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IMPERFECT COMPETITION IN A NETWORK INDUSTRY: THE CASE OF THE EUROPEAN RAIL FREIGHT MARKET

Florent Laroche, Christa Sys, Thierry Vanelslander, Eddy Van de Voorde. Imperfect competition in a network industry: The case of the European rail freight market. *Transport Policy*, Elsevier, 2017, 58, pp.53 - 61.

Abstract

The European rail freight market has been liberalised since 2007, yet knowledge about this new market and its dynamics are limited in the academic literature. This paper¹ takes a time-varying approach to measure competition in the European rail freight sector and thus answer two questions: what is the current level of competition and how is this expected to evolve in the long term? Two indicators are used. First, a firm-level dynamic panel estimates the persistence of profit in the European rail freight sector, revealing a high degree of competition in the short term but imperfections in the long term due to barriers in the market. Secondly, the ratio between capital and labour cost is calculated and discussed. The findings indicate moderate economies of scale. The research is relevant for policy makers wishing to monitor the rail freight market and also contribute to an improved understanding of the European single market.

Keywords: barriers, competition, persistence of profit, rail freight, single market

1 – Introduction

The European Commission has supported free competition on the European rail market since 1991 (1991/440/EEC). The goals are twofold: to increase efficiency and to develop a single market in accordance with the common transport policy defined by the Treaty of Rome (1958). More than 20 years later, however, it is only the rail freight market that is open to free competition: in 2007 (2004/51/EC), rail freight shifted from national-level markets with monopolies and cooperation to a European-level market with free players and competition. In this paper, the main objective is to assess the coherence between the European goal of the single market and the rail freight market by answering two questions:

- What is the current level of competition?
- How is competition expected to evolve in the long term?

Knowledge about this topic is limited at the European level. This applies to the academic literature, where most analyses are based on comparisons of incumbents' efficiency (De Borger, 1992; Cantos & Maudos, 2001; Friebel *et al.*, 2010), on national approaches (Vierth, 2011; Laisi *et al.*, 2012; Woodburn, 2014) or on aggregate approaches for the European market (Crozet *et al.*, 2014; Gevaers *et al.*, 2015). It also applies to the European Commission, whose market monitoring addresses only the industry level and uses aggregate data. In general, the analysis of competition and its dynamics on the European rail freight market is incomplete because of a lack of data and the belief that railway transportation is characterised by high barriers between national markets and high sunk costs, leading to reduced chances of successful competition (Nash & Preston, 1992; Brewer, 1996; Vierth, 2011; Crozet *et al.*, 2014; Woodburn, 2014). Analyses are often limited to the identification of barriers and the comparison of market share between incumbents and newcomers. No deep analyses have been made of firm behaviour or market structure, though other sectors do this routinely using industrial economics (Mueller, 1977; Tirole, 1988, Lipczynski *et al.*, 2013).

This study proposes a new approach to competition analysis through firm behaviour on the rail freight market. We analyse competition at firm level using an indicator developed by industrial economics: persistence of profit (POP). Data was collected on a selection of firms across Europe, covering the time period between 2007 and 2014. POP was able to provide us with a dynamic picture of each firm's behaviour by measuring its average profit and the persistence of profit from one year to the next.

The organisation of this paper is as follows. Section 2 begins by painting a general picture of the freight market in Europe and demonstrating the current lack of knowledge about competition on this market. Section 3 then presents the methodology we used to assess the degree of competition in the short and long term based on the POP principle.

¹ This research was supported by the Belgian Federal Science Policy Office (BELSPO).

In Section 4, the database is described. Section 5 provides an overview of the results. Finally, Section 6 discusses the results and suggests that the only objective reasons for a low degree of competition on the European market are the imperfections of the single market (barriers to entry/exit) and a lack of market regulation, which leads to a high degree of concentration. Section 7 concludes by emphasising the need for European regulation to manage competition and ensure an efficient market.

2 – Context: liberalisation in 2007 and impacts on the European rail freight market in 2014

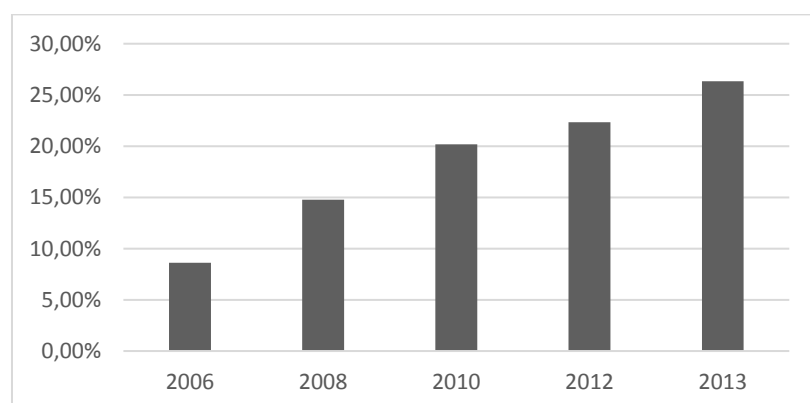
European rail freight liberalisation changed the paradigms of the market from national markets and monopolies into a single European market with competition. The goal was to find a solution to the decline of the railway freight market in Europe and to its lack of competitiveness compared to road freight (91/440/EEC). In this section, we provide a short overview of the rail freight market and the related literature in order to clarify doubts about the effect of liberalisation since 2007 and the need to perform deeper analyses.

2.1 – A long path to change in the rail freight market

The European policy for the liberalisation of the rail freight market came a long way between 1991 (91/440/EEC) and 2007 (2004/51/EC). The initial disentanglement of infrastructure (network manager) from transport services (operator) was intended as the first step towards a more efficient market through competition. Besides certain pioneers, such as the UK (1994), Germany (1994) and Sweden (1996), the majority of European countries opened their national markets between 2004 and 2007, following the European deadline. The main reasons for this delay were strong national preferences on the part of the Member States themselves and strong opposition from trade unions to competition and open access markets².

