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Effects of RoPax shipping line strategies on freight price and transporter's choice. Policy implications for promoting MoS

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ABSTRACT

Motorways of the sea operated as RoPax services are natural competitors with only-road freight haulage transportation. Cost, time and quality perceived are the determinants that make transporters and shippers use one route or another.

This research considers the role that a shipping company and its ship deployment and pricing strategy has in the equation, in a quasi-monopolistic state. It is checked whereas to what extent the pricing policy helps in the maximization of the modal shift or it is detrimental for it.

A model of the ships and transporter costs is developed considering different business models for the transporter (accompanied versus unaccompanied cargo) followed with a discrete choice model that, once calibrated, allows testing the influence that variables like ship size, fuel price or commercial speed might play into the competitiveness of a shipping line. As a result, different pricing strategies for the shipping line are developed and the characteristics of the optimal shipping line for each of them is found, that maximizes profit of the shipping company. The paper concludes assessing a subsiding policy based in bonus per unit transported and its effectiveness in promoting modal shift and the likely effect it would have in the profitability of the shipping line.

1. Introduction

The term Motorway of the Sea (MoS) was officially coined by the European Union in 2004 to provide a legal framework for funding projects for new or updated maritime connections within the European seas in the framework of the TEN-T network (Trans European network of transport) (European Parliament and Council of the European Union, 2004). The term has evolved – in the literature – from referring to certain European maritime corridors to cover any maritime link being 'High frequency, regular, door-to-door intermodal services where the main haulage is done by Short Sea Shipping (SSS) and last mile connectivity by road transport" (Baindur and Viegas, 2012).

Supply chains with a SSS/MoS link can be competitive in terms of door-to-door cost and time when compared to the only road chains (Galati et al., 2016; Tsamboulas et al., 2013). However due to the less reliable behavior (according to shippers perception) and flexibility along with the increase in complexity of the chain, shippers do not seem predisposed to leave the only road option unless there is a significant decrease in terms of cost (or time) when taking the "SSS option" (Feo et al., 2011; Paixão Casaca and Marlow, 2009). Since the maritime leg accounts for the highest internal cost of the intermodal transportation chain, the profit factor applied to it is critical to the SSS competitiveness regarding the alternative supply chains available.

Pricing in MoS lines differs from ocean shipping in the demand's elasticity. The traditional overall low elasticity of the later contrasts with the elasticity of MoS, where SSS competes directly with road transportation and where the cost of backshift from SSS to road is negligible for the transporter (DG Move, 2015). This is especially true for the accompanied case where a substantial difference in the necessary pool of transport units does not exist (Morales-Fusco et al., 2012).

This paper conveys what might be the most appropriate pricing strategy for a regular RoPax (roll on-roll off with passage) shipping line taking into account the demand's elasticity to tariff, the ship's cost structure and the requirements and cost implications of each cargo format transported. In that sense, two optimal pricing strategies are being considered: fares for a given shipping line already on operation and fares for a line in its planning stage where, the optimal size of the vessel can be determined as well. The methodology is calibrated and checked against a specific sea connection between Spain and Italy to, finally, assess the effect of two different bonus policies to promote modal shift from road to sea.

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The paper is laid out as follows: firstly, an overview of on pricing in shipping lines and discrete choice models applied to SSS lines is provided; secondly, the scenarios considered are introduced together with the database of maritime traffic between Spain and Italy; in third place the methodology applied is introduced; later on, the results obtained are given and discussed and; finally, some conclusions are provided.

2. Literature review

2.1. Pricing in shipping lines

When referring to pricing strategies related to the maritime world, existing literature reviews mainly focus on port pricing strategies. Shipping line pricing, however, is not a usual topic. Certainly, there are works that try to determinate the relationship between freight rates charged and economic determinants, that is, they do not establish a tariff strategy, and rather give a descriptive way to predict tariffs behavior in the future (Alizadeh and Talley, 2011).

From a theoretical perspective, tariffs should equal short-run marginal costs; however, this is only true in a perfectly free economy or in an efficient socialist economy. In fact, this is the pricing system the EC advocates for in all transport services (European Commission, 2001).

Pricing in liner shipping used to be dominated by the conference system. However, such agreements do not longer apply to traffic within Europe since its prohibition as consequence of the repeal of Council Regulation 4056/86 and within the United States of America (USA) since the passage of the Ocean Shipping Reform Act (OSRA) which has made such agreements anecdotic, at most (Acciaro, 2011; Fusillo, 2006). Nowadays, the most usual pricing system in liner shipping is what is commonly referred to as service contracts, where fares are agreed between shipper and shipping company after some negotiation (Brooks, 2000; Marlow and Nair, 2008). Although carriers may publish their tariffs, rarely those are the ones applied in practice with exception maybe of the occasional shipper (Acciaro, 2011).

