EXTENDED ABSTRACT

Comparing shippers and freight forwarders' port choice criteria: an application to the Spanish tile industry

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Abstract

In the last few years, manufacturing industries have undergone an integration process into global supply chains, where ports around the world have played a leading role as international trade facilitators (Lam, 2011).

In this context, although port authorities (PAs) have traditionally prioritised investments in port infrastructure (Tongzon, 2009; Malchow and Kanafani, 2004), in the last decade, the port regionalisation process (Notteboom and Rodrigue, 2005) towards the hinterland put pressure on the ports to develop strategies to improve their competitiveness. The main objective is to attract cargo from the land leg of the maritime supply chain. As an example of the importance given to the hinterland by PAs, the investment planning for the development of land infrastructure and intermodal facilities have become a priority for cargo attraction for policy-makers (Notteboom and Rodrigue, 2005; Van der Horst et al., 2008; Van den Berg et al., 2011). In this context, the identification of port competitiveness factors for land decision-makers is becoming more and more relevant for port managers.

Although some authors have studied the differences in port choice criteria between shippers and freight forwarders (De Langen, 2007; Yuen et al., 2012; Nazemzadeh and Vanelslander, 2015), the results obtained do not show unanimity among researchers. In this sense, De Langen (2007) concluded that there were no relevant differences in port choice criteria between Austrian shippers and freight forwarders, as they value the majority of attributes in a similar way. However, the author pointed out that the main differences lie in port costs, where freight forwarders were more price-elastic in demand than shippers. In contrast, Yuen et al., (2012) concluded that shippers were more cost-sensitive than freight forwarders in port choice decisions. Furthermore, the authors indicated that the later could be considered more sensitive than shippers to the high frequency of shipping services. Nazemzadeh and Vanelslander (2015) did not find relevant differences between them, as for both agents, port costs were the main port choice determinant.

Therefore, the present research aims to identify and compare the port choice criteria of shippers and freight forwarders, allowing to define the differences between them. Specifically, the study is focused on the port decisions made by the shippers belonging to the Spanish tile industry and the freight forwarders who manage their shipments, both located in Valencia and the province of Castellón. This is a particularly interesting case study because of the strong competition between the ports of Valencia and Castellon to attract this type of cargo, as this industry is located in the hinterland of both Spanish ports. Moreover, the port choice decisions made by the land decision-makers are addressed to two specific trade corridors: North Africa (Algiers, Egypt, Israel, Lebanon, Libya, Morocco, Tunisia) and the Arab Gulf (Jordanian, Kuwait, Saudi Arabia, Qatar and Arab Emirates).

Our study is based on data obtained from a choice experiment. Regarding the tile industry, personal interviews with 39 shippers were conducted, representing this sample 27,85% of the tile companies identified in Castellón. For freight forwarders, personal interviews with 13 companies were carried out, representing 9% of the total population of these agents located in Valencia and Castellón. Therefore, a total sample of 52 companies completed the questionnaire.

Regarding the choice experiment, a Stated Preference (SP) survey (choice set of 12 scenarios) was conducted (Vermeiren and Macharis, 2016; Nugroho et al., 2016). The

methodology used for the choice experiment is the efficient design which aims to minimize the standard errors of the parameters to be estimated (Bliemer and Rose, 2005; Rose and Bliemer, 2007; Rose et al., 2008; Bliemer et al., 2017). The experimental questionnaire was designed by using the Ngene 5.1 software, developed by ChoiceMetrics (ChoiceMetrics, 2012).

To do this, discrete choice models, specifically Mixed Logit, are used. A mixed logit model can be used without a random-coefficients interpretation, as simply representing error components that create correlations among the utilities for different alternatives (Train, 2009). The utility functions for the Mixed Logit with error components is given by the following equation:

$$U_{nA} = \beta_1 \, COST_A + \beta_2 \, (DDEC \times COST_A) + \beta_3 \, FREC_A + \beta_4 \, RET_A + \beta_5 \, (DDEST \times DVAL \times RET_A) + \beta_6 CLOS_A + \beta_7 \, DDEC + \mu_{n+} \varepsilon nA$$

$$U_{nB} = \beta_1 \, COST_B + \beta_2 \, (DDEC \times COST_B) + \beta_3 \, FREC_B + \beta_4 \, RET_B + \beta_5 \, (DDEST \times DVAL \times RET_B) + \beta_6 \, CLOS_B + \varepsilon_{nB}$$

The port attributes included in the model specification are as follows:

- Transport chain cost (COST): this variable aggregates the cost of land transport (Tiwari et al., 2003, De Langen, 2007, Steven and Corsi, 2012), port charges (Yuen et al., 2012) and the maritime transport cost. To our knowledge, this is the first study in which the transport chain cost is measured jointly when modelling port choice.
- Frequency (FREQ): the number of weekly departures from the ports of Valencia and Castellon to the countries under analysis, which are located in North Africa and the Arab Gulf (Steven and Corsi, 2012, Tongzon, 2009, Ugboma, 2006, Yuen et al., 2012; Vermeiren and Machiaris, 2016).
- Reliability (REL): this variable is used as a proxy for reliability and it is measured as the percentage of delays suffered along the whole maritime supply chain (including port access congestion, port operations and those originated by vessel delays). To our knowledge, this is the first study that includes this variable.
- Closing Time (CT): this variable measures the latest time established by the port to accept export cargo before the scheduled call of the vessel. It is a proxy

variable of the importance of time and flexibility for companies, since the Closing Time requires the cargo to be at the port no later than48h before the arrival of the vessel. To our knowledge, this is the first study that includes this variable.

