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Visualizing the maritime connectivity of African countries

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1. Introduction

Containerization is still on-going in Africa. In the last decades, a number of new port and terminal projects have emerged in parallel with the reorganization of services by shipping lines. To support the analysis of the maritime connectivity of African countries, this paper proposes a visualization of the Liner Shipping Bilateral Connectivity Indicator (LSBCI).

This research aims to contribute to the current debate on the ways in which containerization is shaping the connectivity of African countries (Mboya, 2021) by advancing the use of effective map visualizations of port connectivities. Previous studies have shown the improvement of maritime connections of African countries to Asia. For example, the countries of East Africa are better connected to the Indian Ocean than to Europe (Ducruet and Notteboom, 2012, Niérat and Guerrero, 2019). Some have argued that these improvements have mainly affected the connections of Africa with Asia, but without significantly changing the connectivity within Africa or between Africa and other world regions. Others have advanced the counter-argument that the enhancement of maritime connectivity of Africa with Asia also leads to an improvement of connectivity among African countries and also with other regions (Kuo, 2017, cited by Mboya, 2021). Another debate that is germane to our work is that of regional economic integration in Africa versus dependency relationships with outside actors, the processes undergirding transition towards integration, and the role of freight network connectivity (Arizala et al., 2018). As the evidence to inform these debates has been limited, confusing, and sometimes contradictory, this research purports to shed light onto these debates by proposing a visualization of bilateral connectivity of African countries with other countries around the globe. It is hoped this visualization will help clarify the changing dynamics behind commercial relationships of Africa countries and behind the connectivity of Africa ports. The following sections present the data and method (section 2), the visualization and interpretation of the inter-regional and intra-regional links (section 3). The last section concludes on this work.

2. Data and method

Maritime connectivity is the access to regular and frequent transport services combined with a diversity of service opportunities brought by competition between multiple service providers (Wilmsmeier et al., 2006). It is often measured through various indicators based on vessel movements. One of them is the LSBCI, which measures the quality of container transport connections between pairs of countries. It is the average of five normalized components

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(Fugazza and Hoffmann, 2017): (a) the number of transshipments required to get from country A to country B; (b) the number of direct service connections common to both countries A and B; (c) the number of common service connections by country pair with a single transshipment; (d) the level of competition on services that connect country A and country B; (e) the size of the largest ship on the weakest route connecting countries A and B.

In this study we analyze the LSBCI links of 39 African countries and nine geographical groupings of countries outside of Africa. Summarizing the links for these groupings enables us to tease out some of the most salient relationships, leaving aside more localized detail. The LSBCI between each geographical group and each African country is computed on the basis of the original LSBCI statistic as follows. The LSBCI between a country group and any African country is equal to the maximum LSBCI link of all the countries in the group and the country under consideration. For this study we have used the most recent data available, namely 2020. To facilitate the visualization, Africa is partitioned into four sub-regions, based on the UN partition² (Table 1). The maximum LSBCI is in North Africa while the highest average is in the Southern part of Africa. The values for the West and East regions are very similar.

Table 1. Descriptive statistics of the LSBCI in Africa

	Max	Min	Avg	Median	Std Dev
North	0.57	0.09	0.18	0.16	0.09
West	0.36	0.08	0.16	0.16	0.05
South	0.39	0.11	0.19	0.19	0.06
East	0.36	0.08	0.16	0.16	0.05
Africa	0.57	0.08	0.17	0.17	0.06
Non-Africa	0.97	0.09	0.24	0.20	0.13

Source: Authors, based on UNCTAD, 2020

² For the sake of simplicity, the UN subregions of Central Africa and Western Africa were merged.

