DOES PRODUCT HETEROGENEITY INFLUENCE THE RELATIONSHIP BETWEEN SHIPPING CONTAINER CONNECTIVITY AND MARITIME TRADE? AN APPLICATION TO COASTAL EU COUNTRIES

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1. INTRODUCTION

Maritime connectivity has become a key factor for the **competitiveness** of countries, ports and importing and exporting companies. The main reason is that the 75% of all cargo (value) delivered in the world is transported by sea, with 60% of that packed in large steel containers (UNCTAD, 2021).

Therefore, the industries integrated into global supply chains are increasingly dependent on maritime transport services (Lam, 2011). The empirical evidence produced to date has demonstrated the positive effects of increasing connectivity levels:

- Connectivity is deemed essential to help companies and countries **integrate into global value chains** (Mohamed-Chérif and Ducruet, 2016).

- Reduce **maritime transport costs** (Wilmsmeier et al., 2006; Wilmsmeier and Hoffmann, 2008; Schøyen et al., 2018)

The main objective of connectivity is to **facilitate bilateral trade** and to improve the **competitiveness** of products and their **access to international markets** (Fugazza and Hoffmann, 2017; Saeed et al., 2020).

1. INTRODUCTION

However, there is **scarce research** to date exploring the relationship between trade flows and connectivity:

- Fugazza and Hoffmann (2017) finds that not controlling for bilateral liner shipping connectivity leads to an overestimation of the distance effect on international trade.
- Hoffmann et al. (2020) find a positive impact of bilateral liner shipping connectivity on bilateral South African trade flows.
- del Rosal and Moura (2022) find that bilateral liner shipping connectivity impacts positively on maritime containerised exports and (surprisingly) negatively on maritime non-containerised ones.

So far, existing studies have undertaken a generic analysis of trade flows, treating the container as a homogeneous box, without specifically incorporating information regarding the type of product transported.

However, there can be a large degree of heterogeneity because of the potentially different characteristics and needs of each product, giving rise to different results in the valuation of connectivity by industry.

1. INTRODUCTION

MAIN OBJECTIVE

Exploring the effect of shipping container connectivity on maritime container trade by product disaggregation

- An application to maritime trade between coastal EU countries and non-EU countries using the Eurostat's **Comext database**.
- Liner Shiping Bilateral Connectivity Index (**LSBCI**) developed by UNCTAD is used as a measure of Connectivity
- Gravity equation is estimated using the Poisson Pseudo Maximum Likelihood (PPML) estimator
- Value and volume of trade flows is analysed.

2. METHODOLOGY

We use the gravity equation to investigate the impact of connectivity on maritime trade. Taking into account that our variables of interest are time-variant dyadic.

$$X_{ijt} = exp(\alpha_{it} + \alpha_{jt} + \alpha_{ij} + \beta LSBCI_{ijt})u_{ijt}$$

Where X_{ijt} denotes maritime (containerised) exports from country i to country j in year t, measured in nominal values.

$LSBCIijt$ is our variable of interest, α_{it} and α_{jt} are exporter-year and importer-year fixed effects and capture the multilateral resistance terms (third-country trade cost effects). α_{it} are country-pair fixed effects and capture observed and unobserved heterogeneity for each pair of countries. Finally, u_{ijt} is an error term.

2. METHODOLOGY

We estimate the gravity equation using the Poisson Pseudo Maximum Likelihood (PPML) estimator because the regressors enter exponentially in Eq. (1).

The PPML estimator is robust to different patterns of heteroscedasticity and provides a convenient way of dealing with zero bilateral trade flows (Santos Silva and Tenreyro, 2006).

Concerns about endogeneity may arise in the case of our variable of interest $LSBCIijt$, an indicator that is intended to reflect maritime connectivity.

To treat the endogeneity of any regressor in the gravity equation, Baier and Bergstrand (2007) advocate the inclusion of country-pair fixed effects, which control for all observable and unobservable time-invariant bilateral factors that simultaneously influence liner shipping connectivity and trade flows.