The traditional forms of price discrimination since the conference system are by shipment, shipper and commodity (Jansson and Shneerson, 1987). The final fares come from the negotiation game within shipper and carrier. Shipping companies aim for a 'what the traffic can bear' charging system, taking advantage of the low elasticity of ocean transportation to freight rates, which in turn is counterbalanced by the fluctuations in demand leading to seasonal variations in tariffs in order to smooth demand over the year (or week) or applying discounts to bulk customers, serving small ones only if some capacity is left. As Acciaro (2011) points out, this has two justifications: bulk customers tend to stabilize the demand and their order usually arrive before the occasional small shippers and those might be more difficult to be accommodated.

However, MoS shipping lines system behave differently. The cost of switching from RoRo or RoPax (the most common kind of ship used for MoS connections) to road transportation (modal back shift) is negligible and the flexibility that road transportation offers is currently not comparable to the usual shipping lines (DG Move, 2015). The MoS market is likely to behave as the bulk system pointed by Acciaro but given the characteristics of what is being offered, with a more prevalent role of the small costumers.

Assessing the negotiation game between provider and consumer of the service (transporter or shipper) is out of the scope of this paper. Instead, a fixed rate that discriminates by kind of cargo (full truck, with driver included, versus trailer) is the pricing system considered. Considering a homogenous pricing system, it is possible to examine the effect of price over transportation choice, taking all the current demand and without entering in the discussion of the prevalent heterogeneity within the demand and their different negotiation power.

2.2. Choice models in maritime transportation

The contributions from the existing literature specifically dealing with modal choice applied to maritime transportation competing with road transportation are few and most of them are discussed in Feo-Valero et al. (2011) a bibliographical assessment of Freight Value of Time (FVOT) considerations in freight transportation discrete choice models.

Most references on the topic are, in fact, participated by Feo-Valero and spanning from 2003 to 2015. In the series of papers, the authors discussed the best approach to identify the attributes behind mode shifts from road to MoS lines, and provided weighted values for the parameters of several Logit models to assess a transporter's choice.

After a first approach, the authors built an Adaptive Stated Preference (ASP) database obtained from interviewing freight forwarders, since forwarding was usually subcontracted in Spain (Espino et al., 2007). The authors identified significant variations in the Freight Value of Time (FVOT) observed depending on the origin (Spanish province) and probably the nature of the cargo. In fact, in a later paper (Garcia-Menendez et al., 2009), using a revealed preferences database, some bias towards the road option was found with more valuable cargo and for freight forwarders. Additionally, besides the typical attributes of cost, time and reliability that appeared in the first papers, other attributes were found to be significant in the modal choice: larger road distances play in favor of SSS and the size of the shipment benefits road since a "lorry's larger cargo capacity is an advantage" (sic) towards a container counterpart. This would not be the case for RoRo/RoPax shipments (considered in this chapter), where the ITU (Intermodal transport unit) would have the same size.

Afterwards, the authors produced a comprehensive assessment of the existing literature in terms of Freight Value of Time (FVOT) (Feo-Valero et al., 2011). The paper provides a good overview of the different approaches and the diversity of attributes considered and methodologies as well as FVOT values, depending on the country, cargo, mean of transportation, cargo, etc.

The last paper included in the set, (Arencibia et al., 2015), moved forward in the application of the ASP using four basic attributes (time, cost, frequency and punctuality) and played an equilibrium game with the interviewees. Afterwards, different mixed logit models were considered and the randomness and correlation of the different existing errors in the attribute perception were discussed. The study provided is solid, complete and determined that given the actual level of service of the connections between Spain and Northern Europe, the most significant driver behind modal shift is the cost and the best policies to move trucks from road to sea would be by internalizing the external costs of the transport chain.

More references on mode choice including a MoS chain include the one from Bergantino and Bolis (2004), in fact the first reference to introduce RoRo as an alternative by itself competing with road. It used an ASP database to which it applied a Tobit model instead of the typical Logit, considering four variables: cost, time, frequency and reliability. Variables reliability and frequency were found to have a threshold after which they did not affect the competitiveness of the RoRo option whereas cost and time were considered all along (hence, the Tobit model). Besides that, and although other authors stated it otherwise (Garcia-Menendez et al., 2009), no bias towards road was found. The lack of bias could be caused by the good knowledge of the maritime mode from the companies consulted and the small size of the sample (7 companies), as stated by the authors of the paper.

Russo and Chilà (2007) also considered the feasibility of a high-speed RoRo line (peak speed of 38 knots), in this case addressing two time-sensitive industrial sectors (perishables and industrial manufactured commodities). After applying a multinomial Logit to the existing demand (no disaggregate database used), a simple cost model was built to assess the best speed to be deployed. The authors concluded that there was room for high-speed RoRo connections due to the reduction in transit time. However, the model used some unlikely assumptions, like full cargoes, non-empty returns, an unlikely bunker consumption progression with vessel speed, and other which may have effects on the findings of the paper.

Since the approach and scope of the research participated by Feo-Valero is the most complete and the closest to the practical case studied in this