The role of the market potential in the port choice process: A case study

Lorena Garcia-Alonso (Corresponding author)
lorena@uniovi.es
Applied Economics Department, Regional Economics Laboratory (REGIO*lab*)
University of Oviedo, Spain

Miguel A. Márquez
mmarquez@unex.es
Applied Economic Analysis Group
University of Extremadura, Spain

Lorena Garcia-Alonso, Ph.D (Economics), is Associate Professor at the Applied Economics Department of the University of Oviedo (Spain). She has presented numerous papers in international conferences and published several articles in prestigious international journals such as Maritime Economics and Logistics, Maritime Policy and Management, Transport Reviews, Transportation Journal or International Journal of Shipping and Transport Logistics. She is Member of the International Association of Maritime Economics (IAME), Regional Science Association International (RSAI), European Regional Science Association (ERSA) and Spanish Association of Regional Science (AECR), and founding member of the researching group Regional Economic Analysis Laboratory (REGIOlab).

Miguel A. Márquez, Ph.D. (Economics), is Head of the Department of Economics at the University of Extremadura (Spain) and Scientific Secretary of the Spanish Association of Regional Science (AECR). He is Affiliate Research Professor at the REAL (University of Illinois, USA) and member of the European Union Regional Economics Applications Laboratory (EU-REAL). His major research work has covered a variety of topics on regional economics, particularly economic growth and economic models. He has published numerous books and articles in prestigious international journals on these topics like European Economic Review, Environment and Planning A, Papers in Regional Science, etc.

Abstract: According to the theoretical postulates of the New Economic Geography, the ability of ports to attract traffic from the economic activity centres should be influenced by their geographical location regarding them. The aim of this paper is to test that hypothesis through the Spanish case study by introducing the concept of market potential in the analysis. For this purpose a double perspective is used: that of the province where the port is located and that of the province where the traffic is generated. The obtained results validate the stated hypothesis and open the door to very interesting queries about the planning of both the infrastructure map and the regional economic policy.

Keywords: inland traffic distribution; inter-port competition; market potential; port choice; port hinterland; Spanish Port System.

1. Introduction

As Ducruet *et al.* (2015) stated, "*the link between transport and regional development is one central pillar of new economic geography*". A suitable planning of the infrastructure (and the transport services) improves the accessibility, which could favour the improvement of both the competitiveness of any economy and its regional cohesion. This is why the best understanding on how and (especially) why the flows of traffic are distributed across the territory is required. Nevertheless, the previously cited authors also highlighted that Fujita and Mori (1996) is the only reference that addresses the role of ports in that context[1], despite the fact that ports have been crucial for the socio-economic development of the regions where they are located ((Deng *et al.* 2013), (Ng *et al.* 2014), (Bottasso *et al.* 2014)). Furthermore, the largest amount of the flows of foreign trade are channelled through their facilities. Therefore, the inland distribution of the maritime traffic resulting from the port choice process contributes to explain the spatial configuration of freight corridors across a country and, consequently, it also contributes to identify where and how the land transport infrastructure actually needs to be improved, for instance, by setting inland terminals (see Cullinane and Wilmsmeier (2011), Monios (2011), Rodrigue *et al.* (2010), Rodrigue and Notteboom (2012), Roso *et al.* (2009), Van den Berg and De Langen (2011), Wilmsmeier *et al.* (2011) or Witte *et al.* (2014) for a deeper knowledge of the relevant role that those facilities can play in the configuration of the port hinterland). That knowledge is not only important for the regions where the improvement of the transport infrastructure takes place, but also for the neighbouring areas of these regions because of its spillover effects (Laird *et al.* (2005), López *et al.* (2009)).

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[1] These authors highlighted that ports contribute to create endogenous growth by providing a competitive advantage to the economic activities located around it.

As Ng *et al.* (2016) highlighted: "To ensure the sustainable growth of the global economy, research on the role of ports, and their impacts as 'nodal points', will contribute towards significant value not only to the academic literature, but also in boosting regional development". This paper aims to contribute in that field. The proposal is to bridge the port choice analysis and the regional economy perspective. In order to achieve that goal, the case study carried out analyses the inland distribution of the maritime traffic focusing on the role of the market potential. The remainder of this paper is organized as follows. Section 2 offers a brief literature review on the relevance of the inland perspective in the port choice analysis. Section 3 introduces the concept of *market potential*. Section 4 shows the explanatory spatial data analysis used to analyse the geographical dimension of the *market potential* variable. Section 5 describes the theoretical frame supporting the empirical analysis, which is focused on the Spanish case and whose results are provided in Section 6. Finally, Section 7 summarises the main conclusions drawn and also discusses the pending points for further research in this field.