3. DATA

We use **two** main databases:

1. **Dependent variable** comes from Eurostat's **Comext database**:
   A. We select the database that uses the "**Transport NST/R**" classification of products, which allow using the **value** and **volume** of total trade flows for different **types of goods** separating by transport and **container modes**.
   B. The sample period is 2010-2018.
   C. The final sample includes 24 EU countries and 132 non-EU countries

2. **LSBCI** data were retrieved from the UNCTADstat (2021) platform. The LSBCI is computed at the country-pair level and it is composed by 5 main variables:
   A. The number of transhipments between a pair of countries,
   B. The number of common direct connections to both coutries,
   C. The geometric mean of the number of direct connections
   D. The number of carriers offering services in the loop
   E. The size of the largest ship deployed in the loop

3. DATA

Code	NTSR-E name	export value		export quantity		import value		import quantity	
		year 2010	year 2018	year 2010	year 2018	year 2010	year 2018	year 2010	year 2018
0	AGRICULTURAL PRODUCTS AND LIVE ANIMALS	2.4	2.6	7.2	10.2	5.1	4.8	10.8	12.1
1	FOODSTUFFS AND ANIMAL FODDER	14.4	15.0	17.6	20.3	10.0	9.2	13.3	13.2
2	SOLID MINERAL FUELS	0.0	0.1	0.5	0.8	0.0	0.0	0.5	0.3
3	PETROLEUM PRODUCTS	0.6	0.7	1.0	1.2	0.5	0.2	2.3	0.8
4	ORES AND METAL WASTE	2.2	1.2	3.6	1.9	2.0	1.8	8.1	1.9
5	METAL PRODUCTS	4.3	4.3	4.6	5.0	3.2	4.0	4.6	6.5
6	CRUDE AND MANUFACTURED MINERALS, BUILDING MATERIALS	2.1	2.0	11.3	11.1	1.1	1.0	7.8	7.5
7	FERTILIZERS	0.2	0.3	1.1	1.2	0.1	0.1	0.3	0.3
8	CHEMICALS	19.1	21.5	23.6	21.6	9.2	12.0	12.2	15.5
9	MACHINERY, TRANSPORT EQUIPMENT, MANUFACTURED ARTICLES	53.1	51.0	27.9	26.0	68.4	66.4	39.6	41.5
	TOTAL	100	100	100	100	100	100	100	100

3. DATA

NTSR-E name	export value		export quantity		import value		import quantity	
	year 2010	year 2018	year 2010	year 2018	year 2010	year 2018	year 2010	year 2018
AGRICULTURAL PRODUCTS AND LIVE ANIMALS	40.2	49.0	18.3	28.4	42.2	48.9	24.3	21.8
FOODSTUFFS AND ANIMAL FODDER	75.3	70.5	64.3	66.7	32.0	41.9	12.9	17.0
SOLID MINERAL FUELS	13.4	24.3	15.9	29.8	0.3	0.6	0.2	0.3
PETROLEUM PRODUCTS	2.6	3.7	1.0	1.2	0.4	0.3	0.3	0.1
ORES AND METAL WASTE	43.3	31.5	12.5	7.7	15.9	24.4	4.7	1.8
METAL PRODUCTS	30.8	45.8	17.6	31.9	17.0	25.1	10.4	13.9
CRUDE AND MANUFACTURED MINERALS, BUILDING MATERIALS	72.4	76.6	32.6	35.2	35.6	56.6	10.4	16.7
FERTILIZERS	28.8	45.0	16.2	23.5	3.2	4.6	1.2	1.8
CHEMICALS	52.7	63.2	51.5	46.0	31.6	50.5	20.1	27.1
MACHINERY, TRANSPORT EQUIPMENT, MANUFACTURED ARTICLES	38.4	41.2	51.1	55.6	41.8	51.5	46.2	54.1