As of 2016, the European rail freight market can be defined *a priori* as an integrated market with open access to tracks and non-discrimination between newcomers and incumbents. Figure 1 shows that the market share of newcomers has increased since 2006 from 9% to 26% (Eurostat, 2016).

Figure 1: Market share of newcomers in EU-28 between 2006 and 2013.



Source: Eurostat, 2016

This evolution of newcomers' market share can be interpreted as a success for European policy. The Western European rail market consists of around 170 active operators and has a turnover of €15 billion (Laroche *et al.*, 2016).

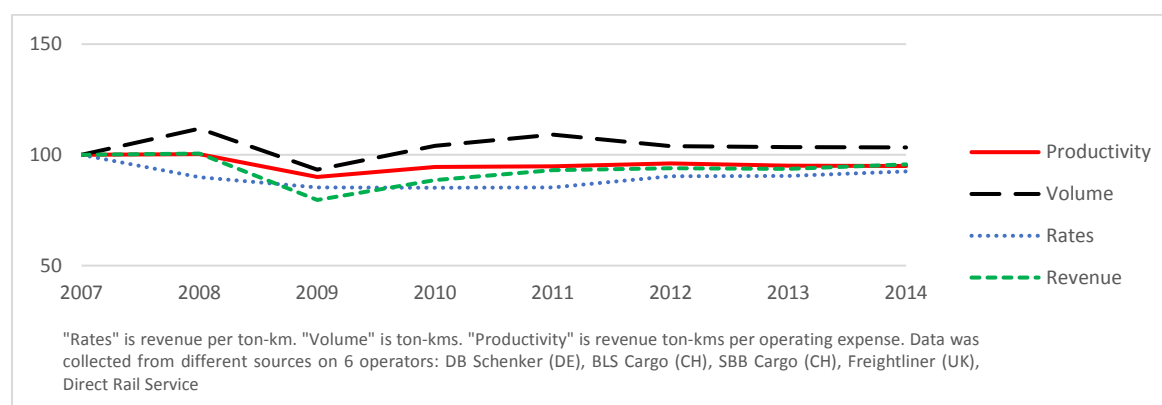
Nevertheless, some authors have shown that the European rail freight market still lags behind other modes, such as road or air, in terms of competitiveness (Guihery & Laroche, 2013; Bonnafous & Crozet, 2014; Gevaers *et al.*, 2015). The same authors also question the impact that liberalisation and competition have had on market efficiency (Friebel *et al.*, 2010).

² Passengers are still in limbo in some of the pioneering countries which opened their markets to competition (UK, Germany, Sweden and Italy for high-speed trains) and other countries which have maintained the monopoly system (France, Spain, Belgium). The Fourth Railway Package, currently being discussed by the EC and the Member States, is to propose 2019 as a deadline for passenger competition.

2.2 – A non-evident impact of liberalisation on the rail freight market

The impact of the Staggers Act (1980) on the US rail freight market is commonly used to illustrate the beneficial effect of a deregulation policy. Faced with a lack of productivity on the US rail freight market, the Federal Government decided in 1980 to deregulate the market by ending price regulation on transport services, which had been fixed by the Interstate Commerce Commission (ICC) since 1887 (Ivaldi & McCullough, 2007). Since then, the market has undergone major changes: productivity tripled and volume doubled, while rates were cut in half (see Figure 2). Hence, the modal share of rail freight increased from 25% in 1990 to 31% in 2012 (Eurostat, 2015). This success certainly inspired the European Commission to develop a common railway policy. Twenty years after the change of policy in Europe, however, the results – as shown in Figure 2 – are rather different.

Figure 2: Performance of rail freight operators in EU-28 from 2007 to 2014 (2007 = 100)



Source: Own composition

The results for some of the biggest rail freight operators in Europe show no significant changes since 2007 in terms of productivity, volume, revenue or rates. While the period of analysis for Europe is short, because of a lack of long-term data, this finding raises questions about the true impact of the European policy on the rail freight market despite the newcomers' success.

2.3 – Reviewing the market analysis literature on the rail freight sector

A review of the academic literature reveals a large volume on the rail freight market in general but only a small range of analyses in terms of competition. Firstly, most studies focus mainly on classic efficiency analyses of main operators (De Borger, 1992; Cantos & Maudos, 2001; Hilmola, 2007; Friebe *et al.*, 2010). However, only incumbents (no newcomers) are considered, which provides a narrow, retrospective view of the market.

Secondly, while some studies give a broader overview of the market (Beck *et al.*, 2013; Crozet *et al.*, 2014; Gevaers *et al.*, 2015; ECA, 2016; IGR-Rail, 2016), this is mainly to compare the performance of the rail freight industry to other modes of transport. Nevertheless, the level of analysis remains too aggregated to produce insights into the degree of competition.

Finally, several deeper market analyses have been performed, but the market scope was reduced either to a national market (Vierth, 2011; Deville & Verduyn, 2012; Van de Voorde & Vanelander, 2014; Woodburn, 2014) or to a very limited number of operators (Gasparic *et al.*, 2009).

This overview highlights a mismatch between the new market conditions for rail freight (European market and open access) and the tools and scopes that are typically used to analyse it (descriptive approach, aggregated data or panel of incumbents only). Most often, competition is analysed using growth in ton-kms, rail freight market share compared to other modes or the market share of newcomers. In order to conduct a proper assessment of the degree of competition on the European rail freight market, deeper market analyses are required.