2. Literature review

Over the last decades maritime traffic has concentrated around a decreasing number of ports as a consequence of the transport sector modernization (Hoyle and Charlier 1995), reinforcing the inter-port competition (Malchow and Kanafani 2004). This process has been reflected in the maritime economics literature field, and the number of articles focusing on the consolidation of the hub-and-spoke port model has notably increased in recent years. Moreover, the perspective of the analysis has been expanded: while traditional studies focused on the analysis of the economic impact, the efficiency or the port activity costs, many recent articles deal with the analysis of the logistic network configuration, the role of the port facilities in these networks or the comprehension of the port choice process (see Meersman *et al.* (2010), Paixao

Casaca *et al.* (2010), Pallis *et al.* (2010), Woo *et al.* (2011), Woo *et al.* (2012) or Martínez Moya and Feo-Valero (2017) for more in-depth knowledge of this field in the literature).

From a revision of the literature, it can be observed that despite the fact that both the origin and the destination of the maritime flows are on the inland side (Garcia-Alonso *et al.* 2016), the landside approach is not common when analysing the port choice. The empirical investigation of the port traffic distribution has received much more attention from the maritime side (see Cullinane and Wilmsmeier (2011), Guerrero (2014) or Monios (2011)) although geographers have developed numerous models to analyse the spatial evolution of nodes and corridors linked to ports and port systems (see Ng (2013) or Wilmsmeier *et al.* (2014)).

Besides the lack of data, many authors consider that the focus of the competition for the traffic takes place among logistical chains (see, for instance, Magala and Sammons (2008) or Robinson (2002). This approach suggests that the development of the intermodal transport implies that the activity of ports no longer depends on their socio-economic environment. Nevertheless, Meersman *et al.* (2010) point out that competition between ports "is also affected by regional factors". In this sense, Fleming and Hayuth (1994) were pioneers in recognising the relevance of the hinterland in the port activity despite the process of containerisation. More recently, other authors also suggest that each port belongs to a system and, consequently their activity is directly linked to the evolution of their political and socio-economic environment, particularly when there are large centres either of production or consumption in the surroundings of the port facilities (Bichou and Gray (2005), Deng *et al.* (2013), Guerrero (2014), Notteboom (2010), Yap and Lam (2006)). Besides this, Rodrigue and Notteboom (2010) suggest that foreland and hinterland reinforce themselves and Notteboom and Rodrigue (2005) highlight specifically the relevance of the inland maritime traffic distribution. That is mainly explained by two facts. On the one hand, no relevant improvements are expected in the maritime side of the transport system and, on the other hand, the inland transport costs represent

the highest cost component in the transport chains (Halim *et al.* 2016). Therefore, the inter-port competition (at least in Europe) is currently focused mostly on the hinterland transportation systems (Vermeiren and Macharis 2016).

This paper agrees with that conceptual approach. Its aim is to go further in the identification of the variables determining the port hinterland configuration by analysing the links between the port activity and the regional economy. The location of ports is a variable often considered when analysing the port choice process though its role is usually controversial (Tongzon, 2009). Nevertheless there is no doubt about its influence when the inter-port traffic distribution is analysed from the landside perspective (see for instance the articles focusing on the Spanish case: Garcia-Alonso and Sanchez-Soriano (2009), Veldman *et al.* (2011), Veldman *et al.* (2013) or Veldman *et al.* (2016)). Taking that evidence as a starting point, this paper takes into account the links among regions (those generating the flows of traffic and those where the ports are located) to explain the port choice and, consequently, the configuration of the hinterland of ports.

