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How can the African Continental Free Trade Area (AfCFTA) help develop regional value chains across Africa? An exploration

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How can the African Continental Free Trade Area (AfCFTA) help develop regional value chains across Africa? An Exploration

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Abstract

All African countries participate in the African Continental Free Trade Area (AfCFTA) to boost intra-African trade to accelerate structural transformation. At the same time, increasing geopolitical tensions around the world are pressuring countries to 'reshore' by retreating from engagement in Global Value Chains (GVCs) towards Regional Value Chains (RVCs). High values for RVC indices would indicate that African exports have a high import content of intermediates originating in Africa and that exports destined to other African countries undergo further processing, an indication of structural transformation. The paper uses the EORA Multi-regional Input-Output (MRIO) data over 1995-2022 to present new, more comprehensive measures of participation in supply chains at several levels: across countries, regions, and sectors. Comparisons are with countries (e.g. China or India) and aggregates of countries (e.g. Europe, Americas, Asia) engaged in deep market integration. Measures for 50 African countries are compared with those for other regions. .../...

Keywords: trade policy, global value chains, digitalization, servicification, trade costs, national data infrastructure, Sub-Saharan Africa, Middle East and North Africa.

JEL Codes: F2, F1, F6.

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... / ... On average, African exports have a low content of imported intermediates and undergo further transformation in importing countries before reaching final consumers. Compared with other regions, African countries mostly engage in supply chain trade with countries outside Africa, displaying low values of RVC indices. In sum, compared to other regions, African Regional Economic Communities (RECs) and other regional trade agreements across the continent have failed to launch intra-African trade.

The paper then explores the determinants of participation in supply chains. At the world level, from 1995 to 2022, geography factors and policy-related instruments like openness (captured by tariffs) and Foreign Direct Investment (FDI) stimulate GVC trade. For Africa, low tariffs and FDI are positively associated with regional supply chain activity, an indication that AfCFTA implementation should stimulate intra-African trade.

1. Introduction: Africa in the era of ‘slowbalization’

Regional cooperation across Africa started around 1994 when the Abuja Treaty became operational. This cooperation was to culminate in an African Union (AU) following a minimum integration program across the 8 AU-recognized Regional Economic Communities (RECs). The resulting deep integration would be reflected in substantially higher intra-African trade. Thirty years later, intra-African trade still plays only a minor role and has been unable to gain in importance since 1995. Notably, trade within the REC building blocks is still stubbornly low. The ratio of within-REC to between-REC trade has fallen to 2, and African trade continues to be deeply oriented toward extra-continental partners.¹

Participation in a supply chain allows a country to enter niches along the chain without building the whole product through vertical specialization. This shifts trade patterns from trade in final goods towards trade in intermediate goods. Taking a long-run perspective, in the early 1960s, trade in intermediates started growing faster than trade in final goods. Supply chains took off from the 1980s onwards when trade costs fell through several channels (fall in transport costs, reduction in tariffs, and information and Communication Technology (ICT)). A handful of East Asian and Central European countries joined and contributed to the development of production networks in ‘factory Asia’ and ‘factory Europe’. Offshoring activity took off, captured by growing values of Global Value Chains (GVCs) indices.

Entering production networks is particularly important for the small-market, low-income African countries. All African countries participate in the African Continental Free Trade Area (AfCFTA) to increase intra-African trade and accelerate structural transformation. High GVCs index values complemented by high values for Regional Value Chains (RVCs) would also be an indicator of structural transformation.

As documented in this paper, over the period 1995-2022, Africa has lagged relative to other regions across several indicators of supply chain trade. Can the AfCFTA help remedy this situation?

In trying to address this question, our exploration faces three challenges. First, the AfCFTA is still to be implemented, and the tariff needed to answer is scant for Africa. Second, the financial crisis of 2008-09 followed by the recent geopolitical tensions (China-US trade war) and the war in Ukraine, slowed and re-oriented supply chains (‘friend-shoring’) as trade uncertainty and discriminatory trade measures grew, affecting GVC activity.² Politically,

¹ Krantz (2024) measures the evolution of inner-African trade using a definition of REC membership that excludes multiple REC membership. He estimates that within-REC trade to between-REC grew from 1.2 times in 1960 to 2.75 times in 1990. Since then, trade in RECs has fallen. Currently, in 2022, within-RECs trade is 2 times between-RECs trade. He also documents the striking absence of direct East- West trade: the EAC does not trade meaningful quantities with ECOWAS or CEMAC and the exports between AMU and SADC are below 0.1% of GDP from both sides.

² A tally of trade measures applied by countries shows that discriminatory measures have been growing more rapidly than liberalizing measures since the crisis and that these measures have impacted trade See

countries are pressured to ‘reshore’ by retreating from engagement in Global Value Chains (GVCs) towards RVCs.³ Third, is the arrival of ‘Industry 4.0’ (growth of artificial intelligence, automation and robotics, machine learning and big data analytics, the Internet of Things (IoT), and 3D printing). By increasing the possibilities for onshoring, when combined with geopolitical tensions, this arrival would contribute to the end of the ‘made in world’ era of world trade, a challenge for African countries depending on extra-continental trade.

Miroudot and Nordstrom (2020) document this ‘slowbalization’ reflected in a shortening of supply chains, which they attribute to a rise of protectionism and technological advances like digital transformation.⁴ The continued growth of economies like China and India, where the stages of supply chains are increasingly carried in the domestic economy, also contributed to this outcome, which might be replicated on a smaller scale across Africa under a successful AfCFTA.

The exploration draws on the Eora database from 1995 to 2022, the only database that includes most African countries. We then proceed on two fronts. First, in section 2, we contrast values for several indicators of participation in supply chains by Africa and other regions. We show that Africa has participated in supply chains, but the import content of exports is at the start of supply chains, where the benefits of exposure to imports may be less than at the end of a supply chain. We also document that Africa’s participation in production networks stands in sharp contrast with those in other regions as extra-continental participation always dominated the picture. In section 3, we explore the correlates of GVC indices across countries and regions. We show that geography and other structural determinants like domestic industrial capacity, trade policy and investment matter in the entire sample but are often statistically insignificant when the sample is restricted to the small, unbalanced panel of African countries. However, we show that lower tariffs are significantly associated with greater RVC participation in the whole sample and across Africa, suggesting that tariff elimination under AfCFTA would stimulate regional supply chains across Africa. Section 4 concludes.

2. Patterns of GVC participation: 1995-2022

Firm-level data allows measuring a country’s engagement in supply chain trade by the percentage of firms that simultaneously import and export and/or have foreign ownership or

<https://www.globaltradealert.org/> for the count of trade measures and Evenett and Fritz (2015) on how these measures discriminated most against LDCs.

³ Using monthly trade data over Jan.2016-Feb.2024, Blanga-Gubbay and Rubinova (2024) show trade fragmentation around East-West geopolitical lines (near-shoring), first in 2018 when trade tensions grew between China, then after the start of the Ukraine war starting in February 2022, but none during COVID.

⁴ Using the OECD TiVA MRIO database, they estimate that from 2012 to 2016, the average length of supply chains has shrunk by 50 km per year.

international certification.⁵ The approach has the advantage of measures at the firm level where the fragmentation of production takes place. Unfortunately, the measures of participation from this granular approach are rarely representative of the economy and comparisons across countries difficult to interpret.

The alternative is to methodically combine transaction data from customs (that do not identify selling and purchasing firms) with national aggregate production data. This is the broad approach taken in the several Multi-Region Input-Output (MRIO) tables like those in the OECD TiVA data set, the World Input-output (WIOD) database or the EORA data set used here. MRIO-based measures sacrifice the granularity obtained from firm-level data for the clarity gained from the methodological uniformity imposed in the data analysis, which helps interpret comparisons across sectors and countries.

