Incentives to freight railway undertakings compensating for infrastructural gaps: Methodology and practical application to Italy

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**A B S T R A C T**

The paper illustrates an incentive scheme to freight railway undertakings, proportional to the infrastructural gaps they experience on the rail network with respect to optimal performances in terms of loading gauge, length and weight. The proposed incentive is equitable and provided on an origin-destination pair basis, as opposed to the watering-can principle underlying current incentives schemes. In practice, it can be simply dispensed as a discount of the access charge the railway undertakings should pay to the rail network infrastructure manager. It also differs by type of train, to account for their different infrastructural needs, and can be adjusted on a yearly basis to account for ongoing network improvements. The main methodological challenge lies in the quantification of the infrastructural gap, defined as the difference of the unit transport costs in the current and in the optimal scenario, as a consequence of the non-additivity of concerned costs. For this aim, a specific procedure is illustrated and applied to the railway intermodal transport in Italy, to show the feasibility of the approach and highlight the differences with respect to the current incentive schemes.

1. Motivation and background

The European Union (EU) has set a target objective of modal shift from road freight transport towards other more sustainable transport modes of 30\% by 2030 and of at least 50\% by 2050, for shipments over 300 km (EU, 2011). In this respect, rail freight transport is largely acknowledged as potentially cost-effective and environmentally sustainable, thanks to its capability of enabling economies of scale and reducing pollutant emissions and other externalities, as recognized also by the EU White Paper Roadmap to a single European Transport Area - towards a competitive and resource efficient transport system (EU, 2011), and further explored by Islam et al. (2016). Thus, the EU has released many policies and regulations – key pillars being the so-called four railway packages, see for instance Zunder et al. (2013) and DeHousse and Marsicola (2015) – in the attempt to make railways more competitive, safer, interoperable and with non-discriminatory access.

Within this context, EU aims at targeting common standards for the performance of the EU freight railway network, that should allow trains with a total weight of 2000 ton, a weight per axle of 22.5 tons/m, a maximum length of 750 m and no loading gauge limitations for intermodal transport units (Islam and Mortimer, 2017). Consistently, approximately 28 Billion Euros have been spent between 2007 and 2013 in railway infrastructure projects (European Court of Auditors, 2016), mainly through the cohesion policy (the European Regional Development Fund and the Cohesion Fund) and the Trans-European Network for Transport (TEN-T) program, eventually replaced by the Connecting Europe Facility (CEF) from 2014 onwards.

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Notwithstanding, rail freight transport has been keeping losing market share for years, with a decrease at EU level from 19.7% in 2000 to 17.8% in 2013 in terms of tons-km including only inland modes (road, rail, inland waterways), against an increase of the total volume of inland freight transport in the same period (European Court of Auditors, 2016). As illustrated in detail by Islam et al. (2016), such average value at EU level results from the superposition of substantially different market trends between EU15 countries (i.e. those joining the EU before 1995) and new EU partners. In this respect, a recent analysis by Steer Davies Gleave (2015) explores the diversity of rail freight markets in EU countries. Main factors explaining this mediocre performance include: persistent infrastructural gaps, also determined by the often-long duration of the works needed to upgrade rail infrastructures to the EU standards; delays and compromises in applying EU railway packages; conditions of unfair competition with respect to concurrent modes; failure/delays in full liberalization of EU railway markets; difficulties in providing door-to-door instead of terminal-to-terminal railway services; not full exploitation of vertical integration with 3PLs and logistics operators (Islam, 2014a; Islam, 2014b; Allan et al., 2016). Moreover, many EU member States did not take appropriate countermeasures to revitalize the so-called single wagonload traffic, leading to a particularly significant decrease of the rail freight market share for small shipments, i.e. the freight market segment mostly subject to the competition by road mode (Guglielminetti et al., 2015).

