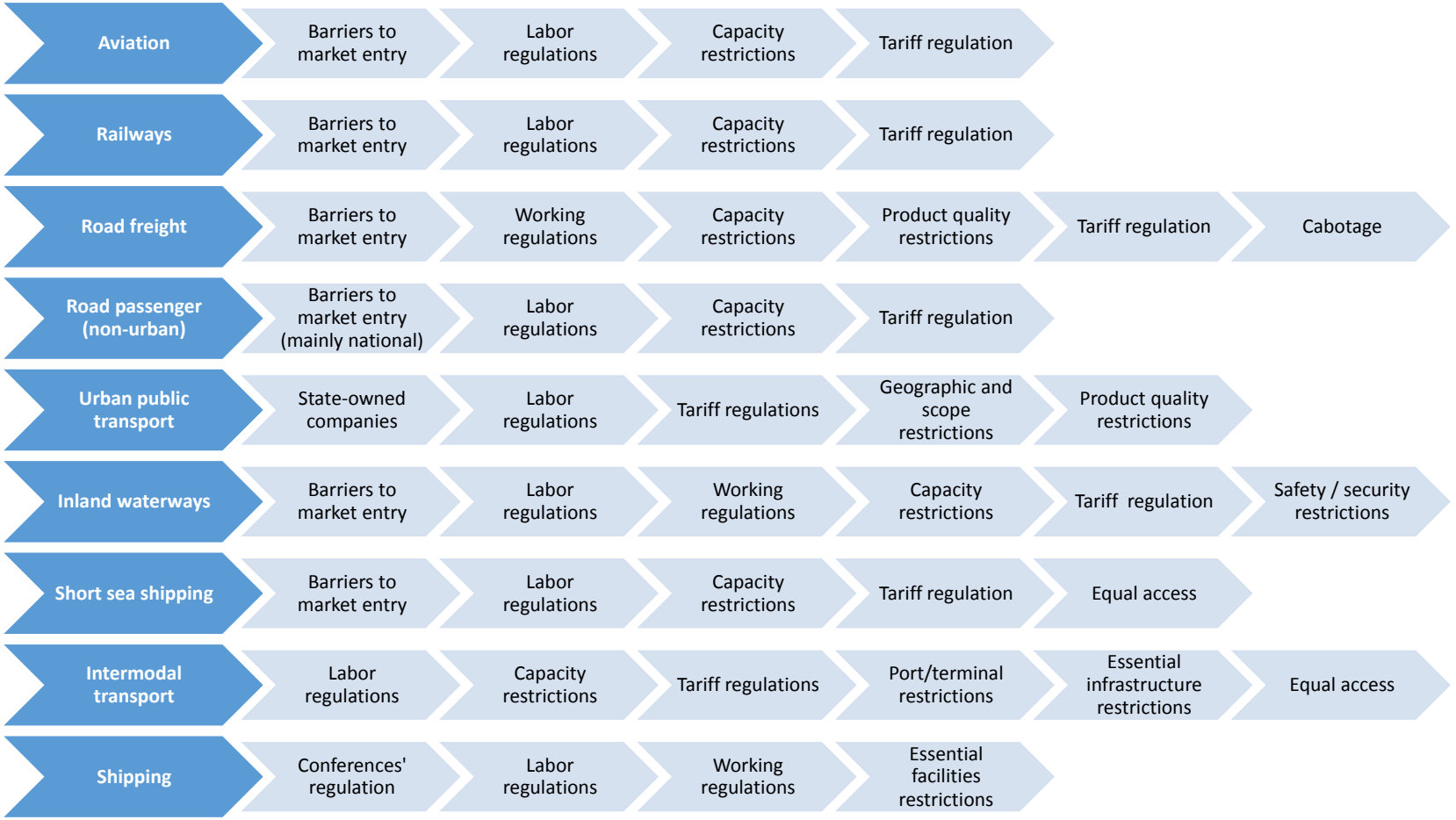

Figure 5 – Overview of most important EU Transport Industry regulations

3.3 State of Play Sectorial Regulations of Transport in Europe

3.3.1 Overview

The EU transport market opening has contributed to a growth in transport flows (especially in certain sectors prior to the 2008-2009 crisis this was more than evident), nevertheless, there is a need to further upgrade the sector by removing obstacles of administrative or regulatory nature. Since the 2001 White Paper on Transport, the EU transport market was further deregulated across all sectors, including aviation, road transport and in rail transport. However, a further and full market opening in the EU requires a uniform approach on many different aspects including safety, security, environmental, economic and social regulation. This further market opening was adopted as part of a 40 Actions initiative described in the 2011 White Paper. More precisely, the European Commission through the 2011 White Paper "Roadmap to a Single European Transport Area" (European Commission, 2011b) supports the modal shift towards environmentally friendlier modes, but is also concerned about providing a level playing field across all transport modes and by making all services as efficient and as attractive as possible. To this extent, pertinent to all EU Documents, the EC is against the development of monopolistic business environments and the main policy objective is to induce competition, even in the cases of natural monopolies.

Before 1980, the transport market was heavily regulated in most European Countries, with different degrees of governmental intervention and/or influence according to the specific local or national political frameworks. The typical market organization followed these parameters:

- Public ownership of infrastructure, of utilities and of networks,
- State owned dominant carrier with either limited or no other carriers,
- Monopolistic supply (mainly) or oligopolistic with either no power or with limited market share by the competitors,
- Assignment of regulatory powers to the government,
- Limited formal rules governing the market, most rules followed the wait-and-see or act-as-you-go principles,
- Close relations and interference between governments and suppliers,

- Service provision based on the Public Goods principle.

Since then, a lot of transformation has taken place in the various sectors and the deregulation led to more competitive market landscapes. The next sections will describe the state-of-play in the transport industry. It has to be noted though that due to the volume of the regulations and the constant changes in the regulatory framework, this section includes an overview of the most important documents[15] per transport mode in the EU. This section complements the previous section (§2.8, "Regulatory policy making in the European Transport Industry" on pp71) describing the regulations on the modal level.

3.3.2 Aviation

The European aviation industry was still subject to significant national control and influence in the early 1980s. This included price controls on fares, regulations on flying frequencies and on airport access conditions, capacity restrictions and strict labor related guidelines. National flag carriers were predominantly state-owned and dominated certain routes in the intra-European airline market. Bilateral agreements between national governments governed the service provision, effectively eliminating competition. In addition to that, essential infrastructure (airports, technical bases, etc) were also state owned.

The current situation is vastly different. EU has introduced the Single European Market principles in the airline industry, where market entry is open without any barriers to enter, no route limitations, or limitations on capacities, flying frequencies and fares. The EC started introducing in 1997 the Airline Packages (three packages, i.e. three sets

[15] Disclaimer: this is not an exhaustive review of all the regulations pertinent to the European Transport industry, rather it covers the most important efforts at the EU level to deregulate and/or re-regulate the Transport Industry, thus describes the political documents and policy efforts issued at the EU level and adopted by the European Parliament. It is understood that further directives that govern specific issues are – constantly – issued and also these regulations are transferred to the National Legislative Body of each Member State, however this level of granularity falls outside the scope of this analysis.

of deregulation actions). Based on the current rules (European Commission, 2008b) the airline carriers are now required to apply for a valid permit, based on quality qualifications, in any EU MS. Valid permits enable carriers to enter on all intra-European routes. The only restriction is that the majority of shares (50%+1) have to be owned by EU member states nationals (even at the entity level). This allowed competition to enter, especially from LCCs (low cost carriers), with many of the routes being served by two or more carriers (although there are routes with only one service provider). The airports also play an important role in this sector, since they base their service provision fully on non-discriminatory terms. It has to be noted that airports were also liberalized during this period as part of the airline sector deregulation and currently, the EC is focusing (European Commission, 2011c) on further improving the competition through releasing restrictions on slot allocation and ground handling as well as improving environmental standards and noise levels.

3.3.3 Railways

The reform process in the EU rail industry started in the early 1990s. Similarly to the European airline industry, the railway sector was dominated by state owned companies which were responsible for both the infrastructure and the service provision (passenger and freight transport services) as well as the provision of ancillary services. Third-party access to the network was either legally restricted or practically impossible. The State heavily relied and used the rail services to induce growth in the economy, thus the European railway sector was significantly influenced by the national governments.

The Railways sector was also one of those the EC introduced the Single Market principles, in order to increase competition and lift entry barriers. The EC introduced the first legislative initiative in 1991 (Council of the European Communities, 1991). The Directive 91/440 set the legal framework and allowed open access to all interested parties. However, up until the early 2000s nothing substantial happened competition

wise to the rail sector, which led the EC to introduce the First Railway Package[16] in 2001, the first tangible initiative to significantly open the rail market EU wide and to improve interoperability. This initiative was followed by three more Railway Packages, the Second Railway Package of 2004[17] further opening the market and establishing Railway Authorities across EU MS, the Third Railway Package of 2007[18] which intended to further improve the market conditions and open up the international rail passenger market to competition and most currently, the Fourth Railway Package [19] which includes interoperability, certification and introduction of other standards for rolling stock, workforce skills, vertical disintegration, independence and liberalization of domestic passenger services. In addition to that, the European Commission has already made provisions to establish the Single European Rail Area through the Directive 2012/34 (European Commission, 2012a).

Many railway companies are still state owned, nevertheless, many initiatives for restructuring, unbundling and vertical and horizontal disintegration of the incumbents have been adopted. Depending on the specific business and political context, new entrants undertake various activities, from non-core (maintenance, rolling stock, etc) to core activities (including infrastructure managers, provision of essential services, capacity-allocating services and of course provision of rail based services for passengers and freight). Nevertheless, there are still significant discrepancies among

[16] The first Railway Package consists of three Directives, namely (European Commission, 2001g), (European Commission, 2001c) and (European Commission, 2001d)

[17] The Second Railway Package consists of Directive 2004/49/EC (European Commission, 2004b), Directive 2004/50/EC (European Commission, 2004c), Directive 2004/51/EC (European Commission, 2004d) and Regulation 881/2004 (European Commission, 2004e)

[18] The Third Railway Package consists of Directive 2007/58/EC (European Commission, 2007a), Directive 2007/59/EC (European Commission, 2007b), Regulation 1371 (European Commission, 2007c) and Regulation 1370 (European Commission, 2007d)

[19] The Fourth Railway package is still at a discussion phase (European Commission, 2013b), adopted by the European Commission but not yet approved by the European Parliament.

the EU MS, since every state and every company had a different regulatory starting point and on top of that, the specific business conditions require different strategies and different policies to be implemented. The domestic passenger market is still regulated in many states (in most of the cases due to the Universal Service obligation or under the Public Goods principle), however this is expected to change when the 4th Railway Package is fully implemented. The ultimate objective is to create a uniform, interoperable Single European Railway Area, restricting technical and operational differences between the EU MS and opening the market to EU competition.

3.3.4 Road freight

Road freight transport was heavily regulated in EU, and more specifically through enforcing entry barriers and price regulations, although the number of the incumbents, the low individual market share and the limited scope for economies of density, scope and scale made it competitive enough. With the exception of the road network which belonged to the state, the service provision was mainly done by private sector companies. Domestic operations were regulated on a national level and international operations were mainly governed through bilateral agreements between national governments with annual duration. One of the main arguments in favor of the regulation was that road freight transport was directly competitive to the rail industry, thus through these restrictions, the rail sector was protected.

The sector has been significantly deregulated through introduction of uniform, on the EU level, rules for access to the profession and access rights to the markets, although bilateral international (extra-EU) transport agreements still exist. The cabotage restrictions on the EU level still exist but are expected to be further liberalized and currently the only restriction is the transit through Austria (through specific areas, i.e. Alps, etc). The entry to the profession is currently based only on qualitative criteria ((European Commission, 1996b), (European Commission, 2009c)) and all quantitative criteria have been abolished. As said above, cabotage (domestic transport) is not fully liberalized yet, since some EU MS have abolished it altogether, whereas other MS still enforce cabotage operations (3 operations or 7 day duration whichever comes first (European Commission, 2009a)). Although the EC has advocated for further

liberalization from 01/01/2014 onwards, national governments still have in place certain national regulations[20] that may prohibit cabotage operations. Latest EC efforts include improving fair competition in terms of fiscal rules, vehicle taxation and road infrastructure charges as well as improving social aspects of the profession, including working time, driver attestation and anti-social-dumping practices. Significant effort is also put on the technical side (vehicles' uniform weight and dimensions, interoperability issues, rest areas, security and safety). Nevertheless, the national enforcement practices are still vastly different per EU MS.

3.3.5 Road passenger (non-urban)

Before the 1980s, regular coach services were either state-owned or heavily regulated. The European market generally followed the USA experience, where these services were considered a direct competitor to the rail services, thus the government regulated this market. Inter-urban and non-urban road passenger transport has been deregulated in the past years, although contrary to the rest of the sectors this was nationally driven instead of EU driven. The EC in the past years tried to abolish cabotage restrictions, although certain restrictions in the market still prevail, especially in the domestic market of certain countries (Sweden, Spain and Greece) or for certain routes (Germany and France restrict operating in routes which directly compete to rail services). The most important reforms were introduced in 1992 (European Commission, 1992b) with Council Regulation 684/92 which abolished restrictions to set tariffs and introduced the liberalization of the international road passenger transport from cabotage.

[20] EU MS are allowed (European Commission, 1990b) to enforce temporary quantitative restrictions on road freight transport in the following cases: (a) crisis, (b) when there is over-capacity in supply and only for a long period and it is unequivocal, (c) significant number of carriers suffer from financial imbalances and their commercial survival is unsure or (d) it is evident that in the short or medium term no market improvement can be expected. However, no EU MS has adopted any measure based on these provisions.

3.3.6 Urban public transport

Urban public transport was heavily regulated before the 1980s. In the metropolitan areas, the state (local, regional or national) owned both infrastructure and operations for all modes (bus, tram, light rail, sub/ urban rail and metro) and didn't allow for any other operator to operate their services. In non-metropolitan secondary and tertiary areas, there were two cases. In the first, as in the metropolitan areas, the state owned the system. In the second, the government (local or national) didn't own the urban public transport system (service provision) and the assignment was contracted out by the government. Additionally, the government ruled the tariffs, the routes, the frequency as well as many other qualitative and/or quantitative elements. State-owned monopolies remained the dominant organizational form across Europe until recently. Currently (2015), in most of the cases, the National Governments have followed the EU stipulations (European Commission, 2007d) and have deregulated the Urban Public Transport market, either assigning the operations (service provision) to a private company or in those cases where this company is state owned, the company has adopted strictly market oriented objectives. The latest trend is to assign contracts for specific routes or specific geographic areas based on competitive tendering processes. In those cases where the economies of scale or scope are such, the current approach is to separate infrastructure from ownership and assign each individually through a competitive tender process.

3.3.7 Inland waterways

Similarly to the previous modes, the pre-1980s market structure in the inland waterways was heavily regulated by each national government (perhaps with the exception of the River Rhine navigable route). Most of the regulations concerned market entry, especially for foreign ownership companies, cabotage operations, capacity restrictions, shipment allocations (essentially this is equivalent to revenue allocation), tariff restrictions and safety restrictions. Although the infrastructure market was essentially a natural monopoly with significant economies of scale, the operational side of the sector had significantly lower economies of scale and/or scope

and the private sector was the dominant one with a large number of shipping companies being involved in this market.

Currently, the inland waterways sector is liberalized across Europe since 1996 (European Commission, 1996a), (European Commission, 1996c), although certain delays were observed in various EU MS. The deregulation included removing many restrictions like the rota system and the tariff setting among others. However, certain problems remain, like administrative and/or regulatory barriers. These are all linked to restrictions at the EU level with regards to harmonization, from the operational side, like ship certification and mutual recognition of boat masters' certificates to technical issues like common safety and security regulations.

3.3.8 Short sea shipping

Short sea shipping was heavily regulated until mid-1980s, including permits, complex administrative procedures, exclusivity on certain routes, routes restricted by cabotage and preferential slot allocation from ports. Short sea shipping was liberalized in 1992 (European Commission, 1992a), although this was actually put into effect on 01/01/1999 with certain exceptions like passenger services to/from mainland as well as the case of the Greek Islands market that opened in 2004. With the Motorways of the Sea initiative and through the Trans-European Transport Network (TEN-T) the EC is deregulating the SSS market and in parallel is introducing financial incentives for the SSS sector so as to provide a level playing field across the different sectors of the transport industry. This is primarily done because the modal competition is very intense and the SSS sector is not completely deregulated, thus facing many internal market failures, for example the restrictive port system as well as administrative red tape, terminal operator monopolies on cargo handling and information and market asymmetries in general.

3.3.9 Intermodal transport

Since the early 1990s the EC adopted a set of policy measures, in order to increase competitiveness of the logistics and of the transport sector as a whole. This initiative has been the most difficult to implement, since intermodal transport being a

intersection of different modes of transport, makes it cumbersome to provide a level playing field for all modes at the same time. One of the recent attempts from the EC (European Commission, 2014c) focuses on further deregulating ports and terminal facilities, with the primary focus on the ownership, especially of the ports / port systems and on the provision of port related services (pilotage, cargo handling, warehousing, etc). Nevertheless, the EC acknowledges the delays in the implementation of these initiatives, primarily due to social factors.

3.4 Key Macroeconomic Data on Transport & Economy

The following section presents an overview of the key macroeconomic data of the European Transport Industry that will set the scene for the analysis that follows in Chapters 4 and 5. Additionally, this overview will depict the effect of the regulatory changes on the European transport industry.

First of all, it has to be noted that the EU, as is the case with other industrialized nations, is currently (2015) recovering from the 2008 deep recession, and as such, is still trying to find its pace. This recovery is further delayed due to the continued fiscal crisis in certain EU countries (Italy, Spain, Portugal, Ireland and Greece) as well as due to the dynamics from the introduction of new Member States. Thus, it can be observed (Figure 6) that although in 2010-2011, the European GDP grew marginally, in 2012 it decreased by 0,4% and in 2013 it remained almost the same compared to the previous year. The industrial production in EU is declining during the 2010-2013 period, indicating a further de-industrialization of the EU-28 market.

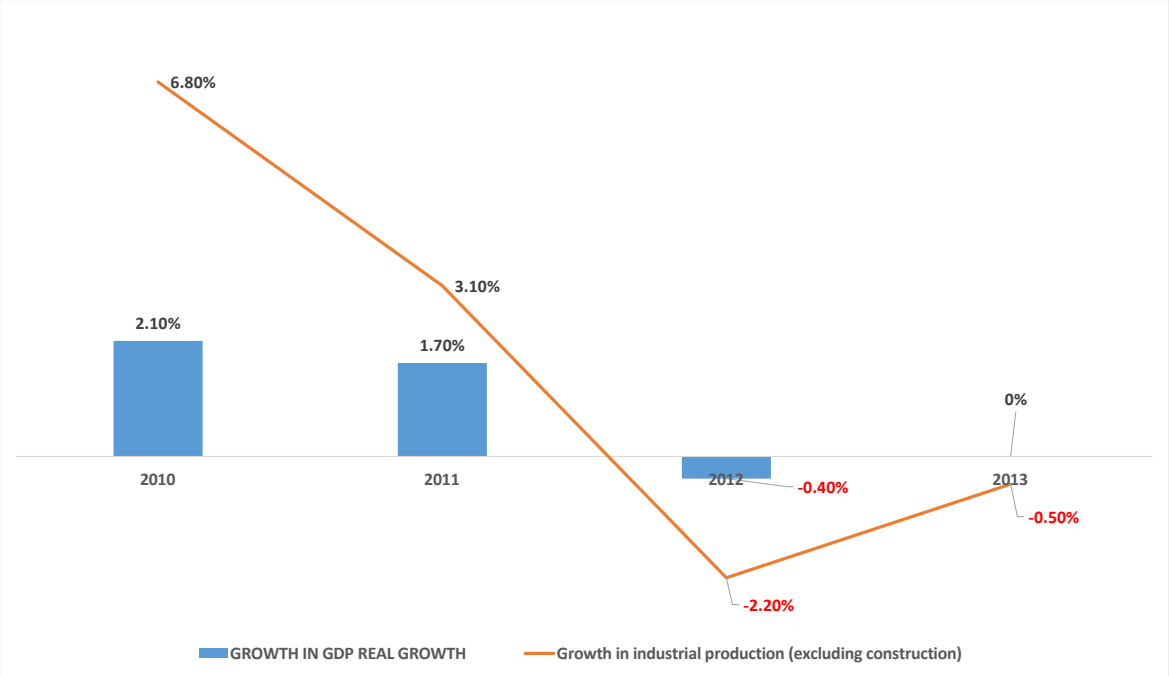

Figure 6 - Growth in GDP and industrial production

Source: (European Union, 2015b), for more details please refer to § "Growth in GDP and Industrial Production (YoY)" pp 258

In order to understand the magnitude of the EU transport sector, Table 1 gives an outline of the density of the EU transport networks as compared to similar ones. EU28 has a dense multimodal network, in terms of total length and in terms of individual sector – by – sector comparisons.

Table 1 - Transport Infrastructure

	EU-28	USA	JAPAN	CHINA	RUSSIA
1,000 km	**2012**	**2012**	**2012**	**2012**	**2012**
Road network (paved)	5,000	4,258	983	3,610	1,038
Motorway network	73.2	92.0	8.1	96.2	50.9
Railway network	215.3	205.5	20.1	97.6	85.6
Electrified rail lines	115.7	N/A	12.4	35.5	43.0
Navigable inland waterways	41.9	40.2	N/A	125.0	102.0
Oil pipelines	37.3	298.6	N/A	91.6	55.0

Source: (European Union, 2015b)

This complex and dense transport network plays a vital role in supporting the trade of goods among the EU28 Member States as well as among the EU28 MS and the other countries. For example in 2013, more than €4.4 Trillion in value of goods (Table 2)

were imported in the EU28 whereas the same year more than €4.5 Trillion were exported (Table 3). This trend is also apparent within EU since the intra-European trade balances are quite significant.

Table 2 – EU Value of Goods Imports (2013, figures in Billion €)

	WORLD	EU-28	EXTRA EU28 of which:						
			TOTAL	CANDIDATES	EFTA	USA	JAPAN	RUSSIA	CHINA
EU-28	4,455.851	2,771.023	1,684.829	61.049	188.523	196.149	56.602	206.913	280.088
BE	340.093	225.908	114.185	3.381	10.249	23.691	7.138	9.992	12.999
BG	25.829	15.423	10.405	2.061	0.214	0.197	0.066	4.782	0.767
CZ	108.621	83.457	25.164	0.941	0.949	1.513	1.028	5.383	6.281
DK	72.728	50.931	21.797	0.747	6.021	1.568	0.271	0.950	4.838
DE	897.187	578.806	318.382	13.378	57.471	36.720	14.481	39.127	57.583
EE	13.684	11.310	2.375	0.048	0.214	0.133	0.027	0.809	0.572
IE	49.584	34.991	14.593	0.210	1.926	4.931	0.773	0.141	2.041
EL	46.808	22.126	24.682	1.578	0.613	0.504	0.120	6.606	2.194
ES	256.455	141.695	114.760	3.822	5.135	8.647	1.815	8.103	14.419
FR	513.114	347.738	165.376	5.438	17.601	26.660	4.817	10.263	24.603
HR	16.581	11.090	5.491	0.583	0.225	0.279	0.091	1.069	0.956
IT	361.002	200.168	160.834	8.193	12.219	11.535	2.566	20.197	23.071
CY	4.754	3.350	1.404	0.008	0.066	0.043	0.026	0.053	0.202
LV	13.451	10.762	2.690	0.072	0.147	0.083	0.012	1.087	0.342
LT	26.208	15.809	10.399	0.130	0.205	0.308	0.026	7.368	0.565
LU	20.087	15.866	4.221	0.034	0.173	1.666	0.170	0.002	1.282
HU	75.379	54.060	21.319	1.150	0.366	1.326	0.924	6.395	5.169
MT	4.625	3.285	1.340	0.094	0.112	0.127	0.047	0.008	0.136
NL	444.015	205.614	238.402	3.131	20.478	28.958	10.006	28.974	53.375
AT	138.000	105.723	32.277	1.777	8.178	2.843	0.745	3.069	4.485
PL	156.319	107.822	48.497	1.471	2.968	2.847	0.975	18.654	8.469
PT	56.906	40.959	15.947	0.552	0.415	0.843	0.238	1.000	1.370
RO	55.280	41.866	13.414	2.215	0.572	0.626	0.218	2.372	1.972
SI	25.129	17.604	7.525	1.444	0.313	0.455	0.109	0.464	1.018
SK	61.543	45.727	15.815	0.598	0.337	0.256	0.302	6.064	2.468
FI	58.407	38.704	19.702	0.232	1.447	1.349	0.287	10.485	1.759
SE	120.254	82.649	37.605	1.028	11.024	3.291	1.296	5.528	6.171
UK	493.808	257.580	236.228	6.733	28.885	34.751	8.033	7.965	40.981

Source: (European Union, 2015b)

Table 3 – EU Value of Goods Exports (2013, figures in Billion €)

	WORLD	EU-28	EXTRA EU28 of which:						
			TOTAL	CANDIDATES	EFTA	USA	JAPAN	RUSSIA	CHINA
EU-28	4,579.096	2,842.505	1,736.591	94.131	222.354	289.462	54.016	119.458	148.154
BE	352.956	247.572	105.383	4.911	6.843	18.036	3.479	5.114	7.230
BG	22.272	13.351	8.921	2.808	0.195	0.304	0.028	0.583	0.651
CZ	122.185	99.119	23.066	2.147	2.557	2.660	0.656	4.474	1.446
DK	82.905	52.569	30.337	0.765	6.492	5.267	1.461	1.562	2.578
DE	1093.160	623.719	469.441	23.709	55.757	89.622	17.221	35.789	67.153
EE	12.311	8.730	3.581	0.168	0.514	0.359	0.065	1.419	0.099
IE	86.105	48.996	37.109	0.491	5.476	18.219	1.684	0.633	1.408
EL	27.559	12.837	14.722	4.655	0.162	0.934	0.046	0.406	0.419
ES	239.314	150.517	88.798	5.073	5.196	8.758	2.253	2.813	3.942
FR	437.439	259.827	177.613	6.705	14.705	27.216	6.878	7.721	14.813
HR	9.531	5.899	3.632	0.767	0.158	0.244	0.044	0.282	0.057
IT	390.233	209.829	180.404	13.236	22.095	27.047	6.023	10.772	9.843
CY	1.520	0.881	0.640	0.005	0.020	0.054	0.001	0.024	0.033
LV	10.893	7.236	3.657	0.137	0.316	0.120	0.045	1.760	0.086
LT	24.545	13.612	10.932	0.145	0.599	0.682	0.035	4.869	0.088
LU	13.880	11.245	2.635	0.331	0.690	0.353	0.056	0.156	0.197
HU	80.945	63.004	17.941	2.792	0.927	2.095	0.376	2.526	1.435
MT	2.738	1.229	1.509	0.018	0.026	0.156	0.128	0.036	0.047
NL	505.651	382.559	123.093	5.726	10.641	17.581	3.380	7.956	8.628
AT	131.885	92.433	39.452	2.021	7.600	6.691	1.230	4.308	2.772
PL	154.344	115.755	38.588	3.024	4.390	3.628	0.506	8.113	1.589
PT	47.266	33.235	14.032	0.396	0.539	1.999	0.139	0.263	0.658
RO	49.571	34.506	15.065	3.207	0.866	0.826	0.233	1.382	0.499
SI	25.615	19.170	6.445	1.409	0.361	0.371	0.040	1.190	0.169
SK	64.566	53.557	11.009	1.439	1.212	1.161	0.135	2.555	1.596
FI	56.048	30.979	25.069	0.717	2.415	3.561	0.994	5.359	2.766
SE	126.297	72.915	53.382	1.661	15.240	7.852	1.702	2.728	4.571
UK	407.363	177.226	230.137	5.668	56.360	43.666	5.176	4.667	13.381

Source: (European Union, 2015b)

In addition to the above, it is interesting to look into the growth of the transport sector for the EU-28 MS since 1995 (Figure 7). Up until 2007, the year before the fiscal and economic crisis occurred, the transport industry was growing close to the GDP rate with regards to the goods transported and at a slower pace for passenger transport.

However post-crisis growth rate was significantly reduced (Table 4) to almost a half the GDP growth rate.

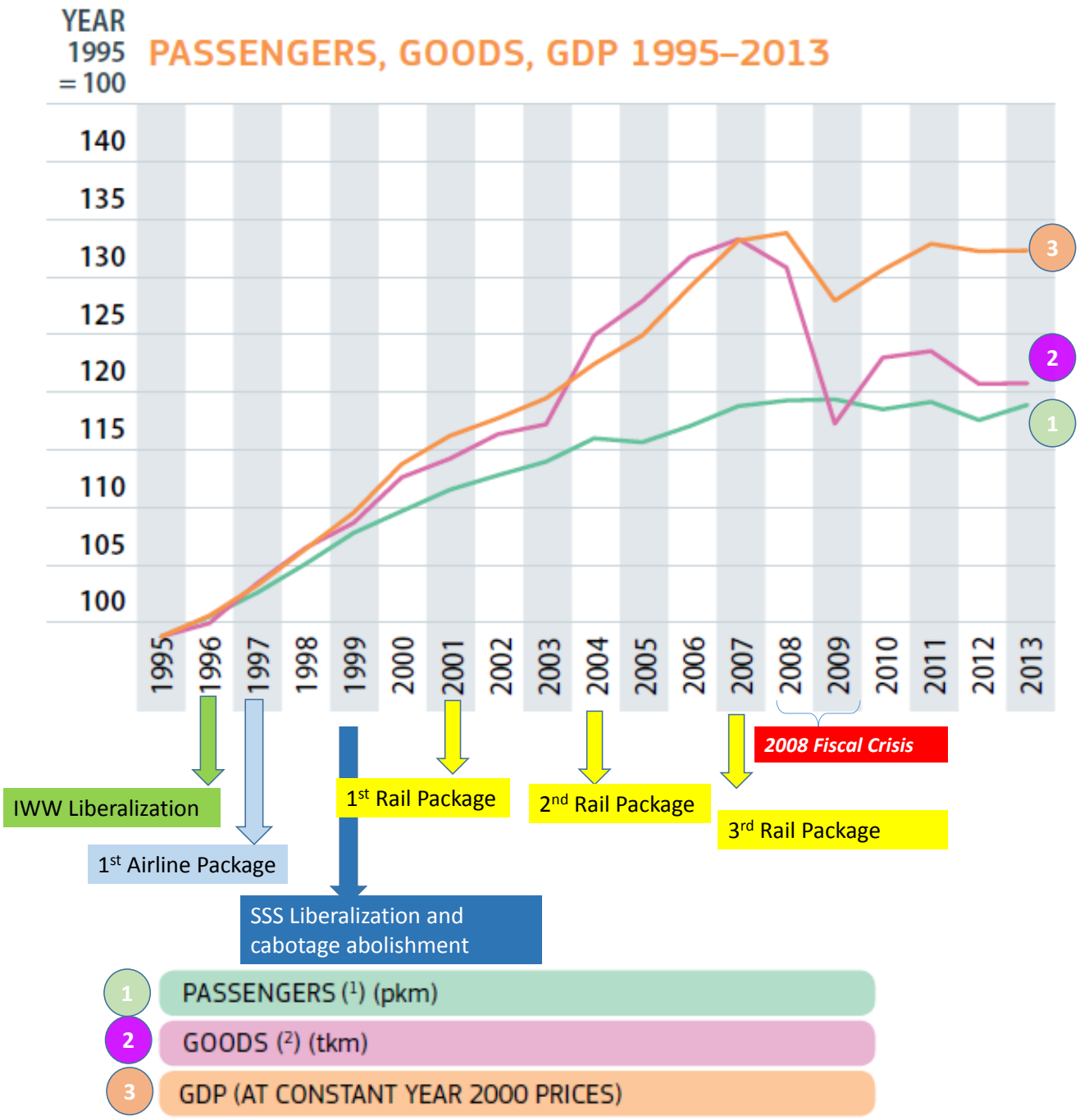

Figure 7 - Transport Growth EU-28

Source: (European Union, 2015b) Notes: (1) Passenger cars, powered two-wheelers, buses & coaches, tram & metro, railways, intra-EU air, intra-EU sea. (2) Road, rail, inland waterways, oil pipelines, intra-EU air, intra-EU sea. GDP: at constant year 2005 prices and exchange rates. Additional graphics and commentary by author.

Table 4 – Annual Growth Rates EU-28

	1995–2013 p.a.	2000–2013 p.a.	2012–2013
GDP at year 2000 prices and exchange rates	1.6 %	1.2 %	0.0 %
Passenger transport (pkm)	1.0 %	0.6 %	1.1 %
Freight transport (tkm)	1.1 %	0.5 %	0.1 %

Source: (European Union, 2015b)

The most used transport mode is the sea both in terms of value and in terms of weight, followed by air and road (based on value, Figure 8) or pipeline and road (based on weight, Figure 9).