This paper complements existing analyses by taking a dynamic approach to competition based on firm behaviour (incumbents and newcomers) and instruments from industrial economics. This is especially useful in responding to two questions in the literature. The first of these concerns the optimal number of players³ (Crozet *et al.*, 2014; Gevaers *et al.*, 2015; Laroche *et al.*, 2016). The response depends on the structure of firms (economies of scale)

³ Crozet *et al.* (2014, p. 37) ask: "Can we expect a market structure with a vast number of operators, as is the case for road haulage? This seems unlikely. Should we then consider as very likely the presence of two or three dominant players, as in air transport?"

and the evolution of the market structure (barriers). The second question, linked to the first, concerns the appropriate level of regulation on the market according to the degree of competition. In both cases, the application of new instruments to the rail freight market may provide useful insights into the potential risks of high concentration and low competition. These risks are usually considered to be high in the rail industry (Crozet *et al.*, 2014).

3 – Persistence of profit (POP) analysis: measure of competition

This section paints a dynamic picture of competition on the market through the persistence of profit (POP) indicator. POP is commonly used in industrial economics to measure the degree of competition and number of barriers on the market over time (Mueller, 1977, 1986, 1990; Lipczynski *et al.*, 2013; Sys, 2010, 2013). Moreover, it can be calculated with simple data in comparison to other indicators like the Panzar-Rosse model or the Boone indicator, the data needs of which are often unachievable for the rail freight market.

The POP method was developed to provide a dynamic approach to firm behaviour on a given market (Cable & Mueller, 2008). The indicator measures the firm's standardised profit rate ($\pi_{i,t}^s$) according to firm's profit rate ($\pi_{i,t}$) minus the average industry profit rate ($\bar{\pi}_t$). The standardisation (average profit rate of all firms) excludes macroeconomic effects in so far as all firms are affected by the same economic environment.

$$\pi_{i,t}^s = \pi_{i,t} - \bar{\pi}_t \quad (1)$$

On this basis, a first-order autoregressive model is formulated and commonly used for each firm as follows:

$$\pi_{i,t}^s = \alpha_i + \lambda_i \pi_{i,t-1}^s + \varepsilon_{i,t} \quad (2)$$

The main purpose of this indicator is to test the correlation between the profit rate of one year and the profit rate of the previous year in the short term (λ_i) and the long term ($\pi_{i,t-1}^s$). In the short term, a POP rate in which $\lambda_i > 0$ is a sign of barriers or dominant position drivers of abnormal profit (above the norm). When $\lambda_i = 0$, however, profit does not persist (quick erosion), which is a sign of high competition and low barriers in so far as all firms compete on one and the same homogeneous market.

In the long term, a positive (negative) α_i may indicate a competitive (non-competitive) position for certain firms when their profit rate is above (below) the norm. However, it may also indicate a niche market with less competition and high barriers, or a dominant player's strategy to maintain market share (Sys, 2010). The interpretation of $\pi_{i,t-1}^s$ is clearer in the long term because of the degree of convergence between the firm's profit rates. When $\pi_{i,t-1}^s = 0$, firms are limited in their attempts to attain abnormal profits because of high competition and low barriers. Consequently, convergence between different firms' profit rates is observed. Conversely, when $\pi_{i,t-1}^s \neq 0$, there is lower or no convergence. This is a sign of heterogeneity in a market with high barriers and a niche market in which abnormal profits persist. The above observations are summarised in Table 1.

Table 1: Interpretation of persistence of profit

Short-term persistence		Degree of competition	Barriers to entry
λ_i			
$\lambda_i = 0$	Year-on-year variation in $\pi_{i,t}^s$ is random	High	No
	No association between $\pi_{i,t-1}^s$ and $\pi_{i,t}^s$		
$0 < \lambda_i < 1$	If $\pi_{i,t-1}^s$ is above (below) zero, it is likely that $\pi_{i,t}^s$ will also be above (below)	Low	Yes
	Positive association between $\pi_{i,t-1}^s$ and $\pi_{i,t}^s$		
Long-term persistence			
α_i			
Positive	Firm's profit rate above the average for all firms		
Negative	Firm's profit rate below the average for all firms		
$\pi_{i,t-1}^s$			
$\pi_{i,t-1}^s = 0$	Convergence between all firms' profit rates in the long term	High	No/Limited
$\pi_{i,t-1}^s \neq 0$	No convergence and different profit rates in the long term	Low	Yes

Source: Sys, 2010 based on Mueller, 1977

In summary, the conditions for perfect competition are achieved when $\lambda_i = 0$, $\alpha_i = 0$ and $\pi_{i,t-1}^s = 0$ (Lipczynski *et al*, 2013).

4 – Data collection: a new database

In this section, we propose a new type of database and source for studying the rail freight market. Usually, the rail freight market is analysed using volume data (ton-km or train-km) and simple financial data (turnover). However, POP assessments require more specific data on the financial characteristics of the firms in question. In what follows, we highlight the limits of traditional databases when it comes to the financial approach before describing the newly proposed database. Finally, we present the panel of companies selected.

4.1 – Limits of traditional databases

Two databases are typically used for analysing the rail market in Europe: Eurostat and UIC. Both are becoming increasingly limited for in-depth analysis of competition.

First of all, these databases mainly contain information on traffic and rolling stocks. There is little information about financials (turnover, EBITDA, etc.) or managerial aspects (number of employees, labour cost, etc.). This applies to Eurostat, which only stores traffic information, but also to UIC, which contains very little data on the period since the European liberalisation.

Second, disaggregated data (per company) is sparse. Eurostat contains only aggregated data by country, while UIC only stores data on national incumbents. Hence, newcomers are entirely absent from these databases.

Consequently, it is assumed that these specific railway databases are no longer sufficient to describe the new market. A new database is suggested in the next section.

4.2 – A financial database for incumbents and newcomers

The database selected for this study is not typically used for rail freight market analysis. Amadeus is a European database containing comprehensive information on around 21 million companies across Europe. It has multiple

advantages, including the high number of financial indicators for companies, disaggregated data per company and data on both incumbents and newcomers.

