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Abstract

Purpose

This paper examines the impact of deregulation on the European transport industry, in the form of privatization, on the managerial efficiency of a panel of deregulated transport companies.

Design/methodology/approach

This research examines a dataset of 25 deregulated transport companies from a sample of 12 EU nations from 1988 to 2015. Some studies have analyzed deregulation by using non-parametric models. However, only a limited number of studies focus on the impact of deregulation on the managerial efficiency. This study answers two questions: whether deregulation, in the form of privatization, in the transport sector has any effect on the managerial efficiency, on the profitability and on the investment decisions of the firm, and whether this premise is robust enough across the European transport industry. This study formulates a multivariate regression framework utilizing data from major privatized European transport companies. The final panel includes 25 companies, from 12 EU-MS for the period 1988-2015 equaling 375 firm-year observations based on a rigorous selection methodology.

Findings

The study confirms that transport companies, post-privatization, are more efficient regarding operating efficiency and profitability. We find no evidence that deregulation improves investment efficiency.

Social implications

The study addresses the regulators' dilemma, whether to deregulate or not, by focusing on analyzing the improvement of the managerial efficiency.

Originality/value

This study contributes to the transport industry management literature in three ways. Firstly, we update the literature of the economic theory of regulation with an empirical examination which covers the latest years across the EU Member States. Secondly, we introduce a comparison of the effects of deregulation on different components of the managerial efficiency, namely, investment, profitability, and operating efficiency of the incumbents in the EU transport industry. Thirdly, we examined deregulation by using two approaches: a traditional one where deregulation is a dummy variable assessing the overall effect on incumbents' efficiency performance; a novel approach where the OECD's deregulation index is used to measure the regulation intensity, accounting also for industry-wide impact assessment. This two-sided approach increases the robustness of the results.

Keywords: deregulation, transport industry, EU, managerial efficiency, privatization.

JEL Classification: L51, L91, R49, R40.

1. Introduction

1.1 *Research issue*

Historically, the European transport market has been intensely regulated. The deregulation process of the EU transport market, since the mid-1980s, has promoted the competition among transport service providers and contributed to increased transport flows (Lafontaine & Valeri, 2009). The main argument in favor of deregulation (Sheshinski, 2003), is that deregulation has clear benefits both for the deregulated company and for the entire transport sector. The European Commission (EC hereafter) has acknowledged the need to further upgrade the transport industry by removing obstacles of administrative or regulatory nature (Islam, et al., 2016).

However, the critique of the impact of the deregulation seems not always positive. Research suggests that in the short run, privatized companies will attempt to optimize their operating efficiency and profitability (Cantos, 1999). 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 compared to pre-privatization (Lafontaine and Valeri, 2009). Moreover, extant literature shows the discrepancy in approaches towards the efficiency performance (Cantos et al., 2012). Some empirical literature uses operational efficiency performance relating to financial indexes such as cost, productivity, and profitability (e.g., (Cantos, et al., 2012); (Gulati & Kumar, 2017)); some use managerial efficiency relating to investment and revenue (e.g., (Rao, et al., 2010)).

Given the above discussion in extant literature, this research aims to further examine the impact of deregulation of the European transport market, specifically on the managerial efficiency performance of the European transport companies.

1.2 Research questions

The research questions this study sets, aim to quantify the relationship between deregulation and its effect on the privatized firms' managerial efficiency, including operating efficiency, profitability and capital expenditure as measured by certain financial metrics. This study focuses exactly on this premise, challenging whether:

- i. Deregulation in the form of privatization on the transport sector has any effect on the operating efficiency, profitability and investment decisions (capital expenditure) of a firm,
- ii. The previous premise is robust enough by analyzing the effect of the intensity of regulation in the European transport industry, as measured by OECD, on operating efficiency, profitability and investment decisions (capital expenditure) of a firm.

To test the above, we use publicly available data and refine a sample of 25 major deregulated transport companies in the 12 EU member states. This paper analyses the impact of deregulation on European transport companies. The panel of deregulated European transport companies that have experienced a significant deregulatory shock was selected for the analysis.

1.3 Intended contributions

We expect to contribute to the knowledge of transport deregulation by analyzing the impact of deregulation on the managerial efficiency. Firstly, we update the regulation literature by our empirical examination which covers the period from 1988 to 2015 across EU Member States (EU-MS hereafter). Secondly, this paper addresses an important gap in the literature by analyzing the post-privatization managerial efficiency in the European transport industry. More specifically, we compared the effects of deregulation on different aspects of the managerial efficiency of the

incumbent companies, namely, investment activity, profitability, and operating efficiency. Thirdly, we examined deregulation by using two approaches: a traditional one where deregulation is a dummy variable assessing the overall effect on incumbents' efficiency performance and a novel approach where we used OECD's deregulation index to account for the regulation intensity especially considering industry wide effects of deregulation. This two-sided approach is novel as it is expected to increase the robustness of the results.

This study is unique in a number of innovations. To the best of our knowledge, this study is the first one that systematically uses OECD's ETCR (Energy, Transport and Communication Regulation intensity) deregulation index (OECD, 2015) to improve the robustness of the results significantly and offers an alternative to measuring the deregulation impact. The study sets up a panel of transport industry entities and compares their efficiency pre and post-deregulation. Additionally, this study is distinctive because the collected data come from transport entities in developed countries only and more specifically from European Union Member States (EU MS hereafter). Previous studies are either country-specific (Martin & Parker, 1995), (Eckel, et al., 1997), etc.), or focus on transition economies / countries (Galal, et al., 1994), (Ramanurti, 1997), (Wallsten, 2001) , or include more than one industries such as financial services and communications together (Boubakri & Cosset, 1998), (Boylaud, 2000), (D'Souza & Megginson, 1999).

