# Cost Structure, Efficiency and Productivity in Hellenic Railways

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**Abstract.** In this paper we analyze the cost structure of Hellenic Railways (OSE) over the period 2000-2006 using plant-level data. Our estimates provide marginal costs, which are essential for rational pricing policies in view of Article 7 in the Commission Directive 2001/14/EC. We find cost efficiency close to 64 percent in rail circulation and 84 percent in maintenance. Technical progress has been substantial in maintenance of rail track but almost zero in rail circulation. Policy measures and recommendations are provided based on our empirical results.

**JEL Classification**: F13, H54, L62
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## 1. Introduction

Empirical research and cost estimation in railways has been an active issue of research for many years. Existing research has focused on estimation of scale economies, efficiency, technical change and productivity. This has been facilitated by the prolific research and implementation on flexible functional forms such as the translog cost function. However, few studies have been concerned with the problem of pricing and financial sustainability of the railways, and none has been concerned with how and to what extent technical inefficiency affects the financial sustainability of the enterprise.

Of the few studies that take up the issue of pricing, all of them focus on estimating marginal costs. The reason is that, despite the fact that marginal cost pricing is not followed by all EU railways; the marginal cost still provides guidance to optimal pricing that can be valuable for management. In this paper, we estimate a cost function to derive marginal costs. Marginal cost is simply the derivative of the cost function with respect to output. For a thorough literature review with an emphasis on empirical estimates of marginal costs and the role of utilization rate, the

reader is directed to Thomas (2002). The data required to implement this kind of analysis typically differ considerably relative to studies that focus on productivity and efficiency. In the latter case, one often has input prices and outputs in real terms (such as passengers and freight), but the data are aggregated and annual. In the former case, one has data disaggregated by line of operation (or similar divisions) on an annual basis but does not have data on input prices, and often one does not have data on outputs in real terms.

One major goal of the European Union (EU) within the ongoing deregulation programme is the liberalization of the European railway sector. This market has been dominated by national natural monopolies that were under public control. However, due to a sub-additive cost structure with respect to the track infrastructure, a competitive system in this sector cannot be established easily. Therefore the EU has decided that monopoly in the provision of the track infrastructure will be maintained, under regulatory restrictions, securing a high standard of efficiency.

In order to secure use of non-discriminatory access to the rail infrastructure, the infrastructure businesses must establish an appropriate set of charges for infrastructure use. Commission directives require that responsibility for access charge regimes be independent of any train operator, which they promote efficient use of infrastructure and they do not discriminate among operators wishing to make use of the infrastructure.

The economic principles behind an appropriate access regime are well established. Access charges should reflect the marginal cost that each user imposes on the infrastructure provider. To these marginal costs should be added the external costs (pollution, accidents, congestion, etc.) that each user generates. This is social marginal cost pricing and, if implemented correctly, will result in the most efficient use of the rail infrastructure.

Article 7 of the Directive 2001/14/EC imposes the requirements of marginal cost pricing. Two alternative approaches, used by a number of EU member states and considered to be best practice in terms of consistency with the provisions of the Directive 2001/14/EC are:

- an econometric approach which estimates a total cost function and then takes the first derivative of total cost with respect to gross tonne km to derive the marginal cost (seen in Finland, Sweden and Austria); and
- an approach which allocates total variable cost across all the different vehicles running on the network, using detailed causation engineering relationships (used in Britain).

However, each country appears to treat wear and tear differently and there are different definitions and ways of accounting for operating, maintenance and renewal costs. As a result, each country arrives at very different figures for marginal cost. The differences may partly reflect the overall cost levels in the different countries and the different levels of efficiency with which rail infrastructure is constructed and maintained. They also reflect differences in local circumstances and different objectives concerning the government contribution to infrastructure costs.