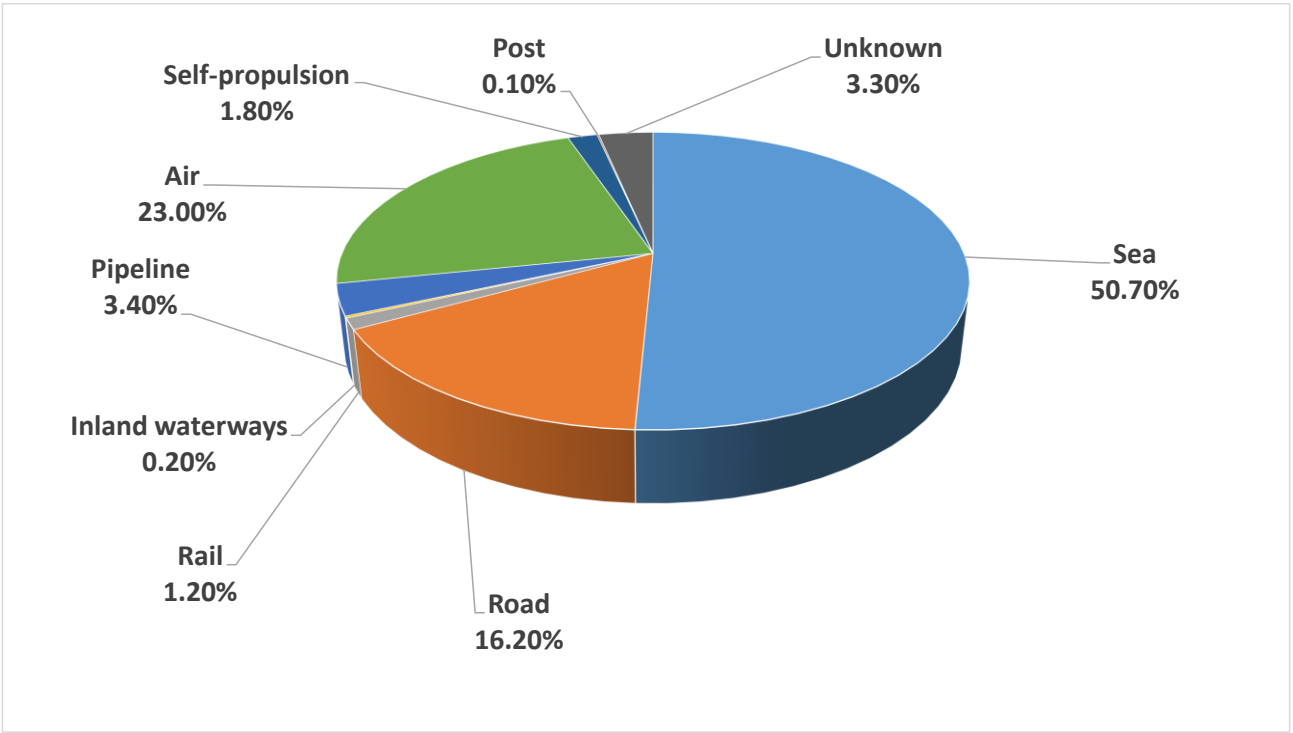

Figure 8 - 28 External Trade by Mode of Transport (in terms of Value, 2013)

Source: (European Union, 2015b) (for more details, please refer to Table 54, pp260)

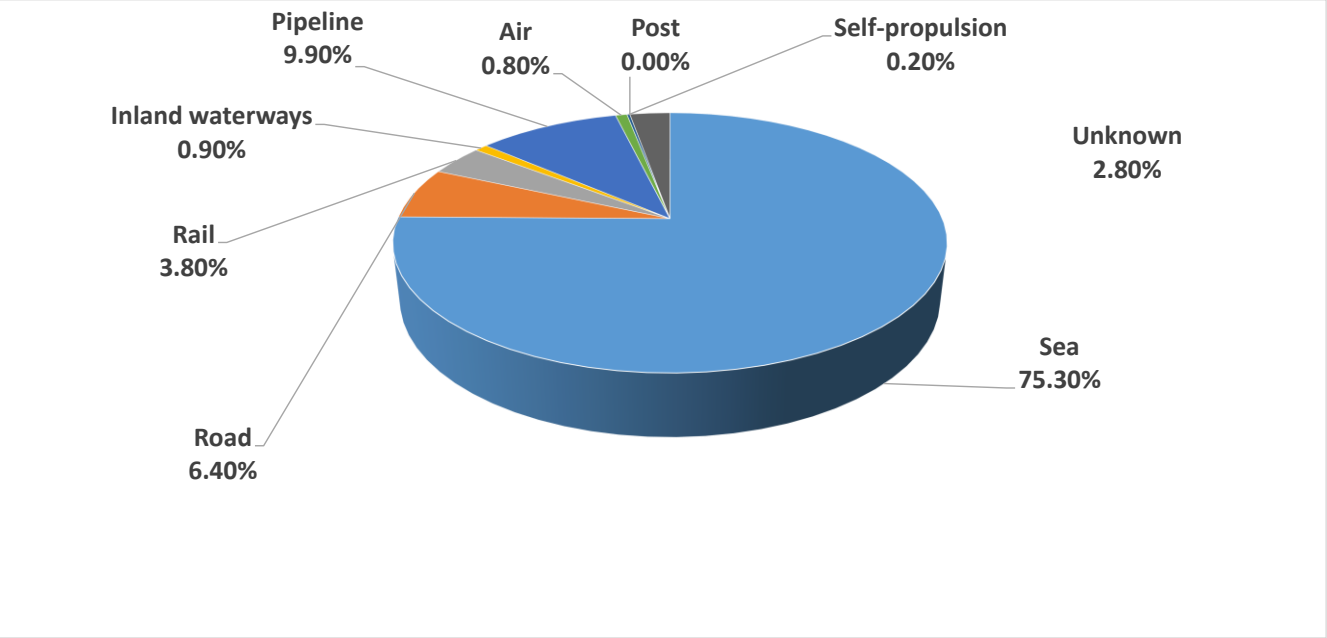

Figure 9 - 28 External Trade by Mode of Transport (in terms of Weight, 2013)

Source: (European Union, 2015b) (for more details, please refer to Table 55 pp.260)

Additionally, in terms of energy consumption, the transport sector is the second most important energy consumer at 31.6% (Figure 10), thus many of the (social) regulation policies aim at such environmental aspects as the energy consumption and the emissions (e.g. the EURO VI engine standards) or the total environmental footprint (e.g. the vignette scheme).

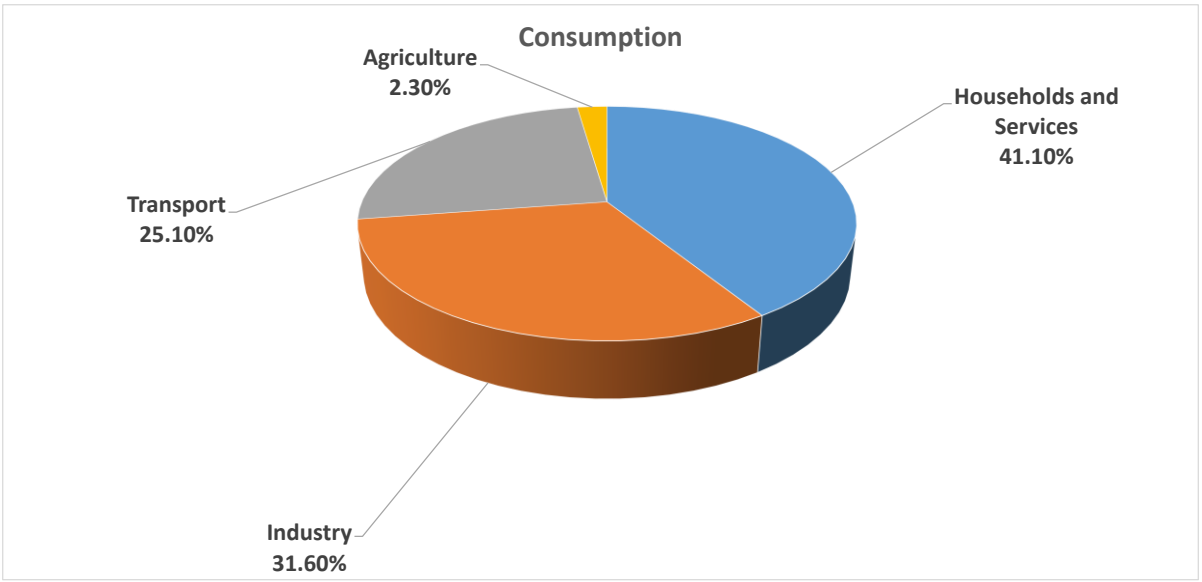

Figure 10 - Energy consumption by sector (Mtoe, 2013)

Source: (European Union, 2015b)

Concluding the macroscopic overview of the transport industry, it has to be noted that at the EU-28 level, the industry employs more than 10.5 Million persons (across all modes, across all EU MS), with the majority of them being employed in the road sector and in the warehousing sector (more details can be found in the Annex – "Employment by Mode of Transport (*) (in 1,000) – 2012", in page 261). Additionally, in terms of enterprises, the total number in the industry is more than 1.1 Million undertakings, with the vast majority of them operating in the road transport sector (more details can be found in Annex – "Number of Enterprises by Mode of Transport (*) – 2012" in page 262). Last but not least, the turnover of the industry in 2012 was over €1.3 Trillion, with the majority of the turnover coming from the road sector (€ 312 Billion) and from the warehousing sector (€478 Billion), indicating the value the industry has on the European economy (more details can be found in the Annex, "Turnover by Mode of Transport (*) 2012 (million EUR)", in page 263).

3.5 EU-28 Performance by Mode of Transport

3.5.1 Freight Transport

The performance of the European Transport industry in terms of ton-kilometer production has an expected course (Figure 11) during the period 1995 – 2013. More precisely, based on the growth rates some interesting observations are drawn:

- Up until 2007 the road transport sector was expanding, mainly due to the deregulation of the market and the reduction of the entry and operational restrictions, across EU. A CAGR of 1.61% for the period '95-'13, similar to the GDP growth for the period is indicative of the growth the sector was experiencing. In addition, the gradual abolishment of the cabotage, especially in large economies like Germany, also contributed to this growth.
- The sea sector (intra EU) experienced a 0.88% growth, close to the GDP growth, although up to 2006 the sector was growing faster compared to the period 2007-2013. In 2008, the sector experienced a significant drop, as a result of the crisis.

- The rail sector had a limited growth, with a CAGR for the period 1995-2013 of 0.27%. The first railway package of 2001 changed positively the weak growth of the sector, however the 2008 crisis affected negatively the growth.
- With regards to the inland waterways, the growth rate for the period was 1.27% (CAGR) similar to the GDP growth rate (CAGR). It can be inferred that the deregulatory efforts helped boost the weak growth of the sector, although significant administrative burdens in the first deregulatory period might have limited this growth.
- The rest of the sectors (air, pipeline) had zero or negative growth rates during the reviewed period.
- Up until 2007, the growth rates (CAGR) across the transport sectors were higher (in some cases even triple the 1995-2013 rate), however, the economic crisis has directly affected those and reduced them significantly.

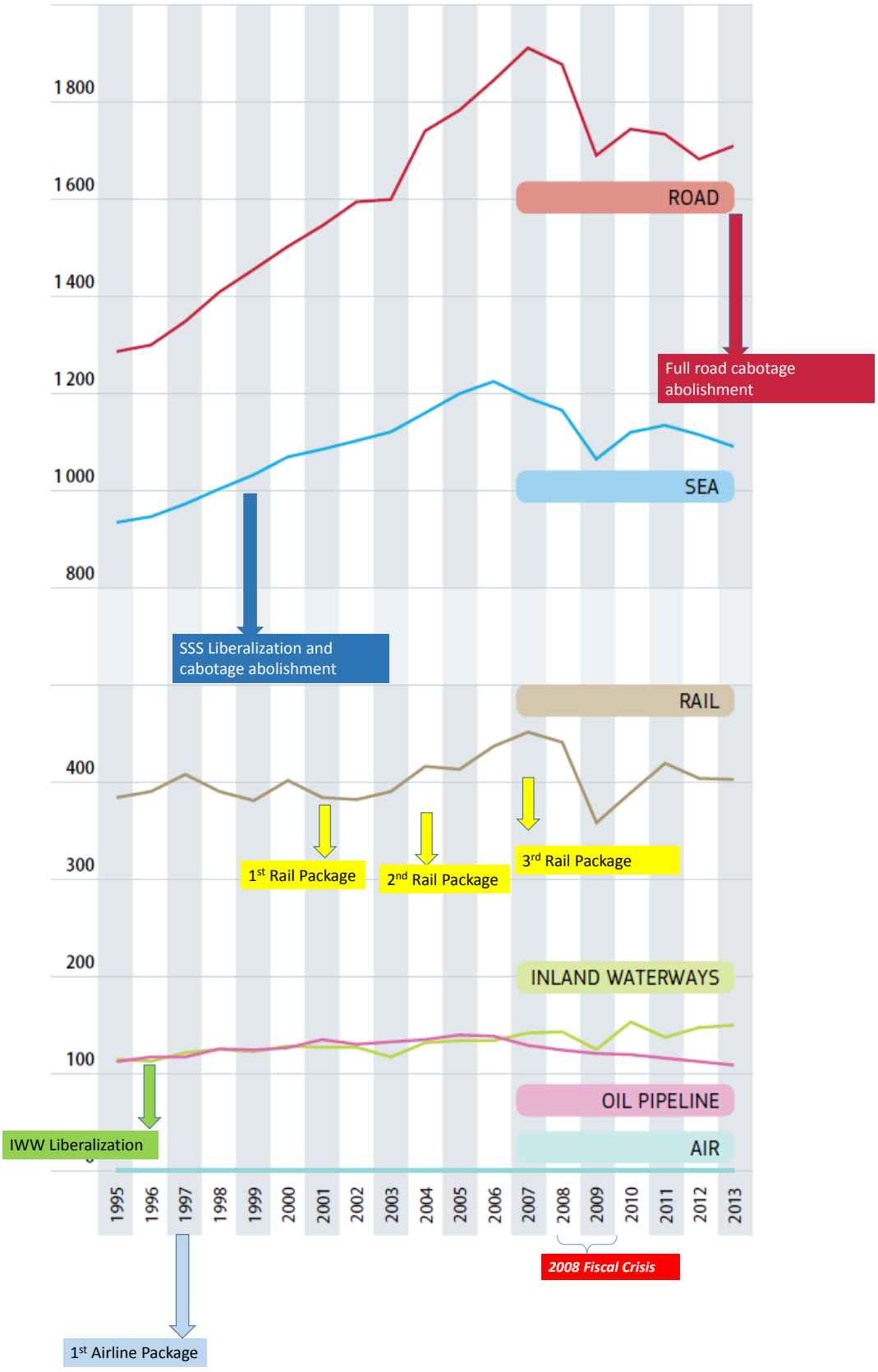

Figure 11 - EU-28 Performance by Mode for Freight Transport – 1995–2013 (in Billion TKM)

Source: (European Union, 2015b). Additional graphics and commentary by author.

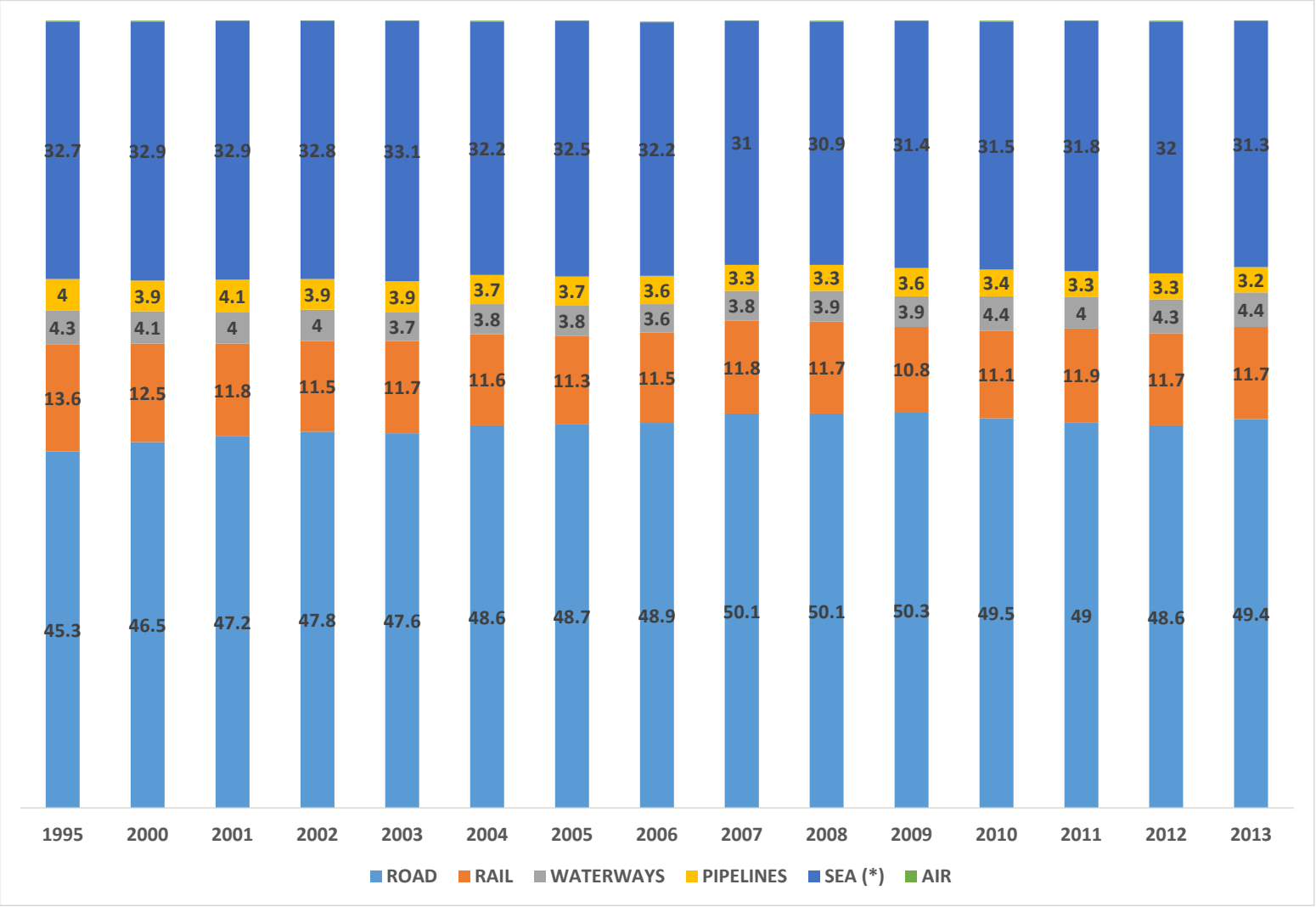

Figure 12 - EU-28 Performance by Mode (Freight Transport, modal split)

Source: (European Union, 2015b)

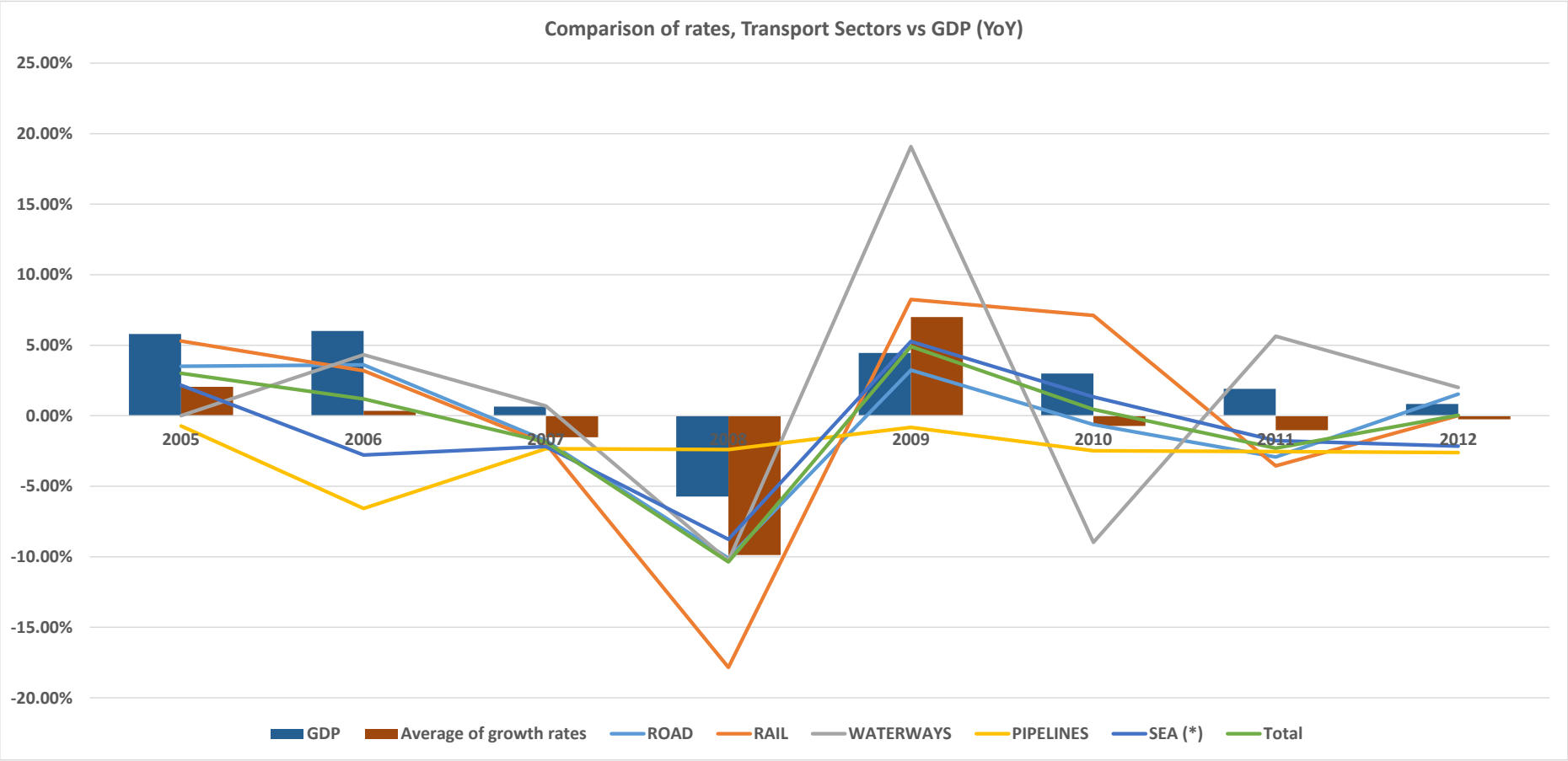

Figure 13 - Comparison of growth rates across transport sectors vs GDP growth (YoY), Freight Sectors excluding Air

Source: (European Union, 2015b), analysis by author

As a conclusion, it can be inferred that with the exception of the road sector, the rest of transport sectors, did not experience as much growth compared to the road sector, in spite of the deregulation efforts from EU. Their growth rate was in most of the cases at best close to the GDP growth. This can also be seen in the modal split between the different modes / across all sectors (Figure 12 above). The road sector improved its standing whereas the rest of the sectors remained about the same. For example the road sector started with a 45.1% share to reach 49.4% in 2013, the waterways started with 4.3% share and remained almost the same in 2013 at 4.4% and the sea sector started at 32.7% to decrease to 31.3%. Similarly, as Figure 13 shows, the YoY growth rates in the transport industry follow the GDP growth rates at best, indicating (at first sight) that deregulation efforts across the transport modes did not boost the transport industry's growth higher than the EU economic growth. Nevertheless, it is understood that this analysis is limited, since it observes only generic patterns without delving into causal relationships. This will be the focus of the next chapters. Last but not least, more detailed figures and tables are presented in Annex, "EU-28 Modal Performance (Freight)" and more precisely in Table 59, in page 264 as well as in Table 60 in page 264.

3.5.2 Passenger Transport

Following the freight transport industry analysis, this section focuses on the passenger movements. Based on the data available, the outlook for the industry is almost similar to the freight industry, growing at similar to the GDP rates (1.04%). More precisely, based on Figure 14 and Figure 15, the following observations may be drawn:

- The passenger kilometers traveled using passenger cars had a CAGR of 0.96% during the period '95-'13, growing at a slower pace compared to the GDP growth. This may be attributed to the economic crisis, which has reduced the available household spending, which in turn obliged the households to optimize the spending towards using other, less expensive modes.
- The powered two-wheelers experienced a small growth during this period at 0.54% (CAGR) whereas, similarly, the bus and coach sector also experienced a 0.32% growth.

- The most important observations relate, first to the railway sector which increased by 1.38% during this period as well as with the tram & metro sector at 2.00% and the air sector at 3.75%. These three sectors had the highest growth, and this growth may be attributed to the deregulation policies as well as the new social regulation the EU has adopted and the changing mentalities (e.g. the "Millennials" coming into age). For example, the air sector deregulation improved competition, reducing at the same time the prices, which made it possible even for non-business travelers to frequently use this mode. Additionally, with respect to the investment by national or local governments on tram and metro systems, the network expansion seems to have had a significant effect on the growth of the passenger-kilometers performance as was the case for the rail sector, which also had a very good performance (nevertheless, this should also be attributed to the urban agglomeration as well as to other drivers too).
- Contrary to the previous findings, the sea sector experienced a decrease of 0.86% during this period, since this mode is directly competitive to the air sector, thus the improvement of the air sector was one of the main drivers that affected negatively the sea sector.

Regarding the modal split rates, it has to be noted that the road sector remained almost the same, experiencing a slight decrease from 73.3% in 1995 to 72.3% in 2013. The air, rail and tram/metro modes increased their shares reaching 9.00%, 6.6% and 1.5% modal share respectively.

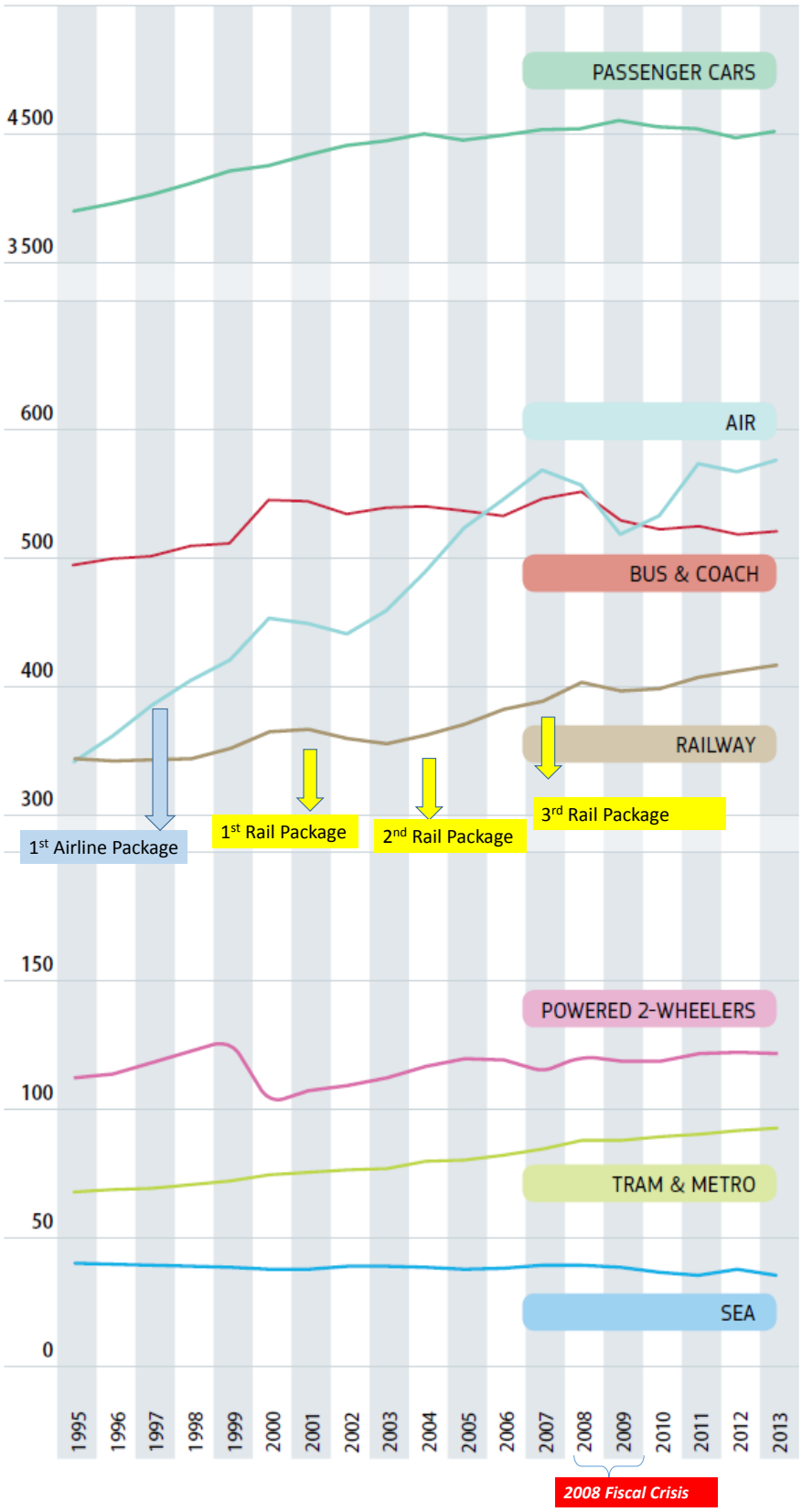

Figure 14 - EU28 Performance by Mode for Passenger Transport ('95-'13 (in bio passenger-kms)

Source: (European Union, 2015b). Additional graphics and commentary by author.

Figure 15 - EU-28 Performance by Mode 1995-2013 (Passenger Transport, modal split)

Source: (European Union, 2015b)

More detailed figures and tables are presented in Annex – "EU-28 Modal Performance (Passenger)" and more precisely in Table 61, in page 266 as well as in Table 62 in page 266.

3.6 OECD Deregulation Statistics

One important element of in this analysis is the level of regulation intensity in the transport industry as a whole. One of the most relevant and most contemporary indices is developed by OECD and measures the intensity of regulation across different countries (more information about the index and its constituent values can be found in "Annex II – Construction of the OECD Overall Regulation Index" in page 229). The index as well as some preliminary analysis are depicted in Figure 16 and in Figure 17.

Based on this index, it is observed that since 1975, the start date of measuring this index, all the countries in this analysis' sample are implementing deregulatory initiatives. Many of the countries had totally regulated transport industries, however during the past 30 years these industries were deregulated to a rather open business environment. It has to be noted though that there are a lot of differences observed in this sample. For example the UK has (2013) the most deregulated transport industry in this sample, whereas Portugal has the most regulated industry (2013). On the other hand, Greece in 2000 had the most regulated transport industry compared to the rest of the sample, and in 2013, after a heavy modernization program complimented with many deregulation initiatives, has an industry regulation intensity slightly above the sample average. Similarly, it is observed that France, Finland, Italy, Portugal and Greece are above (2013) both the sample average as well as the G20 average, meaning that they have more intense regulatory framework (i.e. more restrictive business environment). The rest of the countries are below these averages indicating a pro-competition, pro-deregulation transport policy. Last but not least, it should be noted that Figure 16 also shows quite exceptionally the deregulatory trend after 1985. In all of the countries in this analysis deregulation started in a rather slow pace, but took up especially after 1992.

