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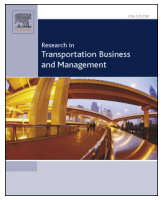

Modal choice preferences in short-distance hinterland container transport

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ABSTRACT

Short distance inland container transport to Western European seaports provides opportunities for additional modal shift to intermodal transport, thanks to the concentration of transport flows transported to the immediate hinterland of these ports. The literature on modal choice behavior, however, fails to explain the (relatively low) success of this market segment. In this paper, a choice-based conjoint experiment is conducted to increase the insight on the preferences of modal choice decision-makers in Belgium, active in the considered market segment. The findings of the experiment suggest that, to enhance a further modal shift, operators should try to provide daily services at a competitive price, with a focus on providing more reliable services than road transport. Additional efforts should be made to correctly inform decision-makers on the available intermodal services.

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1. Introduction

Intermodal transport has been promoted by regional, national and international policies throughout Europe. As advocated by inter alia the European Commission, intermodal transport proves to be a more environmentally friendly alternative to road transport in many cases (Kreutzberger, Macharis, Vereecken, & Woxenius, 2003), although this statement cannot be generalized to all cases (López-Navarro, 2014). Another important reason for stimulating intermodal transport can be found in the effort to ease port congestion.

The main focus of the European Commission's modal shift efforts lay in the long distance transport segment, with the explicit goal to shift 50% of road freight over 300 km to other transport modes by 2050 (European Commission, 2011). The <300 km distance segment nevertheless corresponds to 44% of the ton-km and 89% of the total tons transported in Europe. Tavasszy and van Meijeren (2011), however, show that existing and promising intermodal transport cases below this 300 km 'threshold' distance also exist. An example is that of maritime-based intermodal container transport services to and from north-western European seaports in the Rotterdam-Le Havre range. Particularly intermodal barge transport can be a competitive alternative for short distance road transport in The Netherlands (Ministerie van Verkeer en Waterstaat, 1994), Belgium (Meers, Vermeiren, & Macharis, 2014) and France (Frémont & Franc, 2010). But also in other countries, the feasibility of short distance intermodal services through innovation has been investigated, employing for instance double-stack trains (Resor & Blaze, 2004) or a light-combi concept (Bärthel & Woxenius, 2004). As already stated by Trip and Bontekoning (2002), the key to successful short distance services mainly lies in reducing transshipment costs and time, which should be combined with sufficient transport volumes.

Notwithstanding clear markets exist for short distance intermodal container transport – defined here as transport for which the road-only alternative transport distance is under 300 km – most research projects funded by the European Commission focus on medium- to long-distance transport opportunities. The modal choice literature also mainly focuses on this market segment (Reis, 2014), although exceptions, often focusing on the inland leg of maritime chains, exist (e.g. Feo-Valero, García-Menéndez, Sáez-Carramolino and Furió-Pruñonosa, 2011). Reis (2014) tries to relate short distance intermodal successes to the modal choice literature, but concludes that this literature fails to explain them.

This paper addresses one very specific market focusing on modal choice behavior in one of the 'successful' short distance transport markets for intermodal container transport, where earlier research in this market mainly deals with a variety of loading units and transport distances (e.g. Beuthe & Bouffioux, 2008). A choice-based conjoint experiment, elaborated in Section 3, was set up to investigate the preferences of shippers and logistics service providers for container transport in Belgium, to assess how the 'classic' modal choice determinants, as

Abbreviations: 3PL, third party logistics company; CBC, choice-based conjoint; HB, hierarchical Bayes; IWT, inland waterway transport; LSP, logistics service provider; RLH, root likelihood; RP, revealed preference; SP, stated preference; SSS, short sea shipping.

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identified in the modal choice literature, are valued in the short-distance segment. The case study setting is described in Section 4. The findings from the experiment are discussed in Section 5. Section 6 presents the conclusions.

2. Literature review

To disentangle the transport service requirements of decision-makers in transport planning, an extensive modal choice literature has developed over the past decades, building on the works of, inter alia, McGinnis (1979, 1989, 1990). Older studies have been extensively described and analyzed in the review papers of Cullinane and Toy (2000), Meixell and Norbis (2008), Flodén, Bärthel, and Sorkina (2010) and Feo-Valero, García-Menéndez and Garrido-Hidalgo (2011). Crucial aspects, needing consideration, recognized in these review papers are: the identification of influential modal choice attributes, the mode and carrier selection process and the decision-maker.

In their literature review, Cullinane and Toy (2000) compose a list 15 modal choice criteria categories, each comprising one or several modal choice attributes. Following the reviews of Cullinane and Toy (2000), Feo-Valero, García-Menéndez and Garrido-Hidalgo (2011) and Flodén et al. (2010) and recent modal choice studies (Arencibia, Feo-Valero, García-Menéndez, & Román, 2015; Feo, Espino, & García, 2011; Feo-Valero, García-Menéndez, Sáez-Carramolino, et al., 2011; Feo-Valero, García-Menéndez, & del Saz-Salazar, 2014; Nugroho, Whiteing, & de Jong, 2016) it was decided to include the modal choice attributes of price, transit time, transit time reliability and transport frequency as main criteria in this study. Obviously, parameters such as shipment size and product characteristics can impact these required service levels (Feo-Valero et al., 2014).