The remainder of the paper consists of four sections. Section two reviews the theoretical ground and develops hypotheses. Section three articulates the methods and this is followed by section four which conducts the analysis and presents the results. The final section concludes our findings, contributes to theory, discusses the implications to policymakers and discusses the limitations and potential for further research.

2. Literature Review and hypotheses

2.1 Theoretical ground

Deregulation has been introduced to many industries or sectors such as energy (Davis & Wolfram, 2011), financial services (Noulas, 2001; Gulati and Kumar, 2017) and transportation (Dempsey, 2008) after the mid-1980; examples of deregulation involve liberalization of market control such as pricing, entry and exit barriers (Lafontaine and Valeri, 2009). This minimization of control is reflected in the definition by Waterson: "[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). We specify deregulation in this research in the form of privatization, mainly through transfer of ownership (partial or entire) in an industry or in some sectors (Andersen, 1992), i.e. the transfer of ownership of assets and or of entire undertakings to a third party, who will in turn restrict societal and similar management objectives in lieu of profit-maximizing objectives.

In the microeconomic theory, it is essentially axiomatic (Bailey and Baumol, 1984) that monopoly and regulation prevent fair and competitive market environment and generate sub-optimal efficiency for the whole industry and business entities in the industry. We apply *The Theory of Economic Regulation* (Stigler, 1971) to investigate the effect of deregulation on managerial efficiency, where deregulation is a political act, and managerial efficiency is the expected economic effect of the political act. Therefore, liberalization and privatization, among other deregulatory initiatives, both help to remove inefficiencies, allowing the 'invisible hand' to work in order to improve the performance of businesses (Bailey and Baumol, 1984). The economic theory of regulation provides theoretical ground for the empirical analysis of the

evidence in the EU transportation companies. The transportation system, which is the current research context, is designed to be efficient, solid and financially stable. However, inherent complexities, limitations and network abnormalities induce inefficiencies in the system, thus regulations were previously used in order to correct among others (i) market failures including externalities (e.g., health, safety, and environmental risks), (ii) asymmetric information, (iii) market power, and (iv) long term system viability.

Most governments adopted deregulation initiatives so as to open the market to competition. The expectation is to maximize the sector's contribution to the country's gross domestic product (GDP) and to the competitiveness as well as to improve employment levels. Hence, governments have traditionally focused on achieving specific goals, such as to (i) improve firms' profitability, (ii) improve firms' operating efficiency and (iii) increase firms' capital investment spending.

At this point, it is important to define and distinct the operational and managerial efficiency. Operational efficiency is defined as the output gained per unit of input to run a business operation (Coelli, et al., 2005). Inputs vary from monetary units and people to even time or effort. Outputs typically vary from money (e.g., revenue, margin, or cash) and customer loyalty to market penetration and production. Data envelopment analysis is a linear programming method that is used to measure the operational efficiency of decision-making units from the technical viewpoint. Adapted from Bates & Sykes (1962) and Pi & Timme (1993), managerial efficiency in this study is defined as the processes, procedures, and communication that the leadership of an entity uses so as to make the entity function as per the expectations. The managerial efficiency works at a higher level than the operational efficiency and is often assessed by financial, corporate, operational and accounting measures. In other words, operational efficiency reflects

components of managerial efficiency and we consider operational as part of the managerial efficiency. Operational efficiency relates to the short-term performance of a firm. Contrary to that, managerial efficiency focuses on the long-term, strategic aspects of the firm that improve its performance. Hence, managerial efficiency is more appropriate for this study in order to assess the effects of deregulation on the firm-level performance in the EU transport market. In order to make it easier for the reader, we adopt the term 'operating efficiency' for those indicators that are part of the managerial efficiency, contrasting thus with the technical aspects of operational efficiency.

2.2 *State of the Art*

Extant literature has investigated the operational efficiency of the railway undertakings post-deregulation (e.g. (Bogetoft & Hougaard, 1999), (Cantos, et al., 1999), (Asmild, et al., 2003), (Asmild, et al., 2009)), the productivity at both an aggregate industrial level as well as at the individual level, e.g. (Cantos, et al., 1999), (Powell, 2012), (Ajayi, et al., 2010) and the technical efficiency of a specific sub-sector like the port sector (Tongzon & Heng, 2005). In the same theoretical framework, Lubulwa's General Equilibrium Model (Lubulwa, 1988) contested 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 and comparing the post-deregulation industry dynamics.

These studies use theoretical, non-parametric models and focus primarily on the technical aspects of efficiency, without adequately considering the managerial efficiency. Based on a vigorous literature review, there is a limited set of studies on the impact of deregulation on the

business side of transport companies and more specifically on the managerial decision-making process. Studies that focus on the business side include Dempsey's analysis (Dempsey, 2008) of the efficiency at the strategic level, analyzing the financial performance of the airline industry since the sectorial deregulation in the USA. Koliouisis et al. (Koliouisis, et al., 2013) analyzed the impact of the road transport deregulation on the total production of the European short sea shipping sector, concluding that regulatory reforms and the provision of financial stimuli to road freight transport companies have negative effects on short sea shipping total turnover and production. Furthermore, Cowie and Loynes, (Cowie & Loynes, 2012) examined the British railway infrastructure costs over the period 1980–2009 and showed that for example total operating costs returned to pre-privatization levels by the end of the study period (up to 2010).