4. RESULTS

Tabla 1. Results of the PPML estimation

PANEL A	(1) tot v	(2) sea v	(3) sea cont v	(4) tot q	(5) sea q	(6) sea cont q
LSBCI	0.185	-0.0450	0.857***	-0.531	-0.666	0.332
	(0.203)	(0.246)	(0.308)	(0.532)	(0.553)	(0.298)
N	27197	26048	24917	27197	26048	24917
pseudo-R2	0.994	0.991	0.992	0.986	0.982	0.978

- *LSBI only turned out statistically significant and with expected positive sign in seaborne containerised trade measure in value*
- *An increase of 0.1 in LSBCI score would predict an increase of 8.57% in containerised trade flows (value)*
- *The effect of LSBCI on containerised trade measured in tones turned out not statistically significant*

4. RESULTS

Tabla 2. Results of the PPML disaggregated by NSTR Sectors

Value	(1) agro raw	(2) food	(3) minerals	(4) petroleum	(5) ores	(6) metals	(7) building mat.	(8) fertilizers	(9) chemicals	(10) other manuf.
LSBCI	-0.443	-0.622	-1.681**	-1.304	0.0847	1.475***	-0.957*	1.440	0.861	1.359***
	(0.345)	(0.418)	(0.820)	(0.971)	(2.190)	(0.570)	(0.572)	(0.881)	(0.702)	(0.337)
N	18074	20877	3519	8762	7553	13438	13461	6405	18383	22819
pseudo-R2	0.923	0.962	0.674	0.860	0.918	0.926	0.927	0.697	0.978	0.992

Quantity	(1) agro raw	(2) food	(3) minerals	(4) petroleum	(5) ores	(6) metals	(7) building mat.	(8) fertilizers	(9) chemicals	(10) other manuf.
LSBCI	0.466	-0.373	-1.620***	-3.206	-1.824	1.325**	-0.888	4.465***	-0.818	1.090***
	(0.483)	(0.305)	(0.0169)	(2.843)	(1.338)	(0.611)	(1.076)	(1.498)	(0.514)	(0.411)
N	18074	20877	3519	8762	7553	13436	13461	6405	18383	22817
pseudo-R2	0.913	0.933	0.894	0.881	0.931	0.902	0.955	0.806	0.959	0.975

- *Minerals coefficient turned out statistically significant and negative sign*
- *Manufactures, Metals and fertilizers turned out the expected positive sign and are statistically significant*

4. RESULTS

Tabla 3. Results of the PPML disaggegated by Manufactures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Value	Transport	agr mach	ind mach	Man. material	glass/ceramic	Textil&clothing	Others
LSBCI	2.190	0.678	1.647***	0.822	0.0291	2.023*	0.183
	(1.672)	(1.111)	(0.512)	(0.553)	(0.544)	(1.114)	(0.406)
N	14810	8882	19071	16480	13035	16889	20227
pseudo-R2	0.969	0.879	0.985	0.960	0.926	0.984	0.982

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Quantity	Transport	agr mach	ind mach	Man. material	glass/ceramic	Textil&clothing	Others
LSBCI	0.744	-0.0234	1.462**	1.308***	0.982	1.834***	0.817*
	(1.725)	(1.123)	(0.658)	(0.436)	(0.821)	(0.496)	(0.442)
N	14806	8882	19067	16480	13031	16889	20227
pseudo-R2	0.922	0.776	0.952	0.928	0.888	0.948	0.955

- *Positive and statistically significant coefficient for Industrial machinery, manufactures of material, textile&clothing and Others (furniture, paper and rubber).*

5. CONCLUSIONS

- *We found that liner shipping connectivity had a positive impact on maritime containerised trade.*
- *Huge sectoral heterogeneity across products is obtained, with a negative impact for minerals and building materials, and with a positive impact for metals and other manufactures.*
- *The positive impact of liner shipping connectivity on maritime containerised trade of manufactured products is very strong.*
- *The results show the importance of designing effective policies and strategies to increase the level of maritime container connectivity of EU countries*

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THANK YOU

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