2.1. A tripartite decomposition of GVC participation.

This ‘broad view of GVC participation’ (Antras and Chor, 2022), built around IO tables, allows the decomposition of a country’s gross exports by the source and destination of their embedded value-added. Measures were first by Koopman et al. (2014). Borin and Mancini (2023) provided a quantitative assessment of trade crossing at least two borders. More recently, Borin et al. (2021) refined these measures by accounting for industries that are suppliers of GVC-oriented industries without being directly engaged in exporting (called two-sided and noted GVC2sd in equation (1) below), i.e. those in the middle of the supply chain. Neglecting these industries leads to an underestimation of the absolute levels of GVC participation and to an overestimation of the relative exposure of countries whose traded sectors are mostly GVC-related.

To incorporate industries participating indirectly in GVC trade, Borin et al. (2024) propose the following tripartite decomposition of GVC-related trade between countries s and r :

$$GVC_{sr} = GVCpf_{sr} + GVCpb_{sr} + GVC2sd_{sr} \quad (1)$$

The first term includes exports of a value-added sector entirely generated within domestic sectors (e.g. mining). The pure forward participation is then the difference between the entire domestic value added that is exported and the one that the importer absorbs.⁶ Together, the following two terms give the import content of exports, a measure of vertical specialization

⁵ Dosis and Zaki (2020) give GVC participation measures based on these indicators.

⁶ Forward GVC, also known as IVA (indirect value added) is domestic value-added contained in inputs sent to third countries for further processing. It is a measure of forward integration; whereby higher values indicate that the firm is far from the final consumer. Backward GVC or FVA (foreign value-added) is an indicator of backward integration, with higher values meaning that the firm is closer to the final consumer.

introduced by Hummels et al. (2001).⁷ The pure backward, GVC_{pb} , is the portion of the import content of exports that are further processed and re-exported as final products or intermediates. The two-sided participation, GVC_{2sd} , captures all the imported inputs in a country's exports that are re-exported by the bilateral partner. This three-way decomposition holds for within-region and outside-region linkages and can be expressed in levels or as shares of total exports.⁸

This consistent and comparable decomposition of linkages across regions and sectors is useful to assess how trade in value-added and trade in intermediate goods have evolved within and between groups (e.g. aggregates defined as members of an RTA like COMESA, ASEAN or AfCFTA, or countries belonging to a region like Western Europe or Asia). Since new goods, the flow of ideas, new production techniques and organization are embodied in imports and exports, aggregate measures of GVC participation are also a useful metric of structural transformation.

The backward and forward components in (1) inform on two aspects of supply chain trade relevant to Africa's structural transformation. On the one hand, high forward and backward shares suggest that a country/region is benefiting from the efficiency gains (technological transfer, flow of ideas, learning by doing) associated with outsourcing and the fragmentation of production. On the other hand, high values are an indication of vulnerability to supply shocks via high backward shares and to demand shocks via high forward shares.⁹ Summed at the industry or country level, these two measures give an estimate of the share of trade in value-added in gross exports for an industry or country.

The EORA data set used here includes 188 countries with data reported across 26 sectors over 1990-2022. The reason for using EORA is that it is the only MRIO including data for African economies. Data preparation results in a final set of 175 countries, among which 50 are African. Several caveats apply. First, the EORA database does not draw on a single country IO table for any African country. Second, because measures are at a very aggregated sectoral level (26 sectors in the version of EORA database that we are using), they do not capture the growing fractionalisation of tasks along supply chains. Nor do the measures capture growing share of trade in services that include those that do not cross borders and hence are not recorded in customs data.

⁷ These terms are subsumed by the GVC_{back} term in the Borin and Mancini decomposition used, among others, in Mc. Gregor et al. (2015), WDR (2020), Melo and Twum (2021), ElGanainy et al. (2023).

⁸ Within-region linkages are called RVCs (for Regional Value Chains). Borin et al. (2021) show that this additive decomposition applies to exports and gross output with the adding up property in eq. 1 holding across countries, across sectors and across countries-sectors.

⁹ Baldwin and Freeman (2021) mention a widely read paper by O'Leary in The Atlantic "The Modern supply chain is snapping: The coronavirus exposes the fragility of an economy built on outsourcing and just-in-time inventory". They discuss the alternatives of making GVCs shorter and more domestic or more diversified. In either case, Rules of origin will be a key lever to achieve the objective.

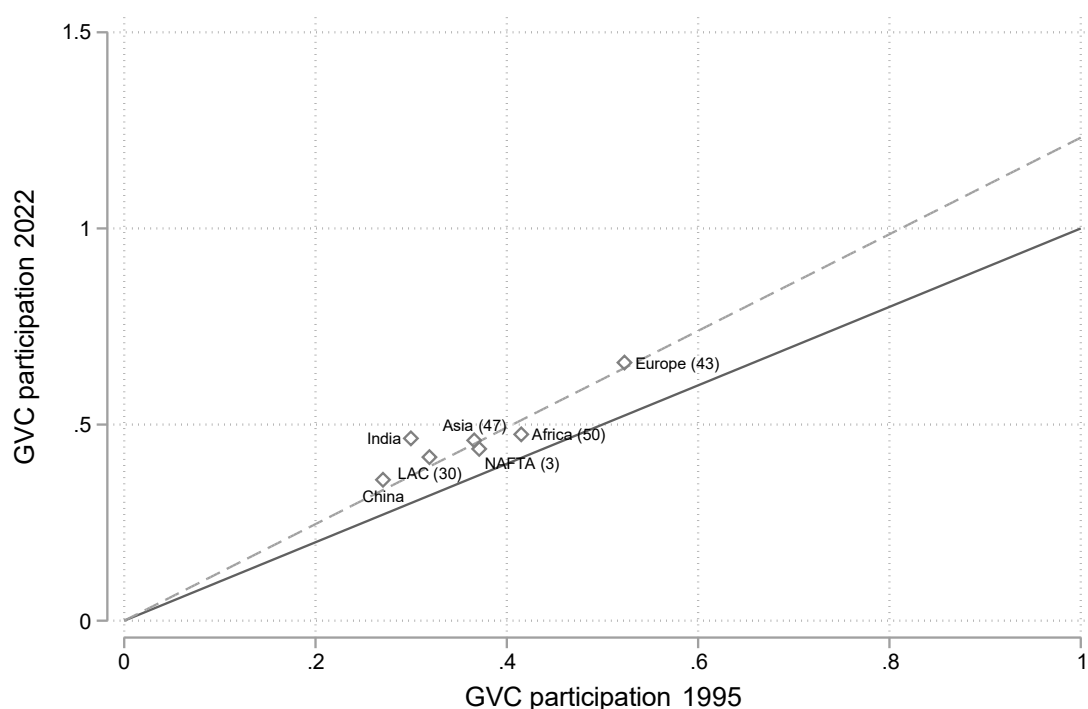
2.2. GVC participation trends across regions

To highlight differences in Africa's participation in supply chains, we create aggregates of countries (i.e. 'regions') by putting together (with some exceptions) either countries that are in the same broad geographic region (e.g. Asia includes Middle East countries) or are engaged in 'deep integration' (e.g. NAFTA, Europe). China and India are reported separately (hence excluded from the Asia region aggregate), if only because each has about the same population as Africa and could stand for AfCFTA's market integration aspirations. Mexico is excluded from the LAC region as it is included in NAFTA. MERCOSUR and other RTAs (e.g., ASEAN) are not reported separately to save space. Except for NAFTA, this definition of regional membership results in relatively large memberships (from 33 to 50) within regions, lending significance to estimates of heterogeneity within regions. Because initial data for 1990 has been entirely estimated for African countries, our comparisons start in 1995.¹⁰

Figure 1 plots the average GVC participation by region for 1995 and 2022. All regions are above the 45° line: on average, across regions, trade in intermediates increased by 22 percent over 1995-2022 (dashed line in figure 1). As large economies, the low GVC shares of China and India are the lowest among the groups in Figure 1. However, GVC growth in both countries--- especially India--- is higher than the average across the much smaller African countries. Somehow, 'factory Africa' has not materialized. It is also noteworthy that for Europe, despite a high GVC share of 49% in 1995 when all barriers to intra-European trade had already been removed, the growth in supply chain trade was higher than the world average over the period.