Regarding the specific case of managerial efficiency, relevant literature (Megginson & Netter, 2001) focuses on estimating different financial metrics and sampling data from panels of entities operating in various sectors or industries. For example, Megginson et al. (Megginson, et al., 1994), examine the firm-level effects of privatization using a large sample of companies across different industries and different countries. Scheraga et al. (Scheraga, et al., 1994) used a pooled matched-sample for the years 1977 - 1987 to examine the strategic adaptability of motor carriers, post-deregulation vis-à-vis financial mobility and performance. Galal et al., (Galal, et al., 1994) compared the actual performance of 12 large firms (mixing airlines and regulated utilities) post-privatization in the UK, Chile, Malaysia, Mexico and showed an increase in the revenues, welfare gains and employee stability. Martin and Parker (Martin & Parker, 1995) used specific indicators like rate of return on capital employed and annual growth of value-added per employee-hour to show that in 11 privatized UK firms (1981–88) the performance was improved. Similarly, Eckel et

al. (Eckel, et al., 1997) analyzed the effect of privatizing British Airways on the competitors' stock prices and additionally documented the fares' trends on competitive routes and found that both stock prices and fares fell by at least 7%. In their analysis, La Porta and López-de Silanes (La Porta & Lopez-de-Silanes, 1999) compared the performance of privatized Mexican firms with industry matched firms regarding performance, output, and employment. Wallsten's (Wallsten, 2001) econometric analysis helps understand the effects of telecommunications' reforms in developing countries by using a panel of 30 African and Latin American countries from 1984–97. Laurin and Bozec (Laurin & Bozec, 2001) focused on two rail carriers before and after the 1995 privatization and compared accounting ratios for 17 years between 1981–97. Similarly, Dewenter and Malatesta (Dewenter & Malatesta, 2001) adopt a parametric model to examine profitability, financial leverage, and labor intensity aspects of the firms in a cross-industry, cross-country sample of companies. These aspects are measured using conventional accounting ratios, including return on sales, return on assets, and return on equity. Previous literature suggested that there are significant increases post-deregulation in non-transition economies and sectors like utilities, energy, airlines, banking ((Megginson, et al., 1994), (Boubakri & Cosset, 1998), (D'Souza & Megginson, 2000)). This study extends the research by analyzing the impact of deregulation on EU transport companies.

2.3 Hypotheses

Deregulation is expected to have a significant impact on the firm's managerial efficiency, regarding increased profitability, improved operating efficiency and growth in investment activity. Sheshinski (Sheshinski, 2003) states that the most important implication is that "publicly owned enterprises in competitive environments would not perform better than privately owned

companies in the same circumstances regarding profitability, and may perform worse.” Additionally, Sheshinski expects important efficiency gains from the change in ownership structure in competitive sectors as well as improvement in profitability. The focus of this paper is to draw insights from a specific regulatory shock that has an identifiable time trace and application so as to understand the effects of regulatory reform on firm profitability, efficiency, and investment. More precisely, we test the following hypotheses:

H1: Deregulation enhances operating efficiency of a firm. This effect is expected because regulated firms have fewer incentives for managing efficiently their operations and face a lower threat of costly reorganization than deregulated firms do in a more competitive environment (Megginson, et al., 1994), (Boubakri & Cosset, 1998) , (D’Souza & Megginson, 1999), (Sheshinski, 2003).

H2: Deregulation improves the profitability of a firm. This effect is expected because regulatory practices force firms operate inefficiently (Megginson, et al., 1994), (Boubakri & Cosset, 1998) (D’Souza & Megginson, 1999), (Sheshinski, 2003) whereas in other industries, regulation may support profitability by insulating firms from market forces and competition. Hence, this research examines this variation across different sectors of the transport industry and more precisely whether deregulation affects positively the profitability of the incumbents.

H3: Deregulation intensifies investment activity of a firm. Extant literature suggests that deregulated companies tend to expand their investment activity (Megginson, et al., 1994), (Boubakri & Cosset, 1998), (D’Souza & Megginson, 1999), (Sheshinski, 2003). The intensified investment activity may be due to any of the following reasons: (i) the deregulated firms’

enhanced access to debt and equity markets (Ovtchinnikov, 2010), (ii) the need for “catch up” investments, i.e. investments to replace obsolete or inefficient equipment which is necessary to compete in a competitive market, or (iii) the inherent entrepreneurial drive in deregulated firms for increased focus on growth opportunities and hence increased investment needs. On the other hand, it is commonly argued that regulated firms invest more due to the implicit support and borrowing power offered by the government or even some governments’ tendency to subsidize regulated firms’ output to achieve socially desirable targets.

3. Methodology

3.1 Sample

3.1.1 Sample industries

The Privatization Barometer Database (Privatization Barometer - Fondazione Eni Enrico Mattei, 2016) identifies privatization transactions that took place since 1977 in various industries. We selected the transport industry and more precisely sectors like freight transport or combined passenger/freight transport, ports, airports, companies engaging in marine cargo handling, road concessions, trucking, postal / courier services, rail, marine transportation and ferry transportation. Table I presents the transport sectors included in the sample, based on their SIC Codes. This table includes deregulatory initiatives taking place after 1985 (as per the privatization transaction referred). We selected our sample companies based on the following deregulatory initiatives: 1) entry/exit barriers, 2) price or rate regulation, 3) state owning (or majority ownership or “golden shares”) of the main incumbent, 4) obligatory separation (vertical

disintegration) between infrastructure and operations, and 5) the market being a natural monopoly or an induced natural monopoly or essential facilities.