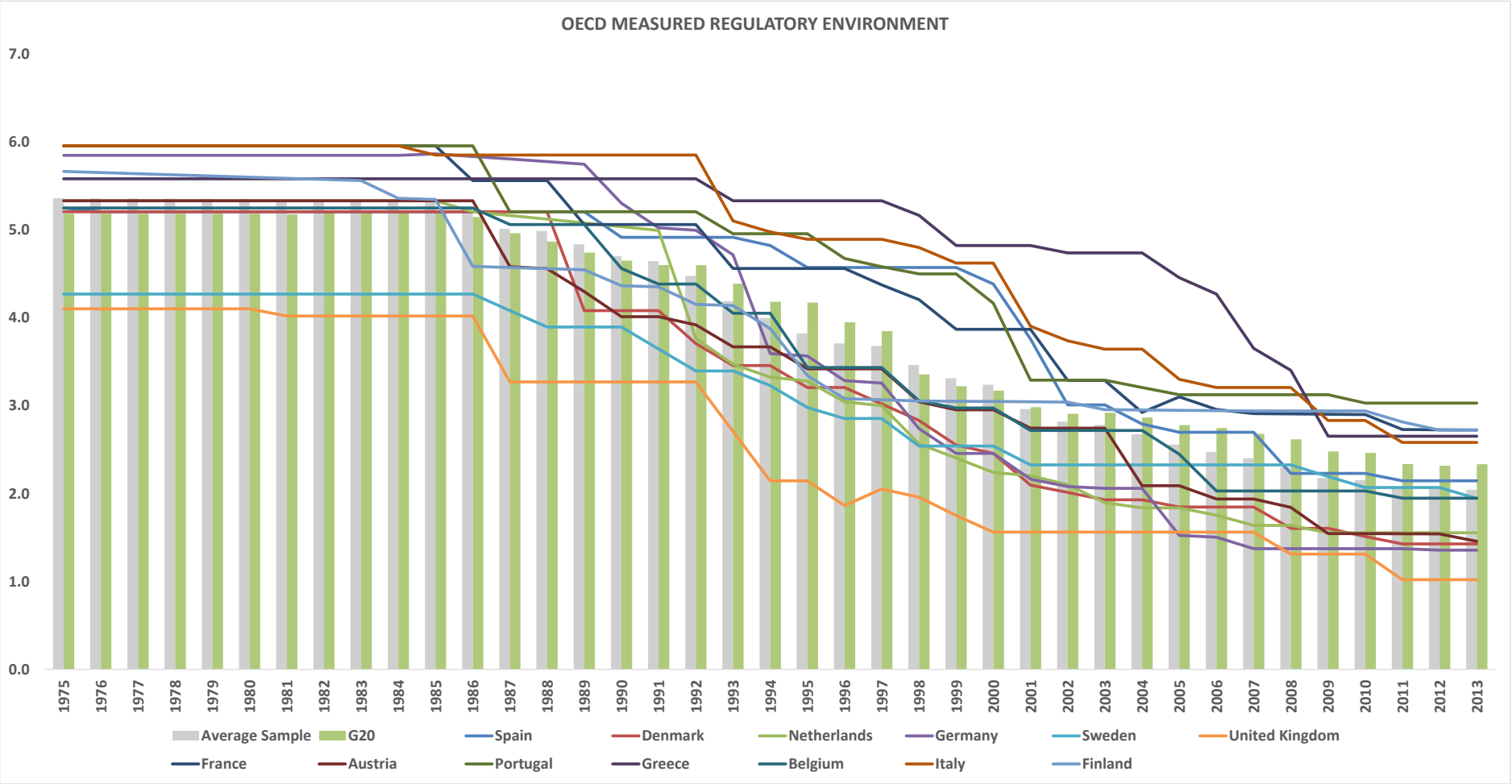

Figure 16 - OECD Index on Regulation (0= no regulation | 6=completely regulated)

Source: (OECD, 2015), the G20 average doesn't contain certain countries (BR, CN, USA, IN) due to missing data. Source data can be found in Table 27, in page 226.

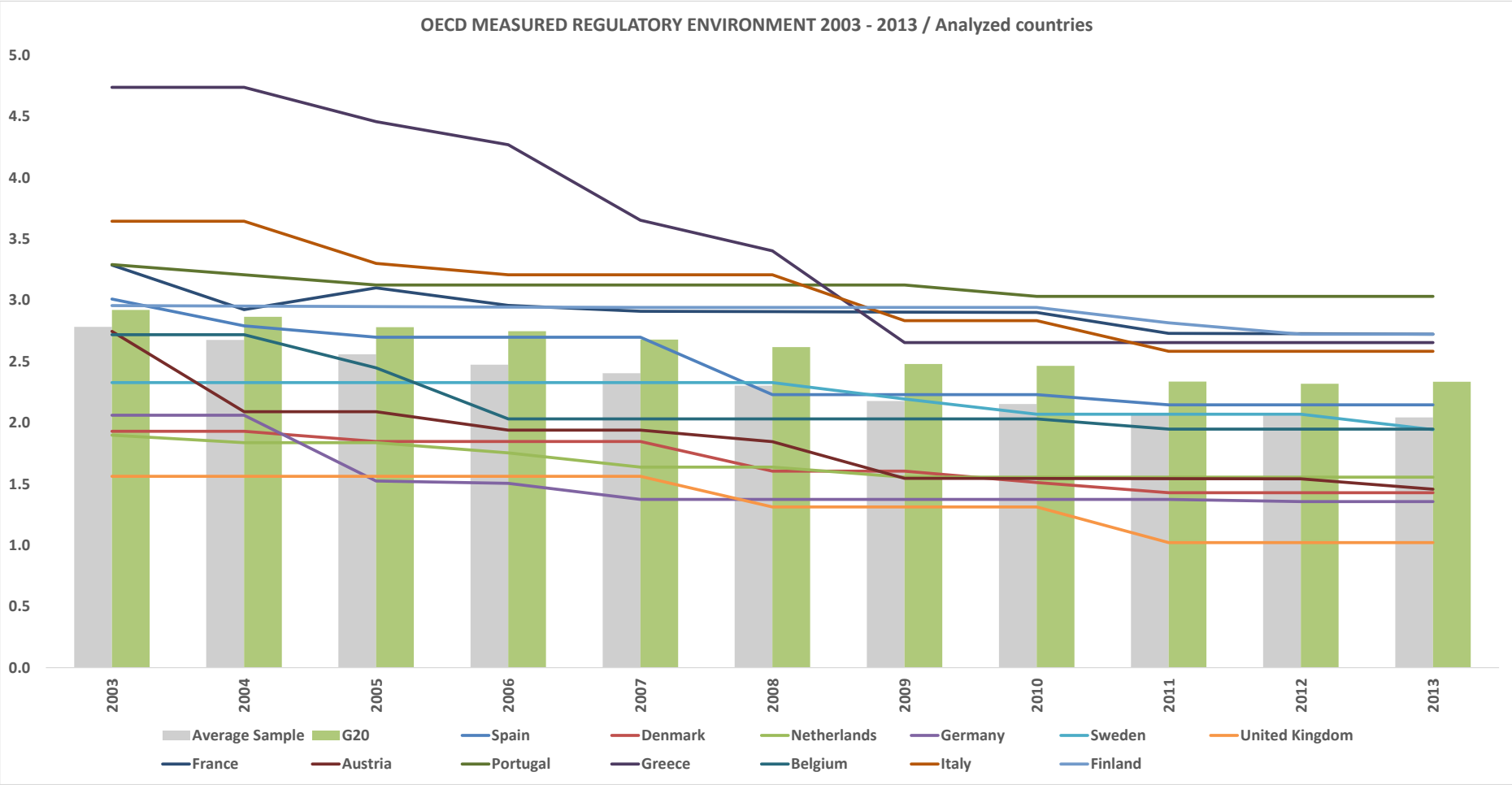

Figure 17 - OECD Index on Regulation: 2003-2013, Analyzed Countries (0= no regulation | 6=completely regulated)

Source: (OECD, 2015), the G20 average doesn't contain certain countries (BR, CN, USA, IN) due to missing data. Source data can be found in Table 27, in page 226.

3.7 World Bank LPI Index

The last index that will set the scene of this analysis is the Logistics Performance Index (LPI), as measured by World Bank[21]. This index measures the performance of the logistics sector across different countries against specific criteria. The following figure (Figure 18) shows the performance of the countries used in this analysis. Additionally, a comparison is made against the OECD deregulation index of the previous section. It can be observed that, as deregulation in the sample is increasing (that is the OECD index is decreasing), the LPI index is also increasing. Again, this is a simple observation and no causation is drawn based on this inference, since it may be Granger-caused, although it seems that the two trends have a similar momentum.

[21] The Logistics Performance Index measures qualitatively a country's logistics services based on a set of criteria, including "efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time". The index ranges from 1 to 5, 1 being the lowest score and 5 the highest performance. Data are collected through surveys conducted by the World Bank. For more information (World Bank, 2015)

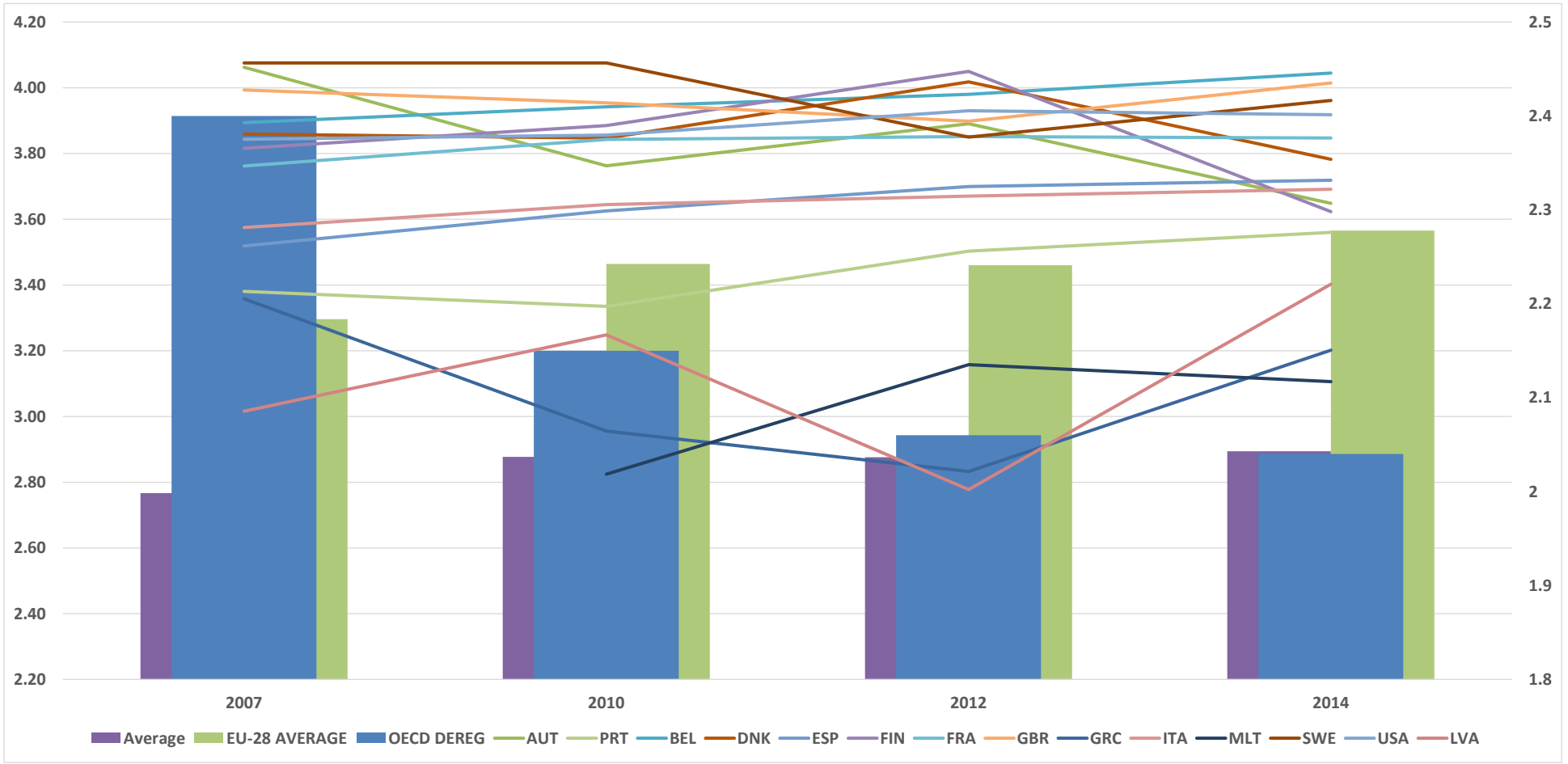

Figure 18 – Logistics Performance Index (1= low | 5=high) against OECD Regulation Index (0= no regulation | 6=completely regulated)

Source: (World Bank, 2015), (OECD, 2015), analysis by author

3.8 Closing Remarks

As closing remarks of this chapter, an overview of the most important deregulation initiatives in EU were reviewed, in order to not only understand the efforts put forward by EU, but more importantly to understand what (de)regulation tools the EU has used so far. More precisely, the most important tools used by EU include abolishing market entry restrictions, development of regulatory authorities and creating a level playing field in terms of certain qualitative aspects of the business. In addition to that, a review of the transport industry was also made, setting the business scene of deregulation in EU. In this brief review of the data, it can be inferred that:

i. The fiscal crisis of 2008-2009 had a significant effect across all modes of transport and for both freight and passengers,
ii. The degree of deregulation is different for each country, based obviously on the individual operational and political differences,
iii. Deregulation and logistics performance have a reinforcing relationship, based on observing the patterns,
iv. Since 1985, there is a strong intention in the EU to deregulate the transport industry, which follows similar initiatives in other industrialized countries,
v. The level of impact deregulation had on individual transport sectors varies and is based on a combination of political and economic reasons in addition to endogenous systemic effects. This is all more apparent when analyzed the effects deregulation of one sector had on another sector.

4 ESTIMATING THE IMPACT OF DEREGULATION ON THE EFFICIENCY

4.1 Overview

This section of the thesis analyses the effects of economic regulation and more precisely the implications of the ownership structure, market entrance restrictions, price regulations and regulatory independence on operational and capital efficiency as measured by essential business related indices using a comprehensive panel data of European transport companies. This analysis leads to the conclusion that deregulation and the related abolishing of certain economic restrictions have a positive effect on the firms in the sample, which tend to optimize their operational efficiency and become more effective if they are privately controlled. However, this analysis indicates that whether the firms' investment decisions and the deployment of capital expenditure are indeed affected by deregulation is inconclusive and in reality are affected by the special conditions that each sector and/or each company has, instead of a widespread diffusion of benefits. The significance of this analysis is based on the fact that, using empirical data, it confirms the theoretical deregulation estimation approaches which support the better use of resources (inputs), however at the short term. In essence, the results obtained are consistent with the theory that privately controlled in a regulated environment firms use inputs more efficiently to obtain better managerial outcomes in the short run, whereas the longer term decisions are based on the specific market attributes as well as on the macroscopic conditions. When looked at the Overall Industry level, the companies seem to better use the inputs at the short term, however, the key strategic decisions are affected by the specific industry conditions.

As discussed previously (§2.8, "Regulatory policy making in the European Transport " pp.71), the judgement of the European Court of Justice in 1985 that ruled against the Council of Transport Ministers and asked to ensure equal market access (freedom to provide services) in the international transport was a paradigmatic shift towards full competition in EU. The European Commission has ever since adopted a free market

access policy for all sectors and the results of this policy are widely considered positive, although the explicit results of this policy are largely uncontested or are estimated at an aggregate and/or theoretical level.

In the previous chapters, it was discussed that most of the studies in this field are centered on the macroscopic estimation of the deregulation effects and on the calibration of theoretical models. This research approach lacks empirical evidence and actual market feedback elements. This element, in addition to the transport sector being a very atypical sector in essence, require further analysis in order to estimate the actual benefits of the deregulation in a manner that can be used for managerial decision making. Regarding the peculiarity of the transport sector, it has to be noted that there are two kinds of inputs that are used to develop and offer transport services: the infrastructure and the vehicles. To this extent, it has to be noted that the transport infrastructure (essentially, the core infrastructure, i.e. the roads, rail network, ports, etc.) is a natural monopoly and as such, free access may be limited. Any heterogeneity in the infrastructure of the sector may be approached and/or induced by various methods, most notably through competitive tendering. In opposition to the transport infrastructure, the competitiveness outlook vis-à-vis the vehicles seems more intense with more market incumbent and potential entrants as a base case.

Contrary to previous studies (Knieps, 2006) that focused on one specific element of one specific sector, thus ignoring system wide effects, the current analysis follows an aggregate approach both at the sector and at the industry level. Ultimately, the approach that was adopted helps understand effects and specific interactions among the transport industry (sub)sectors. Since efficient competition on European transport markets is based on the principle of non-discriminatory access (to the profession, to the infrastructure, to the market, etc) this analysis additionally aims to prove that what is beneficial for everyone else is also beneficial for the incumbent in the transport market, including the causalities.

The structure of this chapter follows a straightforward layout. More precisely, Section 4.2 provides insight on the effects of deregulation on the Capital Structure of the deregulated companies. The next section describes the background research and the

state of the art with regards to the operational efficiency measured in technical and in managerial terms. Section 4.4 sets the hypotheses to be tested and section 4.5 describes the development of the dataset. Section describes the research and more precisely the empirical results whereas Section 4.7 discusses the results. The final section in this chapter makes a significant contribution to the current thinking by devising the Strategic Adaptation Matrix.

4.2 Understanding the effects of deregulation on the Capital Structure

During the 1990s, the policy shift in the EU, created a wave of institutional and regulatory reforms, more precisely a wave of privatizations that affected significantly the incentives, the strategies, and the performance of regulated utilities. Bortolotti et.al. (Bortolotti, Cambini, Rondi, & Spiegel, 2011) emphasized a neglected aspect of this deregulation process, the change in the capital structure of the deregulated company. Based on their empirical research, regulated utilities (energy, water, gas and transport) substantially increased their financial leverage since the early 1990s. Although this trend became widespread country wide and sectoral wide in the EU Member States, it has to be noted that it was not related with the leverage boom in other sectors, which could be blamed for the 2008 Financial Crisis, but has to be attributed to the deregulation mechanics almost exclusively. In order to show a magnitude of this leverage boom, Bortolotti et al estimated the change for Autostrade per l' Italia (RAM), the Italian road network operator, from 32% in 1999, when RAM was privatized, to 88% in 2003. This was not the exception but the base case for the leverage boom, which included companies such as National Grid Group Plc, the UK energy network operator (from 30% in 1997 to 72% in 2005), Telefonica de España, the Spanish incumbent telecom operator (from 36% in 1997 to 68% in 2005) to name but a few. This phenomenon was called the "dash for debt" or "flight of equity" and the main concern against it (by the Regulators) was that high leverage inhibits greater risks of financial instability, which ultimately would transfer risk either to consumers or to taxpayers or to both.

Existing empirical literature has focused on the determinants of the capital structure of regulated firms and its implications on regulated prices mainly in the US markets. It

has to be made clear that the institutional framework in the USA differs to the one in EU in two respects:

- Large utilities in the U.S. have been privately owned whereas in the EU, private ownership and/or control of utilities is only currently (post 1990s, or post 2000s in the transport sector) taking gradually up,
- The U.S. government has intervened by regulating the rates on a state and/or on a federal basis, whereas the EU has only recently adopted the Independent Regulatory Agencies (IRA) concept, with limited scope in the transport sector and with regulations at the State level,

For example, Zingales, (Zingales, 1997) argues that deregulated US trucking companies will not be able to survive due to the high leverages they have adopted, even if trying to strictly control their efficiency. Although there was a delay in reforming the EU regulative framework, it is expected that the capital structure of regulated utilities in the EU will be similar to the US experience and its interaction with regulated prices is directly affected by the ownership structure and by the existence of an IRA.

In their work, Bortolotti et.al. (Bortolotti, Cambini, Rondi, & Spiegel, 2011) analyzed a comprehensive panel of 92 publicly traded EU utilities over the period 1994–2005 in this respect. This paper is the first systematic study of the capital structure of EU utilities based on empirical data, studying the relationship between capital structure, regulated prices, ownership structure, and regulatory independence. The analysis concluded that deregulated companies tend to have higher leverage when they are privately controlled and regulated by an IRA and when companies are privately controlled but are regulated by an IRA, leverage Granger-causes regulated prices (but not vice versa). Additionally, when companies are state controlled, leverage and regulated prices seem not to Granger-cause one another. The authors have included various factors in their analysis, such as size, asset tangibility, profitability, non-debt tax shield, growth rate of GDP, political orientation of the government, and the strength of the legal protection of investors' rights. Nevertheless, it has to be noted that some of these factors are subjective, thus their model has some inherent limitations in its predictability, although the results are robust enough to support the hypotheses set. The results suggest that the "dash for debt" phenomenon is an effect

of the deregulation process in EU and additionally, the financial leverage of regulated firms may lead to higher prices in the medium term.

To the best of our knowledge, the study from Bortolotti et.al. is the first one carried out for EU based deregulated utilities (with a cross sectoral reference in the EU), which study complements similar empirical studies conducted in the USA. For example, Taggart (Taggart, 1981) studied electric utilities and found that they increased their debt-to-equity ratios after the adoption of rate regulation in different states in the U.S.A. This growth may be attributed to a safer business environment due to the regulation provisions, although some utilities may have adopted higher debt-to-equity ratios in order to achieve higher concessions from the regulators. Similarly, Hagerman and Ratchford (Hagerman & Ratchford, 1978) also showed that the allowed rate of return on equity is increasing in the debt-equity ratio for a panel of 33 US based electric utilities. Other studies, (indicatively (Dasgupta & Nanda, 1993), (Klein, Phillips, & Shiu, 2002), (Sanyal & Bulan, 2008)) have all shown that firms operating in less pro-firm regulated business environments tend to have higher debt-equity ratios, that the degree of price regulation and its stringency are positively related to the leverage and that in case of growing competitive uncertainty the incumbents tend to reduce their debt-to-total assets ratios. However, it has to be noted that all of the studies (with the exception of Bortolotti et.al.) focus on non-transport utilities' capital structures, with limited insight on both the transport sector deregulation implications and on the operational efficiency.

The idea behind analyzing the capital structure is to monitor whether the regulated firm may become financially distressed and therefore raise prices charged to the users / consumers when the firm increases its leverage in order to minimize the risk of financial distress. Actually, this is the first indication that deregulation has succeeded, in terms of long term viability of the privatized company.

4.3 State of the Art of the Operational Efficiency of deregulated companies: Operational Efficiency measured in technical and in managerial terms

The previous discussion has focused exclusively on market leverage and book leverage, and more precisely on the capital structure selection of these companies.

However, the operational efficiency of the transport industry, post-deregulation, has been partially measured only at the technical level, missing important insight on the corporate level in terms of business strategy. Most of the studies on deregulation effects on operational efficiency have focused on the banking, on the energy and on the airline industries' technical efficiency, mainly using complex econometric and/or decision making theories, including multifactor productivity analysis, efficient frontier analysis, Data Envelopment Analysis etc. For example, Powell (Powell, 2012) studied the productivity at the aggregate US airline industry level from 1978 to 2009 as well as the individual US airline passenger level from 1995 to 2010. Based on a comprehensive set of productivity measures Powell found that the US passenger airline industry made significant productivity improvements since deregulation, although in terms of profitability, the effect of deregulation was not considered positive. The productivity measures included developing and evaluating Multi-Factor Productivity indices as well as Total Factor Productivity indices, consisting mainly of technical productivity metrics including Revenues-per-Mile, Available-Seat-Miles and Revenue-Tone-Miles. Furthermore, Ajayi et.al (Ajayi, Mehdian, & Guzhva, 2010) examined the operational efficiency of US airlines after deregulation using non-parametric order analysis to estimate several efficiency indices and solving linear programming models. Ajayi et.al. found that operational efficiency, post deregulation, was improved for all market players. Other studies also investigate various aspects of airline productivity leading to similar results in terms of improvement of operational efficiency (in terms of technical efficiency).

In the same theoretical framework, Lubulwa (Lubulwa, 1988) developed a General Equilibrium Model to assess the implications of road freight transport deregulation to the Australian economy and contest the Wheeler-Gilmour hypothesis (Wheeler & Gilmour, 1974) that "in the event of deregulation, it would be unlikely that there would be massive movement away from the railways to the road operators". By analyzing the macroeconomic situation in Australia, Lubulwa estimated that the post-deregulation industry dynamics as depicted in the modal split would change in favor of the road sector. One of the main conclusions is the "vulnerability" of one sector compared to another which (sector) seems to adjust quicker to the deregulation, thus

achieving sooner a competitive advantage. Nevertheless, the limitation of this study lies again with the theoretical prediction this research makes instead of the desired empirical feedback.

Likewise, Davis and Wolfram (Davis & Wolfram, 2011) studied the US energy sector efficiency post deregulation, focusing on various technical efficiency indices and found that deregulation and market consolidation have resulted in a 10% growth in operating efficiency, which was achieved primarily by optimizing the inputs. To this extent, Noulas (Noulas, 2001) also uses non-parametric models to calculate the operating efficiency of the banking sector in Greece post-deregulation and found that the adaptation and efficiency improvement of both private and government owned banks were both significant.

Nevertheless, these studies used theoretical, non-parametric models and focused primarily on the technical aspects of efficiency, without focusing on the business side. There is a limited set of studies on the impact of deregulation on the business side of transport companies. For example, focusing on operational efficiency at the strategic level in the transport industry at large, Dempsey (Dempsey, 2008) studied the financial performance of the airline industry since the deregulation of the sector in the USA. More precisely, Dempsey studied the net profit margins of major airline companies from 1955 till 2002 and identified the causes of the unsatisfactory performance which were considered unrelated to the deregulation. Additionally, Dempsey studied the real yields per passenger seat before and after deregulation and found that they fell significantly from 2.3% to 1.4%. However, this study also lacks the identification of causality and simply reports on mere observations.

Complementing the previous studies, Lafontaine and Valeri (Lafontaine & Valeri, 2009) developed a model and analyzed the impact deregulation had on the international road freight transport sector throughout the 1980s and 1990s. Their model included variables like the number of ECMT authorizations, the cabotage restrictions, the border deregulation in terms of cost of time and in terms of the fuel prices and analyzed the causality among these variables and the tone-kilometers transported. Their analysis showed that the changes had a large positive effect on the total amount of international road transport in the EU. Interestingly the authors also

found that post deregulation initiatives (more precisely limitation of cabotage rules) the companies relied more on for-hire trucks rather than on private fleets. Similarly, in a comparative literature review, Boylaud (Boylaud, 2000) identified (pp. 29-30, Table 5) a number of studies on the road transport sector deregulation, where all of these studies, using different methods, focused on analyzing the effects on prices, on quality and on technical efficiency.

Regarding the operational efficiency in managerial terms, relevant literature focuses on estimating the efficiency, based on different metrics and sampling data from company panels, which panels consisted of entities operating in various sectors and in various industries. For example, Megginson et.al. (Megginson, Nash, & Randenbor, 1994), examine the firm-level effects of privatization using a large sample of companies across different industries and across different countries. The authors developed a non-parametric model and assessed whether firms perform better after privatization by assessing the mean and the median of certain financial metrics before and after privatization (spanning 3 years before and 3 years after privatization). in the study, the authors document significant increases in profitability, output per employee (adjusted for inflation), capital spending, and total employment, however, their analysis is limited in terms of (a) limited sample and consequently analysis on companies that issued new shares sold to the public, grouping out the direct selling of equity (e.g. private placements), (b) limited monitoring of country specific variations and (c) limited monitoring of cyclicalities in the economy. However, this study is one of the first (to the best of our knowledge) and the results are quite important and also quite robust when tested in sub-samples. Similarly, Dewenter and Malatesta (Dewenter & Malatesta, 2001) adopt a parametric model to examine profitability, leverage, and labor intensity aspects of the firms in a cross industry, cross country company sample. These aspects are measured using conventional accounting ratios, including return on sales, return on assets, and return on equity. More precisely, the authors compared the average of different performance measurements before and after privatization and concluded that post privatization metrics have a mixed behavior. For example, return on sales increase post deregulation, whereas returns on equity behavior is not confirmed. This is an important analysis, as it shows an

important insight on performance before and after privatization, however it doesn't identify entirely the economic environment (although encompasses the business cycles) and additionally, it covers a very broad mix of different sectors from vastly different industries.

Another study that should be mentioned compares the pre- and post-privatization financial and operating performance of 85 companies from 28 countries that were fully or partially privatized through public share offerings during the period from 1990 to 1996. D'Souza and Megginson (D'Souza & Megginson, 1999) follow up a previous study by Megginson et.al. (Megginson, Nash, & Randenbor, 1994) and document significant increases in the mean and median levels of profitability, real sales, operating efficiency and dividends post privatization, as well as significant decreases in mean and median leverage ratios and insignificant decreases in the mean and median employment levels and capital investment ratios (for a period of 3 years before and 3 years after deregulation). It has to be noted that this study confirms previous and/or similar studies (indicatively (Megginson, Nash, & Randenbor, 1994), (Boubakri & Cosset, 1998), (D'Souza & Megginson, 2000)) which estimate significant increases in the operational metrics post deregulation. Similarly to the previous studies though, D' Souza and Megginson use a cross-industry sample of companies and don't report on the general economic context fixed effects (variations), however, the extensive robustness tests confirm the initial results.

This section (§4.3) covered various studies in the transport industry that discuss the effects of (economic) deregulation. However, based on this analysis, there seems to be a gap in the literature so far. More precisely, the gap includes the following issues, the previous studies have not covered to date, since these studies:

- Have focused primarily on the technical operational efficiency, ignoring the managerial operational efficiency, especially for the transport industry,
- Following the previous issue, the deregulation studies have been either primarily sectoral, focusing only on a specific subset of the same industry, e.g. banks (instead of the financial industry), airlines (instead of the transport industry), or cross-sectoral among different industries (e.g. banks, utilities and

airlines). The gap remains, since there are limited cross sectoral studies focusing on different sub-sectors of the same industry (i.e. transport),

- Have focused on the consumer benefits rather than on the benefits of the deregulated business entities themselves,
- Lack an analytical background of the metrics analyzed (at least, the transport industry oriented studies),
- Do not discuss the implications of the deregulation to a company based on metrics that are the focus of the investment community, since these metrics make-or-break companies,
- Do not give insight on how profitable the deregulated company is based on the total assets it has or how much each currency unit earned is translated into profits or how much investment the company undertakes post deregulation,
- Do not understand effects on a systemic level throughout the transport sector,
- Do not account for country specific and year specific variations.

These are the shortcomings the analysis aims to explore, as will be described in the following sections. The raison-de-entre for this analysis stems from business and strategic questions, including the following:

- First, when the state owns the regulated firm, usually, it doesn't need to seek financial support from the market. Thus, unlike privately owned or privately controlled regulated firms, state-controlled regulated firms do not need to optimize their inputs in order to present a better managerial image to the financial community,
- Second, it is often argued (Bortolotti, Cambini, Rondi, & Spiegel, 2011) that in the presence of IRAs, privately controlled firms have higher leverage (translated to higher costs) compared to state controlled firms leading to higher costs, lower operational performance and higher prices charged to consumers, eventually leading to lower capital expenditure,
- Third, in modern concession contracts, there are clauses relative to corporate profitability (i.e. reduction of concessionary period, claw-back, etc) and there is an urban myth that concessionaries might engage themselves to "regulatory

opportunism" by technically reducing the profitability, an "urban myth" largely unaccounted for,

- Fourth, the Government, after a deregulation effort, myopically focuses on the short term improvement of financial metrics instead of focusing on the longer term, an issue not thoroughly studied in the transport sector, and
- Finally, deregulated companies face greater uncertainty as opposed to the business environment before deregulation, thus their strategic decisions are focused on the short term viability instead of focusing on the longer term.

4.4 Hypotheses

Based on the previous analysis, this study is a rigorous firm level empirical research which claims to fill an important gap in the literature, by quantifying the relationship between deregulation and the effect on the privatized firms' operating efficiency, profitability and capital expenditure as measured by certain financial metrics. Additionally, the analysis quantifies the relationship between deregulation as represented by the OECD indicators of regulation in energy, transport and communications (industry-wide ETCR metrics) and the privatized firms' operating efficiency, profitability and capital expenditure. More precisely, this study tests one of the main arguments in favor of the deregulation, that deregulation has clear benefits both for the company and for the entire transport sector, since, this thesis:

- Analyzes whether deregulation in the form of privatization in a sector has any effect on the operational efficiency, on the profitability and on the investment decisions (capital expenditure) of a firm, and
- Analyzes whether the intensity of competition in the transport industry (the combination of the different transport sectors) as measured by OECD has any effect on the operational efficiency, on the profitability and on the capital expenditure of a firm.

The studies so far have been focused on the consumer benefits/surplus, whereas limited light has been shed on indicators that are very important for the financial sustainability of the company and are heavily used by financial analysts. More precisely, so far, the analysis has focused on the number of new entrants, the changes

of the tariffs/fares/rates, the transformation(s) on the competitive landscape, the new service development, the changes on the quality of service, the reduction on or abolishment of monopoly rents paid to name but a few indicators. On the other hand, in the financial world, the analysts rely on "simpler" but more "robust" indicators that may offer significant insight on the operational efficiency of the companies and on their ability to be sustainable in the short or even more on the long run. Based on market practices, these indicators include Net Income Margin (Net Income / Revenues), Asset Turnover (Revenues to Assets), CAPEX to Assets and Return on Assets. To the best of our knowledge, there is no literature analyzing the management aspects of operational efficiency of transport entities post-deregulation in EU Member States.

In summary, this analysis challenges the following hypotheses:

Intra/Sub-Sectorial Effects	
Hypothesis 1:	***Deregulation is positively associated with increased operating efficiency in privatized European transport firms.***
Hypothesis 2:	***Deregulation is positively associated with improved profitability in privatized European transport firms.***
Hypothesis 3:	***Deregulation is positively associated with increased capital expenditure (CAPEX) in privatized European transport firms.***
	Transport Industry Wide Effects
Hypothesis 4:	**Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with increased operating efficiency in privatized European transport firms.**
Hypothesis 5	**Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with *improved profitability* in privatized European transport firms.**
Hypothesis 6	**Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with increased capital expenditure (CAPEX) in privatized European transport firms.**

It has to be mentioned that these hypotheses are tested for companies where the State has 25% or less in the Share Capital of the deregulated company (post-deregulation), which indicate the limited influence on the managerial decisions of this company. The selection process is presented in the following section.