According to the New Economic Geography (NEG), the core regions tend to have higher income because of their better access to the main markets. Theoretical articles identify the product-market linkages among regions as a key factor of the geographical concentration of the economic activity (see Hanson (2005) for a summarised revision of the literature on spatial agglomeration). Both results make it reasonable to assume that ports located at core regions are able to attract a larger amount of traffic than ports located at peripheral regions. In this sense, Shi and Li (2016) highlighted that the impact of the regional economy on the ports hinterland development is increasingly significant. Indeed, Ferrari *et al.* (2011) already suggested that "the better the connection of a port to the various inland markets, the bigger the potential to enlarge its overall captive area" and vice versa.

Additionally, Mori and Nishikimi (2002) concluded that a greater concentration of industries in a region increases the transport flows through its territory reinforcing its role both as an industrial centre and as a transport hub. LeSage and Polasek (2008) suggested that the flows between two places depend on the characteristics of the origin and the destination and additionally on the features of the surrounding regions. More recently Márquez-Ramos (2016) concluded that the foreign trade of a region benefits from their neighbours' transport infrastructure more because of the regional spillovers than of the port services per se. Previously Márquez-Ramos *et al.* (2011) also found that the larger the size of a port, the lower its freight rates. Simultaneously Ferrari *et al.* (2011) stated that there are gravitational forces linking the ports and the hinterlands. Furthermore Ducruet *et al.* (2015) also concluded that the core regions generate larger, more diversified and more valuable flows whereas peripheral (agricultural and industrial) regions are more specialized in bulk traffic generation. Finally, Xiao and Lam (2017) found that both the distance to markets and the economic factors influence port activities.

Considering the conclusions of all these articles and with the formerly stated idea in mind[2], our hypothesis is that the *market potential* of the regions may contribute to explain the port choice. To check that hypothesis, the market potential variable was defined and introduced into a multinomial logit model. What that variable means and how it was introduced in the proposed model can be seen in the following sections.

3. The Market Potential concept

It is expected that firms prefer to be located in those places where their costs are minimized, both in general terms as, in particular, with regard their access costs. To assess such accessibility, Harris (1954) proposed the concept of *market potential*, widely used in Regional

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[2] Competition between ports "is also affected by regional factors" (Meersman *et al.* 2010).

Economics (Liu and Meissner 2015). That index shows the intensity of the links among different markets and brings similar results than more sophisticated measures (Faiña *et al.* 2013). Nowadays, the market potential concept is also being used in transport planning for assessing the potential economic impact of improvements in transport infrastructures (Salas-Olmedo *et al.* 2015).

In general terms, the *market potential* (*MP*) of a region *i* shows the accessibility of a region to the global market (Clemente *et al.* 2009). It is defined as (1):

$$MP_i = \sum_{j \neq i}^{n} \frac{M_j}{d_j} \tag{1}$$

Where:

- *M* is a measure of the volume of the economic activity of region *j*, accessible from *i*.
- *d* is the distance between *i* and j.

Following Harris (1954), the economic activity will be the highest in those regions closest to big markets. However, the ad-hoc formulation of the market potential only took place once the link between the market access and the regional economic development was explained theoretically by the NEG. According to the NEG models, firms prefer to be located in regions with the highest market potential, reinforcing their initial market potential (Krugman 1991a).

The market potential is one of the most frequently used accessibility indicators in transport planning (Condeço-Melhorado *et al.* 2013). However, as far as we know, it has never been used to explain the port choice. The hypothesis stated in this paper is that the market potential variable contributes to explain the inland distribution of the container maritime traffic and, consequently, the port hinterland configuration. In other words, the market accessibility of the provinces (both those where the flows of traffic are generated and those where the ports are located) influences their port choice.

According to the NEG hypothesis, the shorter the distance between the port and the spatial origin of the flow, the stronger the link between them (and vice versa)). Following that idea, Ferrari *et al.* (2011) have already stated that the flows between a port and a specific place depend directly on their mutual attractiveness and inversely on the distance separating them. Therefore, and from a theoretical perspective, the ability of the ports to attract traffic would be related with their own accessibility to the demand and the resources: those ports located in provinces with better accessibility to the demand (higher market potential) could for instance benefit from economies of scale. That is, the ports located in provinces with higher market potential would have a higher chance to be chosen. Likewise, a higher market potential in the provinces where the traffic is generated (and where the port choice takes place) favours the export propensity and, therefore their chance of choosing a particular port vs other provinces with lower market potential.