¹⁰ The annex describes the data preparation: the selection of 146 countries (50 African countries); the construction of regions, and Regional Trade Agreements (RTAs) reported in the figures and tables.

Figure 1: GVC participation rates: regional averages, 1995 vs. 2022

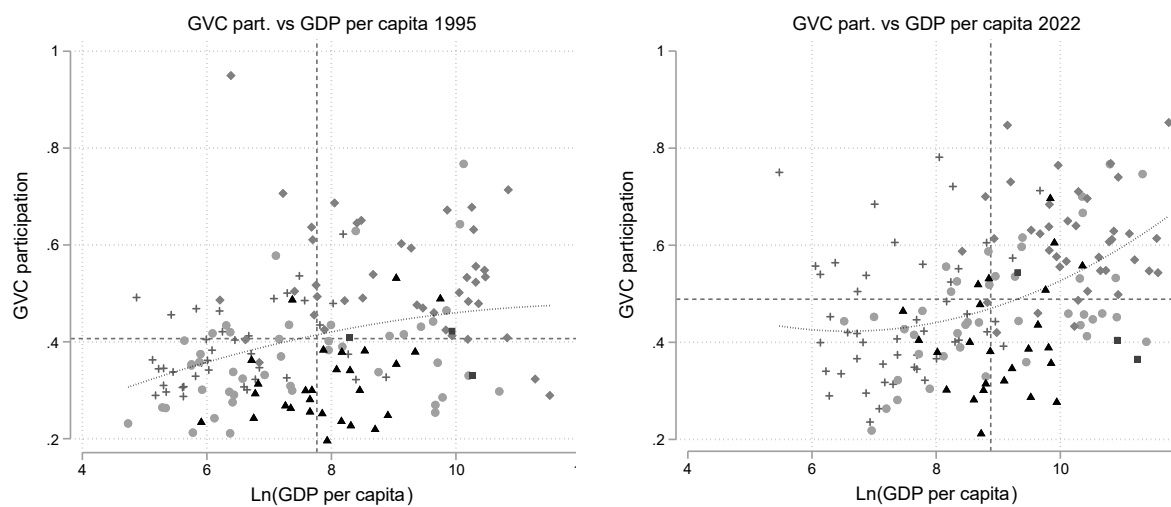


Notes: See Table B1 for the list of countries in each region. LAC excludes Mexico. Asia excludes China and India. Solid line is a 45° line. Number of countries in each region in parenthesis. Dashed line shows the average increase (22%) across the sample.
Source: Authors' calculations from EORA26 data.

Figure 2 plots each country's GVC participation rate against its per capita income for 1995 and 2022. GVC participation is positively correlated with GDP per capita in the sample for 1995 and 2022. The least squares relation (dotted line) is mildly concave in 1995 and mildly convex in 2022. African countries are bunched in the SW quadrant for both years. In both years, LAC countries are usually below average at their respective per capita income levels. European countries are scattered above the line, and LAC countries below.

There is pronounced heterogeneity in the GVC-per capita income relation at the region levels. While the standard deviation for GVC participation is similar in 2022 between Asia, Europe, and Africa (respectively 0.12, 0.10, and 0.13), the log of the GDP per capita exhibit a higher standard deviation in Asia (1.34) versus Europe and Africa (0.84 and 0.97).

Figure 2 GVC Participation vs GDP per capita by country: 1995 and 2022



Notes: Simple averages. All countries in the sample.

The outlier in 1995 is Moldova which sees a decline in GVC participation over the years.

Source: Authors' calculations from EORA26 data.

**Table 1. Decomposition of GVC trade: 1995-2022
(regional averages and selected African countries)**

Share GVC :	Pure Backward (GVC _{pb})				Pure Forward (GVC _{pf})				Mixed (GVC _{2sd})				Total (GVC)			
	1995	2005	2016	2022	1995	2005	2016	2022	1995	2005	2016	2022	1995	2005	2016	2022
By regions and large countries:																
World (excluding Oceania)	.18	.17	.19	.20	.18	.21	.21	.22	.06	.06	.08	.09	.41	.44	.48	.50
Africa [50]	.15	.13	.13	.14	.21	.24	.26	.25	.05	.05	.06	.08	.42	.43	.45	.47
Asia [47]	.16	.15	.17	.17	.17	.21	.22	.22	.04	.05	.06	.06	.37	.40	.45	.46
China	.09	.13	.10	.08	.16	.17	.22	.24	.02	.04	.04	.04	.27	.35	.36	.36
India	.09	.12	.16	.18	.19	.19	.22	.21	.02	.04	.06	.07	.30	.35	.44	.46
LAC [30]	.15	.14	.17	.17	.14	.15	.18	.18	.03	.03	.06	.06	.32	.33	.40	.42
NAFTA [3]	.22	.20	.23	.25	.12	.12	.13	.14	.03	.03	.04	.05	.37	.36	.40	.44
Europe [43]	.22	.22	.28	.28	.19	.21	.19	.19	.09	.11	.15	.15	.49	.54	.62	.63
For selected African countries:																
Chad	.06	.04	.07	.06	.21	.26	.30	.32	.02	.02	.04	.04	.30	.33	.41	.42
Ghana	.05	.06	.07	.07	.29	.31	.34	.34	.02	.03	.03	.03	.36	.39	.44	.45
Kenya	.12	.14	.08	.07	.18	.20	.25	.26	.03	.03	.02	.02	.33	.37	.35	.35
Mauritius	.48	.29	.30	.33	.04	.13	.16	.15	.10	.05	.08	.09	.62	.47	.54	.57
Morocco	.08	.08	.13	.14	.21	.27	.25	.26	.03	.04	.08	.09	.33	.39	.46	.48
Nigeria	.08	.06	.02	.02	.25	.26	.30	.31	.03	.02	.01	.01	.36	.34	.32	.34
Rwanda	.16	.10	.11	.08	.23	.31	.36	.39	.06	.05	.08	.06	.46	.46	.55	.54
Senegal	.10	.09	.08	.09	.19	.20	.24	.25	.02	.03	.03	.03	.31	.32	.36	.37
South Africa	.11	.12	.10	.12	.22	.25	.25	.25	.04	.05	.04	.05	.37	.41	.40	.42

Note: Oceania includes Australia, Fiji, New Caledonia, New Zealand, Papua New Guinea, French Polynesia, Vanuatu, and Samoa. Regions defined as in Figure 1. Asia excludes China and India. LAC excludes Mexico.

Total is the sum of pure backward, pure forward, and mixed, up to rounding errors (see equation (1) for decomposition). Simple average of countries. Number of countries in each region in brackets. Choosing 2016 rather than 2015 avoids using a year with a blip. During Eora updating, the new 2016-2021 years were run as one block, and the old years 1990-2015 were left as-is, thereby creating a seam in 2015.

See: https://worldmrio.com/documentation/faq.jsp#faq_38.

Source: Authors' estimates from EORA26 data.

The top of Table 1 displays the average of three components of GVC across regions and the bottom for a selection of African countries. Overall, GVC participation rose on average by 22% over the 27-year period, with a plateau and stagnation following the sharp recovery of the 2007-08 financial crisis.

For Asia (excluding China and India), GVC participation was on an upward trend from 1995 to 2008, then stayed on a plateau until around 2016, when the import content of exports started to rise again. For China, GVC participation peaked around 2010 when the direct import content of exports started to fall. This reshoring-- expected for large populated economies as they industrialize, exploit economies of scale, and diversify—would have resulted in a lower overall GVC participation had it not been mitigated by an increase in the processing of exports at destination before reaching final consumers (pure forward participation). For India, the opening up of the economy that started in the early 1990s is reflected in a steady rise in the direct import content over 1995-2016 and then a leap forward (almost doubling) over 2016-2022, which is apparent in Figure 1.