Last but not least, it has to be noted that the decision to select privatization as a proxy for assessing the impact of deregulation has been based on the following assumptions and presumptions:

- There is considerable amount of data on the topic, both before and after privatization, thus the causality can be better assessed,
- The deregulatory initiatives took place (and effect) on a specific date which is known,
- Privatization is one of the most intense forms of deregulation, posing a significant shock to the incumbents. Similarly, it is expected that deregulatory initiatives of the same magnitude (for example, but not limited to, abolishment of market entry barriers, backwards looking monopoly rents asked by the government, vertical or horizontal separation, to name but a few similar tools) to have comparable impact on the company level.

Based on this, although it is expected that similar deregulatory initiatives ("shocks") would have similar impact on the operational efficiency and ultimately on the corporate decision making, the analysis of the impact of the entire range of deregulatory tool falls outside the scope of this analysis.

4.5 Developing the dataset

This section explains the main variables that have been used in the analysis and how the dataset has been developed. The data covers practically all major deregulated transport companies in the EU-27 member states. These firms were involved in major privatization transactions in selected sectors since the mid-1980s. The identification

of those companies was primarily relied on the Privatization Barometer's database[22] as well as the author's database and other academic papers and lists. The Privatization Barometer Database identifies privatization transactions that took place since 1977 in the various industries, from which database transportation industry related firms were selected. The dataset that was developed includes ports, airports, companies engaging in marine cargo handling, road concessions, freight transportation, trucking, postal and courier services, rail, marine transportation and ferry transportation. Table 5 presents the transport industry sub-sectors based on SIC numbers that were selected. A first selection of the companies was based on the financial data availability, creating a panel of 44 companies, in 16 countries, for the period 1998-2015.

Table 5 – Sample Industries selected (presented by SIC Code)

Sector (SIC)	Description
4011	Railroads, Line-Haul Operating
4212	Local Trucking without Storage
4213	Trucking, except Local
4215	Courier Services, except by Air
4412	Deep Sea Foreign Transportation of Freight
4482	Ferries
4491	Marine Cargo Handling
4493	Marinas
4499	Water Transportation Services, not elsewhere classified
4581	Airports, Flying Fields, and Airport Terminal Services
4731	Arrangement of Transportation of Freight and Cargo
4785	Fixed Facilities and Inspection and Weighing Services for Motor Vehicle Transportation, Toll Roads, highway bridges, etc.
4789	Transportation Services, not elsewhere classified
9621	Regulation and Administration of Transportation

[22] The Privatization Barometer (http://www.privatizationbarometer.net) is a non-profit research institution launched in 2003 by Fondazione Eni Enrico Mattei. PB is an independent source on privatization reporting being also an official provider of privatization data to OECD (Organisation for Economic Co-operation and Development) and to the World Bank.

In summary, the selection criteria that were adopted, included the following:

- The entity operates in the transport sector and more precisely in freight transport or combined passenger / freight transport or passenger transport,
- The transport sector is regulated by the government in terms of (at least one):
    - entry/exit barriers,
    - price/rate regulation,
    - the state owning (or majority ownership or "golden shares") the main incumbent before deregulation,
    - obligatory separation (vertical disintegration) between infrastructure and operations post deregulation,
    - the market being a natural monopoly or an induced natural monopoly, or essential facilities[23],
- Financial data availability,
- At least one company from each sub-sector selected,
- Inclusion of both "Old Europe" and "New Europe" companies (i.e. EU-12 AND EU-12+15)
- The state has in total 25% or less of the share capital of the company post deregulation.

It has to be noted that for certain cases, the declared SIC was not in accordance with the main business or the highest earnings, for example the SIC codes 4493 and 4785. However, after checking the corporate websites, the company brochures and the Bloomberg data, the firms were included in the sample under a more appropriate classification. The panel selection methodology appears on Figure 19.

[23] As discussed by Sidak and Lipsky (Sidak & Lipsky, 1999)

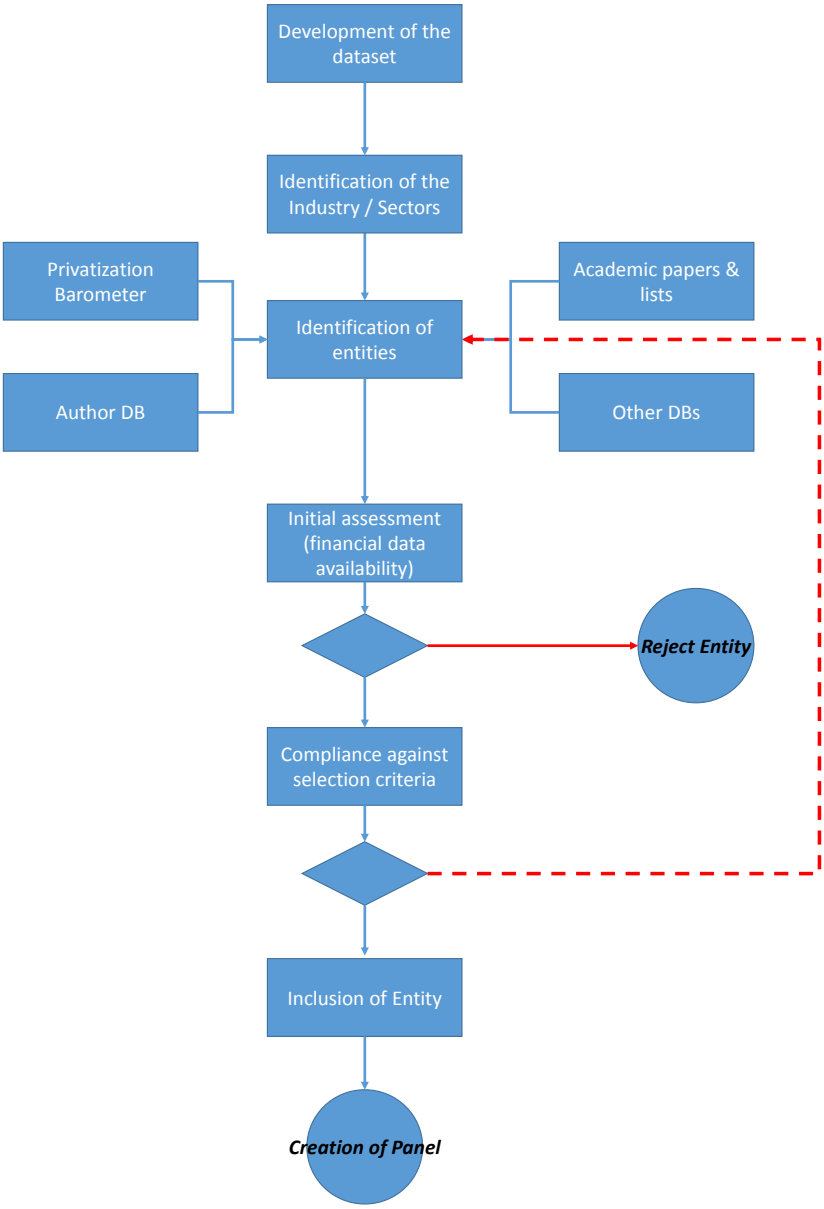

Figure 19 – Panel Selection Methodology

The companies in the dataset were privatized and the sector was deregulated, opening the market to anyone interested to participate[24]. From this sample, two sectors, namely 41.11 (local and suburban transit, i.e. public urban transport) and

[24] We acknowledge that post deregulation and post privatization, the legislative environment may produce a stricter, artificial or induced regulation.

45.12 (air transportation, scheduled, i.e. airline carriers) were excluded, since it is deemed that deregulation in those sectors has led to a more cumbersome framework that has artificially increased regulatory restrictions. More precisely, although the public urban transportation has been deregulated and concessions were awarded, the markets across EU are heavily regulated in almost all of the cases. The central or the local government awards specific contracts for specific routes and new entrants are excluded from participating in the market (entry barriers) unless awarded a permit from the IRA or the Government. In the majority of the cases, the awardees are state owned companies or companies were the State owns golden shares or the majority of shares. Additionally, the rates (fares) are usually the focus of political debates, leading to increased pressure to the operator to either reduce or to retain the same prices and the local governments usually take advantage of such companies in order to accomplish their employment objectives. As for the airline industry, the inherent peculiarities of the market have created problems affecting the sustainability of the carriers themselves. The main peculiarities include the high share of fuel cost in the cost structure and the labor conventions / restrictions each carrier has to abide with. The significant volatility of the latter and the country specific restrictions of the former have affected the pricing models, which in an intensely competitive environment has led many companies out of market. After assessing the financial data, it was considered more appropriate to exclude these companies from the sample.

The raw data of the sample comprise of 548 firm-year observations. Table 6 lists the firms included in the sample.

Table 6 - Sample Set

Company	Country	Sample Period	Year of Privatization[25]	Sector (SIC)
DSB	Denmark	2006-2012	2001	4011
ABX Logistics Worldwide SA/NV	Belgium	2006-2013	2006	4212

[25] The year of privatization refers to the first year in which a change in ownership took place.

Company	Country	Sample Period	Year of Privatization[25]	Sector (SIC)
NordCargo Srl	Italy	2006-2013	2008	4212
Hamburger Hafen und Logistik AG	Germany	2004-2014	2007	4213
bpost SA	Belgium	2006-2014	2013	4215
CTT-Correios de Portugal SA	Portugal	2010-2014	2013	4215
Deutsche Post AG	Germany	1990-2014	2006	4215
Express Truck SAU	Spain	2008-2012	2013	4215
Oesterreichische Post AG	Austria	2002-2014	2006	4215
Post Danmark A/S	Denmark	2006-2011	2005	4215
Postkantoren BV	Netherlands	2006-2012	1993	4215
PostNL NV	Netherlands	1996-2014	2004	4215
Royal Mail	UK	2010-2015	2013	4215
Finnlines OYJ	Finland	1989-2014	2006	4412
Latvijas kugnieciba	Latvia	1999-2014	2002	4412
Portline - Transportes Maritimos Internacionais SA	Portugal	2006-2011	1991	4412
Scandlines GmbH	Sweden	2006-2007	2000	4482
Societe Nationale Maritime Corse Mediterranee SA	France	2006-2011	2006	4482
Associated British Ports Holdings Ltd	United Kingdom	1988-2008	1984	4491
Piraeus Port Authority	Greece	2000-2014	2003	4491
Thessaloniki Port Authority	Greece	1998-2014	2001	4491
Trieste Marine Terminal SpA	Italy	2007-2013	2010	4491
Port of Tilbury London Ltd	United Kingdom	2007-2013	1992	4493
Rigas Transporta Flote A/S	Latvia	1995-2003	1996	4499
Aeroporti di Roma SpA	Italy	2002-2010	1997	4581
Aeroports de Paris	France	1988-2014	2006	4581
Ana-Aeroportos de Portugal SA	Portugal	2000-2012	2013	4581

Company	Country	Sample Period	Year of Privatization[25]	Sector (SIC)
Brussels International Airport	Belgium	2001-2003	2004	4581
Flughafen Berlin Brandenburg GmbH	Germany	2010-2013	1999	4581
Flughafen Dusseldorf Immobilien GmbH	Germany	2008-2010	1997	4581
Flughafen Hamburg GmbH	Germany	2008-2011	2000	4581
Flughafen Wien AG	Austria	1991-2014	1992	4581
Fraport AG Frankfurt Airport Services Worldwide	Germany	1998-2014	2001	4581
Kobenhavns Lufthavne	Denmark	1992-2014	1994	4581
LHR Airports Ltd	United Kingdom	1988-2014	1987	4581
London Luton Airport Group Ltd	United Kingdom	2006-2013	1998	4581
Malta International Airport PLC	Malta	2003-2014	2002	4581
Transinsular - Transportes Maritimos Insula	Portugal	1988-2009	1990	4731
Autostrade SpA	Italy	1988-2002	1999	4785
Brisa Auto-Estradas de Portugal SA	Portugal	1994-2013	1997	4785
Autoroutes du Sud de la France SA	France	1999-2014	2002	4789
SANEF SA	France	2001-2013	2005	4789
Societe Des Autoroutes Paris-Rhin-Rhone	France	2001-2014	2004	4789
Forth Ports	United Kingdom	1992-2010	1992	9621

Source: (Privatization Barometer, 2015), individual entries processed by the author

It has to be noted that for those firms with available financial data only during pre- or only during post-privatization, their participation was considered only for analyzing and assessing the industry effects of deregulation.

Financial and accounting data (including balance sheet, income statement and cash flow statement data) were obtained from Bloomberg. Three main aspects of the firms in our sample were examined: efficiency, profitability and investment activity. The dataset includes the following key empirical financial variables which are necessary to construct measures of efficiency, profitability and investment activity at the firm-year level in our analysis:

- ***Net Income Margin***: defined as the ratio of net profits to revenues for a company, which indicates a company's core profitability and shows how much of each currency unit earned by the company is translated into profits.
- ***Return on Assets (RoA):*** calculated by dividing a company's annual net income by its total assets. It is an indicator of how profitable a company is relative to its total assets, illustrating how efficient management is at using its assets to generate earnings.
- ***Asset Turnover (Revenues to Assets):*** this is a metric similar to RoA, since the ratio indicates how efficient management is at using its assets to generate earnings in form of revenues. It is calculated by dividing a company's Revenues by its Total Assets.
- ***CAPEX to Assets:*** capital expenditure (CAPEX) are funds used by a company to acquire, maintain or upgrade its assets illustrating initiatives undertook by the company to maintain or expand its scope and operations. The ratio is calculated by dividing CAPEX by the company's assets, showing the firm's investment activity.

The following table (Table 7) summarizes the key statistics for the main variables used in this analysis. On average, the findings indicate that the sample firms illustrate positive profitability, operating efficiency and investment activity metrics. More than 1,900 firm-year-metric observations were finally collected for this sample.

Table 7 - Financial Variables - Key Statistics

Financial Metric	N	Mean	Std. Deviation
Net Income Margin (%)	539	10.453	16.260
Asset Turnover	526	0.565	0.485
CAPEX / Assets	357	0.137	1.423
Return on Assets (%)	488	4.539	5.179

Source: (Bloomberg, 2015), calculations by author

Additionally, data regarding the growth rate of real historical GDP (gross domestic product) for all countries involved in this study, were retrieved through the World Bank and/or the IMF databases based on availability (based on the World Bank World Development Indicators and on the International Financial Statistics of the IMF). Table 8 below illustrates the key statistics for the growth rates of GDP used in this analysis.

Table 8 - GDP Growth – Key Statistics

Country	N	Minimum	Maximum	Mean	Std. Deviation
Austria	40	-3.82	5.36	2.13	1.77
Belgium	40	-2.80	5.65	1.85	1.70
Denmark	40	-5.70	6.10	1.70	2.16
Finland	40	-8.54	7.12	2.21	3.16
France	40	-3.15	4.67	1.83	1.57
Germany	40	-5.10	5.30	1.87	1.97
Greece	40	-7.11	7.25	1.56	3.51
Italy	40	-5.49	7.13	1.50	2.26
Latvia	40	-32.12	12.23	2.31	8.11
Malta	40	-2.65	19.56	4.85	4.50
Netherlands	40	-3.67	4.79	2.04	1.87
Portugal	40	-4.35	7.49	2.15	2.96

Country	N	Minimum	Maximum	Mean	Std. Deviation
Spain	40	-3.83	5.55	2.18	2.08
Sweden	40	-5.03	6.56	2.04	2.19
United Kingdom	40	-5.17	5.03	2.23	2.13

Source: (World Bank, 2015), (International Monetary Fund, 2015), calculations by the author

Finally, data regarding the OECD indicators of regulation in energy, transport and communications (ETCR) were obtained through OECD. OECD (OECD, 2015) has developed a database that monitors the regulation in the energy, transport and communications markets from the mid-1970s until 2013[26]. This is the first systematic approach which measures a predefined set of economic regulations. From the OECD Regulation Database, the metrics pertinent to the transport sectors were obtained and were calculated. More precisely, the indicators summarize the regulatory restrictions in the transport industry and consist of entry barriers, public ownership, market structure, price regulation, vertical / horizontal integration (separation) assessment and in brief, they summarize the regulatory restrictions in the transport industry. With respect to EU, data are available for all EU-27 countries for the period 1975 to 2013 and the values range from 0 (indicating minimum restrictions, i.e. free market) to 6 (indicating a highly regulated market). In this analysis, as will be described below, the average score of the indicators (entry, public ownership, market structure prices and vertical integration indices) for all transport sectors for each year and for each country was used as a proxy for the level of deregulation in each country studied. This assumption was based on the lack of individual observations for specific transport sectors (e.g. for ports, for airports, for rail operators) and based on the results obtained it may be considered robust enough to support the findings. Table 9 below

[26] More information on the transport index may be found in Annex II – Construction of the OECD Overall Regulation Index, pp. 192

illustrates the key statistics for the OECD indicators of regulation and reveals the different state of regulation for each country.

Table 9 - OECD indicators of regulation - Key Statistics

Country	N	Minimum	Maximum	Mean	Std. Deviation
Austria	39	1.5	5.3	3.6	1.4
Belgium	39	1.9	5.3	3.8	1.3
Denmark	39	1.4	5.2	3.5	1.5
Finland	39	2.7	5.7	4.0	1.1
France	39	2.7	6.0	4.5	1.2
Germany	39	1.4	5.9	3.8	1.9
Greece	39	2.7	5.6	4.9	1.0
Italy	39	2.6	6.0	4.8	1.3
Latvia	1	2.3	2.3	2.3	
Malta	1	1.8	1.8	1.8	
Netherlands	39	1.6	5.3	3.6	1.6
Portugal	39	3.0	6.0	4.6	1.2
Spain	39	2.1	5.3	4.2	1.2
Sweden	39	1.9	4.3	3.2	0.9
United Kingdom	39	1.0	4.1	2.6	1.2

Source: (OECD, 2015), calculations by the author.

4.6 Empirical Results

4.6.1 Introductory Analysis and Observations

In this section, we examine whether deregulation (in the form of privatization) affects the firms' profitability, operational efficiency and investment activity described above. Table 10 reports the sample means of profitability, operational efficiency and investment activity variables. The observations have been divided into four groups, showing pre- and post-deregulation metrics as well as metrics per type of transport firm (infrastructure or services oriented) for firms with available financial data both pre- and post-privatization. Univariate tests were developed and performed to

compare financial metrics among firms pre- and post-privatization and understand whether deregulation (in the form of privatization) affects Operational Efficiency (measured by the Return on Assets indicator), Profitability (measured by the Net Income Margin indicator) and Investment Activity (measured by the Capex / Assets indicator) as well as to understand whether differences are driven by a specific transport sector.

As evidenced in Panel I, the operational efficiency metric is significantly higher post-deregulation, and this observation appears to be mainly evident in transport infrastructure firms of this sample. Similarly, Panel II illustrates that the profitability metric is significantly higher post-deregulation, and this observation also appears to be mainly evident in transport infrastructure firms. Additionally, transport-infrastructure firms are more profitable than transport-services firms, both pre- and post-deregulation. Panel III shows that the mean CAPEX/Assets doesn't present statistically significant difference pre- and post-deregulation.

To derive the conclusions described above, the non-parametric Mann-Whitney test was used, which compares population means without using any distribution assumptions, i.e. does not assume that the dependent variable is a normally distributed interval variable.

Table 10 - Univariate Tests: Operational Efficiency, Profitability and Investment Decisions Measures Pre- and Post- Deregulation

Panel I: Operational Efficiency (RoA)				
	Total Observations (N=345)	Pre-Deregulation (N=119)	Post-Deregulation (N=226)	Deregulation Difference (p-value)
Total Observations (N=345)		3.30%	4.94%	1.64%*** (0.537)
Infrastructure (N=190)	4.67%	2.87% (N=57)	5.45% (N=133)	2.57%*** (0.525)
Services (N=155)	4.00%	3.69% (N=62)	4.21% (N=93)	0.51% (0.987)

Sector Difference	0.67% (0.519)	0.81% (0.843)	1.24%** (0.648)	
Panel II: Profitability (Income Margin)				
	Total Observations (N=383)	Pre-Deregulation (N=151)	Post-Deregulation (N=232)	Deregulation Difference (p-value)
Total Observations (N=383)		5.71%	11.48%	5.77%*** (1.268)
Infrastructure (N=202)	15.21%	8.85% (N=69)	18.51% (N=133)	9.65%*** (1.322)
Services (N=181)	2.50%	3.05% (N=82)	2.04% (N=99)	1.01% (1.995)
Sector Difference	12.71%*** (1.294)	5.79%*** (1.214)	16.468%*** (1.925)	
Panel III: Investment Activity (Capex / Assets)				
	Total Observations (N=213)	Pre-Deregulation (N=86)	Post-Deregulation (N=127)	Deregulation Difference (p-value)
Total Observations (N=213)		0.068	0.060	0.008 (0.007)
Infrastructure (N=103)	0.075 (N=103)	0.097 (N=33)	0.064 (N=70)	0.033*** (0.011)
Services (N=110)	0.053 (N=110)	0.050 (N=53)	0.055 (N=57)	0.005 (0.009)
Sector Difference	0.022*** (0.007)	0.047*** (0.011)	0.009 (0.009)	

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error. N= denote the number of observations

The results suggest that deregulation affects transport firms' efficiency and profitability. However, the univariate tests described above do not control (by definition) for several factors which may affect profitability, operational efficiency and investment decisions. Therefore, the above analysis and the results obtained are only suggestive and require further investigation of the different attributes that may affect the independent variables. To account for such factors and hence to better understand the causality and the effect of deregulation on a firm's strategic decisions as well as to draw robust conclusions, a multivariate regression framework is developed, answering the hypotheses set previously and which will be described in the following sections.

4.6.2 Hypothesis 1: Deregulation is positively associated with increased operating efficiency in privatized European transport firms.

In order to test this hypothesis, a linear regression model is applied to measure the effect of deregulation on the operating efficiency of privatized EU transport firms. Operating efficiency is measured by the metric Return on Assets. As discussed above, the choice of this financial ratio is driven by the fact that it shows how profitable a company is relative to its total assets, illustrating how efficient management is at using its assets to generate earnings.

The model specification (Model 1) is given by the following function:

Model 1 – Return on Assets

$$RoA_{it} = a_0 + a_1 * Deregulation\ Index_{it} + a_2 * GDP\ Growth_{it} + \sum_n \mu_{in} Country_n + \sum_j \lambda_{ij} Sector_j + \sum_t \nu_t Year_t + \varepsilon_{it}$$

Where,

- RoAit is the Return on Assets of firm *i* in year t,
- Deregulation Indexit is a dummy binary variable, equal to 1 if firm i was privatized in year t and subsequent years (t+1, t+2,…), 0 otherwise,
- GDP Growthit corresponds to the real GDP Growth for Country i in year t,

- Country, Sector and Year are dummy variables, and
- ε_{it} is the error term.

It has to be noted that the analysis controls for time-series variation in the general level of economic activity (such as changes in firms' attributes arising from fluctuations in economic activity), as well as for country-, sector- and year-specific features that may confound comparison pre- and post-deregulation.

The following table (Table 11) presents the regression results and describes the relationship between the operating efficiency of a privatized firm as approximated by using the RoA ratio, deregulation and the remaining explanatory variables described above. The results illustrated in the table are the unstandardized coefficients and standard errors respectively. The Appendix (please refer to "Annex IV – Regression Results" pp 233 onwards) contains further details of the regression results.

Table 11 - Operating Efficiency Hypothesis 1: Regression Results

Metric / Variable	Return on Assets
	Coefficients
Deregulation Index	2.552*** (0.695)
GDP Growth	0.251** (0.116)
(Constant)	0.962 (1.264)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	Yes
Adjusted R^2	28.2%
Observations	343

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

The positive and statistically significant Deregulation Index beta coefficient suggests that deregulation affects positively the privatized firms' operating efficiency. The estimated effect on RoA amounts to 2.5% on average. The coefficient of the GDP Growth is also positive, as anticipated, and statistically significant. Thus, it may be deduced that increased economic activity is translated into higher RoA, as expected.

In parallel and in order to test the robustness of the analysis above, the effect of deregulation on the operating efficiency of privatized EU transport firms was also measured by using the Asset Turnover (Revenues to Assets) metric (Model 2).

Model 2 – Asset Turnover (Revenues to Assets)

$$\boldsymbol{Revenues\ to\ Assets_{it}} = \boldsymbol{a_0} + \boldsymbol{a_1} * \boldsymbol{Deregulation\ Index_{it}} + \boldsymbol{a_2} * \boldsymbol{GDP\ Growth_{it}} + \sum_{n} \boldsymbol{\mu_{in} Country_n} + \sum_{j} \boldsymbol{\lambda_{ij} Sector_j} + \sum_{t} \boldsymbol{\nu_t Year_t} + \boldsymbol{\varepsilon_{it}}$$

Where,

- Revenues to Assets is the ratio of Revenues to Assets of firm *i* in year t.
- Deregulation Indexit is a dummy binary variable, equal to 1 if firm i was privatized in year t and subsequent years (t+1, t+2,…), 0 otherwise,
- GDP Growthit corresponds to the real GDP Growth for Country i in year t,
- Country, Sector and Year are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is the error term.

Table 12 that follows summarizes the regression results. The Regression Results are presented in greater detail in § "Annex IV – Regression Results" pp.233.

Table 12 - Operating Efficiency Hypothesis - Other Models - Regression Results

Metric / Variable	Revenues to Assets
	Coefficients
Deregulation Index	0.098* (0.052)
GDP Growth	0.007 (0.009)
(Constant)	1.097*** (0.113)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	Yes
Adjusted R^2	53.6%
Observations	381

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

The Deregulation Index beta coefficient is again positive and statistically significant, suggesting that deregulation affects positively the privatized firms' operating efficiency, reaching the same conclusion as the one reached from Model 1.

The results suggest that d*eregulation is positively associated with increased operating efficiency in privatized EU transport firms post privatization* and thus confirm *Hypothesis 1.*

4.6.3 Hypothesis 2: Deregulation is positively associated with improved profitability in privatized European transport firms.

The next step is to test Hypothesis 2, where a similar linear regression model is applied to measure the effect of deregulation on the profitability of privatized European transport firms. Profitability is measured by the financial metric Net Income Margin. The choice of this financial ratio is driven by the fact that it shows how much of each currency unit earned by the company is translated into profits for the company.

The model specification is given by the following function (Model 3):

Model 3 – Net Income Margin

$$\boldsymbol{Net\ Income\ Margin_{it}} = \boldsymbol{a_0} + \boldsymbol{a_1} * \boldsymbol{Deregulation\ Index_{it}} + \boldsymbol{a_2} * \boldsymbol{GDP\ Growth_{it}} + \sum_{\boldsymbol{n}} \boldsymbol{\mu_{in} Country_n} + \sum_{\boldsymbol{t}} \boldsymbol{\nu_t Year_t} + \boldsymbol{\varepsilon_{it}}$$

Where:

- Net Income Margin$_{it}$ is the ratio Net Income to Revenues of firm *i* in year t,
- Deregulation Index$_{it}$ is a dummy binary variable, equal to 1 if firm i was privatized in year t and subsequent years (t+1, t+2,…), 0 otherwise,
- GDP Growth$_{it}$ corresponds to the real GDP Growth for Country i in year t,
- Country and Year are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is an error term.

Table 13 demonstrates the regression results of this model and describes the relationship between the profitability of a privatized firm as approximated by the net income margin metric, deregulation and the remaining explanatory variables described above. The results illustrated in the table are the unstandardized coefficients and standard errors respectively. Appendix contains further details of the regression results.

Table 13 – Profitability Hypothesis 2: Net Income Margin Regression Results

Variable	Coefficients
Deregulation Index	6.070*** (1.775)
GDP Growth	0.483 (0.328)
(Constant)	1.128 (3.209)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	No
Adjusted R^2	26.8%
Observations	381

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

Based on this analysis, the Deregulation Index is found to be significantly associated with Net Income Margin, suggesting that deregulation affects positively the privatized firms' profitability. In particular, deregulation leads to a 6% mean increase in Net Income Margin. These results confirm Hypothesis 2, that deregulation affects positively the efficiency of the post-privatization company in transforming earnings to profits.

4.6.4 Hypothesis 3: Deregulation is positively associated with increased capital expenditure (CAPEX) in privatized European transport firms

Hypothesis 3 is tested by applying a linear regression model to measure the effect of deregulation on the privatized EU transport firms' investment activity. This is measured in the form of the financial metric CAPEX to Assets. The choice of this financial ratio is driven by the fact that it illustrates the activities a firm undertakes to maintain the production / operational capacity or the initiatives to expand its scope and operations. The model specification is given by the following (Model 4) function:

Model 4 – Capex to Assets

$$\boldsymbol{CAPEX\ to\ Assets_{it}} = \boldsymbol{a_0} + \boldsymbol{a_1} * \boldsymbol{Deregulation\ Index_{it}} + \boldsymbol{a_2} * \boldsymbol{GDP\ Growth_{it}} + \sum_{n} \boldsymbol{\mu_{in} Country_n} + \sum_{j} \boldsymbol{\lambda_{ij} Sector_j} + \sum_{t} \boldsymbol{\nu_t Year_t} + \boldsymbol{\varepsilon_{it}}$$

Where

- CAPEX to Assets$_{it}$ is the ratio of capital expenditure to assets of firm *i* in year *t*,
- Deregulation Index$_{it}$ is a dummy binary variable, equal to 1 if firm i was privatized in year t and subsequent years (t+1, t+2,…), 0 otherwise,
- GDP Growth$_{it}$ corresponds to the real GDP Growth for Country i in year t,
- Country, Sector and Year are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is an error term.

Table 14 presents the relevant regression results. The results illustrated in the table are the unstandardized coefficients and standard errors respectively. Appendix contains further details of the regression results.

Table 14 - CAPEX Model Regression Results

Variable	Coefficients
Deregulation Index	0.007 (0.010)
GDP Growth	0.008*** (0.002)
(Constant)	0.010 (0.017)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	Yes
Adjusted R^2	35.9%
Observations	211

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

The values reported in the table above indicate that there is no statistically significant difference in investment activity pre- and post-deregulation. In particular, the Deregulation Index coefficient is statistically insignificant. *Therefore, we cannot determine whether* deregulation is positively associated with increased capital expenditure (CAPEX) in privatized European transport firms*, based on these empirical results.*

Last but not least, the robustness of the results derived by the Models 1 – 4 was also examined by splitting the sample firms in two key transport categories: transport infrastructure and transport service providers, and investigating how the results vary across subsamples. By using similar specifications, we obtain comparable results, confirming the impact of deregulation on operating efficiency and profitability. Therefore, it appears that the deregulation impact is robust to the type of transport firm we use in our analysis.

4.6.5 Hypothesis 4: Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with increased operating efficiency in privatized European transport firms.

This hypothesis is tested by applying a linear regression model to quantify the effect of the regulation intensity as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) on the operating efficiency of privatized EU transport firms. Similarly as was performed when testing Hypothesis 1, operating efficiency is measured in the form of Asset Turnover (Revenues to Assets). The model specification (Model 5) is given by the following function:

Model 5 – Hypothesis 4 testing: Revenues to Assets (based on OECD Deregulation Index)

$$\boldsymbol{Revenues\ to\ Assets_{it}} = \boldsymbol{a_0} + \boldsymbol{a_1} * \boldsymbol{OECD\ Regulation\ Index_{it}} + \boldsymbol{a_2} * \boldsymbol{GDP\ Growth_{it}} + \sum_{\boldsymbol{n}} \boldsymbol{\mu_{in} Country_n} + \sum_{\boldsymbol{j}} \boldsymbol{\lambda_{ij} Sector_j} + \sum_{\boldsymbol{t}} \boldsymbol{\nu_t Year_t} + \boldsymbol{\varepsilon_{it}}$$

Where

- Revenues to Assets$_{it}$ is the relevant financial metric of firm *i* in year t,
- OECD Regulation Index$_{it}$ is a variable that ranges from 0 to 6 (more on this index and its development can be retrieved from § "Annex II – Construction of the OECD Overall Regulation Index" pp.229),
- GDP Growth corresponds to the real GDP Growth for Country i in year t,
- Country, Sector and Year are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is an error term.

Table 15 demonstrates the regression results and describes the relationship between the operating efficiency of a privatized firm, the OECD index on deregulation and the remaining explanatory variables described above. The results illustrated in the table are the unstandardized coefficients and standard errors respectively. For more details on the regression results please refer to § "Annex IV – Regression Results" pp.233.

Table 15 - OECD Index Hypothesis – Revenues to Assets Regression Results

Variable	Coefficients
OECD Regulation Index	-0.147** (0.065)
GDP Growth	0.031*** (0.012)
(Constant)	1.695*** (0.207)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	Yes
Adjusted R^2	50.1%
Observations	472

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

The negative and statistically significant OECD Regulation Index beta coefficient suggests that the reduction of the index (i.e. market deregulation) leads to improved privatized firms' operating efficiency. The coefficient of the GDP Growth is also positive, as anticipated, and statistically significant.