4. Exploratory analysis of data

The hypothesis of this work arises from the observation of the result of a brief exploratory analysis of the variable *market potential* carried out for the 47 Spanish peninsular provinces. This variable shows the capacity of access to the market of each Spanish peninsular province. Besides the constraint regarding the availability of data for some variables, 2007 is the year just before the outbreak of the financial crisis and, therefore, before the economic cycle and the trade flows were disrupted.

In this paper, the market potential is defined for each province according to (2):

$$MA_i = \sum_{j=1}^{n} \frac{GDP_j}{d_{ij}} \tag{2}$$

Where:

- GDP_j is the gross domestic product of the province *j*.

- d_{ij} indicates the distance that separates the considered province capitals.

- *n* denotes the number of considered provinces.

From (2), the *market potential* is calculated as the weighted sum of the *GDP* of the Spanish peninsular provinces, where the weighting scheme is the distance between the capitals of each province measured in km. The internal distance of each province (d_{ii}) is considered proportional to the square root of the area of the province according to (3):

$$0,66 \sqrt{Area/\pi} \tag{3}$$

Where:

- *Area* represents the size of province *i* in km^2 (see Crozet (2004), Head and Mayer (2000) or Nitsch (2000) for a discussion on this internal distance).

The analysis of the results reflects the existence of an east-west dichotomy in the spatial distribution of the market potential of the Spanish provinces, as can be observed in Figure 1. The provinces included in quantiles 3 and 4 generated more than three quarters of the Spanish foreign trade in 2007 (Ministerio de Economía y Competitividad n.d.). Inside this group we can find the provinces greatly responsible for the largest amount of flows: Barcelona and Madrid (22 and 11 per cent of the total respectively). These provinces together with Valencia (6 per cent), Zaragoza (4.4 per cent), Bizkaia (4.2 per cent) and Gipuzkoa (3.5 per cent) generated half of the Spanish foreign trade in 2007. All of them are included in quantile 4 (except Zaragoza, included in quantile 3). The provinces of Madrid, Barcelona and Valencia were also mainly responsible for the Spanish GDP generation in 2007: more than one third of the total (Instituto Nacional de Estadística de España n.d.). The triangular area delimited by Basque Country-Gerona-Valencia (including Madrid) was already identified as the core of the Spanish Peninsular economy by López-Rodríguez *et al.* (2008): almost one half of the population and

60 per cent of the Spanish GDP is concentrated there. These authors also found that the highest values of the market potential were concentrated there.

Figure 1. Quantiles of Spanish peninsular provincial market potential

A contrast of global space autocorrelation for the variable *market potential* was made using the statistical Moran's I ((Anselin 2003), (Cliff and Ord 1981)). It compares the value of a variable located at a specific place with its values at the neighbour regions. It is defined as (4):

$$I = (N/S_0)(z'Wz/z'z) \qquad (4)$$

Where:

- N is the number of provinces.

- $S_0 = \sum_i \sum_j w_{ij}$, w_{ij} being an element of the contiguity matrix W. This matrix is defined in such a way that it identifies the interactions between neighbouring provinces: each province (rows) is linked to those that belong to its surroundings (columns). Formally, $w_{ij} = 1$ if the provinces i and j are adjacent and $w_{ij} = 0$ if they are not. In order to facilitate the economic interpretation of the results, the elements of each row of the matrix W add up to one (row-standardized). Therefore, the terms of the spatial delays represent the weighted averages of the bordering values.

- z_{it} represents the deviation of the market potential of province i with respect to the mean (a vector of OLS residuals).

The value of Moran's I for the variable *market potential* in 2007 is 0.433, far above the expected value for this statistic according to the null hypothesis of absence of spatial correlation, $E[I] = -0.0217$ (p-value $= 0.001$). This indicates that positive spatial autocorrelation

exists and that, therefore, there is a strong and statistically significant degree of spatial dependency in the distribution of regional market potential (see the Moran scatterplot in Figure 2). As a result, regions with high (low) market potential have neighbouring regions with high (low) market potential, raising the necessity to explore the contribution of this positive spatial dependence on the port choice.

Figure 2: Moran's I for the Spanish peninsular provincial market potential.