Factory Europe, visible in Figure 1, is driven by an increase in mixed GVC trade, i.e. in GVC-related trade positioned in the middle of the chain and pure backward with no change in the pure forward share, i.e. in activities at the start of the supply chain. For NAFTA, less engaged in supply chains than Europe, the domestic value-added in exports that is then re-exported (i.e. the pure forward share) is about equal to the import content of exports (i.e. the pure backward share).

LAC and Africa's pure backward shares are about half of NAFTA. For both, forward participation is about twice as important as backward, i.e. both regions are located upstream at the start of supply chains with a small content of imported intermediates in their export baskets. This slow increase in the import content of exports (i.e. backward shares) suggests the importance of high trade costs in both regions.¹¹ For Africa, these indices suggest slow structural transformation.

Despite the sharp disparities within regions visible in Figure 2, these supply chain patterns across regions are consistent with hubs around Europe, Asia and North America. Remote Africa and LAC are then still specialized in upstream stages while the more central countries specialize in downstream production stages. On average, across the region, the imported content of gross exports is slightly below 50 percent, and the imported inputs in gross exports (including re-exported imports) is at about 22% (14%+8%).

¹¹ As shown by Baldwin and Venables (2013) and illustrated by Ferrantino (2012), compared with spider-like GVCs, trade costs compound along snake-like GVCs. Compared with GVCs in Europe, those in the African and LAC regions are more snake-like.

The bottom of the table shows participation rates for selected African countries. For all countries, except Mauritius,¹² forward participation is higher than backward participation. Mauritius, Morocco and South Africa are the only countries with an import content of exports above 10%. Particularly striking is the very low import content of exports for Nigeria, but also for Ghana and South Africa. Whatever imports penetrate these countries, they are not embedded in exports.

Table 2 highlights the sharp difference in supply chain trade patterns between Africa and the other regions in Table 1. First, only across Africa did the share of imports in exports (pure backward in column 1) fall over the period. By contrast, India's share double from 9% to 18%, and those of the other regions also rose. The slow structural transformation is also visible in the figures on forward participation, where Africa has the highest initial share, which increases by almost a third over the period. Africa continues to export primary commodities and mining that undergo further processing at destination.

Table 2: Anatomy of GVC trade by region: 1995 and 2022

	Year	Share P.Back	Share P. Forw.	(NRVC) Share Non-Regional.	(RVC) Share Regional
Column		1	2	3	4
Africa	1995	.15	.21	.36	.05
	2022	.12	.27	.40	.05
Asia	1995	.16	.16	.20	.16
	2022	.17	.22	.20	.26
LAC	1995	.15	.13	.25	.07
	2022	.17	.18	.34	.08
NAFTA	1995	.22	.12	.12	.25
	2022	.25	.14	.15	.29
Europe	1995	.24	.18	.12	.40
	2022	.27	.20	.20	.42
China	1995	.08	.16	N.A.	N.A.
	2022	.09	.24	N.A.	N.A.
India	1995	.09	.19	N.A.	N.A.
	2022	.18	.21	N.A.	N.A.

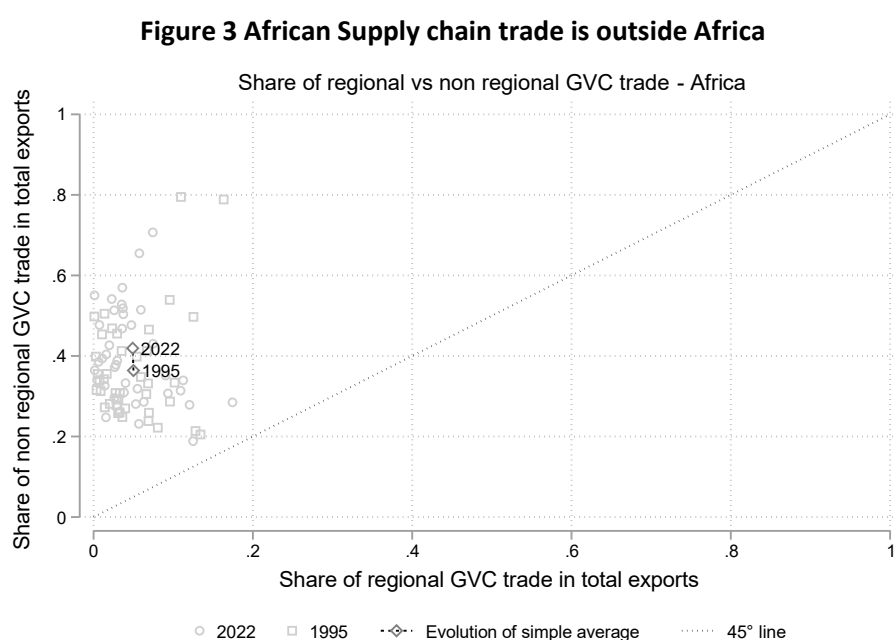
Notes: Regions as defined in Table 1. Cols 1 and 2 from table 1. LAC excludes Mexico. For RVCs, exports are defined as exports that cross at least two borders within the same defined region. Africa includes all members of AfCFTA. Shares add up to the total GVC in Table 1, up to rounding errors. Column 1 and column 2 figures are from the corresponding figures in Table 1. N.A. not applicable.

Source: Authors' calculations from EORA26 data.

¹² The high backward figure for Mauritius for 1995 is suspicious. So is the low figure for backward participation by Nigeria.

Looking at the direction of supply chain trade, columns 3 and 4 show that supply chain trade grew outside of the defined regional blocs for both LAC and Africa. Figure 3 shows that this pattern of supply chain growth outside the region is particularly strong for Africa where not a single country has a non-regional share (NRVC) larger than a regional share (RVC).¹³

The re-shoring of production networks in Asia is evident: the NRVC share falls over the period while the RVC share increases from 20% to 26%. This distinctive Asian pattern reflects several forces at work, largely absent across Africa and, to a lesser extent, LAC. First are strong agglomeration economies (external economies and developing specific skills in the workforce). Second is the widespread adoption of trade facilitation policies, characterized by Vezina (2014) as a ‘race-to-the bottom’, unilateral tariff cutting across the region to attract Japanese foreign direct investment (FDI). Other trade facilitation measures include simple and transparent rules of origin to facilitate regional cross-border trade (Cadot and Ing, 2016). Third Asian economies are surrounded by other fast-growing economies, a spillover effect across the region. Section 3 explores the correlates of supply chain trade, first for the whole sample, then for Africa.



Notes: Simple averages. Each point is a country.

Source: Authors' calculation from EORA26 data.

¹³ Using monthly trade data over Jan.2016-Feb.2024, Blanga-Gubbay and Rubinova (2024) fail to detect a regionalization of trade following the COVID shock but show for Africa a strong growth of NRVC driven by complex products.

3. Determinants of GVC Participation

Implementing the AfCFTA is expected to accelerate the development of supply chain trade, especially RVCs, since tariffs on intra- African trade are to be quasi-eliminated. Indeed, tariff removal among members is the Agreement's cornerstone.¹⁴ Other AfCFTA measures that will support supply chain trade include the reporting of NTBs to the AfCFTA secretariat, establishing a Dispute Settlement mechanism, and implementing the WTO-negotiated multilateral Trade Facilitation Agreement ratified by all AfCFTA participants.

Since tariff reductions have not yet started, we explore the likely effects of AfCFTA by looking for determinants of supply chain trade based on historical data at two levels. First, we take the full sample of countries described in section 2 with a potential of 50 African countries. We look for the determinants of GVC measures, taking inspiration from Fernandes et al. (2022) in our choice of regressors. They gathered GVC determinants into seven categories: (i) factor endowments; (ii) geography; (iii) domestic industrial capacity; (iv) institutional quality; (v) connectivity; (vi) macroeconomic factors; (vii) policy variables, tariffs and FDI. We take their list of factors, the most extensive for their sample of 121 countries and apply it to our extended sample of 142 countries.¹⁵ Having shown that tariffs are a brake on the use of imported inputs in exports (i.e. backward GVC participation), we check that results are robust to the exclusion of several country groups, including African countries (results reported in Table 3).