In addition, to test the robustness of the conclusion above, the effect of regulation intensity in the transport sector as measured by the OECD ETCR regulation indicators on the operating efficiency of privatized EU transport firms was quantified by using an alternative efficiency metric, the Return on Assets (RoA). In particular:

Model 6 – Hypothesis 4 Return on Assets based on OECD Deregulation Index

$$\boldsymbol{RoA_{it} = a_0 + a_1 * OECD\ Regulation\ Index_{it} + a_2 * GDP\ Growth_{it} + \sum_j \lambda_{ij} Sector_j + \sum_t \nu_t Year_t + \varepsilon_{it}}$$

Where,

- Return on Assets$_{it}$ is the relevant financial metric of firm *i* in year t,
- OECD Regulation Index$_{it}$ is a variable that ranges from 0 to 6 (more on this index and its development can be retrieved from § "Annex II – Construction of the OECD Overall Regulation Index" pp.229),
- GDP Growth corresponds to the real GDP Growth for Country i in year t,
- Sector and Year are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is an error term.

Table 16 demonstrates the regression results for the above specification. For more details on the regression results please refer to § "Annex IV – Regression Results" pp.233.

Table 16 - OECD Index Hypothesis – Return on Assets Regression Results

	Coefficients
OECD Regulation Index	-0.641* (0.331)
GDP Growth	0.184 (0.151)
(Constant)	5.288*** (1.253)
Year Dummies	Yes
Country Dummies	No
Sector Dummies	Yes
Adjusted R^2	3.8%
Observations	437

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

In line with Model 5's results, the negative and statistically significant OECD Regulation Index beta coefficient suggests that the reduction of the index (i.e. market deregulation, intensification of competition) leads to improved privatized firms' operating efficiency.

4.6.6 Hypothesis 5: Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with improved profitability in privatized European transport firms.

Hypothesis 5 is tested by similarly applying a linear regression model to quantify the effect of regulation intensity as estimated by the OECD indicators of regulation in energy, transport and communications (ETCR) on the profitability of privatized European transport firms. Profitability is measured by the financial metric Net Income Margin. The choice of this financial ratio is driven by the fact that it shows how much of each currency unit earned by the company is translated into profits.

The model specification (Model 7) is given by the following function:

Model 7 – Net Income Margin based on OECD Deregulation Index

$$Net\ Income\ Margin_{it} = a_0 + a_1 * OECD\ Regulation\ Index_{it} + a_2 * GDP\ Growth_{it} + \sum_n \mu_{in} Country_n + \sum_j \lambda_{ij} Sector_j + \sum_t \nu_t Year_t + \varepsilon_{it}$$

Where

- Net Income Margin is the ratio Net Income to Revenues of firm *i* in year t,
- OECD Regulation Index$_{it}$ is a variable that ranges from 0 to 6 (more on this index and its development can be retrieved from § "Annex II – Construction of the OECD Overall Regulation Index" pp.229),
- GDP Growth corresponds to the real GDP Growth for Country i in year t,
- Country, Sector and Year are dummy variables, and
- ε_{it} is an error term.

Table 17 demonstrates the regression results and describes the relationship between the profitability of a privatized firm, the OECD index on deregulation and the remaining explanatory variables described above. The results illustrated in the table are the unstandardized coefficients and standard errors respectively. Appendix contains further details of the regression results. For more details on the regression results please refer to § "Annex IV – Regression Results" pp.233.

Table 17 - Profitability Hypothesis – Net Income Margin (OECD Index) Model Regression Results

	Coefficients
OECD Regulation Index	-4.690** (2.093)
GDP Growth	0.300 (0.415)
(Constant)	20.732*** (3.642)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	Yes

Adjusted R^2	18.3%
Observations	485

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

The evidence in the table above strongly supports the view that market deregulation leads to improved privatized firms' profitability. In particular, the negative and statistically significant OECD Regulation Index beta coefficient suggests that the reduction of the index (i.e. market deregulation, intensification of competition) leads to improved privatized firms' profitability, confirming Hypothesis 5.

4.6.7 Hypothesis 6: Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with increased capital expenditure (CAPEX) in privatized European transport firms.

The last test used to confirm Hypothesis 6, is a similar linear regression model which estimates the effects of deregulation as estimated by the OECD indicators of regulation in energy, transport and communications (ETCR) on the privatized European transport firms' investment activity. The latter is measured in the form of the financial metric CAPEX to Assets. Again, the choice of this financial ratio is driven by the fact that it illustrates the project a firm undertakes to maintain or expand its scope and operations. The model specification (Model 8) is given by the following function:

Model 8 – CAPEX to Assets based on OECD Deregulation Index

$$\boldsymbol{CAPEX\ to\ Assets_{it}} = \boldsymbol{a_0} + \boldsymbol{a_1} * \boldsymbol{OECD\ Regulation\ Index_{it}} + \boldsymbol{a_2} * \boldsymbol{GDP\ Growth_{it}} + \sum_{n} \boldsymbol{\mu_{in} Country_n} + \sum_{j} \boldsymbol{\lambda_{ij} Sector_j} + \sum_{t} \boldsymbol{\nu_t Year_t} + \boldsymbol{\varepsilon_{it}}$$

Where,

- CAPEX to Assets is the ratio capital expenditure to assets of firm *i* in year t,
- OECD Regulation Index$_{it}$ is a variable that ranges from 0 to 6 (more on this index and its development can be retrieved from § "Annex II – Construction of the OECD Overall Regulation Index" pp.229),
- GDP Growth corresponds to the real GDP Growth for Country i in year t,
- Country, Sector and Year are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is an error term.

The following table demonstrates the regression results and describes the relationship between a privatized firm's investment activity and extent of deregulation, as measured by the OECD index on deregulation, and the remaining explanatory variables described above. The results illustrated in the table are the unstandardized coefficients and standard errors respectively. Appendix contains further details of the regression results. For more details on the regression results please refer to § "Annex IV – Regression Results" pp.233 onwards.

Table 18 – OECD Index Hypothesis – CAPEX to Assets Regression Results

Variable	Coefficients
OECD Regulation Index	0.204 (0.364)
GDP Growth	-0.040 (0.067)
(Constant)	-0.330 (0.687)
Year Dummies	Yes
Country Dummies	Yes
Sector Dummies	Yes
Adjusted R^2	9.0%
Observations	309

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

Based on these results, it is deduced that the OECD Regulation Index beta coefficient is statistically insignificant. Therefore, it cannot be concluded that *deregulation is positively associated with increased investment activity and capital expenditure (CAPEX) in privatized European transport firms*.

Last but not least, in order to examine the robustness of the results derived by Models 5 – 8 by splitting the sample firms in two key transport categories: transport infrastructure and transport service providers. By using similar specifications, comparable results were obtained, thus confirming the impact of OECD indicators of regulation in energy, transport and communications (ETCR) on operating efficiency and on net income margin. Therefore, it appears that the deregulation impact is robust to the type of transport firm we use in our analysis.

4.7 Discussion of the results

This analysis provides some useful insights as to how efficient the transport companies are post-privatization, filling an important gap in the literature. More precisely the hypotheses set (1,2 & 4,5) with regards to operational efficiency and profitability at the sector level as well as at the industry level were all confirmed by the empirical results. Regarding the investment activity of the companies post regulation both at the sector and at the industry level, the hypotheses (3 & 6) were not confirmed by the empirical results, as will be discussed below.

Table 19 – Overview of deregulation effects

	DEREGULATION EFFECTS							
	Measuring the effects within the sector (Deregulation = Privatization)				Measuring the effects throughout the transport industry (all forms of deregulation, to all modes / sectors)			
	Hypothesis 1		Hypo-thesis 2	Hypo-thesis 3	Hypothesis 4		Hypo-thesis 5	Hypo-thesis 6
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Operational Efficiency	☑	☑			☑	☑		
Profitability			☑				☑	
Investment Activity				⊡				⊡

☑= Positive Effects
⊡ = No Statistically Significant effect
☒ = Negative effects

As per the literature review and the expectations, the analysis up to now has empirically proven that transport companies post-privatization seem to use resources more effectively and work closer to their efficient frontier. This analysis confirms these results from the managerial point of view, since privatized companies have more incentives to become more profitable in order to cope both with market forces and with investor requirements. Based on this analysis, deregulation within the same industry has a positive effect on the operational efficiency and on the profitability indices of the privatized firm as per the expectations. The extent of the effect deregulation exercises on the operational efficiency and on the profitability varies.

This could be attributed to pre-privatization inefficiencies that the new ownership was called to handle, for example:

- Labor policies and employment schemes: most of the companies in our sample adopted employee reduction schemes, mainly layoff and retirement packages. Some of the newly formed companies (privatized / post-regulation) were obliged to absorb these costs, increasing (artificially) the corporate expenses.
- New Strategies: it takes time to devise and implement new strategies, especially when moving from a monopolistic environment to a competitive one which was evident for most of the companies in the sample before these companies found their (competitive) pace.
- Inertia: in addition to the previous argument, inertia within the companies in changing the strategy and or the management style, were also responsible for the intensity of the effects of deregulation on the companies' efficiency. For example, the retirement schemes that were implemented led many highly expert employees out of the companies without the companies easily replenishing their human resource capacity.
- High costs for efficiently utilizing legacy equipment, since most of the privatized companies had very expensive legacy equipment that required additional resources.

Nevertheless, it is well noted that even in the presence of these issues, deregulation affected positively the profitability of the companies and the operational efficiency, when considered from within the sector as well as industry wide. This confirms the theory that a private owner puts effort to optimize the inputs whereas the state-owned companies have different strategic objectives. Regarding Hypothesis 3 & 6, it should be noted that the results contradict the experience from other sectors, for example the Telecoms Industry, where the privatized companies invested heavily to modernize their networks and to offer new innovative services, including Next Generation Networks, 4^{th} and 5^{th} Generation Mobile Networks, Fiber-to-the-home, etc. This finding may be attributed to the inherent characteristics of the transport industry/sector itself, and more precisely:

- The competition in the transport sector is much more intense, where post-deregulation and post-privatization is easier for new participants to enter and offer services. In other industries (telecoms, energy/gas), the competition, although intense, is geographically limited; this is not the case for the transport sector, where for example two ports in two different countries compete directly for the same hinterland,
- The transport "product" is considered as a commodity with little innovation needed by the "consumers",
- Similar to the previous arguments, the technological advances in the transport sector are limited at the moment (e.g. the main mega trends include the containerships' enlargement / mega ships, new fuels, ICT technologies, to name the most important).
- The scale of the capital investment is very large for the capabilities of the transport companies,
- The fiscal crisis of 2007-2008 has affected many investment plans with the financial community becoming stricter and more selective in participating in large scale transport projects,
- Intensification of transport industry wide competition doesn't push companies to increase their investment but adopt more risk averse strategies,
- The transport sector was the last one to be deregulated and as such newer data will improve the understanding with respect to long-term decision making[27].

In summary, these results suggest that the privatized firms tend to focus more on short term decision making, in order to improve their operational efficiency and their profitability, that is, to optimize the resource consumption. On the other hand, long term decision making, in terms of new investments, upgrading of infrastructure, new

[27] For comparison reasons, the telecom industry started being deregulated in early 1990s, the energy sector started around mid1990s, whereas the transport sector started in early 2000s.

equipment, is put aside for the time being as the empirical evidence suggests. These two findings suggest that the deregulated companies do not engage on regulatory opportunism (Lyon & Mayo, 2005), that is, execute strategies with significant divestiture / disinvestment and/or decrease of profits and of operational efficiency. The Regulators on the other hand ought to make provisions so as to closely monitor not only the short term viability of the incumbents but most importantly the long term viability as well as the growth and the innovation adoption. Last but not least, the results also confirm the theory (ECMT, 1989) that market agents seem to adapt rather quickly their decisions to market deregulation and "[…] market […] reacts with only a short time lag".

4.8 Devising the Strategic Adaptation Matrix

Based on the previous discussion, it is safe to propose the following matrix (Figure 20), which encapsulates the decision making at the corporate level after deregulation in a sector or in the industry has occurred. This matrix is based on the statistical inferences from the previous analysis both for the short as well as for the long term. On the horizontal axis, the decision horizon differentiates between short term decision making and long term. Decisions affecting the profitability, the revenue streams and similar management aspects are short term, whereas decisions affecting the business in the long run include capital investment. For example, the number of trips or the number of shifts in a transport company affect the revenues and the profitability on an annual basis. Buying new equipment (e.g. rail cars) affect the company in the long run.

Similarly, on the vertical axis, the impact is distinguished in sectoral and in industry wide impact. For example the privatization of the railways' dominant carrier affects the same sector. However, this also has an effect on the industry level as the road and the inland waterways sectors are also affected. The split of the hypotheses (models) discussed previously covers sufficiently this distinction.

In summary and based on the previous analysis, this 2x2 matrix offers a distinct view of the different decisions a company post privatization takes based on the decision horizon. More precisely, the following observations are drawn:

- Deregulation on the sector level:
    - In the short run, the company optimizes both operational efficiency and profitability,
    - In the long run the company investigates sector dynamics so as to understand its competitive position and attempts to adjust to the new competitive landscape that is created from the deregulation. The assets tend to remain the same, indicating that the investment plan doesn't change.
- Deregulation on the industry level:
    - Similarly to the above, on the short run, the privatized company tries to improve operational efficiency and gain as much revenue as possible as well as to improve profitability in order to defend its market share and market position compared to industry wide cross modal competition,
    - On the long run, the company tries to understand the dynamics in the market so as to adjust its profitability to cross-modal competition and also tries to adjust its capital expenditure to the industry wide post deregulation effects. Similarly to the short run, the assets tend to remain the same, indicating that the investment plan doesn't change.

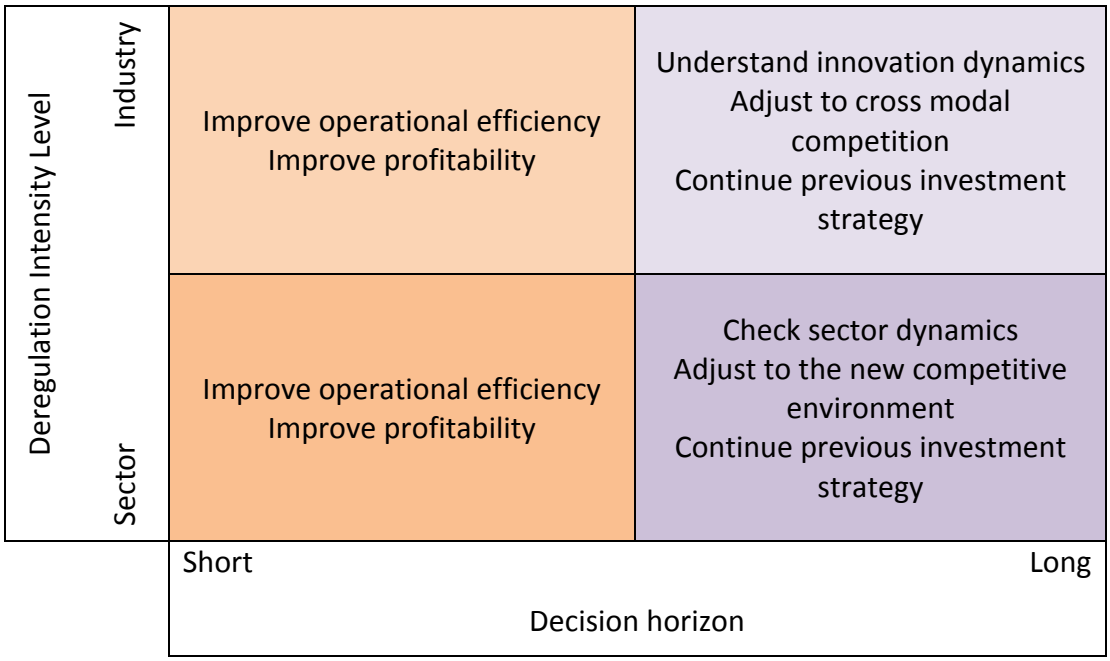

Figure 20 – Post Privatization Strategic Adaptation Matrix

This simple tool is very useful and can be used as a guideline for C-level decision making, not only in post-privatization industries but also after a significant shock is introduced through (de)regulations. For example, similar to privatization are other deregulatory tools adopted by governments or independent regulatory bodies like the abolishment of market entry barriers, the imposing of high rents to all market players (from the government), the enforcing of vertical or horizontal separation based on anti-trust grounds, the breaking up of conferences and generally inducing significant and intense competition on a sector. These deregulation initiatives should be considered to have an equal effect on the decision making profile of the deregulated company based on their intensity. Last but not least, it has to be noted that this tool and this methodology helps understand which companies will produce better financial results and how managerial decisions are steered.

5 ESTIMATING SYSTEM WIDE EFFECTS OF SECTORIAL DEREGULATION

5.1 Overview

The previous chapter analyzed the effects of deregulation on the transport companies, post privatization and post deregulation. Based on the empirical results, this analysis confirms the theoretical predictions and most importantly it confirms that the deregulated companies do not engage in regulatory opportunism post privatization and strive for operational efficiency and profitability at least in the short run within the both the same sector and industry wide. Following the analysis carried out in Chapter 4, this chapter[28] analyzes the effects deregulation produces on a "system-of-systems" level and more precisely, the effects the road transport deregulation had on the Short Sea Shipping sector as well as the transport industry wide effects of deregulation across all modes. The intention is to further test whether certain theoretical arguments are confirmed based on empirical research.

First of all, it has to be noted that one of the last transport sectors the European Union has strived to deregulate after the 2000s is the road transport sector. The main arguments in favor of the deregulation include quality improvements, reduction of the freight rates on the services offered as well as development of new, improved services. Implementing deregulation in the road freight transport aims at protecting the public interest, improving transport services as well as achieving better compliance according with the rules of fair competition. The underlying concept is that

[28] This part of the thesis was submitted as a paper in the IAME 2011 Conference and after peer review, it was selected as one of the best papers. It was further peer reviewed prior to appearing in the International Journal of Shipping and Transport Logistics (Koliousis, Koliousis, & Papadimitriou, 2013). Additionally, part of this chapter, including §5.5 "Analyzing the impact of industry wide deregulation on volume of transport" was submitted in Spoudai Journal and after peer review, it was accepted for the Vol.66 (2016), Issue 1-2. Both are part of the requirements to obtain the PhD Degree.

this sector can increase its value in a D2D context when operating under (more intense) competition. However, certain conditions need to be applied in order to ensure a level playing field, for example a balance between market structure and environmental sustainability. To that extent, the road transport sector already plays an important role in the economy, which affects the national economic and social growth as well as the prosperity. It is a commonplace to suggest that economic and social benefits can be created if the transport system operates efficiently. The role of governmental decisions is crucial for the legal framework that governs the driver behavior, road safety, working conditions and technology. This holds true since a transport system is a multidisciplinary one, consisting of different modes of transport, providers with different roles, different technological systems and diverse regulatory authorities, which all significantly complicate the analysis.

This section examines the impact of road freight transport deregulation on the Short Sea Shipping (SSS) sector in EU. The findings of the analysis challenge a predominant idea, that is, the road sector deregulation is beneficial to other sectors of the economy and to other transport modes. Based on empirical results, this analysis provides a better understanding of the policy measures EU has to adopt in order to maximize the return on investment in the non-road transport as well as understanding the impact on the EU Sustainable Transport Policy.

More precisely, this analysis assesses the contribution of the new legislative environment to the Short Sea Shipping sector's economic growth. An example of this effect is the excessive growth of the supply of road freight transport services (in terms of capacity increases measured in veh-km, in ton-kms as well as in terms of new market players) which might affect SSS in numerous ways, for example through increased congestion, especially on the port side. On the other hand, SSS being both a complementary and a competitive transport mode (to the road mode), could gain market share due to increased congestion thereby contributing to the improvement of its profitability (Paixao Casaca & Marlow, 2009).

Additionally, an additional test is performed in order to understand the wider transport industry deregulation implications. More precisely, this test analyzes whether deregulation as measured by the OECD Regulation Index leads to higher

volume of cargoes transported. Based on this analysis, some interesting observations are collected signifying that in the presence of deregulation the volume of cargo is increased. Combining this finding with the previous analysis helps frame policy interventions that consider not only objectives with direct impact but also policy objectives with indirect and more subtle impact.

Chapter 5 is structured as follows: the next section outlines the EU policy on transportation with a special focus on short sea shipping, the third paragraph presents the related literature review, the fourth paragraph describes the empirical methodology and the hypothesis to be tested, provides details about the data as well as discusses the results of the analysis and the implications. The fifth paragraph questions empirically another hypothesis, the assessment of the effect of transport industry wide deregulation on the transport volume. The final paragraph concludes with policy implications and future research recommendations.

5.2 Sectoral Policies' Background

The European Union enlargement has contributed to the facilitation of free trade among countries but has also induced a demand spike for transport services, thus reducing the effectiveness and the performance of the transport network. Nevertheless, both the European Commission and the US Department of Transport expect that by 2020 the volume of cargo to be transported will continue growing. To that extent, Short Sea Shipping is considered to have ample capacity to meet demand for transport services generated by the rapid expansion of Europe and by the economic development. Among transport practitioners and academics, Short Sea Shipping is considered to be more than capable of playing an important role in reducing road transport externalities, including road network congestion, by offering:

- Low infrastructure cost, charging actual users only a per usage charge, thus lowering the tax burden to the citizens,
- Low operational cost, since SSS freight costs correspond to a fraction of the road transport cost,
- Low energy consumption,
- Environmentally friendlier transport services,
- Safer in terms of number of fatalities.

Eurostat (European Commission / DG MOVE, 2010) indicates that there has been a significant increase of about 15.7% in ton-kilometers for SSS during the period of 2000-2008, whereas for the shipping sector (aggregate figures) the rate for the period 1995-2008 reached 30.7%; for the same period the road transport rate was far greater at 45.7%. Inland waterways increased by about 19% and rail transport increased by 14.7%. It is easily understood that during this period, Short Sea Shipping proved to be rather moderate, playing a vital role vis-à-vis the share of the global ton-kilometers travelled in Europe. Table 20 gives an overview of the growth rates for the transport sector in EU.

Table 20 - Freight Transport Growth in EU (Figures in %)

	Road	Rail	Inland Waterways	Pipelines	Sea	Air	SSS	Total
1995 -2008	45.7	14.7	19.0	8.0	30.7	35.0	N/A	33.7
Average Annual Growth	2.9	1.1	1.3	0.6	2.1	2.3	N/A	2.3
2000 – 2008[29]	23.6	9.7	8.5	-2.0	14.0	10.2	15.7	16.9
Average Annual Growth	2.7	1.2	1.0	-0.3	1.7	1.2	1.8	2.0

Source: (European Commission / DG MOVE, 2010)**,** (Eurostat, 2010)**, calculations by author**

It is a commonplace to suggest that Short Sea Shipping is considered to be the transport mode with the greatest flexibility in capacity, able to accommodate sudden spikes in demand, or at least accommodate the spikes in demand in a more flexible manner compared to other modes. This is also indicated in the figures presented in Table 20, where SSS had a matching rate to that of the road mode for the period 2000-2008. This benefit is strengthened by the lower investment that has been dedicated to the SSS sector as suggested by a stakeholder analysis carried out within the PROPS

[29] Data for certain countries and for certain years where missing. These figures were not considered by the authors.

Project[30] (PROPS Project, 2011). Relevant research (Maritime Transport Coordination Platform - FP6, 2006) implies that the Short Sea Shipping market share is close to 39% of the total ton-kilometers in Europe for 2006, whereas the road mode had a 44% share for the same year. Although this indicates the important role of the SSS, more is yet to come since the road transport mode improves its standing compared to other modes. Eurostat's figures support this statement; road is the preferred inland mode over the rest of the competing modes by 72.5%.

The PRIMES-TREMOVE and TRANSTOOLS transport models predict (European Commission, 2011a) that freight transport activity is to be increased by around 80% by 2050 as compared to 2005 and the congestion costs in Europe so far represent about 1% of the Gross Domestic Product (GDP) every year. To this extent, European Commission has actively advocated in favor of sustainable transportation. In the 2011 White Paper for Transport (European Commission, 2011b), the Commission advocates in favor of *"Using transport and infrastructure more efficiently through using improved traffic management and information systems (e.g. ITS, SESAR, ERTMS, SafeSeaNet, RIS), advanced logistic and market measures such as full development of an integrated European railway market, removal of restrictions on cabotage, abolition of barriers to short sea shipping, undistorted pricing etc."* The closing statement about undistorted pricing is well to be challenged by the findings of this analysis, since the deregulation of the transport market is distorting the pricing in the broader transport sector in favor of road transport and to the detriment of other modes, especially SSS.

The transport sector in EU is experiencing a wide range of changes, mainly due to political decisions. Motivated by the deregulation developments in road freight transport industry in EU this section examines the impact of this policy on Short Sea Shipping based on empirical results. Most researchers have dealt with the impact of

[30]PROPS Project (Promotional Platform for Short Sea Shipping and Intermodality) is an EU funded Coordination and Support action funded through FP7 aiming at promoting the EU Short Sea Shipping sector.

the deregulation of road freight transport on areas such as employment, environmental pollution and fatal accidents rate; nevertheless, there has been no research that analyses in detail the systemic impact of deregulation on Short Sea Shipping. Within this context, this analysis fills a gap in the research by analyzing the impact of deregulation of road freight transport on SSS at an EU wide level.

5.3 Literature Review

Relevant research has been carried out assessing and analyzing the impact of the road freight transport deregulation on various sectors. In each case the deregulation impact depends on the conditions prevailing in each country before the introduction of new legislation as well as on the process this legislation comes into force itself. Thus it may be easily suggested that the effects differ from one country to another. The difficulty of substantiating that the road freight transport deregulation is solely responsible for a change in the conditions of a sector in the economy, coupled with the lack of data on the impact of deregulation on short sea shipping, induces intrinsic difficulties in assessing the real impact.

Paul Teske et al. (Teske, Best, & Mintrom, 1994) estimate that the price regulation and the barriers to entry for new players in road freight transport market result in industry profits only for the incumbents, limiting the spread of those profits from the entities wishing to transport their goods and the economy as a whole. Furthermore, Michel and Shaked (Michel & Shaked, 1987) assess the impact of new legislation on the profits of airline companies, indicating that eighteen months after the implementation of deregulation, a significant increase has been realized in corporate profits.

As far as the US trucking industry is concerned, many researchers have attempted to understand the possible implications from the market deregulation. Wilson and Beilock (Wilson & Beilock, 1994) examined the effect of changing the framework in the interstate trucking industry and concluded that carriers who hold certificates to operate (the so called “Certificate of Public Convenience & Necessity”) have lower costs to attract shipments and have less empty runs, both in the regulated and in the non-regulated markets. Another finding is that in the presence of entry barriers in the freight market, certified carriers will hold less empty runs in regulated markets than

in unregulated markets. However, the result of deregulation would be the reduction of the entry costs for carriers who are not under any regulatory regime, lowering prices and introducing overcapacity in the transport sector. According to Richard Darbera (Darbera, 1998), consequences of the deregulation of road transport included the reduction in prices, the decrease in market share for freight transport by rail and finally the reduction of charges for rail freight transport.

Rachel Dardis et al. (Dardis, Garkey, & Zhang, 1989) examined the benefits resulting from deregulation to the consumers in the US. They concluded that the partial deregulation of road freight transport sector has contributed to:

i. Cost savings of 38 billion dollars for the period 1981-1986,
ii. Improvement of the driving behavior of carriers,
iii. Reduction of accidents and last but not least,
iv. Increase of ton-kilometers being operated.

This study is complemented by Darbera's results (Darbera, 1998) of road transport deregulation in France who argues that the freight rates decreased despite an increase in the costs of the inputs, whereas the rate of accidents caused by trucks decreased by the same level as the number of accidents caused by other vehicles. This indicates the increase of the efficiency in the sector. Adrangi et.al. (Adrangi, Chow, & Raffiee, 1995) focused on economies of scale and production efficiency, examining a short period before and after the implementation of deregulation in the US market, arguing that deregulation has significantly improved the technical efficiency in this sector. A similar research was carried out earlier by Ying (Ying, 1990), analyzing the implications of the reform on the technological structure of the sector. On an international level, Lafontaine and Valeri (Lafontaine & Valeri, 2009) support the idea that the application of deregulation has contributed to the increase of the international road transport movements.

Winston (Winston, 2009) argues that in the USA, the negative effects of road transport deregulation have not yet been eliminated and the infrastructure is still inadequate to accommodate the increased road traffic needs. Additionally, Winston suggests that deregulation has favored transport companies by improving their profitability and consumers by providing services at lower cost. This was achieved by an overcapacity

induced by the entry of new firms, the strengthening of competition from existing carriers and by providing incentives to customers.

5.4 Empirical Methodology and Hypothesis testing

5.4.1 Main Hypothesis

The analysis proposed is based on Dardis' three dimensional model (Dardis, Garkey, & Zhang, 1989) and examines the impact of the deregulation of road freight transport on the supply of Short Sea Shipping services as well as the potential implications on the volume of goods transported. Dardis et.al developed this methodology to analyze the effect of road freight transport deregulation on the road fatalities. The proposed analysis fills an important research gap by quantitatively analyzing, based on empirical data, the impact of the road transport market deregulation on a competitive mode of transport, that is, short sea shipping. The scope of this analysis is focused on the European Union, in order to better understand the implications from a road deregulation process. A similar approach was also followed by Lafontaine and Valeri (Lafontaine & Valeri, 2009), where they disaggregated the types of deregulation in terms of abolishment of authorizations, abolishment of cabotage restrictions and border formalities abolishment.

This analysis quantifies the relationship between road transport deregulation and the volume of SSS transported goods, hence, exploring the effect of the road freight deregulation on the short sea shipping sector. The analysis challenges the following hypothesis:

Hypothesis 7	**Road freight deregulation is negatively associated with the weight of goods transferred with short sea shipping.**

In order to identify the impact of deregulation in the ton-kilometers transported using Short Sea Shipping, a linear regression model is developed to measure the effect of the road freight deregulation status of each country on the goods transferred via short sea shipping. The model specification is given by the following function (Model 9):

Model 9 – Impact of Road Transport to SSS

$$SSS_{ij} = c + b_1 * Dereg_{ij} + b_2 * RGDP_{ij} + b_3 * VehKm_{ij} + \epsilon_{ij}$$

Where:

Short Sea Shipping$_{ij}$: The Gross Weight of Goods transported to/from main ports in thousand tones is used as a proxy of the short sea shipping performance for year *i* and country *j* for each observation respectively,

Dereg$_{ij}$ is a binary variable (dummy variable) equal to 1 when country j deregulated its road freight transport sector in year *i (and subsequent years, i+1, i+2, etc),* 0 otherwise,

VehKm$_{ij}$: Road Freight Transport: The Annual Road Freight measured in million vehicle-kilometers has been used in the analysis. This metric was chosen to be used, since it better captures the availability of a truck, instead of the ton-kilometers which is an output metric. More precisely, the theoretical assumption is the when the road transport market is deregulated, more entrants will join specific submarkets and specific routes, thus the availability of the sector increases.

RGDP$_{ij}$: the data contain the Real Gross Domestic Product per capita, thereby incorporating the effects of inflation and the size of population of each country j, for year i, providing a proxy for the economic conditions prevalent in each country.

In the refined data sample, Italy and Greece are those countries whose road freight sector is considered regulated (with either total regulation or with partial and/or indirect regulatory measures). The majority of empirical research (as discussed previously) has showed that the road freight deregulation has resulted in higher competition, lower prices and increased supply in the road freight sector.

5.4.2 Developing the dataset

This section explains the main variables that have been used in the analysis and how the dataset has been developed. The primary data for this study have mainly been derived from the Eurostat and the OECD databases. 23 European countries have submitted short sea shipping data and more precisely Gross Weight of Goods transported to or from their main ports for the period 2000-2008. For the

requirements of this analysis a dataset containing detailed information about the economic performance, road freight measurements and the road freight market regulatory status for each of those countries was developed.

The raw data comprise of 222 observations. Consistency tests were performed, which verified the records for completeness and removed those countries and those annual observations that failed to report data for all the relevant variables. 159 observations have been used in our refined dataset.

Table 21 presents descriptive statistics for the above-mentioned variables. The statistics are calculated by examining average values across all countries. The gross weight transferred through short sea shipping is 108,085 thousand tons with a median of 78,448 thousand tons. The respective figures for the road freight transport are 78,608 and 36,712 million ton-kilometers and 7,583 and 3,050 million vehicle-kilometers using 1,199,717 trucks on average. 74.73% of freight is transferred via road, while road freight transport consumes 11,595 thousands of tons of oil equivalent. 89% of the observations are related with deregulated road freight transport markets. Out of the 25 countries studied, in three cases the road freight transport market remained regulated during the period under analysis (two cases in our refined sample).