Nevertheless, the database does have some drawbacks when it comes to the rail freight market, drawbacks which limited the panel of firms we were able to use in our case study. Firstly, the data is produced per company. As a result, integrated rail freight companies (infrastructure, freight/passengers services) cannot be taken into account because of data aggregated between two or more different activities. Thus, the panel only includes operators whose primary activity according to the database is rail freight transport. Secondly, the transfer of data from firm to database is not automatic. In many cases, time series are incomplete. Finally, the database is not specific to a sector. It is necessary to identify active operators on the European rail freight market in advance, so as to obtain data on those firms.

4.3 – The panel selected

The panel was composed of 24 of the 169 active rail freight operators on the Western-European market (*see* Table 2). These operators represent 56% of the market in terms of turnover, they are composed of incumbents and newcomers (created after the liberalization of their national market) and the majority are part of larger groups. They were selected based on two criteria: the availability of time series and the guarantee that data are covering their rail freight activities and not more.

Table 2: Characteristics of the selected panel

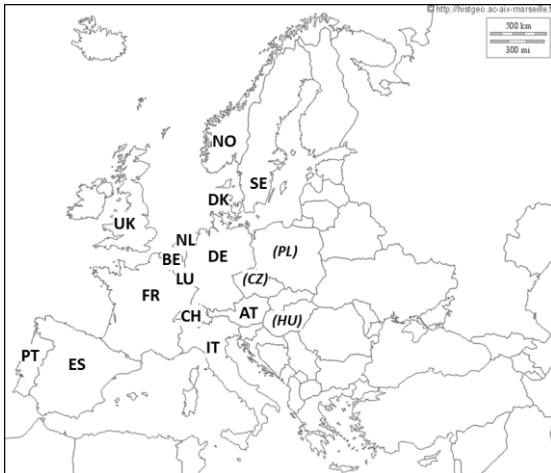
Company	Turnover, € (2014)	Nationality	Creation	Status
DB Schenker rail	3,638,000,000	DE	1994	Incumbent
Rail Cargo	1,078,378,000	AU	1923	Incumbent
PKP Cargo	999,767,000	PL	1918	Incumbent
SBB Cargo	821,240,009	CH	1902	Incumbent
Hupac	459,558,814	CH	1967	Incumbent
Green Cargo	444,266,000	SE	1856	Incumbent
Freightliner	222,137,000	UK	1995	Incumbent
BLS Cargo	138,978,758	CH	1941	Incumbent
VPS	115,651,000	DE	1971	Incumbent
LKAB	112,571,000	SE	1903	Incumbent
Europorte	81,857,495	FR	2005	New comer
Direct Rail Service	78,284,000	UK	1995	Incumbent
Crossrail	78,170,402	CH	2000	New comer
Lokomotion	73,005,000	DE	2000	New comer
Hector Rail	69,943,600	SE	2004	New comer
Rail Traction	48,217,332	IT	2001	New comer
Mendip Rail	37,567,000	UK	1993	Incumbent
Comsa	33,718,000	ES	2007	New comer
Continental rail	28,048,901	ES	2007	New comer
Magyar	18,957,000	HU	2003	New comer
Inrail	18,327,329	IT	2009	New comer
Floyd	15,080,000	HU	2004	New comer
RDT 13	7,538,170	FR	1920	Incumbent
Acciona	890,000	ES	2007	New comer

Source: Own composition

Data was collected on turnover (in euros) and EBITDA to calculate the profit rate in the period between 2006 and 2014.

Figure 3 maps the market scope of the study. Countries shown without brackets on the map were included in the market analysis for reasons of market homogeneity. However, as a number of major active operators are based in other countries (especially Poland, the Czech Republic and Hungary), the reference market was extended to include these countries (shown between brackets).

Figure 3: Market scope of the study



Source: Own composition

Thus, there are two levels of scope: the reference level in terms of volume (broad scope) and the study level for active operators (narrow scope). This distinction is also important for defining a limit to the market without excluding major operators and for balancing their weight by including their national markets.

5 – Results: does profit persist?

Table 3 ranks in descending order the results of the POP analysis according to the short-term persistence (λ_i). The results for the industry (average of all firms) reveal a good level of competition in the short term but persistence of barriers in the long term.

Table 3: Results of POP analysis by firm between 2006 and 2014⁴

Company	λ_i	α_i	$\pi_{i,t-1}^s$
Continental rail	0.918	-0.012	-0.150
Floyd	0.843	-0.025	-0.162
Magyar	0.582	0.020	0.047
PKP Cargo	0.489	0.013	0.025
Comsa	0.431	0.045	0.079
Hector Rail	0.385	0.063	0.103
Inrail	0.340	-0.083	-0.126
Rail Cargo	0.300	-0.057	-0.081
Geneese&Wyoming	0.227	0.019	0.025
BLS Cargo	0.194	0.002	0.002
Verkehrsbetriebe Peine - Salzgitter	0.188	0.006	0.007
Europorte	0.183	-0.143	-0.175
DB Schenker	0.148	-0.007	-0.008
Hupac	0.139	0.033	0.038
Rail Traction	0.126	-0.026	-0.030
Direct Rail	0.119	0.044	0.050
Mendip Rail	0.013	-0.048	-0.049
Green Cargo	-0.027	-0.012	-0.012
RDT13	-0.078	-0.054	-0.050
Lokomotion	-0.101	-0.021	-0.019
Crossrail	-0.108	-0.044	-0.040
LKAB	-0.182	0.295	0.250
SBB Cargo	-0.285	-0.039	-0.030
Acciona	-0.582	0.041	0.026
Average	0.178	0.000	-0.012

Source: Own composition

⁴ Computed on Eviews9.