Table I. Sample Industries selected (based on SIC Code)

Sector (SIC)	Description
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
4499	Water Transportation Services, not elsewhere classified
4581	Airports, Flying Fields, and Airport Terminal Services
4731	The 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

3.1.2 *Sample companies*

The primary data cover practically all major regulated transport companies in the EU-27 member states. At least one company from each transport sub-sector (based on SIC number identification) is participating. We selected and included firms from both “Old Europe” and from “New Europe” (i.e., EU-12 AND EU-12+15). Notably, these firms were involved in major privatization transactions in the selected sectors since the mid-1980s and we identified those through the

Privatization Barometer’s database¹. Therefore, our panel data includes privatized firms with various degrees of privatization, making it one of the most comprehensive in comparison to similar samples which focus solely on pre- or post-privatization data. Table II presents the sample firms, their country of incorporation, the sample period for which reliable financial data were available and their sector classification, following the SIC classification. The year of privatization refers to the first year in which a change in a firm’s ownership took place.

Table II. Sample Set: Privatized Transport Companies participating in the Panel

Company	Country	Sample Period	Year of Privatization	Sector (SIC)
Oesterreichische Post AG	Austria	2002-2014	2006	4215
Flughafen Wien AG	Austria	1991-2014	1992	4581
bpost SA	Belgium	2006-2014	2013	4215
Kobenhavns Lufthavne	Denmark	1992-2014	1994	4581
Finnlines OYJ	Finland	1989-2014	2006	4412
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
Aeroports de Paris	France	1988-2014	2006	4581
Societe Nationale Maritime Corse Mediterranee SA	France	2006-2011	2006	4482
Hamburger Hafen und Logistik AG	Germany	2004-2014	2007	4213
Fraport AG Frankfurt Airport Services Worldwide	Germany	1998-2014	2001	4581
Deutsche Post AG	Germany	1990-2014	2006	4215
Piraeus Port Authority	Greece	2000-2014	2003	4491

¹ The Privatization Barometer (PB; <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.

Thessaloniki Port Authority	Greece	1998-2014	2001	4491
Trieste Marine Terminal SpA	Italy	2007-2013	2010	4491
Autostrade SpA	Italy	1988-2002	1999	4785
NordCargo Srl	Italy	2006-2013	2008	4212
Rigas Transporta Flote A/S	Latvia	1995-2003	1996	4499
Latvijas kugnieciba	Latvia	1999-2014	2002	4412
PostNL NV	Netherlands	1996-2014	2004	4215
Transinsular - Transportes Maritimos Insula	Portugal	1988-2009	1990	4731
Brisa Auto-Estradas de Portugal SA	Portugal	1994-2013	1997	4785
CTT-Correios de Portugal SA	Portugal	2010-2014	2013	4215
Royal Mail	UK	2010-2015	2013	4215

Source: (Privatization Barometer - Fondazione Eni Enrico Mattei, 2016)

The companies in the dataset were privatized, the sectors were deregulated and the market was opened to anyone interested in participating². From this sample, two sectors, namely 41.11 (local and suburban transit, i.e., public urban transport) and 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 public urban transportation has been deregulated and concessions have been awarded, the markets across EU are heavily regulated in a multilayered approach 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 an Independent Regulatory Agency (IRA) or the Government, usually for more than one concessions. Additionally, the rates (rents) are usually the focus of political debates, leading to increased pressure to the operator to either reduce or retain the same prices and the local

² We acknowledge that post deregulation and post privatization, the legislative environment may produce a stricter, artificial regulation due to compliance requirements.

governments usually take advantage of such companies to accomplish their employment objectives. As for the airline industry, the inherent peculiarities of the market have created issues 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 or restrictions, with which each carrier has to abide. The significant volatility of the former and the country-specific restrictions of the latter have affected the pricing models, which in an intensely competitive environment has led many companies out of the market. After evaluating the financial data, we considered more appropriate to exclude these companies from the sample.

3.2 Variables and measures

This study examines three main aspects measuring managerial efficiency of the firms in its sample: operating efficiency, profitability and investment activity (Megginson et al., 1994). Accordingly, three key financial variables are used as empirical measures of managerial efficiency, namely, net income margin, revenues to the asset, and capital expenditure (CAPEX) to the asset. Financial and accounting data were obtained from Bloomberg. Table III describes the definitions for the main variables used in this analysis.

Table III. Definition of variable

Type of variable	Variable	Definition
Explained variable	Net Income Margin	The ratio of a company's net profits to revenues, indicating a company's core profitability and showing how much of each currency unit earned by the company is translated into profits.
	Revenues to Assets	The ratio of revenue to total assets, indicating how efficient management is at using its assets to generate earnings in the form of revenues.

	CAPEX to Assets	The ratio of capital expenditure to the company assets, showing the firm's investment activity, and illustrating initiatives undertaken by the company to maintain or expand its scope and operations.
Explanatory variable	Deregulation index	A dummy variable, indicating whether the firm was privatized: Yes=1; No=0.
Control variable	GDP growth	National GDP growth percentage
	Country	The country as a dummy variable
	Sector	The sector as a dummy variable
	Time	Time as a dummy variable

Data regarding the OECD indicators of regulation in Energy, Transport & Communications (ETCR) were obtained through OECD (Table IV). OECD (OECD, 2015) has developed a database that monitors the regulation in the energy, transport and communications markets from the mid-1970s until 2013. This is the first systematic approach, which measures a predefined set of economic regulations. Concerning the structure of the OECD Index, this is composed (OECD, 2015) of sector-specific components. This study focuses on four relevant components, i.e. Railways, Road Freight, Airline Industry, and Post. More precisely, the railways sector component includes assessing the following indicators: (a) Entry (legal barriers to entry in passenger and freight businesses), (b) Vertical integration (the degree of separation between competitive and non-competitive activities), (c) the Public ownership (i.e. the share of government-owned stakes in major companies), and (d) the Market structure (in terms of market share of dominant operator). The Road Freight sector component includes the following indicators, (a) Entry and (b) Prices (the extent of price regulation). The Airline Industry component includes (a) Entry (entry in domestic and in international routes) and (b) Public ownership (i.e. the share of a government to a -major- airline). For the Postal sector component, the indicators assessed

include (a) Entry (the extent of entry regulation in the basic letter, basic parcel, and courier services) and (b) Public ownership (ownership from the government in companies dealing with a basic letter, basic parcel, and courier services).