Table 21 - Descriptive Statistics

Descriptive Statistics: Summary of statistics for the sample of 222 observations.								
	Number of Observations	Min	Max	Mean	Std. Deviation	Percentiles		
						25%	Median	75%
Short Sea Shipping Gross Weight (thousands of tones; SSS)	183	2,176	369,263	108,085	101,353	22,900	78,448	1,78,630
Real GDP per Capita (RGDP)	222	1,700	45,500	18,798	11,552	6,775	17,300	27,725
Road Freight Transport – million ton-kilometers (TonKm)	178	1,119	343,447	78,608	87,819	17,337	36,712	160,483
Road Freight Transport – million vehicle-kilometers (VehKm)	178	143	31,787	7,583	8,693	1,775	3,050	11,476
Number of Trucks (Trucks)	190	0	5,569,683	1,199,717	1,588,608	116,796	384,648	2,181,366

Descriptive Statistics: Summary of statistics for the sample of 222 observations.								
	Number of Observations	Min	Max	Mean	Std. Deviation	Percentiles		
						25%	Median	75%
Deregulation Variable (Dereg)	222	0	1	0.89	0.311	1	1	1
Road Freight Transport Modal Split (Modal)	220	26%	100%	74.73%	18,733	64%	75.5%	91.75%
Road Freight Transport Energy Consumption (Energy; thousands tons of oil equivalent)	222	64	56,594	11,595	15,407	1,636	4,244	10,790

Source: (European Commission / DG MOVE, 2010)**,** (Eurostat, 2010)**, calculations by author**

5.4.3 Results and Discussion

Table 22 demonstrates the regression results and describes the relationship between the weight of goods transferred through short sea shipping and the variables described above. Columns 2 and 3 present the unstandardized coefficients and standard errors respectively, while column 4 shows the Beta (standardized coefficients) between the dependent variable (gross weight of goods transported via short sea shipping) and the independent variables. Reported t-statistics and significance values show that all the components of the regression equation are statistically significant at any confidence level.

Table 22 - Regression Results

Regression Results: The impact on Short Sea Shipping					
	Unstandardized Coefficients		Standardized Coefficients		
Model	Beta	Std. Error	Beta	t	Sig.
(Constant)	95,699.8	16,666.6		5.742	0.000
RGDP	3,454	0.455	0.333	7.589	0.000
Dereg	-119,218.2	14,998.6	-0.338	-7.949	0.000
VehKm	7.2	0.502	0.635	14.511	0.000
Dependent Variable: SSS R^2: 0.720; Adjusted- R^2: 0.715 F:132.932; Significance: 0.000					

The negative Deregulation ("Dereg") beta coefficient suggests that the road freight deregulation affects negatively the volume of goods transported via short sea shipping. A deregulated market reduces on average the gross weight of goods transferred through short sea shipping by almost 120,000 thousand tones, which represents 6.5% of gross weight of goods transferred in the EU-25 through short sea shipping in 2008. Hence, countries which have adopted deregulated road freight transport markets carry less cargo via short sea shipping. These results confirm Hypothesis 7, that deregulation has a negative impact on the volume of cargo transported via SSS.

Table 23 - Correlations

Correlations					
		SSS	RGDP	Deregulation	Vehkm
Pearson Correlation (Sig. (1-tailed))	SSS	1.000 -	.466 (.000)	-.325 (.000)	.717 (.000)
	RGDP	.466 (.000)	1.000 -	.053 (.253)	.239 (.001)
	Dereg	-.325 (.000)	.053 (.253)	1.000 -	-.006 (.469)
	Vehkm	.717 (.000)	.239 (.001)	-.006 (.469)	1.000 -

The coefficient of the RGDP is positive, as anticipated. Thus, increased economic activity is translated into increased weight of goods transferred via SSS, which confirms the rationale of this hypothesis (based on simple economic assumptions). It has to be noted though that the association between the GDP levels and the cargo transferred is not as strong as often supposed. The "decoupling issue", where both GDP and transport volume show a low elasticity, is also captured in this analysis. The interesting finding from the results shown in Table 22 is that if RGDP changes by one standard deviation, the gross weight (SSS) will change in the same direction by 0.33 standard deviations on average. Therefore, it can be claimed that the decoupling issue is prevalent in the Short Sea Shipping sector, based on this analysis.

Finally, the regression results report a positive coefficient on the variable VehKm. This can be explained by the modal complementarity, in other words the availability of trucks improves the level of service of the short sea shipping based services. In addition to that, supplementary tests showed that these results remain robust when additional variables (mentioned in Table 21) are included. Unreported results also show that the variable Road Freight Transport in millions of ton-kilometers ("TonKm") has a negative coefficient, as expected, which is mainly attributed to the competition between the two transport modes, and does not change neither the sign nor the statistical significance of the VehKm coefficient. Those findings confirm our expectation that over-capacity issues in road freight transport affect short sea shipping positively (however with a certain time lag).

These findings also indicate that short sea shipping offers prospects of sustainable economic growth without the corresponding increase in road transport externalities. The millions of vehicle-kilometers travelled in road freight transport ("VehKm") may be used as a proxy not only of the goods transferred but also of the utilization of the road freight transport capacity. For a given level of demand (availability of goods), higher vehicle kilometers result in lower utilization of road transport equipment (trucks). An additional insight is that the higher transport demand may also be accommodated by short sea shipping which implies that less cargo is moved by road transport. This is mainly based on the complementary nature of the two modes and on the efficiency of the truck usage for a given supply of trucks. Overcapacity issues and empty loads in road transport imply higher vehicle-kilometers travelled without the respective increase in the weight of goods transferred, thus leading to inefficient utilization of road freight vehicles.

This result indirectly leads us to the following potential implications:

- **Implication I**: Over-capacity issues in road freight transport affect positively the utilization of the short sea shipping transport mode.

The overcapacity issues in the road sector imply a poor utilization of this sector, thus incurring more costs in the supply chain. Due to the complementarity of the modes, a

more expensive road transport sector will strengthen the demand for SSS services and vice versa.

- **Implication II**: Decoupling of GDP and SSS

This finding suggests that the demand for SSS is mainly affected by the provision of road transport services and not from the macroeconomic status of the economy. This is an important assumption in setting the policy context for incentivizing the transport users.

Last but not least, it should be noted that this analysis has certain limitations, since it mainly measures the volume of the transported cargo and not the value. It is possible that the value of goods transported might have different effect on the results of this analysis. To this extent, it is well perceived that there is a preference by logistics decision makers with respect to the volume of cargo towards short sea shipping based transport solutions, although as indicated by this analysis, this is contested in and deregulated freight market.

5.4.4 Calculating the elasticity of SSS services

The regression results obtained above may be used to define the elasticity of demand for SSS based service with respect to the demand of road transport services. In order to estimate the elasticity, the arc elasticity formula will be used. This solution solves asymmetry problems inherent to using non-continuous, discrete observation samples (Pindyck & Rubinfeld, 2009), (McConnell, Brue, & Flynn, 2012). Using the average of the observations obtained from the sample general statistics, the arc elasticity[31] will be derived. Although this is an approximation and is not statistically accurate, it can be used as a robust metric of the elasticity, since in strategic and policy decisions, the

[31] This is also known as the midpoints formula, since it computes the averages of the two arc endpoints.

point elasticity might not be ideal enough to substantiate large scale multivariate decision making.

Model 10 – Elasticity of SSS services

$$E_{SSS_{VehKM}} = \frac{\overline{VehKM}}{\overline{SSS}} \times \frac{\Delta SSS}{\Delta VehKm} = \frac{\overline{VehKM}}{\overline{SSS}} \times b_3$$

Based on Table 21 results, the elasticity of demand for SSS services is:

$$E_{SSS_{VehKM}} = 0{,}62$$

This result indicates that the elasticity for SSS services is relative inelastic to the changes of vehicle-kilometers, indicating that the demand for SSS services is affected by the availability of trucks as measured by the vehicle kilometers traveled but not significantly. Finally, it has to be noted that this finding confirms the complementarity of the two modes, suggesting that the road transport deregulation itself affects significantly the SSS sector, exercises a decline on the ton-kms carried, whereas the availability of the new entrants complements the sector (with a certain delay).

5.5 Analyzing the impact of industry wide deregulation on volume of transport

5.5.1 Introduction and data collection

In the previous section, the impact of road transport deregulation on the Short Sea Shipping was assessed in order to understand the effects of cross sectional deregulation, in other words what the impacts of deregulation of a single mode to another mode are. In order to obtain a better view on this topic, an additional assessment is undertaken in this section. More precisely, this section[32] analyzes the deregulation of the entire transport industry on the transport output of this industry as a whole.

In order to analyze this, two proxies are used:

[32] This section has been submitted and peer reviewed to the Spoudai Journal (Vol 66, 1-2).

- In terms of analyzing the transport industry output, the ***volume of freight transport relative to GDP*** for the sample is used as a proxy of the transport industry output. This is the ratio of inland freight transport volume (road plus rail plus inland waterways) relative to GDP (chain-linked volumes, at 2000 exchange rates), and indexing on a single reference year (2000), and
- In terms of analyzing the transport industry deregulation, the ***OECD regulation index*** is used, which averages the regulatory status for the three transport modes used in the volume statistics[33].

The data were obtained from Eurostat (volume data, GDP data) whereas the OECD deregulation data were obtained from the OECD Deregulation index.

5.5.2 Hypothesis

Based on the previous discussions, it is evident that most of the analysis is limited on the technical issues of deregulation and doesn't explain the causality between the actual production of the transport industry and the deregulatory initiatives as was analyzed in Hypothesis 7. One of the main issues that remain unanswered is whether the deregulation has any effect on the production of the transport industry (or a combination of transport sectors) as measured by basic metrics like total ton-kilometers or total vehicle kilometers. This causality between the two is yet to be confirmed based on empirical data. Thus, in order to prove this concept, the following hypothesis will be tested:

Hypothesis 8: Deregulation level as measured by the OECD indicators of regulation in energy, transport and communications (ETCR) is positively associated with increased volume of freight transport.

[33] This index follows the construction principles described in § "Annex II – Construction of the OECD Overall Regulation Index" pp 224 for the aforementioned transport modes.

The following sections describe the model used and the results from the analysis.

5.5.3 Model construction

In order to test Hypothesis 8, the following model was developed and used:

Model 11 – Volume of freight hypothesis

$$\boldsymbol{Volume\ of\ freight\ transport\ relative\ to\ GDP_{it}} = \boldsymbol{a_0} + \boldsymbol{a_1} * \boldsymbol{OECD\ Regulation\ Index_{it}} + \boldsymbol{a_2} * \boldsymbol{GDP\ Growth_{it}} + \sum_{n} \boldsymbol{\mu_{in} Country_n} + \sum_{t} \boldsymbol{v_t Year_t} + \boldsymbol{\varepsilon_{it}}$$

Where

- ***Volume of freight transport relative to GDP of country i in year t***, is the ratio of inland freight transport volume (road, rail and inland waterways) relative to GDP (chain-linked volumes, at 2000 exchange rates), and indexing on a single reference year (2000)
- ***OECD Regulation Index*** is a variable that ranges from 0 to 6, 0 being equal to a free market and 6 being equal to a completely regulated market. More information can be found in World Bank ETCR database (World Bank, 2015). In order to construct the index, the road, post and rail sectors (sub-segments) were selected and their average was calculated and used as a proxy for the entire inland freight deregulation,
- ***GDP Growth*** corresponds to the real GDP Growth for Country i in year t,
- ***Country*** and ***Year*** are dummy variables, and
- $\boldsymbol{\varepsilon_{it}}$ is an error term.

The index "Volume of freight transport relative to GDP of country" was selected primarily because this index by definition levels out the effects of country specific and economy affected transport volume variations.

5.5.4 Results and Discussion

The following table demonstrates the regression results and describes the relationship between Volume of freight transport relative to GDP, the OECD index on deregulation

and the remaining explanatory variables described above. The results illustrated in the table are the unstandardized coefficients and standard errors respectively.

Table 24 - Hypothesis 8 Regression Results

	Coefficients
OECD Regulation Index	-13,489*** (2,894)
GDP Growth	0,002 (0,384)
(Constant)	174,264*** (14,577)
Year Dummies	Yes
Country Dummies	Yes
Adjusted R^2	0,595
Observations	335

*** denotes significance at 1%
** denotes significance at 5%
* denotes significance at 10%
Figures in the parentheses denote the standard error.

The results from the statistical analysis appear on the following table (Table 25).

Table 25 – Transport Volume deregulation effects, ANOVA Results

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	84908,011	38	2234,421	13,927	,000
	Residual	47648,611	297	160,433		
	Total	132556,622	335			

a. Dependent Variable: Volume of freight transport relative to GDP

Table 26 – Transport Volume deregulation Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Volume of freight transport relative to GDP	336	50,3	168,3	97,720	19,8920
OECD Indicator	336	1,361	5,541	3,028	0,747
GDP Growth	336	-14,098	10,648	1,919	3,211
Valid N (listwise)	336				

The OECD Regulation Index beta coefficient is statistically significant and is negative. This suggests that market deregulation (i.e. the reduction of the OECD index from 6 to 0) leads to higher volume of cargoes transported, reconfirming Hypothesis 8. This is a very interesting observation, confirming that industry wide deregulation (which is captured by the OECD Index that measures deregulation across many different sectors and industries) affects positively the volume of cargoes.

The significance of this analysis lies into understanding the causality based on empirical data of the industry wide deregulation on the volume of cargoes that is transported. Based on the results, transport sector deregulation in the road, rail and post sectors as measured by the OECD ETCR index has a positive impact on the volume of transported cargo as measured by ton-kilometers across all the main sectors in the European transport industry. This analysis confirms the impact of the deregulatory initiatives on the volume of cargoes, signifying the importance at the systemic level (industry wide). Thus it may be argued that one of the main objectives of deregulation, that of increasing the transport sector volume, is met at the EU level.

Nevertheless, this analysis has certain explanatory limitations, for example doesn't focus on the analysis of sustainability principles. More precisely, the research showed that the entire inland freight transport industry in EU has grown and this is attributed to the deregulatory initiatives across EU. However, this study didn't focus in detail on the modal split but instead focused on the aggregate level. Considering this and based on the results, although the intention of the deregulatory efforts might be the transfer of cargoes to more sustainable modes, this transfer may have not been achieved,

primarily due to mode specific market failures or stronger value capturing capabilities of specific modes (more precisely the road sector over the other transport sectors). Additionally, this analysis doesn't study in detail the country mix. As such, certain dynamics in the industry at the country level, which may distort certain aspects like labor or foreign direct investment, may also be negatively affected by the deregulation, again due to country or mode specific market failure.

5.6 Discussion of results and policy implications

All transport modes have experienced significant changes over the last decades, as an immediate result of globalization, economic integration and technology advancements. One of those changes is the deregulation of the road freight transport. Analyzing the effects of the deregulation of the road freight transport on the short sea shipping sector as well as the wider transport industry implications, it was found that:

i. Road freight transport deregulation reduces the cargo that is transported via short sea shipping routes, thereby increasing the associated road transport related externalities,
ii. The decoupling of economic growth and short sea shipping transport is confirmed, which sets the prerequisites for the development of sustainable logistics,
iii. Short sea shipping constitutes the alternative means of transport that can solve over-capacity issues faced by the road freight transport,
iv. Road transport and SSS services are complementary, however, the negative effect of road transport deregulation has to be attributed to market failures and market distortion,
v. Industry wide deregulation affects positively the transported volume of freight, however the potential industry growth seems to be captured by road based transport solutions.

The research findings, which emphasize the linkages between the deregulation of the road freight transport and the utilization of the short sea shipping mode, call for dedicated additional policy resources, policy interventions and intensified priority towards the enhancement of short sea shipping as a preferable mode of transport.

The results have two important implications on the formation of transport policy. First, regulatory reforms and the provision of stimuli to road freight transport companies have negative effects on short sea shipping. Hence, the effectiveness of the resources already allocated to the short sea shipping sector (e.g. financial contribution through the Marco Polo I and II programs and through the TEN-T funding scheme) are significantly weakened. Secondly, environmental benefits can be gained if the policies towards the enhancement of short sea shipping are complemented by focusing on reducing road freight transport externalities, including reducing truck movements based on load factors / empty runs and actively decreasing the number of trucks.

This analysis indicates that the demand for Short Sea Shipping services is affected to a greater extent by the road transport sector rather than by macroeconomic conditions of the economy. As such, pricing practices used by the road sector in a deregulated context affect directly the SSS sector and diminish the effect of the incentives given by EU to sustainable transport modes. This result should also be coupled with the second analysis, that is, the increase of the volume of transport industry output as caused by deregulation. Based on these two results, a significant policy related conclusion is drawn since the impact deregulation has on certain modes, especially where competition asymmetries are observed, is different and might steer transport routing operational decisions towards modes otherwise considered unsustainable.

Nevertheless, it has to be noted that further research is required in order to explore which types of regulatory reforms in the road transport sector have the biggest impact on short sea shipping and to quantify individually those effects. Such types include, but are not limited to, service restrictions, barriers to entry and price controls. Although currently EU has been considering the Euro-Vignette as an alternative measure, the possibility of artificially reducing the number of incumbents in the road transport sector should not be entirely disregarded.

6 CONCLUSIONS

6.1 Overview

This thesis focused on the deregulation impact on the European transport companies and on the European transport industry in general. More precisely, the analysis addressed the impact of transport deregulation, both intra-sectoral and inter-sectoral, on the managerial efficiency of the deregulated transport company. To this extent, this thesis analyzed the cross modal impact of deregulation by analyzing the effects of entry barriers' reduction and regulation intensity on the transport product. Additionally, this thesis introduced a strategic tool to be used as a guideline for C-level decision making, not only in post-privatization industries but equally after a significant regulatory shock is introduced.

It has to be noted that transport industry deregulation is by definition a very complex issue due to interlinkages among different modes and among sectors as well as due to the involvement of different stakeholders with, quite frequently, mutually exclusive objectives. Considering this, the key objectives of regulation is to control opportunistic behavior by market players, to improve welfare both on the public but also on the industrial level and also to reduce market failures. Similarly, the primary objective of the deregulation is to increase public welfare, by fixing (from a different perspective this time) market failures. However, if, by-way-of reducing legacy market failures, the deregulation process creates new failures, then this process will shoot back to the government asking to "pay" the necessary remedies to these newly created market failures. For example, when the state owns the regulated firm, it doesn't need to seek financial support from the market, thus, unlike privately owned or privately controlled regulated firms, state-controlled regulated firms do not need to optimize their inputs in order to present a better managerial image to the financial community. However, when trying to optimize the inputs, the deregulated company may create or engage in new market failures, which will affect negatively the financial sustainability of the company, thus producing a difficult environment to seek financial support.

The main objective of this analysis was to understand whether the market dynamics and more importantly whether the transport company, post-deregulation, is

operationally efficient in managerial terms, so as to ensure not only long term sustainability but also to closely monitor any regulatory opportunism the company may engage in. To this extent, it is essential to acknowledge that deregulated (privatized) companies face greater uncertainty as opposed to the uncertainty within a regulated business environment; this uncertainty will significantly affect the deregulated firms' strategic decisions, forcing them to focus more on the short term viability instead of focusing on the longer term.

With respect to the current legal framework, the EU has adopted the 2011 White Paper on Transport which has set vigorous objectives and most importantly aims to further improve the Single European Transport Area and to further complete the Internal Market for the transport of both goods and passengers. Based on this policy document, the EU aims to remove major barriers to transport operations and to promote safe, efficient and environmentally friendly transport services without affecting mobility. In this context, the EU strongly promotes liberalization and private ownership sector structures.

Based on the literature review, most of the research so far has focused primarily on understanding deregulation effects based on the technical aspects of efficiency, with limited analysis of the business implications or of the transport industry-wide effects. Regarding business implications, for example operational efficiency in managerial terms, relevant literature focuses on estimating efficiency based on different metrics and sampling data from company panels consisting of companies operating in various sectors and in various industries. For example, Megginson et.al. (Megginson, Nash, & Randenbor, 1994) examined the firm-level effects of privatization using a large sample of companies across different industries and across different countries. They developed a non-parametric model and assessed whether firms do better after privatization by assessing the mean and the median of certain financial metrics before and after privatization (spanning 3 years before and 3 years after privatization). They document significant increases in profitability, output per employee (adjusted for inflation), capital spending, and total employment, however, their analysis is limited in terms of (a) company sample, (b) country specific variations and (c) monitoring economy cyclicalities. Similarly, Dewenter and Malatesta (Dewenter & Malatesta,

2001) adopted a parametric model to examine profitability, leverage, and labor intensity aspects of the firms in a cross industry, cross country company sample. These aspects are measured using conventional accounting ratios, including return on sales, return on assets, and return on equity. They concluded that post privatization metrics have a mixed behavior; for example, return on sales increased post deregulation, whereas returns on equity behavior was inconclusive. Similarly, D'Souza and Megginson (D'Souza & Megginson, 1999) on a follow up of a previous study (Megginson, Nash, & Randenbor, 1994) documented significant increases in the mean and median levels of profitability, real sales, operating efficiency and dividends post privatization, as well as significant decreases in mean and median leverage ratios and insignificant decreases in the mean and median employment levels and capital investment ratios (for a period of 3 years before and 3 years after deregulation). Nevertheless, these studies used a cross-industry sample of companies and didn't report on the general economic context effects (variations) as opposed to the methodology used in this thesis.

More precisely, this thesis has focused exclusively on the business side of the deregulation effects, addressing the following aspects:

- A solid focus on the business and managerial side rather than focusing on the technical operational efficiency,
- A wider coverage of the most important transport sectors instead of focusing only on a specific industry subset or across different industries, with an objective to understand cross sectoral implications for the same industry,
- An inclusion of time, country and sector specific variations,
- A study based on analytical estimations and analytical data using a rather large sample of companies, rather than a simple review of statistical figures,
- A study focusing on the implications of the deregulation to a company or entity based on metrics that are the primary focus of the investment community, since these metrics make-or-break companies,
- A focus on understanding transport industry wide effects, as measured by output metrics, from specific types of deregulatory initiatives based on empirical analysis.

6.2 Conclusions from the operational efficiency and strategic adaptability analysis

The operational efficiency and strategic adaptability analysis fills in an important gap in the literature, by analyzing how efficient the companies are post-privatization. In order to estimate this effect, two sets of hypotheses were developed, one focusing on the effects of deregulation (privatization) on the transport company within the sector and another focusing on the effects of deregulation of the entire transport industry on the deregulated (privatized) companies. More precisely, it was tested whether deregulation is positively associated with increased operating efficiency, with improved profitability and with increased capital expenditure (CAPEX) in privatized European transport firms. Additionally, the effects of industry wide regulation, as measured by the OECD ETCR index, again on operating efficiency, profitability and increased capital expenditure (CAPEX) in privatized European transport firms were estimated.

The empirical results confirm the hypotheses with regards to operational efficiency and profitability at the sector level as well as at the industry level; the privatized transport companies seem to "do-better" compared to their pre-deregulation status. This indicates that post-privatization, transport companies seem to use resources more effectively and work closer to their efficient frontier in financial terms. Confirming these hypotheses from the managerial point of view, it is concluded and backed by empirical data that companies indeed have more incentives to become more efficient and more profitable in order to cope with both internal market forces and with investor requirements. Based on this analysis, deregulation within the same industry has a positive effect on the operational efficiency and on the profitability of the privatized firm. The extent of the effect varies, due to various reasons. Indicatively, pre-privatization inefficiencies that affect the level of post-deregulation operational efficiency include:

- Labor policies and employment schemes,
- Delays in implementation of New Strategies,
- Inertia,
- High costs for efficiently utilizing legacy equipment.

The analysis confirms the theory that a private owner puts effort to optimally use inputs whereas the state-owned companies have different strategic objectives. Nevertheless, this applies in the short run and the empirical data do not confirm a certain pattern with regards to the strategic decision making in the long run, in the form of increasing capital expenditure. More precisely, the results contradict the experience from other sectors, for example the Telecoms Industry, where the privatized companies invested heavily to modernize their networks. This finding may be attributed to the inherent characteristics of the transport industry itself, including more intense competition without geographic limitations (with the only exception that of essential infrastructure), the commoditization of the transport "product", the limited technological advances in the transport sector that are considered as critical by the clients, the scale of the capital investment (including economies of scope, scale, and density) as well as incidental issues like the fiscal crisis of 2007-2008.

Regarding the industry wide effects, the empirical results show a similar behavior. When it comes to operational efficiency and profitability, the empirical results confirm that system-wide deregulation in the entire transport industry has a positive effect on the (privatized) incumbents. However, in terms of capital expenditures, the results do not suggest that companies invest more, indicating that these companies post-deregulation have more intense modal competition to cope with, thus capital expenditure should be studied on a case by case basis. These results contradict the main argument in favor of privatization, as discussed previously, that intensification of transport wide competition and private ownership will bring more investment in the industry (as a whole).

In summary, these results suggest that the privatized firms tend to focus more on short term decision making, in order to improve their operational efficiency and their profitability, that is, to optimize the resource consumption. On the other hand, long term decision making, in terms of increased investments, for example to upgrade infrastructure or to acquire new equipment, is "put aside for the time being" as the empirical evidence suggests.

The findings also clarify another issue deregulation may cause to the transport industry. Based on the empirical results of this sample of deregulated (privatized)

companies, these companies appear not to engage in regulatory opportunism, in other words do not execute strategies with significant divestiture / disinvestment and/or decrease of profits and of operational efficiency.

6.3 Conclusions from the cross-modal impact analysis

Two additional cases were studied in order to estimate system wide effects of deregulation to other transport sectors. More precisely, the first study focuses on the effects the deregulation of the road freight transport sector has brought on the Short Sea Shipping (SSS) sector. The empirical results of this analysis show that:

i. Road freight transport deregulation reduces the cargo that is transported via short sea shipping routes, thereby increasing the associated road transport related externalities,
ii. The decoupling of economic growth and short sea shipping transport output is confirmed and key implications were observed through the empirical analysis,
iii. Short sea shipping constitutes the alternative means of transport that can solve over-capacity issues faced by the road freight transport, due to modal complementarity,
iv. Road transport and SSS services are complementary, however, the negative effect of road transport deregulation as a whole, has to be attributed to market failures and market distortion as well as modal distortion.

The research findings of this empirical analysis, which emphasize the linkages between deregulation of the road freight transport and the utilization of the short sea shipping mode, call for dedicated additional policy resources and prioritization towards the enhancement of short sea shipping as a preferable mode of transport. These findings have two important implications on the formation of transport policy. First, regulatory reforms and the provision of market induced competition stimuli to road freight transport companies have negative effects on the other transport sectors and more precisely on the short sea shipping sector. Hence, the effectiveness of the resources (financial support) already allocated to the short sea shipping sector is weakened. Secondly, environmental benefits can be gained if the policies towards the enhancement of short sea shipping are complemented by focusing on reducing road

freight transport externalities, including reducing truck movements based on load factors / empty runs and decreasing the number of trucks (which is similar to the truck availability).

Furthermore, the second analysis focused on the cross modal effect of deregulation. The empirical results suggest that market deregulation, as proxied by the OECD Regulation index (ETCR Indicator), leads to higher volume of cargoes transported. This is a very interesting observation, confirming that industry wide deregulation (as captured by the OECD Index) affects positively the volume of cargo transported EU wide. This analysis explains the causality between transport industry-wide deregulation and transport industry output based on empirical data from the road, rail and inland waterways. These results also suggest that the mode with the strongest modal capture capability will also have a direct impact on the modal share post deregulation.

6.4 Policy Implications

Based on the analysis, certain policy implications have to be successfully addressed in order to improve the transport industry structure as a whole post-deregulation. Some key conclusions derived from the previous analysis include:

- Deregulation on its own is inevitably incomplete when exercised on complicated transport systems which include infrastructure, more than one modes of transport competing one-another and significant intra- and inter-market competitive forces,
- Agility is essential and close monitoring of the post-deregulation market is needed, in order to ensure that no adverse effects will occur,
- An independent regulator or an Independent Regulatory Agency (IRA) covering the entire transport industry, instead of isolated IRAs should be developed and implemented. The main aim of the regulator is to provide a consistent and level playing field for all transport modes and for all incumbents, in addition to a combination of discretion with transparency. However, up until now, mode specific IRAs are the base case, with many incidents of mutually exclusive objectives among the existing IRAs. Policy making should focus on combining

regulatory functions in a single agency, ideally for all modes, since fragmentation threats communication, setting objectives etc. A dedicated industry wide regulator may achieve more focus on critical issues, be more effective in mobilizing resources and attempt to optimize the industry as a whole instead of individually optimizing each transport mode.

- The transport sector / transport industry is inherently risky due to the large economies of scale and of scope. Especially when planning and developing infrastructure, the decisions should not reflect short term decisions, fused by (strong) political pressures, but rather focus on long term objectives.
- The deregulatory initiatives should ensure non-discrimination for all market players and equal access to infrastructure, including essential and/or critical infrastructure, which should be monitored by an IRA, and complement self-regulation in the sectors and across sectors.
- Deregulation in one sector should also be bundled with efficiency improvements in other sectors. The example of road deregulation, when at the same time the SSS sector was heavily bureaucratic and heavily regulated is a case in point with SSS effectively losing cargo to the road sector.
- Provide a robust framework that can cope with external ("unexpected") shocks. Deregulation is planned according to a business-as-usual scenario. The latest fiscal and economic crisis in Europe of 2007-2008 and elsewhere indicated that more robust planning should be adopted prior to deregulation. More precisely, long term decision making, especially in key economic sectors, should be a key attribute, thus a combination of input optimization (in the short run) with long term capacity and sustainability planning is required. Black Swan events should therefore be accounted for (e.g. the 2008 fiscal crisis effects on trade and eventually on the transport industry, the Eyjafjallajökull eruption and the effects on the airline industry, the Greek Crisis and the effect on network development) in a deregulation policy, so as to include pre-specified policy adjustments with both short- and long-term horizon,

- Information availability should be ensured, with strict requirements to publicize key data, especially in essential infrastructure or in monopolistic bottlenecks.

Furthermore, this study has contributed to the debate "Regulation, Deregulation, Re-regulation or Self-regulation?" clarifying certain implications that deregulatory tools have. It has to be noted though that there is no such thing as complete deregulation, or to be more precise, absence of regulation. Even in extreme cases, there is some short of self-regulation within the transport systems, for example the quality assurance schemes that all incumbents strive for is a form of self-regulation. Similarly, all clients select their transport service suppliers based on some quality levels (either preset or regularly controlled post-contract-assignment). In summary a more industry-wide review of the benefits and of the disadvantages of each deregulatory (or re-regulatory) initiative should be monitored, addressing the cross modal implications, instead of analyzing mode specific implications.

6.5 Further Research

Overall, from the country-level analysis it appears that although all transport sectors have been deregulated, effective deregulation is still not realized thoroughly and the benefits from the deregulation are not widespread. International and transnational services have been deregulated in EU, in terms of economic deregulation by reducing, significantly, the barriers to entry. Some EU MS have encouraged market players whereas others have delayed as much as possible the deregulation process. Nevertheless, there is still a long way to complete the deregulation process at the transport industry level and at the same time provide a modal agnostic level playing field for every transport industry incumbent and stakeholder.

Understanding the limitations of this research in terms of scope, there is still a long way to further understand implications at the business level and to further contribute to the understanding at the corporate and at the market level. More precisely, a more inclusive model may be devised, addressing both business and technical efficiency, backed up by empirical evidence. Additionally, cross sectoral analyses of the transport

sector are also needed in order to identify both the actual effect and also the implications from/to other transport modes and the optimal regulatory restrictions.

Additionally, in this research, the privatization of the state owned monopoly was considered equal to significant deregulatory shocks. These deregulatory shocks might include, but not limited to, breaking up conferences (especially in the shipping sector), vertical/horizontal separation due to anti-trust grounds, backwards looking monopoly rents, etc. It was inferred that these would have similar impact on the companies, however, in order to improve the academic accuracy, the impact of these tools should be further explored and confirmed individually.

Similarly, this study is all but a first to a series where further business aspects can be investigated. More operational metrics from the business side have to be collected so as to see whether deregulation has an impact on important supply chain metrics, including inventory costs, transport chain efficiency in terms of costs and in terms of On-time performance and Value, Information technology adoption, Customer service levels and Security & Safety.

Conclusively, transport industry deregulation being a very complex subject, has important implications to all economy sectors and as such, a deeper understanding of the impact of the deregulatory initiatives is required.