Results in the short term (λ_i)

In the short term, the persistence of profit from one year to the next is lower ($\lambda_i = 0.177$) than for other industries, which are often between 0.4 and 0.5 according to Lipczynski *et al.*, 2013. This indicates erosion of high profits from one year to another and the entry of newcomers (Goddard & Wilson, 1996), in line with Figure 1. Moreover, the result is close to that for the container liner shipping industry. Sys (2010) obtained a λ_i value of 0.19775 and concluded that this POP was “relatively low” in comparison to other industries.

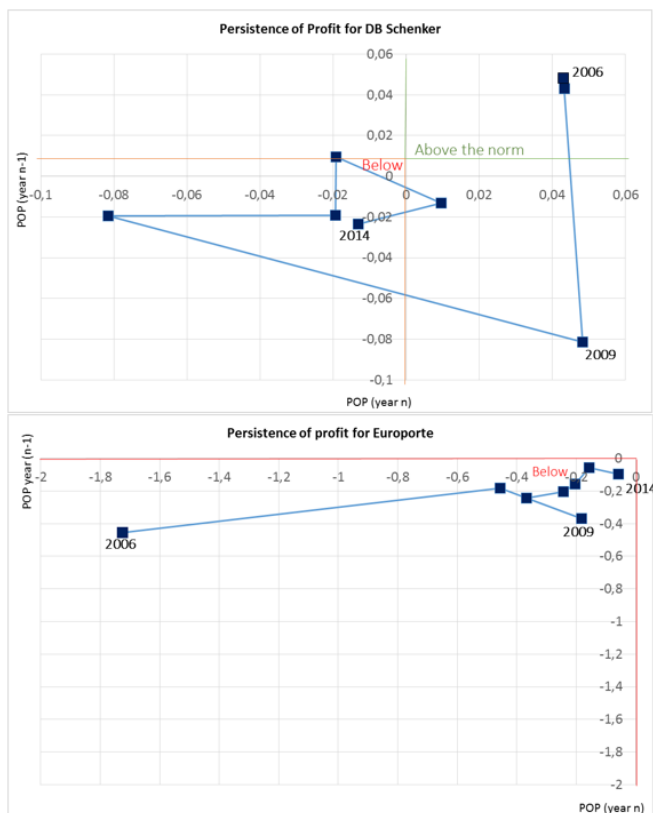
At firm level, the results are convincingly heterogeneous with a positive POP for 72% of the operators, varying between 0.91 (Continental rail) and -0.58 (Acciona). However, the biggest operators on the European market – namely DB Schenker (0.14), Rail Cargo (0.29) and PKP Cargo (0.48) – have low to moderate persistence. Low persistence of profit among large operators can be interpreted as a strategy for maintaining a dominant position (Sys, 2010), while high persistence of profit among newcomers (e.g. Hector Rail, Continental Rail) may be a sign of niche strategy. What is more, some of the largest incumbent operators still operate a network of wagonload services, although it is road competition that has the largest impact on these services. New entrants only operate full trainloads in particular commodities. In general, the low POP in the short term shows that there are new entries and competition on the market, even though many operators are positioned in a niche market.

Results in the long term (α_i)

In the long term, the results are less optimistic and we see a negative persistence of profit ($\alpha_i < 0$) for 54% of the operators and a low convergence of standardised profit rates among all firms ($\pi_{i,t-1}^s = -0.011$).

A negative persistence of profit can be interpreted as an aggressive strategy caused by high levels of competition or as a lack of efficiency compared to the other firms. Firms may attempt to keep their profit rates just below the norm in order to challenge other companies. The biggest operator, DB Schenker, can be ranked in this category. Figure 4, which depicts the POP of DB Schenker compared to the standardised POP (average of all firms), demonstrates the firm’s change of strategy between 2006 and 2009, with its acquisition of Railion.

Figure 4: Persistence of profit for DB Schenker and Europorte between 2006 and 2014



Source: Own composition

The vertical axis of Figure 4 refers to the percentage of difference between the average profit for all firms during the year and the company; while the horizontal axis corresponds with the difference from the previous year. From figure 4, it is clear both companies employ different strategies. The incumbent, DB Schenker, shifted from a positive POP (first quadrant) to a negative POP and remained just below the norm (third quadrant). Its POP was 5% higher than the rest of the industry in 2006 and lower than 2% in 2014. Sys (2010) found that the main operators on the containership market used a similar strategy to maintain their market shares in the face of competition. Europorte, on the other hand, is a newcomer. Europorte entered the market between France and the UK in 2005 through the Channel Tunnel. Its POP was negative between 2006 and 2014 because of an aggressive strategy to increase its market share, resulting in high losses to enter the market. Europorte bought part of Veolia Cargo in 2009 and GB Railfreight in 2010 in order to achieve a critical mass. Negotiations are currently in progress between Europorte and Hector Rail (Swedish group) to sell the latter GB Railfreight.

In sum, this section demonstrates the existence of competition on the European rail freight market. Nevertheless, some aspects require further analysis, such as:

- The heterogeneity of companies' strategies for maintaining high profit in the short term ($\lambda_i > 0$).
- The trend towards a movement of consolidation on the market because of the negative persistence of profit in the long term ($\alpha_i < 0$).
- Imperfect long-term convergence among companies as a sign of remaining barriers ($\pi_{i,t-1}^s \neq 0$).

6 – Discussion: strategies of competition and consolidation

In what follows, we discuss the results of both competition and consolidation strategies in three sub-sections. Sub-section 6.1 analyses firms' paths using a synthesis of results from the POP and C/L ratio analyses. Sub-section 6.2 describes the movement of consolidation on the market. Sub-section 6.3 discusses the risks associated with a high degree of market concentration.