Then, we examine the correlates of RVC participation across Africa, focusing on the FTAs and CUs. Results are reported in Table 4.

3.1. Full sample results

We estimate 5-year averages of the determinants of GVCs described above

$$Y_{ct} = \beta_0 + \sum_j \beta_j X_{jt} + I_t + \varepsilon_{ct} \quad (2)$$

Where c and t stand for country and time subscripts, Y is a measure of GVC participation, X is the vector including the seven categories of determinants identified by Fernandes et al. listed above. Table A1 gives summary statistics for the variables in (2).

Tariffs, the key instrument under negotiation under AfCFTA at the HS6 level, are only available from WITS at the product level for many countries. Used in all multi-country multi-year studies, WITS data have shortcomings due to missing data (countries rarely report applied tariffs every year) and misreporting especially for applied preferential tariffs (for example, for

¹⁴ The AfCFTA calls for eliminating tariffs among African countries for 90% of trade over a 10-year period, starting from when all countries will have submitted tariff offers acceptable to the AfCFTA secretariat.

¹⁵ Down from 175 countries in section 2 due to missing data in explanatories.

FTAs, WITS enters the applied MFN tariff when the applied bilateral tariff is not available). After correcting for missing data and misreporting, Teti (2024) produces a corrected database of applied tariffs at the HS6 level for 197 countries over 1988-2017, doubling the number of observations in WITS.¹⁶ Unfortunately, her database of effectively applied tariffs at the importer-exporter-product year is not publicly available, so we also use tariffs from WITS.

We use the same measures of GVC participation as in the figures and tables of section 2. Regressors are those in Fernandes et al. The estimation strategy follows closely Fernandes et al. (2022) using Least squares between effects (LS-BE) where each observation is a 5-year average of the relevant variable. Table 3 reports results for the whole sample, and Table 4 explores the regional dimension of supply chain trade. We discuss the possibility of bias in the coefficient estimates for tariffs and FDI below.

Table 3 replicates the estimation in Fernandes et al. Table 1 col.2 with the sample of 136 countries (see table B1 in annex for definitions of regions and RTAs) over the period 1995-2020.¹⁷ The panel includes up to 5 observations per country, each covering a five-year average. Taking five-year averages may help wash out measurement errors, especially in the input-output tables for African countries. The 5-year fixed effects allow us to account for common shocks like the financial crisis or COVID-19. Due to missing observations for some variables, the panel is unbalanced [number of African countries in each period in brackets], with 55 countries in 1995-2000 [4], 91 in 2000-2005 [10], 106 in 2005-2010 [18], 114 in 2010-2015 [26], and 126 in 2015-2020 [31]. The total number of different countries in the regression is 142.

Column 1 replicates the Fernandes et al. specification with our sample. Signs and significance of estimates are close to those in Fernandes et al., but the overall fit is tighter in Fernandes (R^2 of 0.53 vs. 0.35). Lower tariffs and larger FDI inflows are associated with higher backward participation. Better institutional quality, as captured by the score on the political stability index, is also positively correlated with backward participation. Larger land endowments or resource rents are linked to lower backward GVC. As in Fernandes et al., exchange rate misalignment is unrelated to GVC participation. Manufacturing capacity and geography also matter. Countries with greater domestic industrial capacity, as captured by a larger manufacturing sector, have lower GVC participation as domestic inputs may replace imports. Shorter distance to a GVC hub is positively correlated with backward GVC participation.

¹⁶ Teti reports that tariff data are missing for 56% of observations for LDCs and 42% for developing (non-LDC) countries. However, she notes that reporting started to increase after 1995. For LDCs, the number of years in which preferential tariffs are reported is less than half of the number of years of the respective preferential scheme is in force.

¹⁷ Fernandes et al. have a maximum of 121 countries included in the regression, and we have 142 (out of 174 countries in the database). Estimates cover 5 periods of 5-year averages, while Fernandes et al. cover the period 1990-2017 with 3 decadal averages). Due to missing data, Fernandes et al. lose 40% of observations in their panel, whereas we lose only of 32% of observations.

Column 2 shows that coefficients' signs, significance, and magnitude are unaffected when estimates are carried out with decadal rather than 5-year averages. In column 3, we replace the backward GVC share with the pure backward measure introduced by Borin et al. (2024), which is the portion of import content of exports closer to the end of the chain. The magnitude of the coefficients decreases slightly, but the results are very close, which is to be expected given the high correlation between the two backward GVC indicators (0.995 for our five-year averages).

The following columns report on further robustness tests keeping the pure GVC indicator that characterizes activities at the end of the supply chain, i.e. activities that pertain to the final transformation of goods into final products. Column 4 excludes high-income countries. Now, the estimation sample is reduced by almost one-half. Manufacturing capacity no longer enters significantly. Interestingly, the value of the coefficient estimate for tariffs is 42% larger in absolute terms than in column 3, an indication of attenuation bias from measurement error for low-income countries.

Column 5 excludes African countries. Now FDI is positively significant as in the whole sample, indicating that FDI may not be correctly captured for this group of countries or that FDI is responsive to political or other incentives. Overall, the estimates in columns 4-6 conform with those in column 3 for tariffs, FDI, proximity to hubs, and market size captured by the manufacturing sector.¹⁸

Column 6 adds dummy variables for each region, with Europe as the reference region. All regional dummies except the African one are significant, showing that other factors beyond those captured by the regressors are at play at the regional levels, except for Africa, whose supply chain trade is not significantly different from Europe.

¹⁸ Most coefficient estimates remain similar and significant when each country is removed in turn. However, FDI loses significance when Hong-Kong, a destination of high FDI, is removed. However, the significance of FDI returns when removing Hong Kong and African countries. Both countries are individually influential observations on the overall fit but in opposite directions. We also dropped 18 countries with a population of less than 1 million. Results, available upon request, remain unaffected, except for the barely significant capital/GDP that now becomes insignificant.

Table 3: Determinants of Backward GVC participation: Full sample

Column	(1) GVC Backward	(2) GVC Backward	(3) GVC P.Backward	(4) GVC P.Backward	(5) GVC P.Backward	(6) GVC P.Backward
Av. Tariff	-0.00541*** (0.00115)	-0.00486*** (0.00144)	-0.00380*** (0.000836)	-0.00540*** (0.00131)	-0.00371*** (0.000984)	-0.00325*** (0.000800)
FDI inc. (log)	0.0118** (0.00540)	0.0154** (0.00663)	0.00961** (0.00379)	-0.00925 (0.00598)	0.0137*** (0.00400)	0.0109*** (0.00372)
Dist hub (log)	-0.138*** (0.0300)	-0.152*** (0.0388)	-0.0699*** (0.0216)	-0.106** (0.0425)	-0.0727*** (0.0221)	-0.0143 (0.0214)
Pol. Stability	0.0271*** (0.00800)	0.0283*** (0.00978)	0.0152*** (0.00570)	0.0272*** (0.00880)	0.0171*** (0.00612)	0.00974 (0.00745)
log Mfg. VA	-0.0240*** (0.00477)	-0.0256*** (0.00621)	-0.0185*** (0.00332)	-0.00514 (0.00527)	-0.0190*** (0.00367)	-0.0195*** (0.00348)
Res. Rents	-0.00495*** (0.000709)	-0.00455*** (0.000868)	-0.00377*** (0.000498)	-0.00221** (0.000928)	-0.00442*** (0.000489)	-0.00356*** (0.000445)
Log Cap/GDP	0.0268* (0.0139)	0.0216 (0.0179)	0.0183* (0.00977)	0.00290 (0.0117)	0.0246** (0.0105)	0.0124 (0.0100)
Land/GDP (log)	-0.0164*** (0.00395)	-0.0122*** (0.00465)	-0.0119*** (0.00273)	-0.0141*** (0.00314)	-0.0112*** (0.00287)	-0.0122*** (0.00272)
Share High +Med skill (log)	-0.0809 (0.100)	-0.0821 (0.0947)	-0.0398 (0.0736)	-0.00355 (0.0773)	0.0724 (0.102)	-0.0317 (0.0750)
Share low skilled (log)	-0.00753 (0.0201)	-0.00211 (0.0193)	0.00238 (0.0135)	0.0128 (0.0131)	0.0193 (0.0178)	0.00796 (0.0141)
E. Rate mis.	0.00000550 (0.00000843)	0.00000336 (0.0000119)	0.00000425 (0.00000671)	-0.00000152 (0.00000802)	0.00000739 (0.00000746)	0.00000543 (0.00000654)
Africa						-0.0415 (0.0280)
Americas						-0.0659*** (0.0254)
Asia						-0.0477** (0.0216)
Constant	2.232*** (0.425)	2.372*** (0.527)	1.338*** (0.305)	1.365*** (0.497)	1.482*** (0.317)	0.768*** (0.261)
Observations	492	308	492	277	403	492
R ²	0.390	0.395	0.351	0.230	0.354	0.365
Adjusted R2	0.371	0.368	0.331	0.186	0.328	0.341
# countries	142	142	142	89	103	141
Period FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All column estimates are Least squares- between (LS-BE)

