#### 11.10.2021

David Guerrero<sup>+</sup>, Patrick Niérat<sup>+</sup>, Jean-Claude Thill<sup>‡</sup> & Emmanuel Cohen<sup>+</sup>

**+Université Gustave Eiffel, IFSTTAR, AME-SPLOTT** 

**‡University of North** Carolina at Charlotte

Shifting proximities. Visualizing the maritime connectivity at the level of African countries and its recent change (2012/2020)







# **Research issue & aim**

- Freight performance indicators are increasingly used for benchmarking countries, assessing port infrastructure projects, etc.
   Ex.: Logistics Performance Index (LPI), World Bank Liner Shipping Connectivity Index (LSCI), UNCTAD
- A <u>number of academic papers uses them</u> to explain the effect of maritime connectivity on trade costs (Fugazza and Hoffmann, 2017), measure barrier effects, build policy scenarios, etc. But <u>only few works are</u> <u>critical with the indicators</u> (Niérat & Guerrero, 2019).
- This paper aims to <u>question the relevance and applicability</u> of <u>the</u> <u>Liner Shipping Bilateral Connectivity Indicator</u> (LSBCI) in Africa. Is it <u>in line with the assessment needs</u> of African countries?
  - To do so we **try to visualize the LSBCI links between African** countries.



# **Context: Containerization in Africa (still on-going)**

Debate about the effects of containerization on developing countries:

- (+) A way to reduce economic dependence on former colonial powers (White, 2019).
- (-) High costs and danger of overdependence through debt trap and focused connectivity (Mboya, 2021).

#### Whithin Africa:

- Land transport is poorly developed.
- Containers used for both deep-sea and short-sea connections.
- Top ports are in the North and South.
- Port investments (new ports, expansion of existing ones).
- Reorientation of African trade from Europe to Asia.



UNC CHARLOTTE

Gustave Eiffel

Université Gustave Ei

# Data. LSBCI (bilateral) (UNCTAD, 2017)

What is maritime connectivity? Access to <u>regular</u> and <u>frequent</u> transport services combined to a <u>level of competition</u> in the provision of these services (Wilmsmeier et al., 2006)



Jan Hoffmann, UNCTAD

Liner Shipping Bilateral Connectivity Index (UNCTAD, 2017). For each inter-country link, it provides the average score of 5 components:

- 1) <u>number of transshipments</u>
- 2) number of common connections by country pair (direct)
- 3) number of common connections by country pair (indirect)
- 4) number of companies

5) size of the largest vessel

Rather complex! LSBCI matrix = 168 x 168 countries / 2 Around 14 000 LSBCI links (Africa alone: 1 150 links)



# **Data. Descriptive statistics**

- African connectivity (0.17) is below the average of the rest of the World (0.24)
- Between 2012 and 2020, African connectivity greatly improved (+13.3%), but slightly less than the rest of the World average (+14.3%)
- Largest Max in the North (Morocco, 0.57), Largest Average in the South (0.19)
- On average/median, few differences between the West and the East

	Max		Min		Average		Median	
	2012	2020	2012	2020	2012	2020	2012	2020
North	0.43	0.57	0.09	0.09	0.16	0.18	0.14	0.16
West	<u>0.26</u>	<u>0.36</u>	0.09	0.08	0.15	0.16	0.14	0.16
South	0.36	0.39	0.12	0.11	0.17	0.19	0.17	0.19
East	<u>0.29</u>	<u>0.36</u>	0.09	0.08	0.15	0.16	0.14	0.16
Africa	0.43	0.57	0.09	0.08	<u>0.15</u>	<u>0.17</u>	0.15	0.17
Non- Africa	0.82	0.97	0.11	0.09	0.21	0.24	0.18	0.2





# Method: How to make sense from <u>thousands of links</u>? A tentative solution: Multi Dimensional Scaling (MDS)

- This technique places countries in an abstract cartesian space of n dimensions based on distances between these entities (Kruskal and Wish, 1978).
- The metric used for this purpose is the inverse of LSBCI (1/LSBCI)
- The quality of MDS is measured by stress measures.

This method is similar to other Dimension reduction techniques such Principal Component Analysis (PCA)





#### **MDS results**

# 39 African countries 9 non-African groupings 48 entities (Matrix 48<sup>2</sup>/2)=1150 links



		Number of dimensions					
Year		2	3	4			
	Kruskal's						
2020	stress	0.279	0.192	0.146			
	Iterations	286	199	293			
	Kruskal's						
2012	stress	0.277	0.189	0.142			
	Iterations	97	354	289			

• The larger the number of dimensions the lower the stress.

Number of dimensions

The stress levels seem stable over time





# The situation in 2020. Dim 1 & 2



# 2012

2020

- **1.** The West and « non-Africa » are separated. Morocco and South Africa are in-between
- **2.** The East is splitted in two:
  - 1. (Djibouti, Sudan vs the rest).
  - 2. Egypt mediates between both « Easts » and with « non-Africa »
- **3.** The « non-Africa » is relatively well separated from African countries

- **1.** Africa becomes more compact (except the East)
- 2. The West gets closer to both Morocco and « non-Africa ». South Africa gets closer to Egypt and the East.
- 3. The East become a coherent whole
- 4. The « non-Africa » is increasingly embedded (in the West, North and South)

UNC CHARLOTTE

Université Gustave Eiffel



# Weird neighbourships. What are these two doing together?









#### Adding a 3rd dimension. Dim. 3 and 2 Top links



high and far apart when it is low. X and y axes are meaningless.(Borgatti et al., 2013).



**Gustave Eiffel** 

#### These graphs are rather enticing but...

Why a pair A & B of countries is close or far?

Α

Α

В

B

Two sources of explanation:

- a) Connection between A & B
- b) More or less common connections with other countries



Université

Ε

# Discussion

(+) Useful for an overview of the positions of regions and countries.
(+) Useful to visualize both <u>intra-regional</u> and <u>inter-regional links</u>
(-) The stress may be a problem. A third dimension could be useful (to avoid strange neighbors)

(-) The interpretation of distances may be challenging (intra/inter regional)

(-) The best connections of African countries are <u>inter-regional</u>
(+) In Africa, container is used for intra-regional connections. Can comparisons be made with other regions (ex. Asia)?





#### Conclusion

 LSBCI appears as an useful indicator to assess maritime connectivity in Africa, but it is complex.

• To help to make sense of it, this paper proposed a visualization (MDS) which may be useful for the countries aiming to link the commercial success of ports with economic development.

• The results of this work may also be useful for the current users of LSBCI (ex. policy makers, scholars), to understand their relevance and limitations.

• Important issues related to connectivity remain unanswered: land access to the port, intermodality, availability of warehouse space, etc.

• Avenue for further research: exploring the individual components of LSBCI (e.g. frequency, vessel size, number of companies) for a better understanding of country proximities.



#### **Thanks!**