5. Specification of the model

In this paper, the observed port choice is explained by a multinomial logit model. It is defined according to (5):

$$P_{ijk}(p = k/p = 1, ..., P) = \frac{e^{-U_{ijk}}}{\sum_{p=1}^{P} e^{-U_{ijp}}} \tag{5}$$

Where:

- P_{ijk} reflects the probability that the province i chooses port k to channel its traffic to or from j. As it is defined, P_{ijk} can be interpreted as the market share of the port k in the traffic established between the province i and the foreign origin/destination j.

- U_{ijk} represents the utility derived from the choice made. In the context of the Discrete Choice Theory, the province i chooses the port k to channel its traffic to/from j only when that port provides the highest utility.

The utility is usually decomposed into two parts: i) the observed component (V_{ijk}), defined regarding the variables linked to flows and port alternatives, and ii) the unobserved

component (or error term) ($\mathcal{E}_{ijk}$), that captures the factors that affect the utility but which are not included in the previous part, as it is shown in (6).

$$V_{ijk} = U_{ijk} + \mathcal{E}_{ijk} \tag{6}$$

Usually the utility function analyses the role of factors related both to the costs and to the quality of the transport service in the port choice. Nevertheless, as is common in this type of studies, it ignores aspects related to demand, such as the access to the market (Redding and Venables 2004) or the real market potential (Head and Mayer 2004). Our aim is to overcome this limitation using the framework of the so-called New Geographic Economy ((Krugman 1991a), (Krugman 1991b)). Therefore we incorporate the distance to the economic mass (distance to the consumer markets or market potential) as an explanatory variable of the process of port choice. This variable is defined from a double point of view: i) the provinces that house the analysed ports, and ii) the provinces in which the traffic is originated. Consequently, the utility function V_{ijk} was defined as a linear combination of the explanatory variables gathered in (7), as it is usual in the literature:

$$V_{ijk} = \alpha_0^k + \alpha_1 LC_{ik} + \alpha_2 MC_{jk} + \alpha_3 Q_k + \alpha_4 MA\_PROV_i + \alpha_5 MA\_PORT_k +$$

$$\alpha_6 MA\_PROV_i MA\_PORT_k \tag{7}$$

Where:

- LC_{ik} represents the land transport cost between the province i and the port k.

- MC_{jk} reflects the maritime transport cost between the port k and the overseas origin/destination j.

- Q_k is a fictitious variable linked to the port that channels the traffic. It entails aspects related to the characteristics of the service offered in it and not expressed through other variables.

- *MA_PROV*$_i$ reflects the market potential of the province in which the traffic is generated.

- *MA_PORT*$_k$ represents the market potential of the province in which the port is located; both of them defined for each province according to (2), in section 3.

From an economic perspective, the new variable MA $_i$ introduces the idea that those ports located in regions/provinces with better access to the large markets (with greater market potential) would tend to remunerate their local production factors (workers) better according to the higher average salaries paid in those regions with higher GDP. Therefore, the higher the GDP of the provinces nearest the port, the greater MA_PORT (and the resulting wage levels as previously was stated). It could mean a comparative disadvantage with respect to other facilities, discouraging its choice. In addition, this higher level of activity in the surroundings of the port may also lead to greater levels of congestion of all types of infrastructures, elevating access times and decreasing its attractiveness. Nevertheless, the location in a province with a high market potential can also mean a saving in the cost of transport of the goods (and even a reduction of travel time): the larger the transport flows in a region due to the concentration of industries, the lower the generalized cost of service because of the existence of economies of density and scale, stronger competition among carriers/shippers and the higher investment in logistic and infrastructure facilities ((Alamá-Sabater *et al.* 2012), (Mori and Nishikimi 2002), (Wilmsmeier *et al.* 2006)). Besides, Murphy *et al.* (1992) found that port users would be willing to accept higher costs in return for a better service, presumably easier to find in those regions with better connections to large markets. Therefore the expected sign of the influence of this variable is positive though it is not absolutely clear from a theoretical perspective [3]: as stated

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[3] Similarly, Bottasso *et al.* (2014) suggest that the agglomeration power of ports depends on the balance between agglomeration and dispersion forces, which can vary in time and are affected by several factors. The same ambiguity can be found with respect to the population variables in gravity models. The sign of their

before, the probability of choosing the port k could also diminish when increasing its market potential because of the higher costs and a hypothetical congestion of the region's facilities.

