The profit maximizing liner shipping problem with flexible frequencies: logistical and environmental considerations

The literature on liner shipping includes many models on containership speed optimization, fleet deployment, fleet size and mix, network design and other problem variants and combinations. Many of these models, and in fact most models at the tactical planning level, assume a fixed revenue for the ship operator and as a result they typically minimize costs. This treatment does not capture a fundamental characteristic of shipping market behavior, that ships tend to speed up in periods of high freight rates and slow down in depressed market conditions. This paper develops a simple model for a fixed route scenario which, among other things, incorporates the influence of freight rates, along with that of fuel prices and cargo inventory costs into the overall decision process. The objective to be maximized is the line’s average daily profit. Departing from convention, the model is also able to consider flexible service frequencies, to be selected from a broader set than the standard assumption of one call per week. It is shown that this may lead to better solutions and that the cost of forcing a fixed frequency can be significant. Such cost is attributed either to additional fuel cost if the fleet is forced to sail faster to accommodate a frequency that is higher than the optimal one, or to lost income if the opposite is the case. The impact of the line’s decisions on CO2 emissions is also examined and illustrative runs of the model are made on three existing services.

General information
State: Accepted/In press
Organisations: Department of Management Engineering, Management Science, Transport DTU, Operations Management, Universita di Padova
Contributors: Giovannini, M., Psaraftis, H. N.
Number of pages: 31
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Flexible Services and Manufacturing Journal
ISSN (Print): 1936-6582
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.29 SJR 1.633 SNIP 1.544
Web of Science (2017): Impact factor 2.346
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.32 SJR 1.612 SNIP 1.644
Web of Science (2016): Impact factor 1.98
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.21 SJR 1.274 SNIP 1.409
Web of Science (2015): Impact factor 1.857
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.68 SJR 1.035 SNIP 1.691
Web of Science (2014): Impact factor 1.872
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.48 SJR 1.204 SNIP 1.68
Web of Science (2013): Impact factor 1.439
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.79 SJR 0.807 SNIP 0.524
Web of Science (2012): Impact factor 0.857
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.5 SJR 0.551 SNIP 0.783