Col. 1: 5-year averages Full sample

Col. 2: 10-year averages. Full sample

Col. 3: 5-year averages. Pure backward measure. Full sample.

Col.4: 5-year averages. Pure backward measures High income countries excluded.

Col. 5: 5-year averages. Pure backward measures African countries excluded.

Col. 6: 5-year averages. Pure backward measures. Europe is the reference region.

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As discussed by Fernandes et al., some determinants in equation (2), like tariffs and FDI, could be endogenous or determined simultaneously with GVC participation. First, attenuation bias could be important due to measurement errors in some regressors, particularly tariffs. Also, as noted by Fernandes et al., GVCs may lower tariffs to attract FDI, in which case coefficient estimates would be too large in magnitude. They report IV estimates for tariffs and FDI that are larger in magnitude than those with LS-BE. We tried the same approach, but though we obtained a value close to theirs, our regression did not pass the weak IV tests, so IV regression estimates are not reported here.

3.2. Africa results

Since we are interested in AfCFTA's potential to increase participation in supply chains we focus on the determinants of pure backward participation (table 4) and RVC participation (table 5) across African countries. Now, because of missing data, the sample is unbalanced and reduced to 89 observations out of a potential of 205 (=38x5) observations. On average, around 17 countries are included in each year, with a low number of countries in the initial periods.¹⁹

We also look for any role of FTA membership through regional integration for those RECs where applied tariffs have been substantially reduced. The choice of FTAs and customs unions (CUs) is taken from Böschmeier et al. (2022, table 1). The choice relies on Teti's (2020) painstaking correction of applied tariff data in WITS described earlier. This leads them to select the following groups for FTA: SADC, COMESA, and PAFTA; and for CUs: SACU, EAC, CEMAC, and ECOWAS. Using this selection criterion, equation (2) is now:

$$Y_{ct} = \beta_0 + \sum_j \beta_j X_{jt} + D_{CU} + D_{FTA} + I_t + \varepsilon_{ct} \quad (3)$$

Where the subscripts, X_{jt} , and Y_{ct} are defined as in equation (2) and D_{CU} is a dummy set to 1 if c is a member of SACU, EAC, CEMAC, or ECOWAS, D_{FTA} is a dummy set to 1 if c is a member of SADC, COMESA, or PAFTA, and I_t is the period dummy.

Table 4 presents the results of the regression on the African sample. Column 1 is comparable to Table 3 column 3 as it presents a regression of the seven explanatory variables introduced by Fernandez et al. (2022) on the share of pure backward GVC trade. Much significance and stability are lost in the estimates from this small sample. Now tariffs are no longer significantly correlated with the pure backward share of GVC trade, even though the estimated coefficient is still negative. Misreporting also results in attenuation bias, so the results in Table 4, especially those on tariffs should be interpreted with caution.²⁰ FDI now carries a negative sign, though it is weakly significant. However, since African countries are primarily engaged in

¹⁹ We have 4 countries in 1995-2000, 10 in 2000-2005, 18 in 2005-2010, 26 in 2010-2015, 31 in 2015-2020.

²⁰ Teti (2020, p.1), reports 56% missing data on applied tariffs for LDCs, significantly higher than the reported 42% for non-LDC developing countries.

forward supply chain activity, one would expect FDI to be positively correlated with forward GVC participation. This is indeed the case for the estimates in column 2, even though the estimated coefficient is not statistically significant. Distance from hubs is not significant in column 1, though it keeps its significant negative sign in column 2. The market size proxy captured by the manufacturing share in GDP is still negative, as in Table 3, indicating that domestic inputs may be substituted for imports unexpectedly negative in column 1 while it retains its expected positive significance in the forward estimates in column 2.

Most estimates in this sample are not significant, but overall, the results in column 2 are more plausible than those in column 1. Columns 3 and 4 then test separately for any additional effects from participation in a CU or an FTA. Both are significant but of opposite signs (if they were jointly entered, both lose significance). Because of the small sample and problems with the reliability of WITS tariffs, these results are difficult to interpret beyond the likelihood that deeper cooperation in a CU with a common external trade policy than in an FTA could be conducive to a greater import content of exports.

Table 4: Determinants of Backward GVC participation: Africa sample

	(1) GVC share Pure Backward	(2) GVC-share Forward	(3) Share GVC Forward	(4) Share GVC Forward
Av. Tariff	-0.00261 (0.00199)	0.00114 (0.00164)	0.000755 (0.00154)	-0.000865 (0.00140)
FDI inc. (log)	-0.0217* (0.0111)	0.00171 (0.00763)	0.00649 (0.00813)	0.000222 (0.00724)
Dist hub (log)	0.0295 (0.0472)	-0.143*** (0.0499)	-0.170*** (0.0523)	-0.138*** (0.0491)
Pol. Stability	0.0165 (0.0135)	0.000908 (0.00910)	-0.00166 (0.00875)	-0.000888 (0.00878)
Mfg. VA (log)	-0.0230*** (0.00490)	0.0103*** (0.00346)	0.0113*** (0.00347)	0.0135*** (0.00328)
Res. Rents	0.000123 (0.00113)	0.00165** (0.000770)	0.00166** (0.000788)	0.00165** (0.000768)
Cap/GDP (log)	-0.0462* (0.0252)	0.0357* (0.0183)	0.0510*** (0.0182)	0.0364** (0.0175)
Land/GDP (log)	-0.0118*** (0.00444)	0.00197 (0.00335)	-0.00139 (0.00404)	0.00101 (0.00360)
Sh High+Med skill (log)	0.0526 (0.135)	-0.0872 (0.103)	-0.104 (0.0962)	-0.0932 (0.0889)
Share low skilled (log)	0.0382* (0.0220)	-0.0161 (0.0151)	-0.0181 (0.0140)	-0.0102 (0.0135)
Exch. rate mis.	-0.000157 (0.000138)	0.000177 (0.000107)	0.000191* (0.0000972)	0.000205*** (0.0000681)
CU			0.0337** (0.0151)	
FTA				-0.0487*** (0.0144)
Constant	-0.613 (0.558)	1.863*** (0.571)	2.321*** (0.591)	1.781*** (0.542)
Observations	89	89	89	89
R^2	0.489	0.517	0.552	0.572
Adjusted R^2	0.384	0.418	0.453	0.477

Notes: All column estimates are Least squares- between (LS-BE). Period fixed effects included

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Determinants of Regional Value Chain (RVC) participation