3. Visualization of interregional and intra-regional links

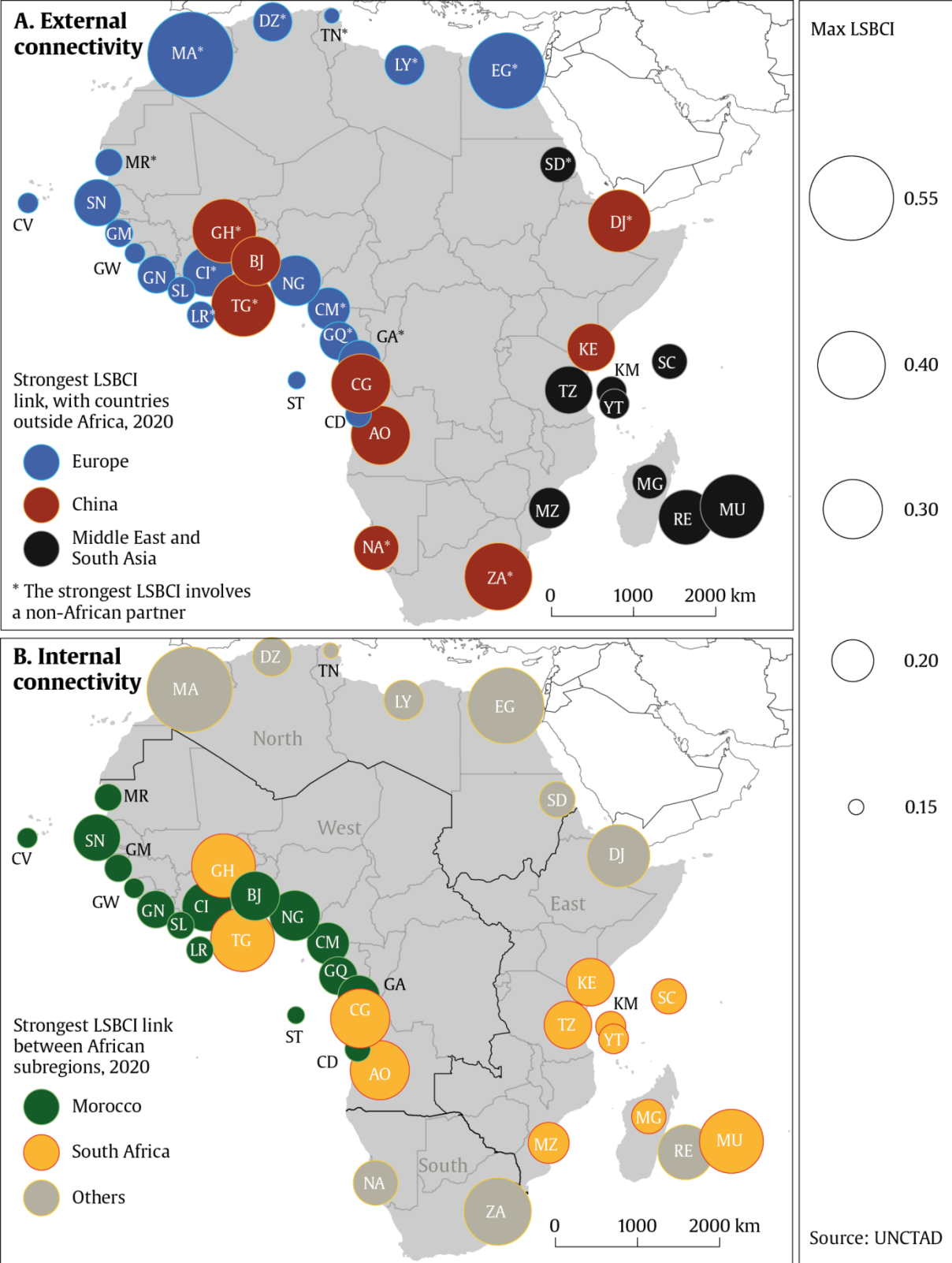


Figure 1. Strongest LSBCI links of African countries

Figure 1 depicts country or world region associated with the strongest LSBCI link of each African country. In particular, Figure 1a displays the links with regions outside Africa. Amongst the non-African regions, Europe, China and the Middle East and South Asia are the most

prominent. While North and West African countries are rather oriented to Europe, a majority of East African countries are oriented towards the Middle East and South Asia. China has very prominent connectivity with some of the countries of West Africa (Benin, Togo, Ghana, Congo), in the Southern tip of Africa, and on a limited basis in East Africa (Djibouti and Kenya), where it exhibits the strongest LSBCI links. In many of the latter countries (marked with an asterisk) the LSBCI with China is even stronger than with their partners within Africa.

In Figure 1b, we depict the strongest connection of each country with the countries of other African sub-regions. It highlights the well-known hub positions of Morocco and South Africa ports competing to attract the feeder flows of West African countries. It is worthwhile noting that the connectivity of Morocco is mostly related to Tanger Med while the connectivity of South Africa stems from several ports (Durban, Cape Town and Ngqura). **Conclusions**

LSBCI appears to be a useful indicator to assess maritime connectivity in Africa, but it can be difficult to interpret because of the complexity stemming from the multiple dimensions it encompasses. To help make sense of it, this paper proposed a set of map visualizations which may be useful for countries aiming to link the commercial success of ports with economic development and disentangle the contested state of logistical connectivity and integration of Africa.

The map visualizations showed that West Africa and East Africa appear as two separated subsystems. Morocco, South Africa and Egypt stand out in our visual analysis as they are by far the best connected countries of Africa. These countries have asserted themselves as nation hubs in the continental freight shipping network. However, only the former two countries play mediating roles within the region, while the latter remains largely focused on North Africa and East-West trade routes.

In addition to the former works, the present work revealed that the largest maritime nations of South and West Africa, are now also tightly connected to China. This supports the hypothesis that recent improvements in African connectivity have mainly affected the connections of Africa with Asia and more specifically with China. More research is needed however to assess if these changes have also improved (or not) the connectivity within Africa and with other world regions.

This study shows that the position of individual countries and of large ensembles of countries on the global trade map inform network connectivities. Thus, it is suggested that geography matters in the organization of the African maritime connections, but other factors -such as the strategies of maritime companies- play important roles as well.

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