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Horizontal transshipment technologies as enablers of combined transport: Impact of transport policies on the modal split

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ABSTRACT

The technological solutions for the horizontal transshipment of non-liftable semi-trailers allow the decision makers in the transport market to consider an additional transport alternative to road transportation in the mode choice decision: combined transport. This study explores the modal split between road freight transport and combined transport that is enabled by horizontal transshipment technologies, given a dependence on the changing transport mode characteristics that are caused by direct intervention through transport policies as well as by changing environmental factors such as increasing freight volume or diesel prices. In addition, the impact of the heterogeneous forwarders' business models is considered. To estimate the modal split between the road and the combined transport, we combine a Bass model with a discrete choice model. Based on the data derived from an online questionnaire distributed to German forwarders, the model estimates a maximum 42% market penetration ratio for the combined transport. This ratio is captured with the help of the direct subsidization of rail line hauling, which is consequently the strongest lever for the modal shift. This lever is followed by the introduction of long trains, bringing a maximum market penetration of approximately 35%. We reveal that the policies that directly promote combined transport have a stronger effect on the modal shift than the policies that discriminate against road transport. Furthermore, we find that the leverage of the transport policies for the medium range distances is significantly higher than for the long distances. These results can be used as a decision support by government officials for the configuration of their specific transport policies as well as by logistics service providers to adjust their technology investment decisions based on the anticipated user demand in different situations.

1. Introduction

According to the latest forecasts, freight volume will continue to show significant growth in the coming years. Rich and Hansen (2009) expect that the total transport volume in road freight transport (RFT) in EU 27 will increase to 2442 billion tonne kilometer (t km) by 2030, which is 43% more than in 2005. In the US a total road freight tonnage is expected to grow by 21% by 2023 (American Trucking Associations, 2012). With the increasing congestion of public highways and in light of the emerging environmental awareness, the high increase of transport volume in road freight transport is considered to be particularly critical. Therefore, one of the current objectives of the EU transport policy is to shift more than 50% of the road freight transport to waterborne or rail transport for longer distances (>300 km) (European Commission, 2011). Because

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70% of the total road freight transport volume – approximately 214 billion t km – was produced by means of semi-trailers in Germany in 2009 (Federal Motor Transport Authority, 2010), they might be considered to be the primary target group for producing a significant modal shift from road to rail. However, only the minority of semi-trailers (up to 5%) are liftable and thus accessible to the existing continental combined freight transport (CCFT).

Consistent with the transport policy objectives, there are a variety of technology providers offering solutions for the horizontal transshipment of non-liftable semi-trailers (e.g., CargoBeamer®, Modalohr, Mega Swing by Kockums Industrier). In recent years, accelerated marketing efforts can be observed from several technology providers who are strongly pushing horizontal transshipment technologies for non-liftable semi-trailers into the transport market. The figures above illustrate the market potential that "theoretically" could be shifted to rail if the barrier to access to the CCFT is overcome by the means of these new technologies. Therefore, horizontal transshipment technologies might be seen as a powerful driver for the modal shift from road to rail. Still, the policy objectives and technology developments do not always correspond to the micro-economic choices of the individual forwarders (Chiara et al., 2008). Hence, defining a new type of continental combined service requires prior knowledge of freight transport demand (Feo et al., 2011). The accurate anticipation of demand is crucial for both investment decisions and policy making (Lee and Cho, 2009). Depending on the estimated market potential, investors such as logistics service providers can address the high demand market segments with the combined transport. Government officials can ex-ante evaluate the impact of the proposed transport policy or the combination of different policies and configure the appropriate transport policies to enable the highest leverage for a modal shift to combined transport (Tsamboulas et al., 2007). Therefore, forecasting the impact of the proposed transport policy is considered to be an important component of the transportation planning process on the macro-level (Tal and Cohen-Blankshtain, 2011). In addition, because there are several different types of players in the transportation field, each with its own set of objectives and means (Crainic and Laporte, 1997), the forecasting approaches in the transportation market should address, along with the specifics of the supply side (transport modes), the characteristics of the demand (decision makers) (Tsamboulas et al., 2007).

Considering the above, the objective of the current paper is to forecast the modal split between road freight transport and combined transport enabled by horizontal transshipment technologies, given a dependence on the changing transport mode characteristics caused by direct intervention through the state transport policies and by changing environmental factors such as increasing freight volume or diesel prices. In addition, the impact of the heterogeneous forwarders' business models is investigated, as forwarders are considered to be the decision makers with respect to the mode of transport. To achieve this aim, we use a combination of the Bass model with the discrete choice model, analogous to the works of Walther et al. (2010) and Lee et al. (2006). Due to the significant volume in the road freight transport (313 billion t km in 2010) generated in Germany (Eurostat, 2011), we decided that Germany provided an appropriate scope of research for our survey and, in turn, to address the forwarder's companies that are located in Germany. However, due to a similar market structure in the road freight transport market in Europe (which is highly fragmented, with a large number of small and medium-sized companies), the results obtained in the study may be partially extrapolated to other European countries in terms of the impact of product awareness on the modal shift.

After this introduction, the paper is structured as follows. The literature review on the combined transport research is presented in the next section. In Section 3, the research methodology is presented. The procedure for data collection is described in Section 4. The policy actions for increasing the attractiveness of combined transport are also thoroughly described in this section. In Section 5, the definition of the scenarios and the forecasting results are depicted and discussed. The paper concludes with final remarks, followed by the implications for the practitioner and the questions for future research.

2. The state of the art in combined transport research

In our work, we use the common definition for intermodal transport, proposed by the European Conference of Ministers of Transport and the United Nations, although Bontekoning et al. (2004) claim that this definition only covers the physical characteristics of intermodal transport while lacking the organizational aspects such as synchronized schedules, task division between modes, and multi-actor chain management. Nevertheless, consistent with Van Duin and Van Ham (1998) and Tsamboulas and Kapros (2000), we decided to apply this definition because it reflects the scope of our research by providing a further classification of the different forms of intermodal transportation. According to the European Conference of Ministers of Transport and the United Nations, intermodal transport is defined as "The movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes" (UN/ECE, 2001). Combined transport is a special form of intermodal transport, and it is defined as "intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are short as possible" (UN/ECE, 2001). Depending on the transport mode included in the main run, the combined transport can also be differentiated into maritime (with the sea in the main haulage) or continental (with the rail in the main haulage). In continental combined freight transport (CCFT), the following components can be distinguished: pre- and post-carriage by the road transport (collection and distribution from shippers to receivers), exchanging loading units at the intermodal (rail/road) terminals and the rail line hauling (main haul) (Janic, 2008). This contribution considers the unaccompanied continental combined transport with a semi-trailer to be an intermodal transport unit that builds a target group for the horizontal transshipment technologies.