	(1)	(2)	(3)	(4)	(5)	(6)
	Share GVC	Share GVC	Share GVC	Share GVC	Share GVC	Share GVC
	Pure	Pure	Pure	Pure	Pure	Pure
	Backward	Backward	Backward	Backward	Backward	Backward
	NRVC	RVC	NRVC	RVC	NRVC-AFR	RVC-AFR
Av. Tariff	-0.000663 (0.000606)	-0.00316*** (0.000656)	-0.000590 (0.000635)	-0.00264*** (0.000615)	-0.00156 (0.00183)	-0.00111** (0.000513)
FDI inc. (log)	0.00531** (0.00237)	0.00438 (0.00322)	0.00540** (0.00245)	0.00217 (0.00311)	-0.0137* (0.00764)	-0.00785*** (0.00215)
Dist hubs (log)	-0.0105 (0.0141)	-0.0584*** (0.0146)	-0.0154 (0.0197)	-0.0483*** (0.0185)	0.00891 (0.0420)	0.0180 (0.0141)
Pol. Stability	-0.00780* (0.00444)	0.0229*** (0.00408)	-0.00557 (0.00444)	0.0149*** (0.00392)	0.00383 (0.0140)	0.0121** (0.00529)
Mfg. VA (log)	-0.0136*** (0.00197)	-0.00484* (0.00281)	-0.0129*** (0.00201)	-0.00776*** (0.00286)	-0.00896* (0.00526)	0.00391* (0.00199)
Res. Rents	-0.00123***	-0.00255***	-0.00141***	-0.00209***	0.000374	0.000256
Cap/GDP (log)	-0.00481 (0.00598)	0.0233*** (0.00652)	-0.00692 (0.00628)	0.0210*** (0.00585)	-0.0247 (0.0225)	-0.0218*** (0.00645)
Land/GDP (log)	-0.00742*** (0.00152)	-0.00465** (0.00221)	-0.00628*** (0.00157)	-0.00573*** (0.00211)	-0.0157*** (0.00423)	0.00489*** (0.00178)
Share High+Med skill (log)	-0.0670 (0.0494)	0.0252 (0.0447)	-0.0497 (0.0502)	0.00178 (0.0410)	-0.00390 (0.117)	0.0686** (0.0289)
Share low skilled (log)	-0.00714 (0.00898)	0.00927 (0.00752)	-0.00472 (0.00933)	0.00872 (0.00649)	0.0238 (0.0197)	0.0169*** (0.00447)
Exchange rate mis.	-0.00000208 (0.00000427)	0.00000659 (0.00000550)	-0.00000309 (0.00000402)	0.00000555 (0.00000495)	-0.000102 (0.000123)	- (0.0000279)
MERCOSUR			-0.0300*** (0.0100)	0.0227** (0.00963)		
ASEAN			0.0212** (0.00994)	0.0486*** (0.0137)		
EU			-0.00929 (0.0111)	0.0524*** (0.0131)		
NAFTA			-0.0238*** (0.00880)	0.109*** (0.0313)		
Constant	0.284 (0.182)	1.042*** (0.185)	0.318 (0.249)	0.953*** (0.227)	-0.113 (0.488)	-0.331** (0.149)
Observations	492	492	492	492	89	89
R ²	0.147	0.399	0.162	0.455	0.434	0.527
Adjusted R ²	0.120	0.380	0.128	0.433	0.318	0.429

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Observers suggest that the recent increase in protection among big players and the unfolding of industry 4.0 is both shortening supply chains and changing their orientation towards regional value chains (RVCs).²¹ The recent EORA data used here covering the period 1995-2020 suggests this may be the case.

Table 5 contrasts the determinants of the import content (pure backward) of exports in RVCs (trade flows that cross at least two countries in the same region) with those directed outside the region (NRVCs). For the whole sample, openness to trade is significantly associated with increased RVC participation (column 2 and 4), but it is insignificant for NRVCs, i.e. supply chains outside the region. This pattern also holds across Africa, suggesting that tariff elimination under AfCFTA would stimulate regional supply chains across Africa.

The fit for RVC correlates is much higher than for NRVC. The other coefficient estimates are also plausible. FDI is also significant for NRVC but not for RVCs, which would be the case if FDI mostly stimulates imports for supply chains outside the region. Distance from hubs matters for RVCs but not for NRVCs. The dummy variables for the main FTAs (EU, MERCOSUR, ASEAN, NAFTA) are all positive and highly significant, an indication of other factors at play not included in the model. For Africa, none of the FTA dummies are significant so they are not reported. More accurate data on applied bilateral tariffs would be necessary to explore the impact of tariff policy on regional supply chain trade.

4. Conclusions

All African countries participate in the African Continental Free Trade Area (AfCFTA) to increase intra-African trade and accelerate structural transformation. Fostering regional trade networks (i.e. RVCs) is particularly important for the small-market, low-income African countries. It is also important as signs of the end of the 'made in the world' era are growing. The paper draws on the most UpToDate Eora Multi-regional Input-Output (MRIO) data over 1995-2022, covering 142 countries, among which 50 African countries. On average, Africa's participation in GVCs has kept up with trends in other regions. But for African countries, forward participation dominates backward participation, i.e. imported intermediates are concentrated in exports that undergo further processing at destination rather than being concentrated in exports at the end of the production chain.

Suitably defined aggregates of countries highlight significantly different patterns across regions and countries over the period. Africa's share of imports in exports remained stable at 15%, while in India, it doubled from 9% to 18%. Likewise, the share of imports in regional

²¹ Flows that cross at least two borders in the same (defined) regions are included in RVC indices.

African trade stayed stable at 5%, while in Asia (excluding China and India), it rose from 16% to 26%. RVCs failed to take off across Africa.

Quasi-elimination of tariffs on intra-African trade, the cornerstone of the AfCFTA, is expected to accelerate Africa's structural transformation through the development of African networks supply chain trade, captured here by indices of RVC trade. Since tariff reductions have not yet started, we look for determinants of supply chain trade based on historical data at two levels taking inspiration from the categories of regressors selected by Fernandes et al (2022). Using the whole sample, we establish that tariffs are a brake on the use of imported inputs in exports (i.e. on backward GVC participation), a result robust to the exclusion of several country groups, including African countries.

When estimates are carried out only for African countries, the sample is reduced to 89 observations. Results on backward participation are often insignificant (e.g. tariffs are no longer correlated with backward participation), but those on forward participation—the type of participation mostly carried out by African countries—have expected signs that are often significant. As to the determinants of participation in RVCs, a key objective of the AfCFTA, low tariffs are associated with greater participation in regional supply chains.

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ANNEX A: Descriptive statistics for the regressors

Table A1 Descriptive statistics for the whole sample and Africa only

Whole sample												
	Share GVC backward	Av. Tariff	FDI inc. (log)	Dist hubs (log)	Pol. Stability	Mfg. VA (log)	Res. Rents	Cap/GDP (log)	Land/GDP (log)	Share High+Med	Share low skilled (log)	Exchange rate mis.
Nbr of Obs	1044	903	978	1001	1009	932	1017	800	1006	688	688	1003
Mean	0,25	6,82	-17,54	10,01	-0,10	22,14	6,97	-11,88	-12,86	-0,17	-2,13	1,68E+06
SD	0,35	6,09	1,26	0,26	0,96	2,46	10,35	0,57	2,41	0,13	0,70	5,31E+07
Min	0,00	0,00	-23,83	9,55	-3,05	15,23	0,00	-13,34	-21,92	-1,19	-5,75	-2,36E+03
Max	9,77	42,38	-11,89	10,59	1,69	29,14	60,76	-8,55	-7,74	0,00	-0,36	1,68E+09
Africa												
	Share GVC backward	Av. Tariff	FDI inc. (log)	Dist hubs (log)	Pol. Stability	Mfg. VA (log)	Res. Rents	Cap/GDP (log)	Land/GDP (log)	Share High+Med	Share low skilled (log)	Exchange rate mis.
Nbr of Obs	294	243	287	288	288	261	287	227	289	126	126	288
Mean	0,21	10,33	-17,70	10,18	-0,52	20,69	11,14	-11,99	-10,93	-0,20	-2,14	5,84E+06
SD	0,58	6,04	1,23	0,17	0,88	1,88	10,50	0,52	1,53	0,18	0,95	9,90E+07
Min	0,00	0,00	-23,83	9,78	-3,05	15,23	0,00	-13,06	-15,68	-1,13	-5,42	-2,27E+03
Max	9,77	40,89	-15,04	10,45	1,07	24,94	60,76	-10,60	-7,77	0,00	-0,39	1,68E+09

ANNEX B: Countries in the dataset

This annex describes the data set, country classification by region and by RTA membership and the aggregation of the 26 EORA sectors into five broad aggregates: Africa (50), Asia (49), Europe (43), LAC (30), NAFTA (3). LAC and NAFTA are aggregated into “Americas” in the regressions. Oceania is dropped from the sample. China and India are, in some cases, reported separately from Asia. The list of 175 countries is reported in Table A1.