6.1 – Heterogeneous paths in POP and strategies: differentiation

A combined analysis allows us to consider firms' paths over time. The results are summarised in Table 4. We included 24 operators, in line with the panel used for the POP analysis, and classified them according to their POP path. For example, an operator whose persistence of profit was below the norm in 2006 and above the norm in 2014 was classified in the quadrant “persistence of profit BELOW the norm towards ABOVE”.

Furthermore, the operators were characterised by a number of key factors, such as date of creation, which allowed us to separate the incumbents from newcomers; type of activity, to determine their market; acquisition strategy; average C/L ratio (between 2007 and 2014); and finally, ton-kms, where possible, to gain an idea of the size of the company.

Table 4: Synthesis of POP evolution compared to the norm and the average C/L ratio for each firm between 2006 and 2014

Persistence of profit ABOVE the norm towards BELOW						Persistence of profit ABOVE the norm					
Name	Country	Creation	Activity	Acquisition	Ton-kms (2014)	Name	Country	Creation	Activity	Acquisition	Ton-kms (2014)
Green Cargo	SE	1856	Diverse	PostNord	11 000 000 000	LKAB	SE	1903	Iron	-	-
DB Schenker	DE	1994	Diverse	Multiple	109 000 000 000	BLS Cargo	CH	1941	Diverse	-	3 492 000 000
Floyd	HU	2004	Diverse	-	-	Hupac	CH	1967	Combined	-	-
						Direct rail Service	UK	1995	Nuclear	-	1 341 000 000
						Freightliner	UK	1995	Diverse	ERS Railway	11 000 000 000
						Magyar	HU	2003	Diverse	-	500 000 000
						Hector Rail	SE	2004	Diverse	-	-
						Continental	ES	2007	Diverse	-	-
Persistence of profit BELOW the norm						Persistence of profit BELOW the norm towards ABOVE					
Name	Country	Creation	Activity	Acquisition	Ton-kms (2014)	Name	Country	Creation	Activity	Acquisition	Ton-kms (2014)
RDT 13	FR	1920	Diverse	-	-	SBB Cargo	CH	1902	Diverse	-	12 317 000 000
Rail Cargo	AU	1923	Diverse	Multiple	29 000 000 000	PKP Cargo	PL	1918	Diverse	-	28 520 000 000
Mendip Rail	UK	1993	Granulate	-	-	VPS	DE	1971	Diverse	-	1 030 000 000
Crossrail	BE	2000	Combined	DLC	-	Comsa	ES	2007	Diverse	-	1 023 000 000
Lokomotio	DE	2000	Diverse	-	-						
Rail Traction	IT	2001	Combined	-	-						
Europorte	FR	2005	Diverse	Multiple	5 241 000 000						
Acciona Rail	ES	2007	Heavy	-	-						
Inrail	IT	2009	Diverse	-	-						

Source: own composition

The results allow us to make three general comments. First, analysing the distribution of companies by date of creation shows that newcomers are often below the norm and incumbents often above the norm. There are some exceptions, such as Continental and Hector Rail among the newcomers or DB Schenker and Rail Cargo among the incumbents. This finding can be related to the fact that several of the operators are subsidiaries of national, state-owned companies and, as such, might benefit from hidden cross-subsidy or sharing of overheads. Secondly, most companies which made an acquisition after 2006 have a POP below the norm, except for Freightliner, which bought ERS Railway in 2013. Finally, no differences were found based on type of activity (diverse/specialised) and insufficient data was available to identify any differences on the basis of company size.

From these observations, we identified the following paths for operators:

- A POP below the norm and low/moderate economies of scale are signs of a competitive market in which products are standardised and the market is open. For incumbents, like Rail Cargo and DB Schenker, a POP below the norm may indicate price moderation and acquisitions intended to increase their market power. For newcomers, however, this situation reflects the difficulties of establishing their business model on the rail freight market (Crossrail, Inrail). Competition is intense, both with incumbents and with other modes of transport, and compels them to identify means of reducing the cost of their asset basis towards leasing, external maintenance or standardisation of their rolling stock (low-cost model).
- At the opposite end of the scale, operators with a POP above the norm are mostly positioned in niche markets, according to their moderate/high economies of scale. This is obvious for incumbents like BLS Cargo, LKAB and Hupac, as well as for newcomers like Hector Rail and Continental. They are active in markets with specific localisations (BLS Cargo), specific products (Hupac, Hector Rail, Continental) or both (LKAB).

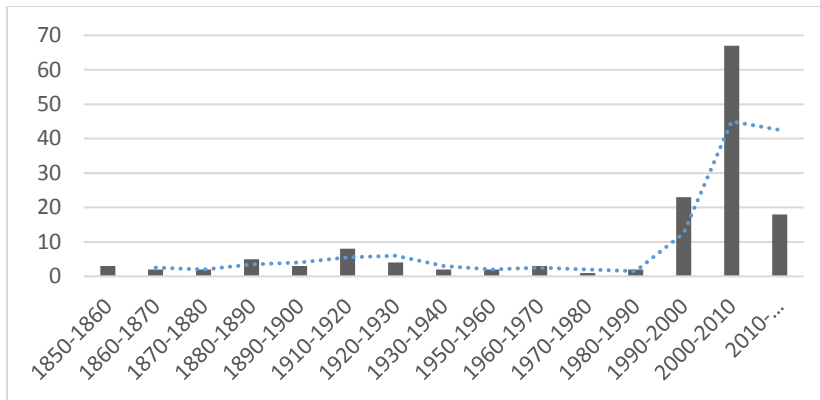
To summarise, the results show that competition is active on the rail freight market, despite the non-evidence of effects of liberalisation at aggregate level described in Section 2.2. Operators develop strategies for differentiation (product/localisation) or low-cost models to increase their advantage or their market power. Nevertheless, when faced with the opening of the European market and the entry of newcomers, firms inevitably need to address the question of market consolidation.