Concerning the EU, data are available for all EU-27 countries for the period 1975 - 2013 and the values range from 0 (indicating minimum restrictions, i.e., free market) to 6 (indicating a highly regulated market). In this analysis, the average score of the indicators (entry, public ownership, market structure prices, and vertical integration indices) for all transport sectors for each year and each country was used as a proxy for the level of deregulation in each country. This approach was driven by the lack of individual observations for specific sub-sectors (e.g., for ports, for airports, for rail operators, etc), however is effectively illustrates the key statistics and reveals the different state of regulation for each country.

Finally, data regarding the growth rate of real historical GDP (Gross Domestic Product) for all countries involved in this study, were obtained through the World Bank and the IMF databases (World Bank World Development Indicators and IMF's International Financial Statistics). GDP growth has been used as a control variable based on a number of studies (Han & Fang, 2000), (Ishutkina & Hansman, 2008) (Gao, et al., 2016) (Beyzatlar, et al., 2014) that show the relationship between GDP growth and the transport industry activity.

3.3 Model Formulation

To account for exogenous factors affecting the key financial metrics and hence to better understand the causality and the effect of deregulation on a firm's strategic decisions, a Fixed Effects Model (FEM) has been developed, using the panel data across years, countries and firms, testing the three hypotheses, described in detail below. According to the FEM theory, the

intercept in the regression model is allowed to differ among individuals to reflect the unique feature of individual units, which is captured by dummy variables (Gujarati, 2006), (Greene, 2018). FEM is an appropriate method in those situations when the number of cross-sectional units is large, which is the case of this research. In comparison with Panel regression models, FEM is a commonly used method to deal with problems such as autocorrelation and cross-correlation associated with cross-sectional units at the same point in time.

The model for this research is adapted from Megginson et al. (1994), which has been applied in similar empirical studies. For instance, D'Souza and Megginson (D'Souza & Megginson, 1999) used this model to examine the financial and operating performance of privatized firms during the 1990s. Results indicate 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.

Function1 (F1) is developed to test H1, the effect of deregulation on the managerial efficiency of privatized EU transport firms, as measured by the metric Revenues to Assets. The model specification is given as the following function (F1):

$$\begin{aligned}
 \text{Revenue to Assets}_{it} = & a_0 + a_1 * \text{Deregulation Index}_{it} + a_2 * \text{GDP Growth}_{it} + \\
 & \sum_n \mu_{in} \text{Country}_n + \sum_j \lambda_{ij} \text{Sector}_j + \sum_t \nu_t \text{Year}_t + \varepsilon_{it}
 \end{aligned}
 \tag{F1}$$

Where Revenue to Assets_{it} is the Revenue to Assets metric of firm *i* in year *t*. Deregulation Index_{it} is a dummy variable, which equals 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 ε_{it} is the error term. Hence, 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 attributes that may confound comparison pre- and post-deregulation.

Similarly, Function 2 (F2) tests H2, the effect of deregulation on the profitability of privatized European transport firms as measured by the financial metric Net Income Margin:

$$\begin{aligned} \text{Net Income Margin}_{it} = & a_0 + a_1 * \text{Deregulation Index}_{it} + a_2 * \text{GDP Growth}_{it} + \\ & \sum_n \mu_{in} \text{Country}_n + \sum_t \nu_t \text{Year}_t + \varepsilon_{it} \end{aligned} \quad (\text{F2})$$

Where Net Income Margin_{it} is the ratio of Net Income to Revenues of firm *i* in year *t* (all other variables are the same as with F1).

Function 3 (F3) tests H3, the effect of deregulation on the privatized EU transport firms' investment activity, which is measured by the financial metric CAPEX to Assets:

$$\begin{aligned} \text{CAPEX to Assets}_{it} = & a_0 + a_1 * \text{Deregulation Index}_{it} + a_2 * \text{GDP Growth}_{it} + \\ & \sum_n \mu_{in} \text{Country}_n + \sum_j \lambda_{ij} \text{Sector}_j + \sum_t \nu_t \text{Year}_t + \varepsilon_{it} \end{aligned} \quad (\text{F3})$$

Where CAPEX to Assets_{it} is the ratio of capital expenditure to assets of firm *i* in year *t* (all other variables are the same as with F1).

4. Results and Analysis

4.1 Descriptive statistics

Table IV presents the summary statistics for the key financial metrics, including the number of useable observations, the mean value as well as the standard deviation of each metric. Financial data were obtained from Bloomberg, and relevant calculations were conducted by the authors.

Table IV. Descriptive statistics of the financial variables

Financial Metric	N	Min	Mean	Max	Std. Deviation
Net Income / Revenues (%)	375	-128,14	9.55	53,16	14.06
Revenues / Assets	375	0,10	0.60	2,33	0.48
CAPEX / Assets	213	0,00	0.06	0,29	0.05
Return on Assets (%)	375	-21,13	4.04	42,16	5.07

Table V presents the summary statistics of the OECD indicators of regulation for each country included in the analysis, including the number of useable observations, the mean as well as the standard deviation for each country. Data to build the research specific index were obtained from the OECD database, and the authors conducted relevant calculations.

