Liner shipping service scheduling and cargo allocation

Tactical service scheduling and operational cargo allocation are two interdependent problems in liner shipping. The schedules and sailing speeds of individual liner shipping services and the synchronization among all services determine the transit times of containers through a liner shipping network. On the other hand, the market demand in terms of container volume and expected transit times between origin and destination ports drive the schedule design of liner shipping services. We present a graph-based model and a branch-and-price algorithm to solve the combined problem. The goal is to minimize the difference between fuel consumption costs and revenues from transporting containers under consideration of transit time limits. Fuel consumption is modeled as a function of both speed and payload. Results are presented for 12 liner shipping networks and emphasize the importance of explicitly modeling schedules in large networks; transshipment times and thus transit times may be severely miscalculated otherwise. The results further show that neglecting payload in the fuel consumption function can result in suboptimal service schedules and cargo routing decisions.

General information
Publication status: Published
Organisations: Management Science, Operations Research, Department of Technology, Management and Economics
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Pages: 897-915
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: European Journal of Operational Research
Volume: 275
Issue number: 3
ISSN (Print): 0377-2217
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
Original language: English
Keywords: Operations research in maritime industry, Liner shipping service scheduling, Cargo allocation and routing, Payload dependent fuel consumption, Branch and price
DOIs:
Source: FindIt
Source-ID: 2442464413
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review