VI MEETING ON INTERNATIONAL ECONOMICS: "FREIGHT TRANSPORT IN EUROPE: FACTS AND CHALLENGES"

SUPPLY CHAINS AND REGIONAL PORT CONNECTIVITY: AN APPLICATION TO THE SPANISH PORT SYSTEM

Julián Martínez Moya

International Economics Institute – University of Valencia

Outline:

- Introduction
- Literature review
- Methodology
- Data
- Results
- Policy implications
- Conclusions

Introduction

- Maritime connectivity has been considered a key factor in facilitating international trade and the fragmentation of global value chains. The effects are clear: **connectivity reduces transport costs** and improves trading relationship between countries (Wilmsmeier et al., 2008).

- In this context, **ports** play a determining role in defining such connectivity:

  - ✓ On the one hand, port connectivity has a direct effect on the **supply chains competitiveness**

  - ✓ On the other hand, competition among ports is fierce when it comes to improving their connectivity. As a result, PAs **design policies** to improve this.

- Therefore, it is important to study port connectivity to help policy-makers in their decision-making process and improve the competitiveness of the supply chains.

Introducción

The objective of the present research is to study the **port connectivity of the Spanish port system** in **containerized SSS traffics**. To this end, the **Annualised Capacity Capacity** (ASC) methodology will be used.

Furthermore, **the regional port connectivity** of Spanish ports to access the main regional markets will be analyzed. This has important advantages:

A. **Highly valuable information for shippers** by showing which ports are the ones offering the best connectivity to the countries of destination / origin of their exports / imports.

B. Identifying the most **competitive Spanish ports** to serve each of the major markets

C. PAs can detect **weak points** of their network when comparing themselves with the most direct competitors

D. Policy-makers have at their disposal more accurate information to **design policies** to improve their connectivity.

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Literature review

1. **Ports connected to shipping networks: obtaining the maritime network patterns and establishing hierarchies between ports.**

    - Methodology: **The graph theory**: to describe the position of a port in relation to the regional or global network (Ducruet et al., 2010; Laxe et al., 2012¸Montes et al., 2012; Ducruet and Notteboom, 2012; Seanone et al., 2013; Tovar et al., 2015).

Literature review

2. Develop an index to measure port connectivity. Different methodologies have been used.

	OBJECTIVE	VARIABLES
Liner Shipping Connectivity Index (LSCI)	Country connectivity	Number shipping lines, Number shipping services, Number Vessels, Vessels Capacity, Max Vessel capacity
Wang et al., (2016)	Inland and foreland connectivity	International connectivity (ASC), Feeder services (ASC), Hinterland connectivity (port accesibility indicator
Bartholdi et al., (2016)	International connectivity	Number shipping lines, Number shipping services, Number Vessels, Vessels Capacity, Max Vessel capacity
de Langen et al., (2016),	RoRo	Destination ports, Frequency, Number Shipping Lines, Max. Number of calls
Jiang et al, (2015),	Transshipment traffics	Transit time, vessel capacity
Jia et al., (2017)	Port connectivity	Number Vessels domestic, Number Vessels internationals, Max. Vessel size, Cargo loads
ASC (Lam and Yap, 2008; Yap and Notteboom, 2011; Lam 2011; Lam and Yap, 2011)	Port connectivity	Vessel capacity, Frequency

Source: own elaboration

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Methodology

The objective is to show the real connectivity between two ports as an indicator of port competitiveness.

Annualised Slot Capacity (ASC):capacity of the vessels per shipping service and the frequency of shipping services

1. Computation the methodology is as follows:

$$ASC_x = \sum_{i=1}^{n} ASC_{xi} = \sum_{i=1}^{n} \sum_{j=1}^{m} V_{ji} F_{ji}$$

Where:

X port of origin,
i shipping service,
n total number of shipping services,
j number of vessels
m total number of vessels,
V vessel capacity
F vessel calling frequency.