Different methodologies can be used to disentangle the preferences regarding these modal choice attributes. Stated preference (SP) and revealed preference (RP) experiments are commonly used to obtain data for disaggregated transport demand models, using utility and cost functions.

There is also the discussion on the actor group that should be questioned and which should be considered as the main transport mode decision-maker. In this type of studies, two types of decision-makers are questioned, being freight forwarders or hauliers on the one hand, managing the freight, and shippers on the other hand, which can be represented by retailers, producers, distributors etc. Feo-Valero, García-Menéndez and Garrido-Hidalgo (2011) find that most studies focus on the shippers as decision-makers, although some studies opt to consider both groups, as arguments can be made in favor of both. In this perspective, Patterson, Ewing, and Haider (2010) find that third party logistics companies (3PLs) are more biased against intermodal transport services, compared to shippers. Holguín-Veras, Xu, de Jong, and Maurer (2011) find that mode choice decisions mainly depend on the interaction between both actor groups and the shipment size. In this study, shippers, logistics service providers (LSPs) and shipping agents are included as decision-makers. The main share of the respondents questioned are however shippers, as the transport market studied is dominated by merchant haulage.

As stated in the introduction, this paper aims to focus on modal choice decisions in the market segment of short distance container transport in Belgium. Reis (2014), tested if modal choice variables from medium- to long-distance transport services can explain behavior in the short distance segment, but he concludes that these variables can hardly justify the choice of a freight forwarder for the intermodal transport services. Only transport price can explain the choice for intermodal services in his case study. Earlier studies already pointed out that modal choice preferences can change according to the transport distance travelled. Rotaris, Danielis, Sarman, and Marcucci (2012), for instance, argue that shippers with a need for fast transport are in general located close their main market, valuing time higher for short distance transport.

The unique focus on containerized goods is in this case study a consequence of their 'ease' to shift from road to intermodal transport services. Also Blauwens, Vandaele, Van de Voorde, Vernimmen, and Witlox (2006) focus on containerized shipments in the hinterland transport market of seaports. They use an inventory-theoretic framework to evaluate the effectiveness of modal shift policy measures. Feo-Valero, García-Menéndez, Sáez-Carramolino, et al. (2011) also focus on the inland leg, but in a long distance corridor where rail and road compete. According to their findings, frequency plays a crucial role in the competitiveness of rail transport, as it can compete with road-only transport on transport cost. Beuthe and Bouffioux (2008) looked at a variety of goods flows, including goods transported in containers. Based on a SP experiment, they calculate monetary values for different quality attributes, and find that the valuation of all included criteria differs rather strongly when comparing transport of containers to, for instance, semi-trailers. The corresponding weights in decision making that were derived for container transport, calculated as a measure of importance, are 71% for cost, 10% for transport time, 7% for reliability and 4% for frequency. Focusing on the short distance transport market (<300 km), cost is weighted higher with 75%, before reliability with 8%, transport time with 4% and 3% for frequency.

Apart from the study of Beuthe and Bouffioux (2008), also the surveys of Grosso (2011), Vannieuwenhuyse, Gelders, and Pintelon (2003) and Vermeiren (2013) focus partly on the Belgian transport market. An interesting finding from Vannieuwenhuyse et al. (2003) was that users of a certain transport mode award higher performance scores to a transport mode than non-users do. Vermeiren (2013), using a SP experiment, finds that cost is a decisive factor for maritime-based container transport on medium and long distance stretches, even when CO_2 savings can be realized. Also the frequency of service comes out as an influential attribute.

3. Methodology

A choice-based conjoint (CBC) experiment was conducted to estimate decision-makers' preferences for the main modal choice criteria, discussed above, that define transport services. The use of disaggregate models, which are based on individual behavior, takes into account characteristics of the decision-maker. The rationale here is that decision-makers will choose the alternative (or concept) that maximizes utility and thus suits their (implicit) service requirements best.

In the CBC experiment, a fixed number of tasks are presented to a respondent, where he has to choose the alternative that matches his requirements best. The alternatives presented in a choice task are differentiated by their attribute levels. The analysis afterwards allows evaluating the trade-offs between the attributes made by the respondents of the experiment. The survey was administered by Sawtooth software and was sent to a respondents list by email.

The first choice made in the survey design concerns the choice of attributes to be considered by the decision-makers. As described above, four attributes were included in the survey. A selective number of attributes makes the choice tasks straightforward and limits the necessary number of choice tasks in the survey reducing the effort required from participants, as it is acknowledged to be difficult to find sufficient suitable respondents (Beuthe & Bouffioux, 2008). Indeed, Hair, Black, Babin, and Anderson (2010) suggest to use a maximum of six attributes for an efficient design. Transport mode was not included as an attribute to avoid that respondents would link service level characteristics to the corresponding alternatives. The attributes finally included in the survey are:

- Transport price: the transport price of a door-to-door (or door-to-port/port-to-door) transport of one container, including loading and unloading
- Transport time: the transit time of a transport, starting from loading

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