Operational performance of European metro systems: the Porto metro case

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Seeing that public services are usually explored by public entities (city councils, regional or central governments, etc.), metro systems do not regard financial profit as being their principal operational goal. Thus, providing each urban area with social and environmental benefits is considered to be their priority, which is achieved by providing adequate levels of mobility and accessibility in urban areas, in a rapid, safe and reliable manner. However, metro systems should optimize their resources and improve their operational performance in order to become less of a burden on public finances.

This paper is concerned with the analysis of the operational performance of a number of European metro systems by adopting a production function approach. To establish this production function, data on diverse inputs is collected: capital and labour variables, as well as variables characterizing the social-economic context of the urban areas where these metro systems operate. Outputs collected include a service supplied characterizing indicator (place-kilometres) and a service demand characterizing indicator (passengers).

The analysis of the production is firstly focused on the estimate of the inputs elasticities of the optimal production function. Next, it is fixed on the efficiency and effectiveness levels of each company. For these two purposes, a stochastic production frontier model is carried out. Using Porto metro efficiency and effectiveness results, two analyses were made: the first establishes the relationship between these performance results and the network infrastructure time development and the second one compares Porto metro results and those of some European metro light systems.

Keywords: metro systems, production, stochastic model, efficiency, effectiveness