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APPENDIX

ANNEX I – OECD Index on Regulation, Raw Data

Table 27 – OECD Index on Regulation, 1975-2013

Year	Spain	Denmark	Netherlands	Germany	Sweden	United Kingdom	France	Austria	Portugal	Greece	Belgium	Italy	Finland	Average Sample	G20
1975	5.25	5.21	5.33	5.85	4.27	4.10	5.96	5.33	5.96	5.58	5.25	5.96	5.67	5.36	5.19
1976	5.21	5.21	5.33	5.85	4.27	4.10	5.96	5.33	5.96	5.58	5.25	5.96	5.65	5.36	5.19
1977	5.21	5.21	5.33	5.85	4.27	4.10	5.96	5.33	5.96	5.58	5.25	5.96	5.64	5.36	5.19
1978	5.21	5.21	5.33	5.85	4.27	4.10	5.96	5.33	5.96	5.58	5.25	5.96	5.63	5.36	5.19
1979	5.21	5.21	5.33	5.85	4.27	4.10	5.96	5.33	5.96	5.58	5.25	5.96	5.61	5.36	5.19
1980	5.21	5.21	5.33	5.85	4.27	4.10	5.96	5.33	5.96	5.58	5.25	5.96	5.60	5.36	5.19
1981	5.21	5.21	5.33	5.85	4.27	4.02	5.96	5.33	5.96	5.58	5.25	5.96	5.59	5.35	5.18
1982	5.21	5.21	5.33	5.85	4.27	4.02	5.96	5.33	5.96	5.58	5.25	5.96	5.58	5.35	5.22
1983	5.21	5.21	5.33	5.85	4.27	4.02	5.96	5.33	5.96	5.58	5.25	5.96	5.56	5.35	5.22
1984	5.21	5.21	5.33	5.85	4.27	4.02	5.96	5.33	5.96	5.58	5.25	5.96	5.36	5.33	5.22
1985	5.21	5.21	5.33	5.87	4.27	4.02	5.96	5.33	5.96	5.58	5.25	5.85	5.35	5.32	5.21
1986	5.21	5.21	5.21	5.84	4.27	4.02	5.56	5.33	5.96	5.58	5.25	5.85	4.59	5.22	5.15
1987	5.21	5.21	5.17	5.81	4.08	3.27	5.56	4.58	5.21	5.58	5.06	5.85	4.57	5.01	4.96
1988	5.21	5.21	5.12	5.78	3.90	3.27	5.56	4.56	5.21	5.58	5.06	5.85	4.56	4.99	4.87
1989	5.21	4.08	5.08	5.75	3.90	3.27	5.06	4.30	5.21	5.58	5.06	5.85	4.55	4.84	4.74
1990	4.92	4.08	5.04	5.30	3.90	3.27	5.06	4.01	5.21	5.58	4.56	5.85	4.37	4.70	4.65

Year	Spain	Denmark	Netherlands	Germany	Sweden	United Kingdom	France	Austria	Portugal	Greece	Belgium	Italy	Finland	Average Sample	G20
1991	4.92	4.08	5.00	5.03	3.65	3.27	5.06	4.01	5.21	5.58	4.39	5.85	4.35	4.65	4.60
1992	4.92	3.71	3.77	5.00	3.40	3.27	5.06	3.92	5.21	5.58	4.39	5.85	4.15	4.48	4.60
1993	4.92	3.46	3.47	4.72	3.40	2.71	4.56	3.67	4.96	5.33	4.05	5.10	4.14	4.19	4.39
1994	4.82	3.46	3.33	3.59	3.23	2.15	4.56	3.67	4.96	5.33	4.05	4.98	3.88	4.00	4.18
1995	4.57	3.21	3.28	3.57	2.98	2.15	4.56	3.42	4.96	5.33	3.43	4.89	3.34	3.82	4.17
1996	4.57	3.21	3.05	3.29	2.85	1.86	4.56	3.42	4.68	5.33	3.43	4.89	3.08	3.71	3.95
1997	4.57	3.02	3.00	3.26	2.85	2.05	4.38	3.42	4.58	5.33	3.43	4.89	3.07	3.68	3.85
1998	4.57	2.83	2.57	2.74	2.54	1.96	4.21	3.05	4.50	5.17	3.06	4.80	3.05	3.47	3.36
1999	4.57	2.55	2.40	2.46	2.54	1.75	3.87	2.95	4.50	4.82	2.97	4.62	3.05	3.31	3.22
2000	4.39	2.46	2.24	2.46	2.54	1.56	3.87	2.95	4.17	4.82	2.97	4.62	3.05	3.24	3.17
2001	3.76	2.10	2.20	2.16	2.33	1.56	3.87	2.75	3.29	4.82	2.72	3.91	3.05	2.96	2.98
2002	3.01	2.01	2.10	2.08	2.33	1.56	3.29	2.75	3.29	4.74	2.72	3.74	3.04	2.82	2.91
2003	3.01	1.93	1.90	2.06	2.33	1.56	3.29	2.75	3.29	4.74	2.72	3.65	2.96	2.78	2.92
2004	2.79	1.93	1.84	2.06	2.33	1.56	2.92	2.09	3.21	4.74	2.72	3.65	2.95	2.68	2.87
2005	2.70	1.85	1.84	1.52	2.33	1.56	3.10	2.09	3.13	4.46	2.45	3.30	2.95	2.56	2.78
2006	2.70	1.85	1.75	1.50	2.33	1.56	2.96	1.94	3.13	4.27	2.03	3.21	2.94	2.47	2.75
2007	2.70	1.85	1.64	1.37	2.33	1.56	2.91	1.94	3.13	3.65	2.03	3.21	2.94	2.40	2.68
2008	2.23	1.61	1.64	1.37	2.33	1.31	2.91	1.84	3.13	3.40	2.03	3.21	2.94	2.30	2.62
2009	2.23	1.61	1.55	1.37	2.19	1.31	2.90	1.55	3.13	2.65	2.03	2.83	2.94	2.18	2.48
2010	2.23	1.51	1.55	1.37	2.07	1.31	2.90	1.54	3.03	2.65	2.03	2.83	2.94	2.15	2.46
2011	2.15	1.43	1.55	1.37	2.07	1.02	2.73	1.54	3.03	2.65	1.95	2.58	2.82	2.07	2.34

Year	Spain	Denmark	Netherlands	Germany	Sweden	United Kingdom	France	Austria	Portugal	Greece	Belgium	Italy	Finland	Average Sample	G20
2012	2.15	1.43	1.55	1.36	2.07	1.02	2.73	1.54	3.03	2.65	1.95	2.58	2.72	2.06	2.32
2013	2.15	1.43	1.55	1.36	1.94	1.02	2.72	1.46	3.03	2.65	1.95	2.58	2.72	2.04	2.34

Source: (OECD, 2015), analysis by author

Annex II – Construction of the OECD Overall Regulation Index

Table 28 – Construction of the OECD Overall Regulation Index

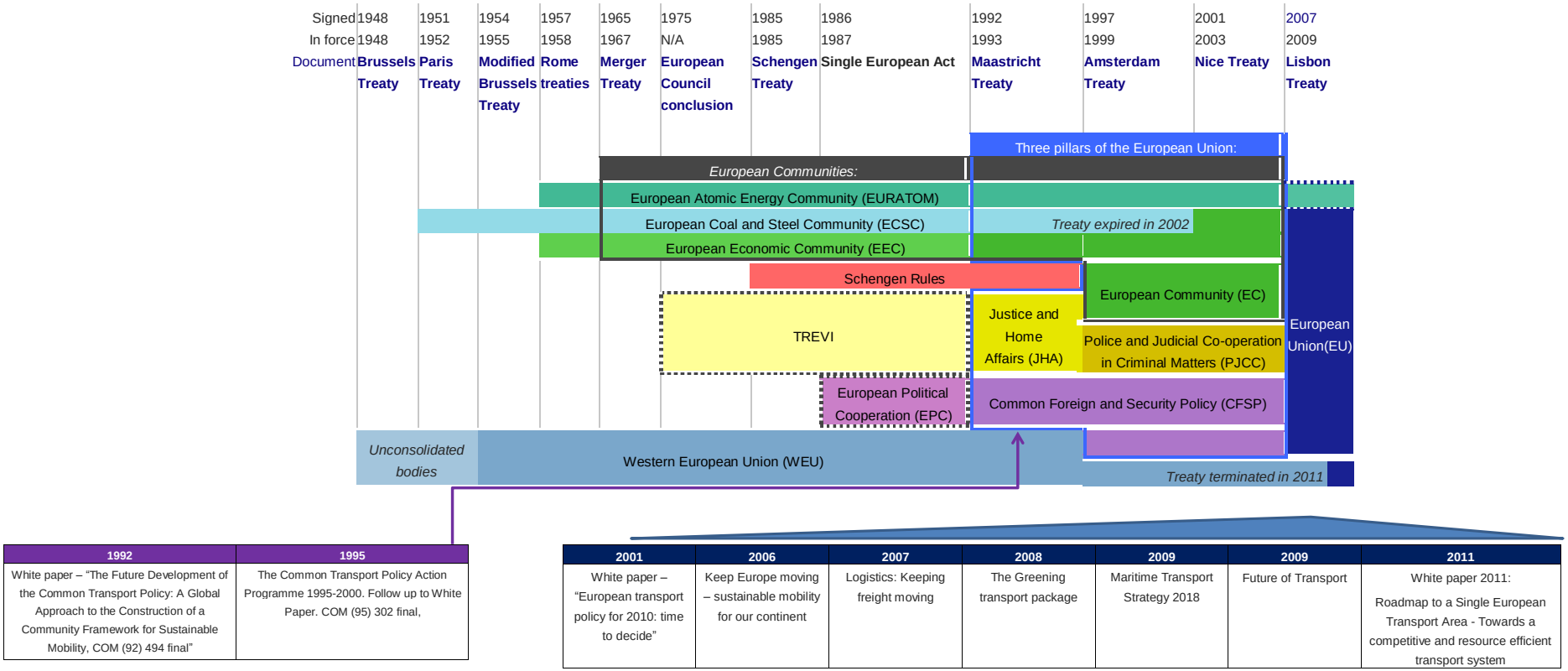
Sector				
Item in the indicator	*Weight*	*Description*	*Weight*	*Coding (Assessment values)*
Railways				
Entry	*¼*	*Average of legal barriers to entry in passenger and freight businesses*	*½*	*Legal monopoly or compliance with EC directive: 6; Regulated entry or open tendering franchise: 3; Free entry: 0*
Vertical integration	*¼*	*Degree of separation between competitive and non-competitive activities*		*Fully separated: 0; Full separation anticipated but not fully undertaken yet: 1.5; Legal separation: 3; Accounting separation: 4.5; Fully integrated: 6*
Public ownership	*¼*	*Share of government in major companies*		*Public owned: 6; mixed private/public: 3; private: 0*
Market structure	*¼*	*Market share of dominant operator*		*No dominant market player: 0; one participant has more than 50% market share in relevant market, or many local de facto monopolies: 3; one participant has more than 90% market share: 6*
Road Freight				

Sector				
Item in the indicator	*Weight*	*Description*	*Weight*	*Coding (Assessment values)*
Entry	*½*	*Legal barriers to entry*		*Free entry: 0; partially liberalised: 3; regulated entry (restrictive licensing): 6*
Prices	*½*	*Extent of price regulation*		*No regulation: 0; guidelines given to companies: 3; regulated: 6*
Airline Industry				
Entry	*1/2*	*Average of indicators for entry in domestic routes (DR) and international routes (Iit)*	*Share of international traffic*	*DR = Domestic market liberalised: 0; domestic market not liberalised: 6* *IR = No regional aviation market , no open sky agreement: 6; regional aviation market, no open sky agreement: 3; no regional aviation market, open sky agreement: 3; regional aviation market and open sky agreement: 0*
Public ownership	*1/2*	*Percent share of government in major airline (SH)*		*6*SH/100*
Post				
Entry	*1/2*	*Average of indicators of degree of entry regulation in basic letter, basic parcel and courier services*		*In each activity = regulated: 6; partly regulated: 3; unregulated: 0*

Sector				
Item in the indicator	*Weight*	*Description*	*Weight*	*Coding (Assessment values)*
Public ownership	*1/2*	*Average of indicators of degree of public ownership in basic letter, basic parcel and courier services*	*Revenue shares of the*	*In each activity = public owned: 6; mixed private/public: 3; private: 0*

Source: (Alesina, Ardagna, Nicoletti, & Schiantarelli, 2005), (OECD, 2015)

Annex III – Timeline of the European Union Treaties



1992	1995
White paper – "The Future Development of the Common Transport Policy: A Global Approach to the Construction of a Community Framework for Sustainable Mobility, COM (92) 494 final"	The Common Transport Policy Action Programme 1995-2000. Follow up to White Paper. COM (95) 302 final,

2001	2006	2007	2008	2009	2009	2011
White paper – "European transport policy for 2010: time to decide"	Keep Europe moving – sustainable mobility for our continent	Logistics: Keeping freight moving	The Greening transport package	Maritime Transport Strategy 2018	Future of Transport	White paper 2011: Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system

Figure 21 – Timeline of the European Union Treaties, adapted with the Transport Policy Documents, High Level Overview

Source: (European Commission, 2015), (Wikipedia, 2015), Own Author Analysis

Annex IV – Regression Results

Model 1: Return on Assets Specification

Table 29 - Model 1 (Return on Assets) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.607	.368	.282	4,074864119849550

Table 30 - Model 1 (Return on Assets) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2921,613	41	71,259	4,292	,000
	Residual	5014,564	302	16,605		
	Total	7936,177	343			

a. Dependent Variable: Return on Assets

Table 31 - Model 1 (Return on Assets) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,962	1,264		,761	,447
	Dereg	2,552	,695	,253	3,672	,000
	GDP Growth	,251	,116	,159	2,172	,031

Austria	1,209	1,073	,076	1,127	,261
Belgium	5,551	1,755	,174	3,162	,002
Denmark	3,428	1,201	,175	2,855	,005
Germany	-,889	1,049	-,061	-,848	,397
Greece	3,241	2,210	,190	1,467	,144
Italy	-1,773	1,125	-,099	-1,575	,116
Latvia	-4,394	2,317	-,228	-1,896	,059
Netherlands	3,672	1,438	,170	2,554	,011
Portugal	,228	,909	,016	,250	,802
United Kingdom	2,282	2,290	,051	,996	,320
Finland	2,028	2,248	,110	,902	,368
42	,710	1,106	,062	,642	,521
44	-2,199	2,017	-,197	-1,091	,276
45	-,362	,902	-,033	-,401	,689
1989	1,062	2,713	,021	,391	,696
1990	-,293	2,375	-,007	-,123	,902
1991	2,070	2,318	,046	,893	,373
1992	1,951	2,148	,049	,909	,364
1993	1,513	1,995	,041	,758	,449
1994	3,783	2,011	,103	1,881	,061
1995	2,669	1,907	,078	1,399	,163
1996	3,318	1,818	,104	1,825	,069

1997	2,967	1,757	,099	1,689	,092
1998	3,426	1,666	,120	2,056	,041
1999	1,804	1,590	,069	1,135	,257
2000	,616	1,542	,025	,399	,690
2001	2,131	1,489	,091	1,431	,154
2002	-,405	1,412	-,018	-,287	,774
2003	,910	1,395	,041	,652	,515
2004	2,261	1,425	,099	1,586	,114
2005	1,232	1,399	,054	,880	,379
2006	1,075	1,402	,049	,767	,444
2007	1,464	1,329	,070	1,102	,272
2008	1,122	1,283	,055	,874	,383
2009	-,599	1,444	-,029	-,415	,679
2010	-,889	1,296	-,042	-,686	,493
2012	1,416	1,276	,071	1,109	,268
2013	1,306	1,267	,065	1,031	,303
2014	2,255	1,337	,102	1,687	,093

a. Dependent Variable: Return on Assets

Model 2: Asset Turnover (Revenues to Assets) Specification

Table 32 - Model 2 (Asset Turnover / Revenues to Assets) Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.766	.587	.536	.332224229686443

Table 33 - Model 2 (Asset Turnover / Revenues to Assets) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	53.238	42	1.268	11.484	.000[b]
	Residual	37.416	339	.110		
	Total	90.654	381			

a. Dependent Variable: Revenues / Assets

Table 34 - Model 2 (Asset Turnover / Revenues to Assets) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	1.097	.113		9.670	.000
	Dereg	.098	.052	.098	1.906	.057
	GDP Growth	.007	.009	.041	.747	.456
	Austria	-.094	.083	-.057	-1.132	.258

Belgium	-.585	.111	-.248	-5.277	.000
Denmark	-.202	.095	-.099	-2.139	.033
Germany	-.292	.081	-.195	-3.604	.000
Greece	-.514	.122	-.288	-4.232	.000
Italy	.393	.079	.217	4.965	.000
Latvia	-.597	.130	-.303	-4.581	.000
Netherlands	.131	.112	.058	1.174	.241
Portugal	.287	.069	.194	4.158	.000
United Kingdom	.896	.168	.209	5.320	.000
Finland	-.342	.126	-.177	-2.720	.007
44	-.224	.118	-.199	-1.907	.057
45	-.672	.072	-.587	-9.332	.000
47	-.979	.085	-.883	-11.510	.000
1988	.069	.237	.013	.292	.770
1989	-.032	.212	-.007	-.152	.879
1990	.008	.203	.002	.037	.970
1991	.082	.182	.019	.453	.651
1992	.128	.171	.033	.746	.456
1993	.149	.165	.038	.903	.367
1994	-.001	.168	.000	-.006	.996
1995	.372	.160	.109	2.323	.021
1996	-.047	.156	-.015	-.302	.763
1997	.027	.154	.009	.177	.859
1998	.052	.149	.018	.349	.727
1999	-.010	.141	-.004	-.071	.944
2000	-.014	.144	-.005	-.095	.925
2001	-.014	.133	-.006	-.106	.916
2002	-.010	.126	-.004	-.077	.939
2003	.037	.126	.016	.294	.769
2004	.006	.131	.003	.046	.964
2005	-.026	.127	-.011	-.205	.838
2006	.006	.128	.003	.048	.962
2007	-.012	.123	-.006	-.095	.924
2008	-.020	.109	-.010	-.184	.854
2010	-.122	.114	-.060	-1.074	.284
2011	-.043	.112	-.021	-.379	.705
2012	-.026	.106	-.012	-.241	.810

2013	-.007	.108	-.003	-.066	.947
2014	-.031	.120	-.013	-.262	.794

a. Dependent Variable: Revenues / Assets

Model 3: Net Income Margin Specification

Table 35 - Model 3 (Net Income Margin) Model Summary

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
3	.586	.343	.268	12.104024054625050

a. Dependent Variable: Net Income / Revenues

Table 36 - Model 3 (Net Income Margin) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	26193,972	39	671,640	4,584	,000
	Residual	50105,530	342	146,507		
	Total	76299,502	381			

a. Dependent Variable: Net Income / Revenues

Table 37 - Model 3 (Net Income Margin) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
3	(Constant)	1,128	3,209		,351	,726
	Dereg	6,070	1,775	,210	3,421	,001

	GDP Growth	,483	,328	,101	1,474	,141
	Austria	-1,894	2,487	-,040	-,761	,447
	Belgium	,172	4,496	,002	,038	,970
	Denmark	8,806	2,991	,148	2,944	,003
	Germany	-8,063	2,177	-,197	-3,703	,000
	Greece	-1,613	2,583	-,032	-,624	,533
	Italy	-5,494	2,673	-,105	-2,055	,041
	Latvia	-25,485	3,024	-,446	-8,427	,000
	Netherlands	-5,193	3,127	-,080	-1,661	,098
	Portugal	3,435	2,345	,080	1,465	,144
	United Kingdom	-6,052	5,830	-,049	-1,038	,300
	Finland	-5,825	2,795	-,104	-2,085	,038
	1988	4,245	7,825	,027	,543	,588
	1989	2,897	6,925	,021	,418	,676
	1990	1,036	6,245	,008	,166	,868
	1991	4,062	5,743	,036	,707	,480
	1992	3,476	5,456	,033	,637	,524
	1993	4,009	5,426	,038	,739	,461
	1994	6,429	5,205	,065	1,235	,218
	1995	8,634	4,966	,093	1,739	,083
	1996	10,320	4,802	,117	2,149	,032
	1997	11,911	4,817	,135	2,473	,014
	1998	11,101	4,516	,137	2,458	,014
	1999	11,054	4,329	,147	2,553	,011
	2000	8,170	4,287	,112	1,906	,058
	2001	10,955	4,076	,160	2,688	,008
	2002	4,916	3,958	,074	1,242	,215
	2003	8,268	3,999	,121	2,067	,039
	2004	10,454	4,019	,153	2,601	,010
	2005	9,737	3,968	,142	2,454	,015
	2006	6,894	3,853	,109	1,789	,074
	2007	8,287	3,751	,134	2,209	,028
	2008	7,059	3,727	,114	1,894	,059
	2009	4,564	4,223	,074	1,081	,281
	2011	3,840	3,653	,063	1,051	,294
	2012	7,322	3,773	,118	1,941	,053
	2013	6,565	3,740	,106	1,755	,080
	2014	5,953	3,934	,087	1,513	,131

	(Constant)	1,128	3,209		,351	,726
	Dereg	6,070	1,775	,210	3,421	,001
	GDP Growth	,483	,328	,101	1,474	,141

a. Dependent Variable: Net Income / Revenues

Model 4: Capex to Assets Specification

Table 38 - Model 4 (Capex to Assets) Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
4	.693	.481	.359	.041969080302939

Table 39 - Model 4 (Capex to Assets) Anova

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
4	Regression	.279	40	.007	3.957	.000
	Residual	.301	171	.002		
	Total	.580	211			

a. Dependent Variable: CAPEX / Assets

Table 40 - Model 4 (Capex to Assets) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
4	(Constant)	,010	,017		,603	,548
	Dereg	,007	,010	,064	,669	,504

	GDP Growth	,008	,002	,381	3,538	,001
	Austria	,004	,019	,017	,193	,847
	Belgium	-,001	,021	-,003	-,046	,964
	Denmark	,011	,018	,053	,576	,565
	Germany	,002	,014	,013	,121	,904
	Italy	-,017	,018	-,080	-,937	,350
	Latvia	,011	,022	,052	,502	,616
	Netherlands	-,011	,019	-,061	-,598	,551
	Portugal	,030	,012	,187	2,621	,010
	United Kingdom	,049	,024	,143	2,091	,038
	Finland	,028	,020	,117	1,404	,162
	45	,039	,012	,304	3,110	,002
	47	-,002	,016	-,015	-,101	,920
	1988	,130	,050	,171	2,605	,010
	1989	,133	,050	,174	2,689	,008
	1990	,112	,049	,147	2,301	,023
	1991	,111	,049	,145	2,275	,024
	1992	,125	,048	,164	2,592	,010
	1993	,044	,036	,082	1,226	,222
	1994	,080	,032	,181	2,476	,014
	1995	,055	,031	,125	1,757	,081
	1996	,045	,030	,102	1,494	,137
	1997	,081	,026	,235	3,131	,002
	1998	,050	,024	,159	2,108	,036
	1999	,018	,022	,065	,810	,419
	2000	-,011	,022	-,041	-,489	,626
	2001	,034	,020	,138	1,708	,089
	2002	,027	,018	,118	1,483	,140
	2003	,009	,018	,037	,489	,626
	2004	,016	,019	,068	,854	,394
	2005	,012	,018	,054	,698	,486
	2006	,030	,019	,128	1,563	,120
	2007	,031	,019	,127	1,653	,100
	2008	,035	,017	,149	2,092	,038
	2009	,054	,019	,221	2,802	,006
	2010	-,015	,017	-,067	-,877	,382
	2011	-,001	,016	-,004	-,046	,963

	2012	,015	,016	,071	,956	,340
	2014	-,010	,016	-,047	-,617	,538
	(Constant)	,010	,017		,603	,548

a. Dependent Variable: CAPEX / Assets

Model 5: Asset Turnover (Revenues to Assets) Specification (OECD Index)

Table 41 - Model 5 – Asset Turnover (Revenues to Assets, OECD Index) Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
5	.741a	.550	.501	.346151750092534

a. Dependent Variable: Revenues / Assets

Table 42 - Model 5 (Revenues to Assets, OECD Index) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
5	Regression	62.264	46	1.354	11.297	.000
	Residual	51.044	426	.120		
	Total	113.308	472			

a. Dependent Variable: Revenues / Assets

Table 43 - Model 5 (Revenues to Assets, OECD Index) Coefficients

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

5	(Constant)	1.695	.207		8.197	.000
	OECD Indicator	-.147	.065	-.337	-2.260	.024
	GDP Growth	.031	.012	.163	2.658	.008
	Austria	-.230	.104	-.123	-2.204	.028
	Belgium	-.785	.116	-.315	-6.776	.000
	Denmark	-.246	.116	-.130	-2.115	.035
	Germany	-.506	.117	-.329	-4.336	.000
	Greece	-.175	.111	-.086	-1.572	.117
	Italy	.306	.076	.172	4.049	.000
	Latvia	-.790	.366	-.074	-2.157	.032
	Netherlands	-.259	.130	-.119	-1.996	.047
	Portugal	.308	.064	.208	4.828	.000
	Spain	.653	.175	.136	3.739	.000
	Sweden	.117	.263	.015	.443	.658
	United Kingdom	-.452	.132	-.332	-3.414	.001
	Malta	-.364	.364	-.034	-1.000	.318
	Finland	-.221	.109	-.101	-2.021	.044
	44	-.490	.083	-.395	-5.871	.000
	96	-.723	.109	-.290	-6.625	.000
	45	-.782	.056	-.746	-13.872	.000
	47	-.992	.076	-.821	-13.069	.000
	40	-.729	.154	-.180	-4.732	.000
	1988	.233	.237	.044	.981	.327
	1989	.132	.217	.028	.606	.545
	1990	.210	.216	.044	.970	.333
	1991	.325	.209	.074	1.556	.120
	1992	.333	.194	.088	1.720	.086
	1993	.312	.177	.082	1.756	.080
	1994	.097	.164	.027	.593	.554
	1995	.217	.160	.061	1.360	.175
	1996	.014	.150	.004	.095	.924
	1997	.078	.147	.024	.527	.599
	1998	.090	.138	.029	.653	.514
	1999	.001	.128	.000	.009	.993
	2000	-.036	.125	-.013	-.287	.774
	2001	-.024	.109	-.010	-.220	.826
	2002	-.054	.102	-.023	-.527	.598

	2003	-.024	.103	-.010	-.230	.818
	2004	-.120	.102	-.049	-1.167	.244
	2005	-.140	.100	-.058	-1.396	.164
	2006	-.115	.092	-.058	-1.257	.209
	2007	-.104	.090	-.054	-1.153	.250
	2009	.089	.097	.047	.914	.361
	2010	-.159	.086	-.085	-1.851	.065
	2011	-.098	.086	-.051	-1.131	.259
	2012	-.061	.089	-.030	-.689	.491
	2013	-.001	.093	-.001	-.013	.990

a. Dependent Variable: Revenues / Assets

Model 6: Return on Assets Specification (OECD Index)

Table 44 - Model 6 (Return on Assets, OECD Index) Model Summary

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
6	.327	.107	.038	4.773410282913263

a. Dependent Variable: Return on Assets

Table 45 - Model 6 (Return on Assets, OECD Index) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
6	Regression	1104.862	31	35.641	1.564	.030[b]
	Residual	9250.891	406	22.785		
	Total	10355.753	437			

a. Dependent Variable: Return on Assets

Table 46 - Model 6 (Return on Assets, OECD Index) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
6	(Constant)	5.288	1.253		4.220	.000
	OECD Indicator	-.641	.331	-.145	-1.932	.054
	GDP Growth	.184	.151	.098	1.221	.223

	42	1.090	.665	.091	1.640	.102
	44	-.710	.668	-.060	-1.063	.289
	96	1.727	1.241	.071	1.391	.165
	47	.276	.757	.023	.365	.715
	40	-3.504	2.204	-.077	-1.590	.113
	1989	.740	2.709	.016	.273	.785
	1990	.029	2.430	.001	.012	.991
	1991	1.418	2.324	.034	.610	.542
	1992	.167	2.245	.004	.074	.941
	1993	1.392	2.037	.041	.683	.495
	1994	3.281	2.217	.096	1.480	.140
	1995	2.347	2.143	.072	1.095	.274
	1996	2.543	2.090	.078	1.217	.224
	1997	2.353	2.114	.076	1.113	.267
	1998	2.685	2.036	.090	1.319	.188
	1999	1.344	1.924	.049	.699	.485
	2000	1.018	1.967	.038	.517	.605
	2001	1.007	1.768	.039	.570	.569
	2002	-.210	1.635	-.009	-.128	.898
	2003	.042	1.653	.002	.026	.980
	2004	.704	1.736	.029	.405	.685
	2005	.462	1.675	.019	.276	.783
	2006	.503	1.810	.021	.278	.781
	2007	1.408	1.622	.073	.868	.386
	2008	-.286	1.356	-.015	-.211	.833
	2010	-1.290	1.488	-.069	-.867	.386
	2011	-.440	1.426	-.023	-.309	.758
	2012	.920	1.315	.047	.700	.485
	2013	1.495	1.400	.074	1.068	.286

a. Dependent Variable: Return on Assets

Model 7: Net Income Margin Specification (OECD Index)

Table 47 - Model 8 (Net Income Margin, OECD Index) Model Summary

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
7	,510	,260	,183	12,694087056642140

a. Dependent Variable: Net Income / Revenues

Table 48 - Model 7 (Net Income Margin, OECD Index) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
7	Regression	24897,094	46	541,241	3,359	,000
	Residual	70740,392	439	161,140		
	Total	95637,487	485			

a. Dependent Variable: Net Income / Revenues

Table 49 - Model 7 (Net Income Margin, OECD Index) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
7	(Constant)	20,732	3,642		5,693	,000
	OECD Indicator	-4,690	2,093	-,379	-2,241	,025
	GDP Growth	,300	,415	,055	,722	,471
	Austria	,317	3,262	,006	,097	,923
	Belgium	-1,866	4,872	-,020	-,383	,702
	Denmark	6,721	3,307	,122	2,032	,043

	France	-2,158	4,505	-,055	-,479	,632
	Germany	-9,181	2,801	-,217	-3,278	,001
	Greece	4,204	6,316	,072	,666	,506
	Italy	-3,077	5,255	-,060	-,586	,558
	Latvia	-32,510	13,475	-,105	-2,413	,016
	Netherlands	-3,424	3,728	-,054	-,918	,359
	Portugal	,657	5,017	,015	,131	,896
	Spain	-,457	6,766	-,003	-,067	,946
	Sweden	10,067	9,623	,046	1,046	,296
	Malta	9,878	13,232	,032	,747	,456
	Finland	-6,902	4,373	-,109	-1,578	,115
	42	-6,675	2,868	-,196	-2,327	,020
	96	,932	3,607	,013	,258	,796
	45	-1,043	2,356	-,034	-,443	,658
	47	8,068	2,720	,231	2,967	,003
	40	-19,796	5,901	-,168	-3,355	,001
	1988	8,914	7,792	,064	1,144	,253
	1989	6,922	7,244	,054	,955	,340
	1990	8,629	7,206	,073	1,198	,232
	1991	8,647	6,968	,078	1,241	,215
	1992	5,643	6,565	,057	,860	,390
	1993	7,945	6,025	,080	1,319	,188
	1994	9,192	5,474	,097	1,679	,094
	1995	9,433	5,359	,100	1,760	,079
	1996	10,146	5,049	,112	2,010	,045
	1997	11,095	5,078	,123	2,185	,029
	1998	9,499	4,722	,113	2,012	,045
	1999	7,878	4,461	,097	1,766	,078
	2000	8,553	4,401	,109	1,943	,053
	2001	5,599	3,938	,077	1,422	,156
	2002	2,935	3,720	,043	,789	,431
	2003	4,492	3,760	,064	1,195	,233
	2004	4,739	3,752	,067	1,263	,207
	2005	6,459	3,682	,091	1,754	,080
	2006	3,007	3,407	,052	,883	,378
	2007	4,503	3,334	,080	1,351	,178
	2009	2,263	3,586	,041	,631	,528
	2010	1,400	3,180	,025	,440	,660

	2011	-,383	3,197	-,007	-,120	,905
	2012	2,089	3,305	,035	,632	,528
	2013	2,959	3,449	,047	,858	,391

a. Dependent Variable: Net Income / Revenues

Model 8: CAPEX to Assets (OECD Index)

Table 50 - Model 8 (CAPEX to Assets, OECD Index) Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
8	.468	.219	.090	1.457135546805062

Table 51 - Model 8 (CAPEX to Assets, OECD Index) ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
8	Regression	157.978	44	3.590	1.691	.007
	Residual	562.660	265	2.123		
	Total	720.638	309			

a. Dependent Variable: CAPEX / Assets

Table 52 - Model 8 (CAPEX to Assets, OECD Index) Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
8	(Constant)	-.330	.687		-.481	.631
	OECD Indicator	.204	.364	.135	.561	.575