On the other hand, the value of the variable *MA_PROV* characterizes the province from which the choice of port is made. In this case it is possible to expect a direct and clear relation with the probability of choice: the greater the level of activity, the greater the probability of the generation of maritime traffic and greater, therefore, the probability of being part of the hinterland of a port by comparison with provinces with lower market potential.

The relative position of the port k with regard to another port p to channel the flow *i-j* is expressed through the quotient between the probability that an exporter (or importer) chooses the port k with respect to choosing the port p. According to (5), the relationship between them becomes (8):

$$P_{ijk}\Big/P_{ijp} = e^{-U_{ijk}}/e^{-U^{ijp}} = e^{U^{ijp}} - e^{U^{ijk}} \qquad (8)$$

Taking logarithms, the model to consider now is (9):

$$Ln\left(P_{ijk}\Big/P_{ijp}\right) = V_{ijp} - V_{ijk} \qquad (9)$$

The empirical contrast of the influence of the variables considered in the port choice is presented in the following section.

6. Data and results

6.1 Data used

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coefficient can be positive or negative depending on the predominant effect: economies of scale or absorption effect (Marquez-Ramos, 2016).

In this paper, all the data used come from official sources. The land transport costs were calculated through the information provided by CIM (2009) and Dirección General de Transporte Terrestre (2008) regarding the distance from provinces to ports. The data relative to the maritime transport was taken from Drewry (2007), and P_{ijk} was calculated from information gathered from the foreign trade database of the Spanish Customs Statistics, that allows to determine: i) the volume of each foreign flow according to the transport mode, ii) its provincial origin/destination, ii) the country with which the exchange takes place, and iv) the port that channels it. Finally, the data relative to the provincial GDP comes from the National Institute of Statistics of Spain.

On the other hand, only the container flows are analysed in this paper. The progress experienced in the transport sector has fostered the spatial volatility of the flows of freight, causing both concentration and diffusion of markets. In the maritime transport context, the meaningful increase of the mobility of flows has taken place for the container traffic (the bulk traffic remains captive of the nearest facility). Consequently, the analysis of the inter-port competition should focus on the container traffic distribution. Likewise, the core economic regions concentrate the most valued and diversified flows, which are increasingly often transported by containers, while the bulk traffic is usually concentrated in the peripheral regions (Ducruet *et al.* 2015) and is captive from its nearest port. This is also a relevant fact to be taken into account for the purpose of this paper.

The analysed container flows were the Spanish peninsular exports handled by the ports of Algeciras (ALG), Barcelona (BAR), Bilbao (BIL), Cartagena (CAR), Castellón (CAS), Valencia (VAL) and Vigo (VIG). That means that the traffic generated outside Spanish borders was ignored, despite being aware that the ports' hinterland can transcend the national borders

and that the national flows can be channelled through ports located in other countries[4]. The main reason is the lack of traffic data from France and Portugal. However, this fact does not affect the conclusions drawn because the bulk of the traffic of the Spanish ports comes from the Spanish trade. Consequently, the flows analysed are a very representative sample of the Spanish inland corridors linked to the national ports. Additionally, the final goal of the analysis is to serve as a starting point for future works on, for instance, the suitability of the inland infrastructure investment. Therefore, the results of this analysis remain valid even though the ports may also handle traffic from other countries (and *vice versa*).

The volume of flows was considered as a whole, without distinguishing their composition although the determinants of the port choice could vary according to the type of traffic. This is because this paper aims to contribute to explain the spatial configuration of transport corridors; not to identify the particular needs of a specific kind of flow. Finally, the country destination of the export flows were grouped into 8 geographical blocks in order to facilitate the calculation of the maritime costs: Western Mediterranean, Easter Mediterranean, Western Africa, Arabian Sea, Eastern Asia, North America, South America (Western) and South America (Eastern).

6.2 Obtained results

The estimation of the model proposed in (9) has been carried out by means of ordinary least squares considering Valencia as the base port. Taking this into account, the results obtained when analysing the inter-port distribution of the export flows in containers in 2007 are those laid out in Table 1. They demonstrate the validity of our hypothesis: the market potential

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[4] Kashiha *et al.* (2016) underlined that it is very common to restrict the analysis to a set of ports located in a single country, and they alert about this practice because it can lead to overlook relevant variables for the port choice. Nevertheless, that should not be a problem in this case because we are not looking for explanatory variables; the aim of this paper is only to verify the role of the market potential in that process.

contributes to explain the port choice. They also show that the influence of this new variable in the port choice is much more relevant than the maritime and land costs.