Additionally, some covariates were also included in the model specification:

- Type of decision-maker (DDEC): dummy variable that takes value 1 when the company is a freight forwarder and value 0 when it is a shipper.
- Value (DVAL): dummy variable that takes value 1 when the monetary value of the shipment is equal to or higher than 10.000€ and value 0 otherwise. The previous authors that included this covariable concluded that the weight given to qualitative attributes (time, delays and frequency) is greater when the value of the shipment is higher (Tongzon, 2009; Vermeiren and Macharis, 2016).
- Market of destination (DDEST): dummy variable that takes value 1 when the markets of destination are the countries located in Arab Gulf and value 0 otherwise. This covariable is included to capture the differences in terms of maritime transit time, frequency of shipping services and delays between maritime services covering regional (North Africa) and interoceanic (Arab Gulf) routes.

Table 1 shows the results of the Mixed Logit specified for shippers and freight forwarders.

Table 1. Results of the Mixed Logit

Variables	Coefficient	T-test
CT	-0.409	**-2.48**
COST	-0.00759	**-2.59**
COSTE*DDEC	-0.0125	**-2.59**
FREQ	0.949	**5.65**
REL	-0.0702	-0.78
REL*DDEST*DVAL	-0.191	**-1.72**
DDEC	1.41	**3.51**
Sigma	1.08	**4.70**
N.Obs=624		
Rho2= 0,17		
Rho2 ajust=0,152		
Log. L= -358,329		
Draws: 1000		

All the coefficients turned out to be statistically significant and with the expected sign, except the delays variable, which was only significant in its interaction with high value shipments and interoceanic markets of destination.

In our model, interactions were specified between the four port attributes and the decision-maker variable (DDEC), which is interpreted for the freight forwarder. However, three of these interactions were not included in the model because of the cost attribute was the only coefficient which showed statistically significant differences between shippers and freight forwarders, therefore, only this interaction was included. The results pointed out freight forwarders as a more cost-sensitive agent than shippers, in line with the result obtained by De Langen (2007). Two points may explain this difference. On the one hand, freight forwarders are intermediate companies that work with a profit margin on the price, so their sensitivity to cost variations is greater. On the other hand, in order to improve the capacity to attract and retain their customers, freight forwarders must offer their services and get better market prices than their competitors as an effective commercial strategy. It is important to note that services offered by freight forwarders are in many cases homogeneous, so the prices are even more relevant as a differentiation factor.

Frequency shows the relevance and positive effects that this variable has on both decision-makers. Particularly, it increases the flexibility in the management and planning of the shipment: a high frequency allows both shippers and freight forwarders to adjust their shipments to the desired days, thus reducing waiting times in port terminals. Besides, in case of significant delays or cancellations of maritime service calls, a high frequency allows to reduce the waiting time until the next service arrives at the port, loading the goods in the shortest possible time.

In the case of the delays variable, only the interaction with the market of destination and the value of shipment was statistically significant. On the one hand, the interaction between the value of the shipment and the variable delays shows a greater relative sensitivity of high value shipments to qualitative factors (Vermeiren and Macharis, 2016). On the other hand, the interaction between the market of destination and variable delays shows the substantial differences between the regional and interoceanic services. The maritime connections from the ports of Valencia and Castellon to the countries

located in North African region requires 1 or 2 intermediate port calls. In contrast, the maritime services linking the Arab Gulf need 4 to 7 intermediate port calls. Therefore, due to the mentioned differences, the result pointed out that shippers and forwarders only consider this attribute in the case of high value shipments to the Arab Gulf.

Regarding the closing time, the result shows the importance attached to flexibility for shippers and freight forwarders. In this sense, closing time requires the cargo to be at the port no later than 48h before the arrival of the vessel, therefore, it may represent a restriction in the management and preparation of the shipment for the companies, stressing its supply chain to meet the fixed terms.

Finally, the variable associated with the type of decision-maker has been included in the specification as a socio-economic variable. The result obtained allows us to conclude that, ceteris paribus, the probability of freight forwarders continuing to choose their current port is higher than the one of shippers. This result has important implications for PAs when designing their competitive strategies to attract freight forwarders and shippers' cargo. On the one hand, the inertia of freight forwarders continuing to use their current port is determinant when implementing policies oriented to qualitative factors (frequency, closing time and delays). This fact implies that the improvement in the current level of service must be higher for them than the one for the shippers. On the other hand, freight forwarders are a more cost-sensitive agents than shippers, therefore, the policies aiming to reduce the transport chain cost would be more effective to attract freight forwarders than shippers' cargo.

Therefore, the results obtained provide relevant information for policy-makers and PAs in their decision-making process. The identification of the cost differences between shippers and freight forwarders is deemed essential to allow PAs to develop the optimal commercial and competitive strategies oriented to the real decision-maker. However, PAs need to make an effort in order to know in depth who is the responsible for port choice decisions in each industry.

Keywords: *discrete choice modelling, port choice, ceramic tile industry, Port of Valencia, Port of Castellón.*

JEL codes: R41, R49, C35