GDP Growth	-.040	.067	-.064	-.595	.552
Austria	.010	.495	.002	.020	.984
Belgium	4.131	.764	.402	5.409	.000
Denmark	-.317	.530	-.049	-.598	.550
France	-.422	.795	-.096	-.530	.597
Germany	.260	.412	.061	.631	.529
Greece	-.388	1.095	-.061	-.355	.723
Italy	-.458	1.018	-.070	-.450	.653
Latvia	.024	1.652	.001	.015	.988
Netherlands	.545	.549	.084	.993	.321
Portugal	-.269	.893	-.057	-.301	.764
Malta	-.125	1.560	-.005	-.080	.936
Finland	-.325	.885	-.038	-.367	.714
42	-.598	.439	-.164	-1.363	.174
44	.031	.587	.007	.053	.958
96	.066	.560	.010	.118	.906
45	.253	.356	.077	.711	.478
40	.317	1.027	.020	.308	.758
1988	-.083	1.793	-.003	-.046	.963
1989	-.119	1.795	-.004	-.066	.947
1990	-.207	1.803	-.008	-.115	.909
1991	-.382	1.333	-.025	-.287	.775
1992	-.323	1.225	-.024	-.264	.792
1993	-.195	1.012	-.016	-.192	.848
1994	-.088	.869	-.009	-.102	.919
1995	-.090	.851	-.009	-.106	.916
1996	-.064	.813	-.006	-.079	.937
1997	-.006	.792	-.001	-.008	.994
1998	-.051	.730	-.006	-.070	.944
1999	-.014	.676	-.002	-.020	.984
2000	.037	.630	.005	.059	.953
2001	.017	.582	.002	.029	.977
2002	.046	.554	.007	.082	.934
2003	1.446	.555	.210	2.607	.010
2004	.136	.525	.020	.260	.795
2005	.138	.499	.022	.276	.783
2006	.218	.519	.032	.421	.674
2007	.187	.497	.028	.376	.707
2008	-.123	.479	-.019	-.257	.798
2009	-.276	.594	-.043	-.464	.643
2011	-.015	.472	-.002	-.032	.974

2012	-.056	.497	-.009	-.112	.911
2013	-.024	.493	-.004	-.048	.961

a. Dependent Variable: CAPEX / Assets

APPENDIX III – EU Macroeconomic figures

Growth in GDP and Industrial Production (YoY)

Table 53 - Growth in GDP and industrial Production (YoY)

	Growth In GDP Real Growth % Change				Growth In Industrial Production (Excluding Construction) % Change			
	2010	2011	2012	2013	2010	2011	2012	2013
EU-28	2.1	1.7	-0.4	0.0	6.8	3.1	-2.2	-0.5
BE	2.5	1.6	0.1	0.3	11.2	4.4	-3.3	0.8
BG	0.7	2.0	0.5	1.1	2.0	5.9	-0.2	0.0
CZ	2.3	2.0	-0.8	-0.7	8.2	5.9	-0.8	0.2
DK	1.6	1.2	-0.7	-0.5	1.7	2.1	-0.1	0.8
DE	4.1	3.6	0.4	0.1	11.0	7.2	-0.4	0.2
EE	2.5	8.3	4.7	1.6	23.0	19.6	1.4	3.0
IE	-0.3	2.8	-0.3	0.2	7.6	-0.4	-1.4	-2.2
EL	-5.4	-8.9	-6.6	-3.9	-6.6	-5.9	-2.1	-3.2
ES	0.0	-0.6	-2.1	-1.2	0.8	-1.7	-6.9	-1.7
FR	2.0	2.1	0.3	0.3	5.1	2.3	-2.7	-0.6
HR	-1.7	-0.3	-2.2	-0.9	-1.5	-1.2	-5.4	-1.9
IT	1.7	0.6	-2.3	-1.9	6.8	1.2	-6.4	-3.1
CY	1.4	0.3	-2.4	-5.4	-1.7	-7.8	-9.6	-12.6
LV	-2.9	5.0	4.8	4.2	14.5	8.8	6.1	-0.3
LT	1.6	6.1	3.8	3.3	6.1	6.5	3.6	3.5
LU	5.1	2.6	-0.2	2.0	8.7	2.0	-4.3	-3.3
HU	0.8	1.8	-1.5	1.5	10.3	5.6	-1.4	1.5
MT	3.5	2.2	2.5	2.5	8.7	-0.5	5.4	-5.3
NL	1.1	1.7	-1.6	-0.7	7.7	-0.7	-0.6	0.6
AT	1.9	3.1	0.9	0.2	6.7	6.8	-0.3	0.8
PL	3.7	4.8	1.8	1.7	11.7	6.8	1.4	2.4
PT	1.9	-1.8	-3.3	-1.4	1.6	-1.0	-6.1	0.5
RO	-0.8	1.1	0.6	3.4	3.8	7.8	2.4	7.8
SI	1.2	0.6	-2.6	-1.0	7.0	2.1	-0.5	-1.4

	Growth In GDP Real Growth % Change				Growth In Industrial Production (Excluding Construction) % Change			
	2010	2011	2012	2013	2010	2011	2012	2013
SK	4.8	2.7	1.6	1.4	8.0	5.4	7.6	5.3
FI	3.0	2.6	-1.5	-1.2	5.2	2.1	-1.6	-3.5
SE	6.0	2.7	-0.3	1.3	8.8	2.5	-1.2	-4.6
UK	1.9	1.6	0.7	1.7	3.1	-0.6	-3.0	-0.2
AL	3.7	2.5	1.6	1.4	19.9	-10.2	16.6	-13.1
ME	2.5	3.2	-2.5	3.3	17.8	-10.3	-7.0	10.6
MK	2.9	2.8	-0.4	2.9	-4.8	6.9	-2.8	3.2
RS	0.6	1.4	-1.0	2.6	1.0	2.5	-2.2	5.8
TR	9.2	8.8	2.1	4.1	12.6	9.5	2.5	3.4
IS	-2.9	2.1	1.1	3.5	12.9	12.1	4.5	-4.0
NO	0.6	1.0	2.7	0.7	-5.4	-4.5	2.8	-5.0
CH	3.0	1.8	1.1	1.9	7.2	2.7	2.3	0.8

Notes: industrial production: includes Nace Rev. 2 Sections b, c and D. Data adjusted by working days. Data has been extracted on 20/01/15. Growth GDP section: data for the 28 member states, RS, IS, NO and CH is provided according to the new eSa2010 methodology, while MK and ME according to eSa95. AL, TR and ME (2013) from national sources. Growth industrial production section: data for the 28 member states, NO, TR, RS and MK provided by eurostat. IS estimated by oecD. AL provided by UNece. ME from national source.

Source: (European Union, 2015b)

EU-28 External Trade by Mode of Transport

Table 54 - EU-28 External Trade by Mode of Transport, measured in value, 2013

	EXPORT		IMPORT		EXPORT + IMPORT	
Sea	827.8	47.70%	905.8	53.80%	1,733.70	50.70%
Road	339.7	19.60%	215.6	12.80%	555.3	16.20%
Rail	23.6	1.40%	18.4	1.10%	42	1.20%
Inland waterways	5.5	0.30%	3	0.20%	8.5	0.20%
Pipeline	3.9	0.20%	113	6.70%	116.9	3.40%
Air	482.2	27.80%	305	18.10%	787.1	23.00%
Self-propulsion	47.2	2.70%	14.5	0.90%	61.6	1.80%
Post	1	0.10%	1.5	0.10%	2.5	0.10%
Unknown	5.7	0.30%	108.1	6.40%	113.8	3.30%
TOTAL	1,736.60	100.00%	1,684.80	100.00%	3,421.40	100.0%

Source: (European Union, 2015b)

Table 55 - EU-28 External Trade by Mode of Transport, measured in weight, 2013

	EXPORT		IMPORT		EXPORT+IMPORT	
Sea	503.8	79.00%	1 186.5	73.90%	1 690.2	75.30%
Road	87.1	13.70%	56.1	3.50%	143.2	6.40%
Rail	19.3	3.00%	65.5	4.10%	84.9	3.80%
Inland waterways	9.4	1.50%	10.7	0.70%	20.1	0.90%
Pipeline	3	0.50%	219.3	13.70%	222.3	9.90%
Air	13.6	2.10%	3.4	0.20%	17.1	0.80%
Self-propulsion	1.2	0.20%	3.3	0.20%	4.5	0.20%
Post	0	0.00%	0	0.00%	0	0.00%
Unknown	0.5	0.10%	61.6	3.80%	62.1	2.80%
TOTAL	638	100.00%	1,606.40	100.00%	2,244.40	100.00%

Source: (European Union, 2015b)

Employment by Mode of Transport (*) (in 1,000) – 2012

Table 56 - Employment by Mode of Transport (*) (in 1,000) – 2012

	Total	ROAD freight transport	ROAD passenger transport (**)	Railways	Pipelines	Inland water transport	Sea transport	Air transport	Warehousing and support activities	Postal and courier activities
EU-28	10,546.60	2,945.70	1,988.50	577	28.4	40.1	164	366.5	2,601.90	1,834.30
BE	211.9	62.1	18	1.3	0.1	0.6	1.1	5.2	90.4	32.9
BG	153.9	51.8	33.6	9.8	0.5	0.9	3.4	2.2	32.5	19.2
CZ	267.4	116.4	38.3	28.6	1	0.5	0	2.5	38.9	41.3
DK	150.6	34	23.9	6.7	0	0.2	21	11	28.3	25.4
DE	2,012.40	396.4	366.1	47	3.3	8.3	19.1	62	599.9	510.1
EE	38.6	14.4	5.7	1.7	0	0	0.8	0.4	11.8	3.6
IE	75.9	18.2	12.5	3.1	0	0.1	2.5	7.9	15.3	16.4
EL	162.3	30.9	65	1.1	0.2	0	13	3.6	35.5	13.1
ES	861.3	321.2	179.1	19.6	1.9	0.4	6.6	29.7	215	87.7
FR	1,382.30	351.5	250.4	171.1	4.9	3.7	11	42.3	262.8	284.6
HR	77.3	19.8	10.5	2.8	0.4	0.2	4.1	3	23.7	12.7
IT	1,076.00	316.2	169.2	40.1	2.2	2.5	26.7	24.6	333.4	161.2
CY	17.8	2.1	3	0	0	0	1.8	1.1	8.4	1.4
LV	72.8	22.7	12.4	3.7	0.2	0.1	0.7	1.5	25.7	5.7
LT	103.3	49	15.1	10.8	0	0	1.6	0.4	17.9	8.6
LU	23	7.9	4.6	0.5	0	0.2	0	2.6	3.7	3.5
HU	219.5	65.1	48	11.7	0.8	0.9	0	1	53.7	38.3
MT	9.6	1	1.5	0	0	0	0.5	2.9	2.7	1
NL	411	117	51.3	30.7	0.1	13.3	13	25.3	82.6	77.8
AT	207.8	58.7	54.7	12	0.5	0.5	0	6.9	49	25.6
PL	729.5	290	138.9	58.2	3.4	0.9	2.4	5.4	128.7	101.5
PT	153.4	59.8	34.1	3.6	0.1	0.6	0.9	10.6	28.4	15.3
RO	330.6	105.5	78.1	31.9	6.7	2.3	0.4	3.9	60.4	41.6
SI	44.3	20.8	5.1	1.3	0.1	0.3	0.2	0.6	8.3	7.6
SK	120.5	37.6	18.4	13.5	1	0.4	0	0.4	33.1	16.1
FI	147.2	44.7	32.2	8.5	0.2	0.4	9.1	9.9	29	13.2
SE	271.7	77.5	68.5	10.3	0	1.5	14.3	24.9	48.7	26.1
UK	1,214.50	253.4	250.1	47.6	0.6	1.3	9.7	74.8	334.1	242.6

Source: (European Union, 2015b), Notes: (*) Data refer to transportation and storage activities (including postal and courier services, removal services). Data are based on Structural business Statistics. Certain values are not from eStat or other official source, but are merely indicative estimates made by DG MOVE. (**) including all urban and suburban land transport modes (motor bus, tramway, streetcar, trolley bus, underground and elevated railways). Economic activity according to Nace Rev. 2 classification

Number of Enterprises by Mode of Transport (*) – 2012

Table 57 - Number of Enterprises by Mode of Transport (*) – 2012

	Total	ROAD freight transport	ROAD passenger transport (**)	Railways	Pipelines	Inland water transport	Sea transport	Air transport	Warehousing and support activities	Postal and courier activities
EU-28	1,134,371	573,148	343,094	804	209	9,430	11,538	4,130	136,888	55,126
BE	17,070	7,760	2,701	11	33	336	123	262	3,200	2,644
BG	19,003	9,943	6,461	11	3	28	24	47	1,979	507
CZ	40,064	31,331	3,610	27	2	84	2	39	4,643	326
DK	11,812	5,500	3,067	18	4	22	332	63	1,402	1,404
DE	87,820	35,662	23,546	144	38	984	2,112	491	15,595	9,248
EE	4,479	2,729	436	7	0	4	35	10	1,182	76
IE	9,152	4,116	1,109	8	0	0	743	45	1,120	2,011
EL	65,823	20,432	35,421	5	3	0	2,187	22	7,392	361
ES	200,928	113,925	63,606	12	7	67	267	81	16,743	6,220
FR	98,575	36,131	46,597	51	53	1,104	655	511	10,228	3,245
HR	9,208	6,136	1,358	2	2	14	603	32	1,018	43
IT	131,755	75,565	28,937	25	13	968	782	233	22,810	2,422
CY	3,137	998	1,189	0	0	0	53	1	719	177
LV	6,303	3,234	826	23	1	13	46	23	1,837	300
LT	9,843	4,511	2,833	5	0	13	11	13	1,637	820
LU	974	486	194	2	0	27	0	20	193	52
HU	28,578	15 099	8,388	32	5	108	12	93	3,621	1,220
MT	1,401	407	705	0	0	0	17	9	235	24
NL	31,485	10,134	5,371	28	10	4,235	777	320	5,463	5,147
AT	13,855	6,587	5,191	26	6	79	0	177	1,338	451
PL	141,739	81,512	46,277	105	5	283	212	221	10,342	2,782
PT	22,899	8,694	11,186	5	3	43	172	67	2,307	422
RO	34,064	21,452	9,053	74	3	119	43	61	2,353	906
SI	8,491	5,661	1,064	6	2	35	39	61	1,064	559
SK	16,734	8,349	4,530	15	5	31	0	15	3,367	422
FI	22,541	10,682	9,170	4	2	80	246	81	1,921	355
SE	29,899	15,202	8,983	54	0	493	800	277	3,655	435
UK	66,739	30,910	11,285	104	9	260	1,245	855	9,524	12,547

Source: (European Union, 2015b). (*) Data refer to transportation and storage activities (including postal and courier services, removal services). Certain values are not from eStat or other official source, but are merely indicative estimates made by DG MOVE. (**) Including all urban and suburban land transport modes (motor bus, tramway, streetcar, trolley bus, underground and elevated railways). The above figures refer to those companies whose main activity lies in the mode concerned. Economic activity according to NACE Rev. 2 classification.

Turnover by Mode of Transport (*) 2012 (million EUR)

Table 58 - Turnover by Mode of Transport (*) 2012 (million EUR)

	Total	ROAD freight transport	ROAD passenger transport (**)	Railways	Pipelines	Inland water transport	Sea transport	Air transport	Warehousing and support activities	Postal and courier activities
EU-28	1,359,850	312,121	121,292	70,992	13,757	7,162	109,978	133,878	478,761	111,889
BE	48,704	11,624	1,388	1,818	158	311	5,153	3,137	21,589	3,527
BG	5,390	2,672	479	142	50	51	159	372	1,215	252
CZ	21,614	7,797	1,379	1,407	303	70	0	1,160	8,237	1,261
DK	49,280	5,742	2,740	274	21	97	25,683	2,934	9,326	2,463
DE	262,616	37,905	27,185	11,071	3,437	2,161	26,865	20,547	106,643	26,801
EE	5,324	1,100	159	172	0	9	522	135	3,143	83
IE	16,579	2,337	845	449	0	0	525	7,298	3,753	1,372
EL	11,602	2,452	2,019	91	256	0	1,618	1,083	3,305	779
ES	98,024	31,726	8,961	1,931	1,751	21	1,740	8,555	39,140	4,200
FR	204,000	42,997	18,484	20,761	2,302	785	13,940	21,196	69,967	13,568
HR	3,671	1,164	296	243	125	6	316	253	1,144	126
IT	144,636	44,310	11,863	5,183	701	169	11,240	9,110	50,338	11,723
CY	1,605	148	141	0	0	0	131	185	942	58
LV	5,402	1,333	171	386	173	0	27	405	2,812	95
LT	7,165	3,028	237	508	0	5	169	121	2,984	113
LU	5,054	1,210	186	138	0	176	0	2,333	924	86
HU	14,277	4,469	1,360	488	666	96	1	998	5,339	862
MT	1,050	74	53	0	0	0	84	121	551	166
NL	73,924	19,657	3,769	2,960	417	2,291	5,424	10,330	23,906	5,171
AT	40,137	9,493	3,972	2,774	757	90	0	3,590	16,859	2,603
PL	40,178	19,893	3,590	2,666	846	144	384	1,708	8,953	1,994
PT	17,424	4,709	1,168	308	143	34	315	3,761	6,123	865
RO	11,962	5,451	1,066	895	373	149	45	533	2,841	609
SI	4,632	2,059	231	90	36	31	166	225	1,491	304
SK	7,468	2,435	392	1,040	302	60	0	123	2,592	525
FI	23,178	5,935	2,377	760	158	139	2,732	2,905	6,618	1,534
SE	49,269	11,373	7,694	1,850	0	167	3,721	2,999	18,033	3,433
UK	185,686	29,031	19,089	12,586	785	102	9,020	27,762	59,993	27,319

Source: (European Union, 2015b), (*) Data refer to transportation and storage activities (including postal and courier services, removal services). Certain values are not from eStat or other official source, but are merely indicative estimates made by DG MOVE. (**) Including all urban and suburban land transport modes (motor bus, tramway, streetcar, trolley bus, underground and elevated railways). The above figures refer to those companies whose main activity lies in the mode concerned. Economic activity according to NACE Rev. 2 classification.

EU-28 Modal Performance (Freight)

Table 59 - EU-28 Performance by Mode (Freight Transport in billion Tonne-Kilometers)

Year	Road	Rail	Waterways	Pipelines	Sea (*)	Air	Total
1995	1,289	388	122	115	930	2	2,846
2000	1,509	405	134	127	1,067	2	3,245
2001	1,553	388	133	134	1,083	2	3,292
2002	1,603	386	133	130	1,100	2	3,353
2003	1,608	394	124	132	1,119	2	3,378
2004	1,751	419	137	133	1,159	2	3,601
2005	1,795	416	139	138	1,198	2	3,687
2006	1,858	438	139	137	1,224	2	3,798
2007	1,925	452	145	128	1,190	2	3,843
2008	1,891	443	146	125	1,164	2	3,771
2009	1,700	364	131	122	1,062	2	3,380
2010	1,755	394	156	121	1,118	2	3,546
2011	1,744	422	142	118	1,133	2	3,562
2012	1,693	407	150	115	1,113	2	3,480
2,013	1,719	407	153	112	1,089	2	3,481
1995–2013	33%	5%	25%	-3%	17%	27%	22%
per year	2%	0%	1%	0%	1%	1%	1%
2000–2013	14%	0%	14%	-12%	2%	4%	7%
per year	1%	0%	1%	-1%	0%	0%	1%
2012–2013	2%	0%	2%	-3%	-2%	-1%	0%

Source: (European Union, 2015b). Notes: (*) In the 2015 edition, the time series for maritime transport performance has been revised, for the period from 2005 to 2013, by replacing previous estimates on port-to port distances with more accurate measurements by Eurostat. The time series from 1995 to 2004 has been recalibrated by DG MOVE in line with the new Eurostat figures to avoid break in series. The revision of tkm figures mainly concerns the calculation of distance travelled and not the tonnages transported by sea. Air and Sea: only domestic and intra-EU-28 transport; estimates for air and for sea (1995-2004). Road: national and international haulage by vehicles registered in the EU-28.

Table 60 - EU-28 Performance by Mode (Freight Transport, modal split)

Year	Road	Rail	Waterways	Pipelines	Sea (*)	Air
1995	45.30	13.60	4.30	4.00	32.70	0.10
2000	46.50	12.50	4.10	3.90	32.90	0.10
2001	47.20	11.80	4.00	4.10	32.90	0.10

Year	Road	Rail	Waterways	Pipelines	Sea (*)	Air
2002	47.80	11.50	4.00	3.90	32.80	0.10
2003	47.60	11.70	3.70	3.90	33.10	0.10
2004	48.60	11.60	3.80	3.70	32.20	0.10
2005	48.70	11.30	3.80	3.70	32.50	0.10
2006	48.90	11.50	3.60	3.60	32.20	0.10
2007	50.10	11.80	3.80	3.30	31.00	0.10
2008	50.10	11.70	3.90	3.30	30.90	0.10
2009	50.30	10.80	3.90	3.60	31.40	0.10
2010	49.50	11.10	4.40	3.40	31.50	0.10
2011	49.00	11.90	4.00	3.30	31.80	0.10
2012	48.60	11.70	4.30	3.30	32.00	0.10
2013	49.40	11.70	4.40	3.20	31.30	0.10

Source: (European Union, 2015b). Notes: (*) In the 2015 edition, the time series for maritime transport performance has been revised, for the period from 2005 to 2013, by replacing previous estimates on port-to port distances with more accurate measurements by Eurostat. The time series from 1995 to 2004 has been recalibrated by DG MOVE in line with the new Eurostat figures to avoid break in series. The revision of tkm figures mainly concerns the calculation of distance travelled and not the tonnages transported by sea. Air and Sea: only domestic and intra-EU-28 transport; estimates for air and for sea (1995-2004). Road: national and international haulage by vehicles registered in the EU-28.

EU-28 Modal Performance (Passenger)

Table 61 - EU-28 Performance by Mode 1995-2013 (Passenger Transport in billion passenger-Kilometers)

YEAR	Passenger Cars	P2W	BUS & COACH	Railway	Tram & Metro	AIR	Sea	Total
1995	3,935	116	503	350	72	348	44	5,368
2000	4,355	108	548	372	78	460	42	5,963
2001	4,454	112	547	374	79	455	42	6,064
2002	4,542	114	539	366	80	447	43	6,132
2003	4,586	117	543	362	81	466	43	6,197
2004	4,652	121	544	369	83	496	43	6,307
2005	4,591	123	541	377	84	530	42	6,288
2006	4,636	123	537	389	86	552	42	6,366
2007	4,690	119	549	396	88	575	43	6,460
2008	4,698	124	554	411	91	563	43	6,486
2009	4,774	122	534	404	91	525	43	6,492
2010	4,717	123	528	405	92	539	40	6,445
2011	4,698	125	530	415	93	580	39	6,480
2012	4,614	126	524	420	95	574	42	6,394
2013	4,672	125	526	424	95	583	39	6,465
'95/'13	18.7%	7.4%	4.8%	21.1%	32.7%	67.4%	-12.1%	20.4%
/year	1.0%	0.4%	0.3%	1.1%	1.6%	2.9%	-0.7%	1.0%
'00/'13	7.3%	16.1%	-4.0%	14.2%	21.7%	26.8%	-6.4%	8.4%
/year	0.5%	1.2%	-0.3%	1.0%	1.5%	1.8%	-0.5%	0.6%
12/'13	1.3%	-0.5%	0.5%	1.1%	0.8%	1.6%	-7.0%	1.1%

Source: (European Union, 2015b). Notes: Notes: Air and Sea: only domestic and intra-EU-28 transport; provisional estimates. P2W: Powered two-wheelers.

Table 62 - EU-28 Performance by Mode 1995-2013 (Passenger Transport, modal split)

Year	Passenger Cars	P2W	BUS & COACH	Railway	Tram &	AIR	Sea
1995	73.30	2.20	9.40	6.50	1.30	6.50	0.80
2000	73.00	1.80	9.20	6.20	1.30	7.70	0.70
2001	73.50	1.80	9.00	6.20	1.30	7.50	0.70
2002	74.10	1.90	8.80	6.00	1.30	7.30	0.70
2003	74.00	1.90	8.80	5.80	1.30	7.50	0.70
2004	73.80	1.90	8.60	5.80	1.30	7.90	0.70

Year	Passenger Cars	P2W	BUS & COACH	Railway	Tram &	AIR	Sea
2005	73.00	2.00	8.60	6.00	1.30	8.40	0.70
2006	72.80	1.90	8.40	6.10	1.30	8.70	0.70
2007	72.60	1.80	8.50	6.10	1.40	8.90	0.70
2008	72.40	1.90	8.50	6.30	1.40	8.70	0.70
2009	73.50	1.90	8.20	6.20	1.40	8.10	0.70
2010	73.20	1.90	8.20	6.30	1.40	8.40	0.60
2011	72.50	1.90	8.20	6.40	1.40	8.90	0.60
2012	72.20	2.00	8.20	6.60	1.50	9.00	0.70
2013	72.30	1.90	8.10	6.60	1.50	9.00	0.60

Source: (European Union, 2015b). Notes: Notes: Air and Sea: only domestic and intra-EU-28 transport; provisional estimates. P2W: Powered two-wheelers.

Logistics Performance Indicator

Table 63 - Logistics Performance Indicator

Country	2014	2012	2010	2007
DEU	4.12	4.03272	4.11445	4.098695
NLD	4.05	4.021571	4.068615	4.177695
BEL	4.04	3.980262	3.942263	3.893764
GBR	4.01	3.898316	3.954449	3.993362
SGP	4.00	4.125813	4.090085	4.190336
SWE	3.96	3.85006	4.075576	4.075383
NOR	3.96	3.684443	3.932997	3.809672
LUX	3.95	3.822217	3.980073	3.536873
USA	3.92	3.930063	3.855811	3.843672
JPN	3.91	3.93286	3.965889	4.023554
IRL	3.87	3.520077	3.893212	3.913845
CAN	3.86	3.846479	3.874453	3.921926
FRA	3.85	3.851483	3.843022	3.761884
CHE	3.84	3.803137	3.974814	4.016196
HKG	3.83	4.121364	3.876525	4.003521
AUS	3.81	3.7265	3.840615	3.790339
DNK	3.78	4.018193	3.846941	3.859046
ESP	3.72	3.699725	3.625576	3.518909
TWN	3.72	3.70712	3.705621	3.640742
ITA	3.69	3.670711	3.644385	3.575143
KOR	3.67	3.695429	3.637197	3.520074
AUT	3.65	3.890392	3.762671	4.062574
NZL	3.64	3.42034	3.648133	3.748162
FIN	3.62	4.049717	3.885315	3.815804
MYS	3.59	3.494042	3.440977	3.480234
PRT	3.56	3.502831	3.33504	3.380607
ARE	3.54	3.77844	3.63034	3.727581
CHN	3.53	3.517017	3.489039	3.321935
QAT	3.52	3.321408	2.95016	2.976327
TUR	3.50	3.509463	3.223389	3.154558
POL	3.49	3.431324	3.435271	3.038003
CZE	3.49	3.141498	3.506553	3.134626
HUN	3.46	3.171371	2.987147	3.154174
ZAF	3.43	3.671317	3.456708	3.533589
THA	3.43	3.176152	3.292271	3.311444
LVA	3.40	2.777878	3.24835	3.016025
ISL	3.39	3.394894	3.197069	
SVN	3.38	3.285889	2.874055	3.141297
EST	3.35	2.860271	3.157967	2.947188
ROM	3.26	2.995036	2.841229	2.90712

ISR	3.26		3.412264	3.205804
CHL	3.26	3.173874	3.094723	3.25037
SVK	3.25	3.029374	3.240829	2.918615
GRC	3.20	2.83265	2.955919	3.357952
PAN	3.19	2.926617	3.024052	2.888717
LTU	3.18	2.948307	3.134939	2.778192
BGR	3.16	3.209452	2.830857	2.870838
VNM	3.15	3.004475	2.964607	2.888855
SAU	3.15	3.177839	3.22077	3.019022
MEX	3.13	3.062717	3.047349	2.868055
MLT	3.11	3.157735	2.82433	
BHR	3.08	3.053371	3.372838	3.152265
IDN	3.08	2.94478	2.76039	3.009695
IND	3.08	3.075887	3.115075	3.070914
HRV	3.05	3.162318	2.769976	2.713622
KWT	3.01	2.829627	3.281263	2.985123
PHL	3.00	3.024864	3.141933	2.689238
CYP	3.00	3.243102	3.129378	2.920566
OMN	3.00	2.887491	2.839455	2.923214
ARG	2.99	3.046716	3.099664	2.982468
UKR	2.98	2.854411	2.574824	2.553951
EGY	2.97	2.978947	2.614613	2.370836
SRB	2.96	2.799765	2.685822	
SLV	2.96	2.601434	2.673786	2.662009
BRA	2.94	3.13114	3.198242	2.750649
BHS	2.91	2.752828	2.746246	
MNE	2.88	2.448077	2.430895	
JOR	2.87	2.556634	2.737719	2.88992
DOM	2.86	2.700172	2.82075	2.380182
JAM	2.84	2.416717	2.533717	2.246703
PER	2.84	2.935029	2.801997	2.768456
PAK	2.83	2.825614	2.530255	2.618554
MWI	2.81	2.807967		2.419533
KEN	2.81	2.433501	2.589852	2.521265
NGA	2.81	2.446722	2.58757	2.396312
VEN	2.81	2.489532	2.677583	2.618491
GTM	2.80	2.804983	2.631329	2.529098
PRY	2.78	2.48255	2.753469	2.569403
CIV	2.76	2.731518	2.533473	2.361346
RWA	2.76	2.267065	2.038687	1.774818
BIH	2.75	2.985346	2.661682	2.456929
MDV	2.75	2.545227	2.403898	
KHM	2.74	2.562333	2.369976	2.497886
STP	2.73	2.481508		2.859236

LBN	2.73	2.580148	3.338473	2.369341
ECU	2.71	2.757479	2.774533	2.59968
CRI	2.70	2.746444	2.908459	2.554926
KAZ	2.70	2.694806	2.83319	2.122284
LKA	2.70	2.750421	2.288414	2.399612
RUS	2.69	2.584962	2.608572	2.368381
URY	2.68	2.983534	2.752718	2.50852
ARM	2.67	2.564369	2.524127	2.136819
NAM	2.66	2.653033	2.020395	2.158763
MDA	2.65	2.330267	2.573285	2.311429
NIC	2.65		2.536625	2.213948
DZA	2.65	2.414844	2.360373	2.06338
COL	2.64	2.869333	2.774487	2.497283
BFA	2.64	2.32259	2.22564	2.241919
BLR	2.64	2.611583		2.531666
GHA	2.63	2.507655	2.472855	2.162203
SEN	2.62	2.491924	2.863148	2.366484
LBR	2.62	2.448261	2.38198	2.314229
HND	2.61	2.533225	2.779117	2.498353
ETH	2.59	2.236854	2.412761	2.326745
NPL	2.59	2.035439	2.203265	2.137593
SLB	2.59	2.413215	2.30959	2.083175
BDI	2.57	1.60996		2.288682
BGD	2.56		2.742782	2.471388
BEN	2.56	2.852637	2.787464	2.44556
TUN	2.55	3.168596	2.835479	2.76442
FJI	2.55	2.419238	2.235183	
AGO	2.54	2.27602	2.247351	2.477522
TCD	2.53	2.029731	2.490989	1.983285
TJK	2.53	2.283679	2.346626	1.933323
MUS	2.51	2.81887	2.721068	2.131801
GEO	2.51	2.774072	2.612827	
MKD	2.50	2.564755	2.773526	2.434144
LBY	2.50	2.282752	2.332419	
MLI	2.50		2.268102	2.29402
BWA	2.49	2.841809	2.318434	
BOL	2.48	2.61324	2.510731	2.307312
GIN	2.46	2.481321	2.596005	2.714835
ZMB	2.46		2.28431	2.366997
GUY	2.46	2.327527	2.268051	2.048011
AZE	2.45	2.481118	2.639554	2.290998
PNG	2.43	2.375238	2.410616	2.380731
GNB	2.43	2.595838	2.101429	2.277626
COM	2.40	2.140745	2.447585	2.477926

UZB	2.39	2.46486	2.791121	2.156746
NER	2.39	2.692196	2.539425	1.971863
LAO	2.39	2.499604	2.46261	2.252732
MDG	2.38	2.723699	2.657541	2.243392
LSO	2.37	2.235958		2.304028
CAF	2.36	2.573243		
MNG	2.36	2.25026	2.250476	2.084905
GNQ	2.35			
ZWE	2.34	2.549114		2.286277
TZA	2.33	2.653681	2.599514	2.083703
TGO	2.32	2.579166	2.599417	2.245802
TKM	2.30		2.491292	
IRQ	2.30	2.159177	2.105455	
CMR	2.30	2.527709	2.548282	2.488765
BTN	2.29	2.520324	2.380236	2.156754
HTI	2.27	2.026325	2.591604	2.211462
MMR	2.25	2.36822	2.328603	1.862039
GMB	2.25	2.463075	2.493386	2.518043
MOZ	2.23		2.292945	2.293826
MRT	2.23	2.396732		2.630425
KGZ	2.21	2.353238	2.619121	2.349655
GAB	2.20	2.344965	2.413772	2.099814
YEM	2.18	2.885715	2.58332	2.289926
CUB	2.18	2.196115	2.067025	
SDN	2.16	2.103464	2.20598	2.710802
DJI	2.15	1.797835	2.394566	1.942744
SYR	2.09	2.603861	2.740144	2.089228
ERI	2.08	2.110199	1.696436	2.187811
COG	2.08	2.084591	2.475881	
AFG	2.07	2.297272	2.24316	1.211669
ZAR	1.88	2.205073	2.675772	
SOM	1.77		1.338373	2.158753
Average	2.89	2.88	2.88	2.77

Source: (World Bank, 2015)

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