Table V. Descriptive statistics of OECD indicators of regulation

Country	N	Min	Mean	Max	Std. Deviation
Austria	39	1,46	3.6	4,01	1.4
Belgium	39	1,95	3.8	2,03	1.3
Denmark	39	1,43	3.5	3,71	1.5
Finland	39	2,72	4.0	4,55	1.1
France	39	2,72	4.5	5,56	1.2
Germany	39	1,36	3.8	3,26	1.9
Greece	39	2,65	4.9	4,82	1.0
Italy	39	2,58	4.8	5,85	1.3

Latvia	39	2,28	2,28	2,28	?
Netherlands	39	1,55	3.6	3,05	1.6
Portugal	39	3,03	4.6	5,21	1.2
United Kingdom	39	1,02	2.6	1,31	1.2

Source: Calculations by the author based on the OECD database (OECD, 2015).

4.2 Regression results

Error! Not a valid bookmark self-reference. presents the regression results and describes the relationship between the key financial attributes of a privatized firm as approximated by the relevant financial metrics, deregulation and the remaining explanatory variables as described above. We have used the SPSS 24 software to analyse and report these data. The results illustrated in this table are the unstandardized coefficients and standard errors respectively.

Table VI. Regression Results

Explanatory Variables	Dependent Variable		
	Revenues to Assets (1)	Net Income Margin (2)	CAPEX to Assets (3)
Deregulation Index	0.186*** (0.051)	5.773*** (1.787)	0.007 (0.010)
GDP Growth	0.006 (0.009)	0.530 (0.332)	0.008*** (0.002)
(Constant)	0.815*** (0.127)	6.004 (3.719)	0.010 (0.017)
Year Dummies	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes
Sector Dummies	Yes	No	Yes
Adjusted R ²	58.0%	25.6%	35.9%
Observations	375	375	213
F – Statistic	13,28*** (.000)	4,289*** (.000)	3,957*** (.000)

* Figures represent unstandardized B, figures in brackets represent coefficient standard errors. *, **, *** is the significance level.

This table presents the results of regressions on efficiency, profitability and investment activity respectively and the estimation is done via Ordinary Least Squares. The dependent variable is Revenues to Assets (1), Net Income Margin (2) and CAPEX to Assets (3). The independent variables consist of a dummy variable, which is equal to 1 if firm *i* was privatized in a given year (0 otherwise), GDP Growth corresponds to the real GDP Growth for a given country/year, dummy variables distinguishing individual countries, years and sector types. The symbols ***, ** and * refer to estimates significantly different from zero at 1%, 5%, and 10% respectively. Standard errors are shown in parentheses. The fewer observations used in the CAPEX to Assets ratio was the result of more restricted available public data related with CAPEX for each firm. In certain models year, country and sector dummies offered additional explanatory power to the model. Thus, they were added to the models. It has to be mentioned that the F-Statistic rejects the null hypothesis in all scenarios.

Operating Efficiency

The positive and statistically significant (at 1% significance level) Deregulation Index beta coefficient suggests that deregulation affects the privatized firms' operating efficiency positively, confirming Hypothesis 1. The estimated effect on Revenue to Assets amounts to 19% on average.

Profitability

We find the Deregulation Index to be significantly associated with the Net Income Margin ratio at 1% significance level, suggesting that deregulation affects the privatized firms' profitability positively. In particular, deregulation leads to a 5.7% mean increase in Net Income Margin. These

results re-confirm Hypothesis 2 that deregulation affects the efficiency of the post-privatization company positively in transforming earnings to profits.

Investment Activity Growth

The values reported in Table VI indicates that there is no statistically significant difference in investment activity pre- and post-deregulation. Therefore, we can't determine whether *deregulation is positively associated with increased capital expenditure (CAPEX) in privatized European transport firms*, based on these empirical results.

4.3 Robustness of the results

4.3.1 Alternative Model Formulation

The key approach selected to test the robustness of the statistical results related to the privatized firms' key financial ratios is by way of developing and using an independent measure of deregulation effects developed by OECD. The measure, an independent variable, replaces the time-dependent Deregulation Index. This measures a predefined set of economic regulations and considers the key regulatory and legal restrictions in the transport industry, such as entry barriers, public ownership, market structure, price regulation as well as vertical/horizontal integration (separation) assessment, hence smoothing any deregulation timing effects. This construct measures the industry wide effects of deregulation, as the metrics come from different sectors of the transport industry. The following three FEM functions, i.e., F4, F5, and F6 test the effect of the regulation intensity on the corresponding managerial efficiency, profitability and investment activity of privatized EU transport firms:

Operating Efficiency:

$$\text{Revenues to Assets}_{it} = a_0 + a_1 * \text{OECD Regulation Index}_{it} + a_2 * \text{GDP Growth}_{it} + \sum_n \mu_{in} \text{Country}_n + \sum_j \lambda_{ij} \text{Sector}_j + \sum_t \nu_t \text{Year}_t + \varepsilon_{it} \quad (\text{F4})$$

Profitability:

$$\text{Net Income Margin}_{it} = a_0 + a_1 * \text{OECD Regulation Index}_{it} + a_2 * \text{GDP Growth}_{it} + \sum_n \mu_{in} \text{Country}_n + \sum_j \varepsilon_{it} \quad (\text{F5})$$

Investment Activity Growth:

$$\text{CAPEX to Assets}_{it} = a_0 + a_1 * \text{OECD Regulation Index}_{it} + a_2 * \text{GDP Growth}_{it} + \sum_n \mu_{in} \text{Country}_n + \sum_j \lambda_{ij} \text{Sector}_j + \sum_t \nu_t \text{Year}_t + \varepsilon_{it} \quad (\text{F6})$$

Where OECD Regulation Index_{it} is a variable that ranges from 0 (fully deregulated) to 6 (fully regulated), and the other variables are the same with those in F1, F2, and F3 respectively.