Methodology

2. ASC per regions: the ASC of the Spanish ports with each one of the markets of the ESN is calculated.

Computation the methodology is as follows:

$$ASC_{xy} = \sum_{i=1}^{n} ASC_{xyi} = \sum_{i=1}^{n} \sum_{j=1}^{m} V_{yji} F_{yji}$$

Where:

X port of origin,
y country of destination,
i shipping service,
n number of shipping services,
j number of vessels
m total number of vessels
V vessels capacity
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Data

LinePort database is elaborated by Valenciaport Foundation.
This database collects information of Shortsea Shipping services calling at Spanish ports.

Criteria for the selection of the sample:

1. Regular shipping services: services called at least 3 times/semester
2. Container traffic
3. European Shortsea Network (ESN): traffic flows between Spain and Morocco, Algeria or Turkey are considered ESN.

"*Shortsea shipping means the movement of cargo and passengers by sea between* ***ports situated in geographical Europe*** *or* ***between those ports and ports situated in non European countries having a coastline*** *on the enclosed seas bordering Europe*." (European Commission).

4. Only foreign traffic has been considered.

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Results

Table 1. Global ASC index

	2015	2014	2013	2012	2011	2010
VALENCIA	2.098.501	2.072.083	1.954.508	1.668.000	1.574.383	1.622.160
BARCELONA	1.069.950	1.104.944	1.083.830	1.293.227	1.522.376	1.433.422
ALGECIRAS	852.379	879.416	851.717	509.806	471.352	447.940
BILBAO	498.919	458.124	513.885	459.866	346.392	379.145
VIGO	414.156	391.247	411.378	299.361	340.983	401.327
CASTELLÓN	405.294	462.852	417.528	392.735	337.072	298.069
GIJÓN	190.588	204.362	207.436	142.366	102.486	106.334
LAS PALMAS G. C.	159.347	135.079	125.614	150.090	178.600	181.228
CÁDIZ	131.788	140.157	68.510	25.808	170.173	147.796
S. C. TENERIFE	105.352	130.193	109.346	138.452	139.983	163.694
VILAGARCÍA	53.200	54.222	54.278	55.006	20.895	519
MELILLA	45.886	42.994	45.700	15.110	15.570	12.938
HUELVA	42.542	39.193	10.210	-	18.688	-
CARTAGENA	38.173	80.106	44.959	36.369	36.298	43.461
SEVILLA	33.504	34.202	18.846	11.168	26.628	25.438
GANDIA	26.910	17.587	20.489	-	-	-
PASAJES	18.992	-	-	-	-	-
ALMERÍA	17.657	13.780	37.194	4.831	-	2.100
TARRAGONA	16.950	43.673	36.536	58.970	57.776	150.240
ALICANTE	14.379	34.365	40.140	40.308	39.433	24.047
A CORUÑA	-	26.524	21.638	11.866	30.550	35.598
MOTRIL	-	13.705	31.351	35.070	35.598	36.296
SAGUNTO	-	4.335	-	-	-	1.557
CEUTA	-	707	3.362	20.356	10.896	13.969
MARÍN	-	-	18.824	13.032	4.194	3.848
MÁLAGA	-	-	698	122.875	50.221	4.448
TOTAL	**6.234.467**	**6.383.850**	**6.127.977**	**5.504.672**	**5.530.547**	**5.535.574**

Source: own elaboration

1. **Positive trend** since 2010, from 5,535,574 ASC to 6,234,467 ASC in 2015.

2. **Valencia, Barcelona and Algeciras** are ranked as the best connected Spanish ports

3. **Connectivity differences** have been found between **regional and interoceanic ports**

4. **High competency** between ports located on the same façade and also between **neighboring ports**

