Cargo-mix optimization in Liner Shipping

International transportation constitutes one of the biggest challenges in limiting CO2 emission in the world: it is technically hard to find viable alternatives to fossil fuels, and due to the international nature, it is very difficult to regulate CO2 emission of intercontinental trade. Moreover, it is hard to motivate companies to pay for cleaner transport since transportation is not visible to end customers, and therefore cannot justify a higher cost. Hence, optimization may be one of the few options for limiting CO2 emission of international trade. A possible direction is to focus on vessels’ utilization. The more containers a vessel carries the smaller is the resulting CO2 emissions per transported ton of cargo. This is what can be seen as a win-win situation. Better vessel utilization will result both in cleaner transport and in better revenue margins for the shippers.

Focus on vessel intake maximization is old news for liner shippers. Container vessels are delivered with a nominal capacity that ship owners know is only theoretical. Unless the cargo weight distribution is perfect, the nominal intake cannot be reached. Stowage coordinators fight this battle everyday. They are the planners of the cargo and have to find a load configuration (stowage plan) that both suits the current cargo to be loaded but also guarantees that the vessel can be utilized to its maximum in future ports. The size of nowadays vessels is, however, making this work harder and harder (Pacino et al. (2011)). Moreover, the cargo composition available in the different ports might not be suitable for the full utilization of the vessel. The focus of our work is the analysis of vessels’ cargo-mix, in particular finding what cargo composition is needed for a vessel to maximize its utilization on a given service. Such a model can have various applications ranging from driving rate prices, improving fleet composition and network design ((Christiansen et al., 2007; Reinhardt and Pisinger, 2012; Broer et al., 2014)).

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