6.2 – Competition and consolidation on the European market

The results of the POP analysis show that more than 50% of the firms in our panel have a negative POP in the long term (lower than the average of all firms). This can be interpreted as a sign of future market concentration through a consolidation movement.

It is possible to anticipate this movement to some extent, because more than 50% of the active operators on the Western European market started to operate after 1990. Figure 5 shows the period of creation for operators active on the Western European market in 2014. Obviously, operators from the last decade are over-represented because only entries on the market and successful operation until 2014 are taken into account. However, Figure 5 distinguishes among three periods. It starts with a first period (1850-1940) of active competition in Europe and a process of concentration around certain national operators, which eventually became the national monopolies and are now the incumbents. A second period begins after World War II and can be considered the Golden Age of monopolies in Europe: from 1950 to 1990. The third period sees the renewal of rail freight competition under the influence of the European Commission and certain countries such as Sweden, the UK and Germany from 1990 to 2014. The pinnacle of creation seems to have been reached in the decade 2000-2010 following European liberalisation and the economic crisis. The rhythm of creation has been decreasing since 2010, with an average of 4.5 newcomers per year compared to 6.7 between 2000 and 2010.

Figure 5: Period of creation of operators active on the Western European rail freight market in 2014



Source: own composition

Viewed in this way, the majority of rail freight operators are new and a movement of consolidation on the market seems inevitable. In fact, we might say that it has already begun, given the series of acquisitions made since 2000 by incumbents or newcomers and an alliance formed among small operators. We will focus on three examples. The first of these is the acquisition strategy used by DB Schenker, which bought the Dutch incumbent (NS Cargo) in 2000, the Danish incumbent (DSB Gods) in 2001 and the British leader (EWS Railway) in 2007. DB Schenker has also become a shareholder of several companies, such as Transfesa (2007) and BLS Cargo (2008). In 2014, the group held a 30% share of the Western European market and had a significant, dominant position (Laroche *et al.*, 2016). The second example is Europorte, which began to operate through the Channel Tunnel (France) in 2005. It bought the French newcomer Veolia Cargo France in 2009 and the British newcomer GB Railfreight in 2010. By 2014, Europorte had climbed from zero to 11th position in terms of turnover, surpassing both RENFE Mercancias and CFL Cargo. The final example is Holding Exploris, an alliance between eleven firms. Six of these firms are rail freight operators, three are trading companies, one is a recruitment company and another one is a maintenance company. This alliance, founded in 2014, could become an alternative model for small operators to compete with the big players. Thus, market consolidation is already a fact and raises important questions about the level of concentration.

6.3 – Does a high degree of concentration pose a risk?

Economy of scale is an interesting indicator for gaining insight into barriers and sunk costs related to market entry. An industry with high economies of scale may foster a concentrated market (high cost to enter), while low economies of scale may promote low market concentration.

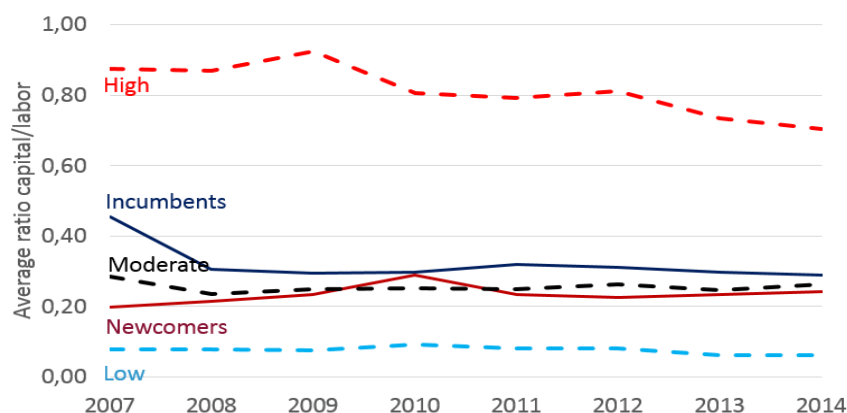
This indicator can be assessed using the capital-labour ratio employed by Meersman *et al.* (2011) in the ground handling industry. Derived from industrial economics, the capital-labour ratio has the advantage of being a good substitute for calculating the curve of the long-term average costs when data is limited; it also provides some clues about sunk costs or barriers on the market.

$$R = \frac{C}{L}$$

The capital cost (C) is related to the amortisation cost of the material and infrastructures used for production, while the labour cost (L) is related to the cost of full-time employees. The relationship between these two costs can be interpreted as follows. There are economies of scale when $R > 0$ and no economies of scale when $R = 0$. Meersman *et al.* (2011) have shown that an industry with high capital intensity has larger economies of scale than an industry with low intensity. Hence, capital intensity can be associated with the sunk costs necessary to enter and operate on the market (cost of material, advertising, research and development, etc.). These costs may differ from one market to another depending on the type of goods and services provided. In the case of the rail freight industry, the main costs are usually related to rolling stock and interoperability (especially for locomotives) or authorisation to start a new service (e.g. licences and safety certificates) (Laisi *et al.*, 2012). These costs can be decreased by renting or leasing.

Figure 6 shows that the rail freight industry, as represented by the test panel⁵, is similar to an industry with moderate economies of scale (between 0.2 and 0.4). Incumbents have higher economies of scale than newcomers due to their larger size and the composition of their assets.

Figure 6: Average ratio of capital cost to labour cost for the rail freight industry



Source: own composition

From a market point of view, most incumbents own their rolling stock and supply the maintenance, while newcomers lease their stock and outsource the maintenance to reduce fixed costs and increase their flexibility. Nevertheless, an inflexion in the curve for incumbents in 2007 suggests that they, too, are moving towards a rationalisation of their productive model for more flexibility.