4.3.2 Alternative Model Results

Table VII demonstrates the regression results and describes the relationship between the managerial efficiency, profitability and investment activity 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.

Table VII. OECD Index Hypothesis – Revenues to Assets Regression Results

Explanatory Variables	Dependent Variable		
	Revenues to Assets (OECD)	Net Income Margin (OECD)	CAPEX to Assets (OECD)
OECD Regulation Index	-0.208*** (0.071)	-1.462** (0.728)	-0.007 (0.020)
GDP Growth	0.036***	0.493**	0.010***

	(0.012)	(0.221)	(0.003)
(Constant)	0.701***	15.866***	0.050
	(0.203)	(2.528)	(0.056)
Year Dummies	Yes	No	Yes
Country Dummies	Yes	Yes	Yes
Sector Dummies	Yes	No	Yes
Adjusted R ²	57.9%	26.5%	42.7%
Observations	334	334	186
F-Statistic	12,185***	10,259***	4,542***
	(0.000)	(0.000)	(0.000)

This table presents the results of regressions on efficiency, profitability and investment activity and the estimation is done via Ordinary Least Squares. The dependent variable is Revenues to Assets, Net Income Margin and CAPEX to Assets. The independent variables consist of the OECD Regulation Index, a variable which ranges from 0 to 6 depending on the level of regulation at a given country/time, GDP Growth corresponds to the real GDP Growth for a given country/year, dummy variables distinguishing individual countries, years and sector types. The symbols ***, ** and * refer to estimates significantly different from zero at 1%, 5%, and 10% respectively. Coefficients' standard errors are shown in parentheses. The fewer observations used for the metrics *Revenues to Assets* and *Net Income Margin* resulted from the (un)availability of the OECD Deregulation Index data; data for this index are available only for years up to 2013 and for specific countries. The fewer observations used in the metric *CAPEX to Assets* was the

result of more restricted available public data related with *CAPEX* for each firm. In certain models, year, country and sector dummies offered additional explanatory power to the model; thus they were added to the models. The F-Statistic rejects the null hypothesis in all scenarios.

Concerning the Revenues to Assets metric, 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, reiterating the conclusion reached concerning Hypothesis 1. Similarly, the evidence in Table VII. 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 leads to improved privatized firms' profitability, supporting our conclusion about Hypothesis 2. Regarding the investment activity, 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, in line with our earlier conclusions.

5. Discussion

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 and 2) with regards to operating efficiency and profitability were all confirmed by the empirical results. The effect on the investment activity of the companies post regulation has found no support by the evidence.

As per suggestions in literature review, e.g., (Boubakri & Cosset, 1998), (Megginson, et al., 1994), (Sheshinski, 2003), (Megginson & Netter, 2001), (D'Souza & Megginson, 1999), transport companies post-privatization seem to use resources more effectively compared to pre-privatization in the EU transport industry since privatized companies have more incentives to increase profitability in order to cope with both market forces and investor requirements. Based on this analysis, deregulation within the same industry has a positive effect on the operating efficiency and the profitability indices of the privatized firm as per the expectations. The extent of the effect deregulation exercises on the operating efficiency and the profitability varies. This could be due to pre-privatization inefficiencies that the new ownership was called to handle, for instance, labor policies and employment schemes, new strategies and the time it takes to devise and implement them, inertia, or high costs for efficiently utilizing legacy equipment.

Nevertheless, it is well noted that even in the presence of these issues, deregulation affected the profitability of the companies and the operating efficiency positively. This confirms the theory that a private owner puts effort to optimize the usage of the inputs whereas the state-owned companies have different strategic objectives. Regarding Hypothesis 3, it should be noted that the results contradict the experience from other industries, 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, 4th and 5th Generation Mobile Networks, Fiber-to-the-home, etc. This finding may be attributed to the inherent characteristics of the transport industry itself. Notably, the competition in the transport sector is much more intense since post-deregulation and post-privatization new participants enter and offer services directly competing the incumbents. In relevant industries (telecoms, energy/gas), competition,

although intense, is geographically limited which is not the case for the transport sector, where for example two ports in two different countries compete directly for the same hinterland.

Furthermore, the transport “product” is considered as a commodity with little innovation needed by the “consumers” and with little or no difference at all. Similarly, the technological advances in the transport sector are limited at the moment. For example the main mega trends include the containerships’ enlargement / mega ships, the potential to widespread use of new fuels and the introduction of advanced ICT technologies. In any case, the scale of the capital investment is very large for the capabilities of the transport companies and the 2007-2008 fiscal crisis has affected many investment plans. The financial community has since become stricter and more selective in participating in large scale transport projects. Thus the intensification of transport industry-wide competition doesn’t push companies to increase their investment but the companies instead adopt more risk-averse strategies.

The transport sector was the last one to be deregulated and as such newer data will significantly improve our understanding of long-term decision making. For comparison reasons, the telecom industry started being deregulated in the early 1990s and the energy industry started around mid-1990s. Contrary to that, the transport industry started being deregulated in EU in the early 2000s.