Table 1. Results of the model estimation for exports.

As it can also be seen in Table 1, the corresponding signs indicate that when the market potential of the province in which the port is located increases, the probability of choosing this port is also increased. Thus, it can be assumed that those ports located in provinces with better higher market potential (higher accessibility to the demand) could for instance benefit from economies of scale and, consequently, they would have a higher chance to be chosen by any flow from any province. Equally, an increase of the market potential of the province from which the choice is carried out means an increase (vs other provinces) in the probability of choosing the base port (Valencia in this case, which have the more expanded hinterland (see Garcia-Alonso *et al.* (2016)). Additionally, an important question pending for future research also arises from our estimation: the interaction between these two variables (the market potential of the province in which the port is located and the market potential of the province from which the choice is carried out) has obtained a negative and significant coefficient. Apparently, this would indicate that the existence of high market potential in both provinces acts like an undesirable factor when choosing port. Nevertheless, that is not necessarily true. A very plausible explanation for that misleading result could lie in the model specification: it considers the port of Valencia as reference for the port choice process. But from the exploratory analysis we know that the main ports (Algeciras, Bilbao, Barcelona and Valencia) are by far the preferred for the traffic generated in their own provinces, all of them with high market potential and responsible of the generation of a huge amount of the maritime Spanish flows.

7. Concluding remarks

From the transport perspective, ports are key elements of the logistic chains. Therefore, they have a relevant role to play in the configuration of the traffic corridors and, consequently, in the use (and design) of the infrastructure as a whole (not only of the maritime endowment). Furthermore, and from the economic point of view, they are a relevant growth engine for the region where they are located, generate positive spillovers on the GDP of nearby regions, and are a key factor supporting the foreign trade of their country. Therefore, the analysis of how the flows of traffic are distributed among the ports deserves attention, particularly of the policymakers engaged in decision-making about the map of infrastructures, the regional cohesion or the national competitiveness.

In light of the convenience of a better understanding of the inter-port traffic distribution for the land infrastructure endowment, this paper contributes to the existing literature by assessing the relevance of the market potential of the regions on the port choice process. We knew that the ports should not be considered in isolation because they are integrated in logistic chains. In addition we knew that they belong to an economic system and consequently the characteristics of their surroundings influence their traffic. Now we also know that the potential market of the regions contributes to explain the inter-port traffic distribution and the hinterlands configuration; i.e., the port choice process. That new finding is relevant because it highlights that the regional economic characteristics are also key for the port choice.

The results obtained in this paper highlight some implications for policymakers. Firstly, some of the port choice determinants are not under the Port Authorities' control, such as the location of their facilities. Secondly, regional and national policymakers can act to improve the relative accessibility of a port in such a way that this improvement can result in a reinforcement of the competitiveness of those regions a priori more willing to divert their traffic through that port. Thirdly, it is important to take into account if the expected growth of traffic is high enough

to justify that intervention regarding the market potential of the involved territories. Therefore, and finally, the potential market can be used as an indicator of which port would be able to attract a higher volume of traffic and, consequently, which land corridor should be reinforced in order to improve the efficiency of the transport infrastructure of a country.

The conclusions stated here are valid for the Spanish case, but they are general enough to be translatable to other countries: any attempt to improve the inland infrastructure aimed to expand the hinterland of any port should take into account the market potential of the territories involved. Nevertheless, more empirical research would be desirable in order to go deeper in that finding. For instance, it is known that improvements in the infrastructure endowment or in the transport services offered can result in an improvement in accessibility. In this paper we used the distance as a proxy of the accessibility of regions when defining the market potential; but this is a static (and even poor) indicator for accessibility. Thus, it would also be very interesting for future research to replace "distance" with a variable able to capture relative changes in accessibility between regions in time. Additionally, the impact of the interaction of the market potential of both provinces (origin-destination) needs to be more deeply studied. Both pending issues suggest the convenience of changing the theoretical approach from the Discrete Choice Theory to the Regional Economy perspective and the Spatial Econometric Analysis.

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