First of all, they have updated their productive organisation by reducing the wagonload service, which is highly impacted by road competition. Second, the market for leasing rolling stock has evolved significantly during the last decade in Europe, with increases in fleet caused by transfers from incumbents to new companies specialised in the management of wagons and locomotive fleets (Vierth, 2011; Woodburn, 2014). In 2000, Rail Cargo created a leasing company to manage its fleet of wagons and locomotives (Rail Cargo Wagon). Maintenance is also provided, and in 2015, more than 30,000 wagons were managed by the company. The same step was taken by SNCF-Geodis, which became the sole shareholder of the leasing company Ermewa (45,000 wagons and 320 locomotives) in 2010, and by DB Schenker with its renting service. Furthermore, the industry is also involved in new markets for renting and maintenance, such as Siemens's new service centre for locomotives in Munich, opened in 2015, and Alstom's maintenance contracts. Thus, the market has moved from an internalised, opaque system of management towards the outsourced, contractual management of assets for more flexibility and, consequently, better opportunities for newcomers entering the market.

From a network point of view, the persistence of moderate economies of scale can be explained by the major barriers that remain. One of the biggest barriers to international traffic is the lack of interoperability between networks (Vierth, 2011; Guihéry & Laroche, 2013; Crozet *et al.*, 2014; Troch *et al.*, 2016). Despite the European Commission's various railway packages, which have offered common frameworks for allocating capacity and managing infrastructure, the rules and practices in place on each market – where network managers are considered natural monopolies – remain diverse. As a result, different languages, signalling systems and electric voltages are used on the same corridors. The persistence of these barriers can be explained by the huge investments necessary to integrate the European network from an economic, political and social point of view in comparison to other network industries (air, road, energy etc.). Consequently, a lot of extra-costs are remaining for railway operators in terms of rolling stock and maintenance (complex locomotives), in addition to the poor reliability of travel times caused by the high number of different actors managing traffic and slots.

To conclude on the C/L ratio, the results exclude *a priori* all possibility of attaining a high concentration on the market in coherence with the POP analysis. The economies of scale are moderate and appear to be stable over the time period. As a result, they provide no reason to assume that a duopoly or a monopoly could emerge on the European market unless barriers (and sunk costs) increase. Such a monopoly may well result from the fragmented nature of the single network (failure of European governance) or from abuse by an operator in a dominant position, hence the necessity of European regulation of both network and market.

⁵ The panel data was limited to 34 active operators on the European rail freight market (cf. Appendix 1). The panel represents €7.9 billion in terms of turnover, which is 53% of the total industry turnover (€15 billion).

7 – Conclusion and policy recommendations

This analysis of competition on the European rail freight market reveals active competition between firms. The methodology and results provide greater insights than more traditional analyses, largely due to the application of new indicators for the rail freight market such as persistence of profit and the ratio of capital cost to labour cost.

Those indicators show positive signs of increasing competition and attractiveness on the market in spite of the non-evident impact of liberalisation at aggregate level. Operators are developing strategies of differentiation and new business models based on new services such as leasing, outsourced maintenance or drivers, and so on. These are important means of reducing sunk costs and increasing the attractiveness of the market. Thus, the strong increase in the number of newcomers after European liberalisation shows that there is a market for rail freight in which it is possible to do business despite intra-modal competition, road competition and the imperfect European single market.

Nevertheless, a number of major obstacles remain. First of all, the ratio of capital cost to labour cost confirms the existence of barriers in the market which increase the costs for newcomers entering the market. Secondly, the persistence of profit analysis reveals imperfect competition on the market caused by imperfections in the single market itself (barriers and segmented market).

To conclude, the results show that, in spite of efforts from the European Commission and the European Railway Agency (ERA) to harmonise rules and support technical interoperability, barriers and fragmentation remain on the single network. The consequences are over-costs for operators and barriers to entry to other national networks. Two recommendations can be formulated for policy makers. Secondly, the setting-up of an European Transport Agency for regulation might improve the market monitoring from an economic point of view on a similar model to other sectors the telecommunication (Body of European Regulators for Electronic Communications, BEREC) or energy (Agency for the Cooperation of Energy Regulators, ACER). The European Commission should transfer the competencies for economic regulation and market monitoring. It has already transferred its competencies for technical harmonisation to the European Railway Agency. A similar transfer of economic competencies to the ERA or other agency would have a beneficial impact on knowledge and active rail market monitoring.

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Appendix 1: Panel of active operators for C/L ratio

List of incumbents	Country	Year	List of newcomers	Country	Year
BLS Cargo	CH	1941	Compagnia Ferroviari	IT	2009
CFL Cargo	LU	1946	Comsa	ES	2008
CP Carga	PT	1951	Continental Rail	ES	2007
DB Schenker	DE	1994	Crossrail	CH/BE	2000
Green Cargo	SE	1856	Direct Rail Service	UK	1995
Hupac	CH	1967	Europorte	FR	2005
Rail Cargo	AU	1923	Floyd	HU	2004
RBH Logistics	DE	1913	Hector Rail	SE	2004
RDT 13	FR	1920	Inrail	IT	2009
SBB Cargo	CH	1902	ISC	IT	2009
Verkehrsbetriebe Peine - Salzgitter	DE	1971	Logitren	ES	2008
Wanne-Herner Eisenbahn und Hafen	DE	1910	Lokomotion	DE	2000
Freightliner (Geneese & Wyoming)	UK	1995	Magyar Magánvasút	HU	2003
			Mendip Rail	UK	1993
			Pressnitzalbahn	DE	2000
			Rail Traction Company	IT	2001
			Railtraxx	BE	2009
			Rushrail	SE	2010
			Takargo	PT	2006
			Traccion Rail	ES	2008
			Wiener Lokalbahnen Cargo	AU	2007

Source: own composition