In this respect, there is consensus on the importance of providing appropriate incentives to railway undertakings, as an effective key policy to foster rail freight transport in the short term and to sustain the often-long upgrading transition towards the EU target infrastructure performance, see amongst others Woodburn (2004) and Reis (2014) and, from a more general logistics perspective, Islam and Zunder (2014). A recent EU-wide analysis, prepared by Steer Davies Gleave (2015) for the EU DG Transport and Mobility, evidences that in 2012 about 30% of total railway costs (including also passenger trains) was covered by subsidies, in a broad sense, corresponding to 35.014 M€. The importance and the role of incentives to rail freight transport is acknowledged also by EU, whose communication 2008/C 184/07 Community guidelines on State aid for railway undertakings provides the necessary regulatory framework for the Member States to implement incentive schemes compliant with the principles of fair market competition (IBM, 2011; Crozet et al., 2012; Zunder et al., 2013; Crozet, 2013; Laroche et al., 2017). Within this framework, many EU countries provide incentives to railway undertakings and, more generally, to the rail freight market, as discussed among others by Matthews et al. (2009) and Finger and MesLEM (2015). Benchmarks and success stories in rail freight incentives are represented, amongst others, by the UK experience, described in a recent report by ORR (2016a,b) and by the Department for Transport (DFT, 2017a,b), and by the Swiss incentive experience described by Finger and Holtemann (2013), who also illustrate a benchmarking analysis with Germany, The Netherlands, Austria and Belgium. Some EU-funded research projects also dealt with this topic, see for instance Troch et al. (2015) for a description of the Brain Trains project and its related literature.

In general, a direct comparison amongst incentive schemes across different countries is difficult, also for the underlying heterogeneity in the corresponding financial structure of railway markets. Interesting insights between the railway system performance and the magnitude of public costs and subsidies in various European countries are illustrated by the Boston Consulting Group (2015), who evidenced that there is a clear correlation between the ranking of railway systems in Europe and the corresponding amount of public costs sustaining them. The study by the Boston Consulting Group (2015) identifies three main types of subsidies/incentives to railway systems: the first occurs when the subsidies are entirely allocated to railway undertakings, the second when there is a sharing of subsidies between railway undertakings and network infrastructure managers, the third when the subsidy is entirely allocated to the network infrastructure manager. A key outcome is a clear tendency between the degree of involvement of the network infrastructure managers and the overall quality of the railway system, specifically countries with best performing railway systems tend to allocate more than 65% of overall subsidies to the network infrastructure manager.

Along this track, the Italian Government, in the attempt to invert the continuing crisis of the national railway freight transport market, has launched in December 2015 an ambitious recovery plan to match EU modal shift objectives, consistent with the national transport policy and planning strategies illustrated in the strategic document Connecting Italy: Strategies for the transport and logistics infrastructures (Italian Ministry for Infrastructures and Transport, 2016). In accordance with the above, the recovery plan identified two types of incentives aimed at stimulating the railway freight market in the short term: the former in favour of Multimodal Transport Operators (MTOs) and shippers to promote the choice of rail freight transport, the latter targeted to railway undertakings in the form of a discount of the access charge paid to the rail network infrastructure manager.

Even if the effects of these incentives are generally noticeable and positive (see Section 2 for details on the Italian case study), there is still room for further improvement of their effectiveness and equity, especially for the discount of the access charge granted to railway undertakings. Indeed, the current incentive to railway undertakings is provided based on a watering-can principle, that is railway undertakings receive the same amount of incentive irrespective of the actual performance of the network (i.e. of the infrastructural gap with respect to EU standard) they face. On the contrary, the performance of the national freight rail network is very heterogeneous amongst origin-destination (o-d) pairs, being in fact this condition very common in EU freight railways (e.g. National Rail, 2015). This prevents achieving equitable market conditions for all railway undertakings: in fact, to the authors’ knowledge, there are no incentive schemes based on a proportionality with respect to the performance of the freight network on an o-d basis.

Drawing upon these premises, the research presented in the paper proposes an o-d based incentive to railway undertakings directly proportional to the infrastructural gap of each o-d pair with respect to the EU standards. Concerned methodological and theoretical issues are also illustrated, and the viability of the proposed approach is demonstrated with an application to the Italian national freight rail market. The paper is structured as follows: Section 2 provides a background overview of Italian freight rail market, Section 3 illustrates the proposed methodology, Section 4 presents an application to the Italian rail freight market, and finally Section 5 draws conclusions and research prospects.

2. Rail freight transport in Italy: market and incentive policies

Based on official national and EU statistics, rail freight market share in Italy in 2015 was 6.2%, corresponding to 92 million tons/
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