European intermodal freight transport network: Market structure analysis

Hamid Saeedi a,⁎, Bart Wiegmans a, Behzad Behdani b, Rob Zuidwijk c

a Transport and Planning Department, Delft University of Technology, Netherlands
b Operations Research and Logistics Group, Wageningen University, Netherlands
c Rotterdam School of Management, Erasmus University, Netherlands

A R T I C L E   I N F O

Article history:
Received 5 August 2016
Received in revised form 25 February 2017
Accepted 5 March 2017
Available online xxxx

A B S T R A C T

The analysis of market structure and concentration measures for the Intermodal Freight Transport (IFT) market is important to avoid market failure and to find the areas for policy making to promote IFT market share. This analysis can be performed for separate segments, for example, the market for transshipment service or the market for main-haulage service. However, due to the multistage characteristic of IFT service, the segmental analysis gives an incomplete view of the IFT market at the network level. In a previous paper (Saeedi et al., 2017), we present the Intermodal Freight Transport Market Structure (IFTMS) model to conduct a network-based study of the IFTMS in which distinctive actors (i.e., pre/post haulage operators, terminals, rail/barge operators, transport chains, and corridors) are competing at different levels inside distinctive markets to deliver an integrated IFT service. There are two main challenges in the application of IFTMS model in real cases, for example, the European IFT network. First, the definition of the geographical and spatial border of the transshipment market areas is needed to determine which actors are potentially competing for a specific service demand. The second challenge is the lack of disaggregated data and the consistency of existing data in nodes (i.e., the transshipment areas) and links (i.e., the rail and barge operators). To cope with these challenges, we develop a four-step methodology in which a model-based approach is used to define the geographic boundaries of the transshipment submarkets and provide detailed and consistent data for market analysis. We also apply the IFTMS model to study the market structure of European intermodal network. Our analysis shows that the majority of transshipment markets as well as main-haulage markets are highly concentrated markets. The corridor markets – which include the IFT chains – are unconcentrated markets. Furthermore, the majority of corridors in the European Union are inside highly concentrated origin-destination markets.

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1. Introduction

One of the main concerns of the antitrust authorities and policy makers in the field of freight transport is the market concentration and competition level inside the IFT market (Gómez-Ibáñez & de Rus, 2006). An IFT market comprises of different IFT chains—which themselves include different actors providing different services (i.e., pre- and post-haulage, transshipment, and main-haulage). All these IFT chains, together, form an IFT network. Anticompetitive behavior of the IFT operators (e.g., vertical or horizontal integration) could increase the market concentration, and potentially reduce the welfare of the customers (Motta, 2004). In fact, antitrust authorities may scrutinize and limit such business practices because they could harm the competition level in the IFT market (Mazzeo & McDevitt, 2014). Accordingly, an economic analysis of the concentration and the market structure is needed.

The analysis of the market structure and concentration measures for IFT service can be done at several different levels. First, the analysis can be performed for separate segments, for example, the market for transshipment service or the market for main-haulage service (see, e.g., Wiegmans et al., 1999; Makitalo, 2010; Lam et al., 2007; Sys, 2009; Merikas et al., 2014). However, due to the multistage characteristic of IFT service, the segmental analysis gives an incomplete view of the IFT market. In other words, the competition is between IFT chains or even between different corridors to transport the cargo from one “origin” to one “destination”; therefore, a network-based analysis is needed. To analyze the market structure for IFT service, the Intermodal Freight Transport Market Structure (IFTMS) model was developed in our previous study (Saeedi et al., 2017). IFTMS uses graph theory and defines distinct submarkets in an IFT network. These submarkets are represented as nodes (transshipments), links (main-haulages), and paths (corridors, and O-Ds) in the model. Each “corridor” may have multiple IFT chains that include a sequence of nodes and links from an origin to a destination. The IFT chains in a corridor are organized by different forwarders.
to deliver an integrated IFT service to the final customer. As distinctive submarkets inside an IFT network are defined, IFTMS applies a flow optimization model to assign the flow to the IFT network corridors, and then to the respective chains, links, and nodes. Next, the concentration indices—like concentration ratio (CR) or Herfindahl-Hirschman Index (HHI) (OECD, 1990)—for these IFT submarkets are calculated. Further details on the IFTMS model can be found in Appendix E and Saeedi et al. (2017).