Policy implications

Table 2. Regional ASC index per destination region

REGION	PORT	ASC 2015
MEDITERRANEAN NO EUROPE	VALENCIA	2.941.944
	BARCELONA	1.174.884
	ALGECIRAS	934.848
	CASTELLÓN	576.087
	VIGO	112.222
	LAS PALMAS DE GRAN CANARIA	97.799
	SANTA CRUZ DE TENERIFE	46.766
	GIJÓN	43.400
	BILBAO	42.532
	SEVILLA	31.410
	MELILLA	30.360
	GANDIA	26.910
	ALMERÍA	17.657
	TARRAGONA	16.950
	ALICANTE	14.379
	CARTAGENA	3.801
Total MEDITERRANEAN NO EUROPE		**6.111.949**
SOUTH EUROPE	VALENCIA	1.396.745
	BARCELONA	974.577
	CASTELLÓN	792.844
	ALGECIRAS	607.150
	VIGO	282.949
	BILBAO	257.004
	CÁDIZ	122.016
	LAS PALMAS DE GRAN CANARIA	95.750
	GIJÓN	76.364
	SANTA CRUZ DE TENERIFE	71.150
	GANDIA	53.280
	VILAGARCÍA	53.200
	HUELVA	34.864
	CARTAGENA	34.372
	SEVILLA	23.732
	MELILLA	15.526
Total SOUTH EUROPE		**4.892.063**
NORTH EUROPE	VALENCIA	2.107.961
	ALGECIRAS	688.059
	BILBAO	547.559
	VIGO	374.850
	GIJÓN	246.080
	LAS PALMAS DE GRAN CANARIA	178.902
	SANTA CRUZ DE TENERIFE	111.894
	CARTAGENA	103.116
	HUELVA	96.914
	CÁDIZ	70.678
	SEVILLA	67.008
	MELILLA	46.578
	PASAJES	25.592
	BARCELONA	3.670
Total NORTH EUROPE		**4.668.861**

1. Non-EU Mediterranean and Southern Europe countries: Valencia, Barcelona, Castellon and Algeciras are the major competitors

2. North Europe: Bilbao, Vigo and Gijon compete on the Spanish Atlantic façade and Valencia and Algeciras on the Mediterranean façade

Results

1. The geographical location is not an advantage for Spanish ports located on the Atlantic façade to serve the northern European markets. In contrast, it is an advantage for ports located on the Spanish Mediterranean façade when exporting flows to southern Europe and non-EU Mediterranean

2. The results show Valencia and Algeciras as the best connected ports to serve the three regions considered in our study. While Barcelona, Bilbao, Castellón and Vigo, focus their connectivity mainly on the markets located on the façades they serve

3. Shipping patterns show concentration of shipping services at ports of Valencia, Barcelona, Algeciras and Castellón to serve the non-EU MED markets, and also Southern Europe.

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Policy implications

- The competitive success of a port ultimately depends on the choice of ports made by shippers and shipping lines.

- APs have at their disposal policies and investments to attract shipping companies to select their port and become an alternative for shippers.

- However, despite the efforts of PAs, the high inter-port competition and the proximity between competing ports make it difficult to attract shipping services.

Negative consequences:

- **A Coruña**, **Málaga** y **Motril** have been losing shipping services until their connectivity disappeared

The number of shipping services available at small ports is quite low: their connectivity is more sensitive to the choices of destination ports made by shipping companies.

Policy implications

Despite the efforts made by PAs to design policies and invest in infrastructure to improve their connectivity, in some cases this has not been achieved and **these infrastructures are underutilized.**

Overinvestment:

- Overinvestment in port infrastructure since 1990 (Castillo-Manzano et al., 2012; Albalate et al., 2015).
- 64% of container terminal investments are considered inefficient (Esparza et al., 2017).

Overcapacity:

- Overcapacity problems in container terminals, which is aggravated when neighboring ports are considered (Esparza et al., 2017).

Policy makers must consider the efficiency of port infrastructure investments: traffic specialization and improving the investment criteria

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Conclusions

✓ Valencia is the best connected port, followed by Barcelona and Algeciras. Also other important ports with high connectivity are Bilbao, Vigo and Castellón.

✓The present research goes further when analyzing the connectivity of Spanish ports with the countries and regions which they connect with, calculating the ASC of the Spanish port for each destination country. This analysis has important implications:

1. For shippers, more precise information for planning and managing their shipments.

2. The used approach allows identifying the most competitive ports for each market.

3. For PAs, it allows them to identify the weakest connections in the regional network through the comparison with their main competitors

Thank you