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WORKING PAPER

Evaluation of Railway Traffic Control Efficiency and its Determinants

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Abstract:

The present paper fills a gap in the literature by examining the efficiency of railway traffic control. In spite of large-scale migration strategies towards centralised signal boxes (traffic control centres), railway traffic control still remains a labour-intensive process in many European countries. In close collaboration with experts from Infrabel, the Belgian railway infrastructure manager, we develop a two-stage benchmarking framework which assesses and explains railway traffic control efficiency. In the first stage, a bootstrapped Data Envelopment Analysis model with categorical variable assesses efficiency, and closely monitors average and individual performance trends over time. Second-stage regressions examine the impact of several factors on efficiency. The proposed framework can be adopted by infrastructure managers as an internal benchmarking tool, evaluating the entire network or specific sub-regions. We demonstrate the practical applicability of our approach with a unique and rich 18-month dataset of Infrabel's relay-technology signal boxes. Aiming to uncover additional insights, we perform our analysis on two subsets of the monthly data: one covering the working week, the other the weekends. Our findings suggest a significant influence on efficiency of spatial and temporal traffic density, infrastructure complexity, geographical centralisation, team size, and opening times. Finally, our results also indicate that railway infrastructure managers should take into account the differences between working week and weekend when assessing efficiency, or when appraising the impact of their strategic and operational decisions on traffic control performance.

Keywords:

bootstrap, Data Envelopment Analysis, efficiency, railway infrastructure, traffic control, two-stage approach.

* The views expressed herein are those of the authors and do not necessarily reflect the opinions of Infrabel.