To study the IFT market structure at the network level, for example, the European intermodal network, there are two main challenges. First is the definition of the relevant geographical transshipment submarkets. Defining which inland terminals are potentially competing for a specific service demand (and therefore, form a transshipment submarket for that demand area) is an important step when determining whether a market is competitive or not. The other challenge is the availability of detailed data—especially at the chain level. Although the primary data about the transshipment and main-haulage submarkets are available, the assignment of the capacity of each transport operator to different routes is difficult—if not impossible—to attain. Furthermore, for many corridors, the available data is fragmented, incomplete, and sometimes inconsistent. To cope with these two main challenges, a methodology that is complementary to the IFTMS model is presented in this paper. This methodology applies a conservative model-based approach to define the geographic boundaries of the transshipment submarkets and creates a data set for market analysis. The scientific contributions of this paper are twofold. First, we present a methodology to define the different IFT submarkets in terms of the geographical and spatial aspects, the players, and their respective market shares. For this purpose, a four-step methodology has been developed. Each step uses a model-based approach to characterize a submarket in the IFT network.

This methodology is especially useful in cases where only aggregated or incomplete data are available. Lack of detailed data can be caused by limited resources, distinctive and detached obligations for data gathering by legislative organizations, and confidentiality issues (Tavasszy & de Jong, 2014). Second, we apply the presented methodology to analyze the European IFT market at the network level.

The remainder of the paper is organized as follows. In Section 2, the market analysis literature is reviewed. Section 3 presents the methodology. In Section 4 the application of this methodology and the IFTMS model to the EU IFT network is presented. Conclusions and policy implications are given in Section 5.

2. Market analysis literature

IFT is defined as “unitized freight transport by at least two transport modes” (Commission of the European Communities, 2001). In the IFT market, different operators (pre- and end-haulage operators, main-haulage operators, terminal operators, and forwarders) are active and compete with each other in different submarkets (see Fig. 1). The IFT market encompasses all operators in all submarkets.

We introduce these submarkets that emerge in the IFT market by means of an example. Suppose that a shipper wants to transfer containers from the Rotterdam area in the Netherlands to the Verona area in Italy. There are many forwarders/LSPs/intermodal operators (further referred to as forwarders) that can arrange for transport and handling. These actors arrange different pre-haulage, transshipment, main-haulage, and end-haulage services, to be able to deliver integrated IFT services to the shippers. The forwarder could hire one of the many truck companies to transit containers from the shipper’s location to one of the terminals in the Rotterdam area. These truck companies compete for forwarders’ demands, so we have a market where there are demand and supply for trucking services (pre-haulage sub-market).

Furthermore, in the Rotterdam area the forwarder needs transshipment services and different terminals in the area; for example, the Rail Service Center (RSC), or ECT Delta, deliver such a service. Therefore, in the Rotterdam area we have a market where there are demand and supply for transshipment services (transshipment submarket). Then, there are different corridors that could be chosen by a forwarder to transport the containers from a terminal in Rotterdam area to a terminal in the Verona area. The forwarder could use any corridor that is competitive (in terms of cost and quality), and directly (or indirectly) connects a particular terminal in the Rotterdam area to a particular terminal in the Verona area. The forwarder could choose the corridor that connects the Rotterdam area to the Verona area through terminals in the Kolin area in Germany, whereas other corridors could pass through terminals in Munchen or Nurnberg. These different corridors, which all connect the Rotterdam area to Verona area, make an O-D submarket. When choosing one of the corridors from the O-D submarket, the forwarder is faced with the choice of different rail and barge operators (also called main-haulage) that are active inside the corridors as well as with different terminal operators in the intermediate transshipment areas. If the forwarder chooses the indirect corridor (including handling at that terminal) via Munchen, he or she could choose between IMS or TX Logistik rail companies, for example, to transport the containers from the Rotterdam area to the Munchen area. Here, we could define a main-haulage submarket between the Rotterdam area and Munchen area. Next, he or she could choose between different terminals in the Munchen area: DUSS-Reim, or Munchen-Laim terminals. So in the Munchen area, like the Rotterdam area, we could define a transshipment submarket. From a terminal in Munchen to a terminal in Verona, for example, the Quadrante Terminal, he or she could decide between the intermodal rail operators CEMAT or Kombivormkehr, which are active inside this

![Fig. 1. Spatial distribution of different submarkets inside a corridor of IFT network.](image)
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