In summary, these results suggest that privatized firms tend to focus more on short-term decision making as a means to improve their operating efficiency and their profitability, that is, to optimize the resource consumption. The results confirm the expectations (ECMT, 1989) that market agents seem to adapt rather quickly their decisions to market deregulation and “[...]”

market [...] reacts with only a short time lag". On the other hand, long-term decision making, regarding indicatively new investments, upgrading of infrastructure, purchase of new equipment is put aside 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 decrease of profits and operating efficiency. On the other hand, the Regulators, ought to make provisions to closely monitor not only the short-term viability of the transport industry incumbents but most importantly both the long term viability as well as the growth potential and the innovation adoption.

6. Conclusions and recommendations

6.1 Theoretical contributions

This research contributes to the literature in a number of ways. First of all, we update the economic theory of regulation in examining the impact of deregulation on the managerial performance of EU transport companies. This paper captures important insight on the corporate level regarding business strategies employed through understanding the impact that deregulation had on the transport industry. Our results empirically confirm the expectations that the deregulation process, in the short term pushes privatized transport companies to optimize their operating efficiency and profitability. However in the longer term, these companies appear to be risk averse and do not increase their capital expenditure by not investing more compared to pre-privatization. Secondly, we introduce a comparison of the effects of deregulation on different components of the managerial efficiency, namely, investment, profitability, and operating efficiency of the incumbents in the EU transport industry. Thirdly, we examined

deregulation by using two approaches: a traditional one where deregulation is a dummy variable assessing the overall effect on incumbents' efficiency performance; a novel approach where OECD's deregulation index is used to measure the regulation intensity. This two-sided approach increases the robustness of the results.

6.2 Devising the Strategic Adaptation Matrix

Based on the previous discussion, it is safe to propose the following matrix (), which encapsulates the decision making at the corporate level after privatization of the companies participating in the panel. This matrix is based on the statistical inferences from the previous analysis both for short as well as for the long term. On the horizontal axis, the decision horizon differentiates between short term and long-term decision-making. 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 vehicle-trips or the number of shifts in a transport company affects the revenues and the profitability on an annual basis. Buying new equipment (e.g., railcars) affect the company in the long run.

Similarly, on the vertical axis, the impact is distinguished in sectoral and an industry-wide impact. For example, the privatization of the railways' dominant carrier affects the same sector. However, this also affects the industry level as the road, and the inland waterways sectors are also affected. The models addressing the main hypotheses discussed previously (F1-F3) cover the intra-sectoral deregulation, whereas the alternative models (F4-F6, referring to the robustness test) cover the inter-sectoral deregulation since these are using cross-sectoral regulatory impact.

Deregulation industry level	Industry	Improve operating efficiency Improve profitability	Understand innovation dynamics Adjust to cross-modal competition Continue previous investment strategy
	Sector	Improve operating efficiency Improve profitability	Check sector dynamic Adjust to the new competitive environment Continue previous investment strategy
		Short	Long
Decision horizon			

Figure 1. Post Deregulation/Privatization Strategic Adaptation Matrix for the Panel Companies

In summary and based on the previous analysis, this 2x2 matrix in Figure 1 offers a distinct view of the different decisions the participating companies post-privatization took based on the decision horizon. More precisely, the following observations are drawn:

- i. Deregulation on the sector level. In the short run, the company optimizes both operating efficiency and profitability; in the long-run, the company investigates sector dynamics to understand its competitive position and attempts to adjust to the new competitive landscape that is created from the deregulation. Capital expenditure tends to remain the same, indicating that the investment plan doesn't change.
- ii. Deregulation on the industry level, based on the OECD – ETCR indicator (impact at the cross-sectoral level). Similarly to the above, on the short run, the privatized company tries to improve operating efficiency and gain as much revenue as possible as well as to improve profitability to defend its market share and market position compared to the industry-wide cross-modal competition. On the long run, the deregulated transport

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

6.3 Policy Implications

Based on the analysis, certain policy implications have to be successfully addressed by policy makers in order to improve the transport industry structure as a whole post-deregulation. We raise some key suggestions to policymakers. First, deregulation 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. Second, the transport sector/transport industry is inherently risky due to the large economies of scale and scope and as such incentives should be provided but also carefully monitored for cross-industry spillovers. Third, the deregulatory initiatives should ensure non-discrimination for all market players and equal access to infrastructure, including essential and critical infrastructure. Fourth, regulators should provide a robust framework that can cope with external ("unexpected") shocks. Finally, information availability should be ensured, with strict requirements to publicize key data, especially in essential infrastructure or in monopolistic bottlenecks.

6.4 Further Research

We acknowledge the limitations of this research regarding 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 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 to identify both the actual deregulatory effects and also the implications from/to other transport modes as well as understand what the optimal regulatory restrictions should be. Conclusively, transport industry deregulation, as a very complex subject, has important implications to all economic sectors, and as such, a deeper understanding of the impact of the deregulatory initiatives on the transport industry and their spillovers to other industries is required.

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Conflict of Interest

The corresponding author states that there is no conflict of interest.

Author's contribution

- i. Dr. Ioannis Koliouisis: Literature Search and Review, Manuscript Writing, Model Formulation and Analysis, Editing, Results' Discussion. Proof reading.
- ii. Dr Dongmei Cao: Contribution to the literature review, improvement of the positioning of the paper, structure, statistics and reporting of results; drafting of the final version of the paper.
- iii. Mr. Panagiotis Koliouisis: Model calibration and robustness analysis, drafting of the final version of the paper.

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