Regarding reliability of estimates, EORA uses national IO tables for more countries (74 countries at various time intervals) and balances these all the while extrapolating or interpolating values through cross-entropy methods for countries that do not have an IO table. Kowalski et al. (2015) give the example of Lao PDR, which has mediocre quality trade statistics and no IO table, so the EORA project uses its algorithms for filling in the table values and instead ‘generates’ this information for this country. Lenzen et al. (2015) discuss the philosophy of the EORA project: develop “a method for rapid, timely, and at the same time low labor and time intensive construction and updating of high-resolution MRIO tables by focusing on standardisation, automation, and advance computation”. Based on Montecarlo

simulations showing that errors on small flows do not affect multiplier estimates, justifying using all available information and the observation that elements of \$10,000 or less dominate MRIO tables, they argue that the methodology allows to obtain ‘holistic’ accuracy. Also, the Eora website explains how the updating created a seam in 2015.²²

Table B2 Countries and membership in regional categories

Region	Country	REC membership (Africa only)	In reg ?
Africa	Algeria	PAFTA	Yes
Africa	Angola	SADC	Yes
Africa	Benin	ECOWAS	No
Africa	Botswana	SACU SADC	Yes
Africa	Burkina Faso	ECOWAS	Yes
Africa	Burundi	EAC COMESA	Yes
Africa	Cameroon	CEMAC	Yes
Africa	Cape Verde	ECOWAS	Yes
Africa	Central African Republic	CEMAC	No
Africa	Chad	CEMAC	Yes
Africa	Congo	CEMAC	Yes
Africa	Cote d'Ivoire	ECOWAS	Yes
Africa	Democratic Republic of Congo	SADC COMESA	No
Africa	Djibouti	COMESA	No
Africa	Egypt	COMESA PAFTA	Yes
Africa	Eritrea	COMESA	No
Africa	Ethiopia	COMESA	Yes
Africa	Gabon	CEMAC	No
Africa	Gambia	ECOWAS	Yes
Africa	Ghana	ECOWAS	Yes
Africa	Guinea	ECOWAS	Yes
Africa	Kenya	EAC COMESA	Yes
Africa	Lesotho	SACU SADC	Yes
Africa	Liberia	ECOWAS	Yes
Africa	Libya	COMESA PAFTA	No
Africa	Madagascar	SADC COMESA	Yes
Africa	Malawi	SADC COMESA	No
Africa	Mali	ECOWAS	Yes
Africa	Mauritania	-	No
Africa	Mauritius	SADC COMESA	Yes
Africa	Morocco	PAFTA	Yes
Africa	Mozambique	SADC	Yes
Africa	Namibia	SACU SADC	Yes

²² See: https://worldmrio.com/documentation/faq.jsp#faq_38.

Africa	Niger	ECOWAS	Yes
Africa	Nigeria	ECOWAS	Yes
Africa	Rwanda	EAC COMESA	Yes
Africa	Sao Tome and Principe	-	Yes
Africa	Senegal	ECOWAS	Yes
Africa	Seychelles	SADC COMESA	Yes
Africa	Sierra Leone	ECOWAS	Yes
Africa	Somalia	-	No
Africa	South Africa	SACU SADC	Yes
Africa	Swaziland	SACU SADC COMESA	Yes
Africa	Tanzania	EAC SADC	Yes
Africa	Togo	ECOWAS	Yes
Africa	Tunisia	PAFTA	Yes
Africa	Uganda	EAC COMESA	Yes
Africa	Zambia	SADC COMESA	Yes
Africa	Zimbabwe	SADC COMESA	No
Asia	Afghanistan	N/A	No
Asia	Armenia	N/A	Yes
Asia	Azerbaijan	N/A	Yes
Asia	Bahrain	N/A	Yes
Asia	Bangladesh	N/A	Yes
Asia	Bhutan	N/A	Yes
Asia	Brunei	N/A	Yes
Asia	Cambodia	N/A	Yes
Asia	China*	N/A	Yes
Asia	Cyprus	N/A	Yes
Asia	Georgia	N/A	Yes
Asia	Hong Kong	N/A	Yes
Asia	India*	N/A	Yes
Asia	Indonesia	N/A	Yes
Asia	Iran	N/A	Yes
Asia	Iraq	N/A	No
Asia	Israel	N/A	Yes
Asia	Japan	N/A	Yes
Asia	Jordan	N/A	Yes
Asia	Kazakhstan	N/A	Yes
Asia	Kuwait	N/A	Yes
Asia	Kyrgyz Republic	N/A	Yes
Asia	Laos	N/A	Yes
Asia	Lebanon	N/A	Yes
Asia	Macao	N/A	Yes
Asia	Malaysia	N/A	Yes
Asia	Maldives	N/A	Yes
Asia	Mongolia	N/A	Yes
Asia	Myanmar	N/A	Yes

Asia	Nepal	N/A	Yes
Asia	North Korea	N/A	No
Asia	Oman	N/A	Yes
Asia	Pakistan	N/A	Yes
Asia	Palestine	N/A	No
Asia	Philippines	N/A	Yes
Asia	Qatar	N/A	Yes
Asia	Saudi Arabia	N/A	No
Asia	Singapore	N/A	Yes
Asia	South Korea	N/A	Yes
Asia	Sri Lanka	N/A	Yes
Asia	Syria	N/A	No
Asia	Tajikistan	N/A	Yes
Asia	Thailand	N/A	Yes
Asia	Turkey	N/A	Yes
Asia	Turkmenistan	N/A	No
Asia	United Arab Emirates	N/A	Yes
Asia	Uzbekistan	N/A	No
Asia	Vietnam	N/A	Yes
Asia	Yemen	N/A	No
Europe	Albania	N/A	Yes
Europe	Andorra	N/A	No
Europe	Austria	N/A	Yes
Europe	Belarus	N/A	Yes
Europe	Belgium	N/A	Yes
Europe	Bosnia and Herzegovina	N/A	Yes
Europe	Bulgaria	N/A	No
Europe	Croatia	N/A	Yes
Europe	Czech Republic	N/A	Yes
Europe	Denmark	N/A	Yes
Europe	Estonia	N/A	Yes
Europe	Finland	N/A	Yes
Europe	France	N/A	Yes
Europe	Germany	N/A	Yes
Europe	Greece	N/A	Yes
Europe	Hungary	N/A	Yes
Europe	Iceland	N/A	Yes
Europe	Ireland	N/A	Yes
Europe	Italy	N/A	Yes
Europe	Latvia	N/A	Yes
Europe	Liechtenstein	N/A	No
Europe	Lithuania	N/A	Yes
Europe	Luxembourg	N/A	Yes
Europe	Macedonia	N/A	No
Europe	Malta	N/A	Yes

Europe	Moldova	N/A	Yes
Europe	Monaco	N/A	No
Europe	Montenegro	N/A	No
Europe	Netherlands	N/A	Yes
Europe	Norway	N/A	Yes
Europe	Poland	N/A	Yes
Europe	Portugal	N/A	Yes
Europe	Romania	N/A	No
Europe	Russia	N/A	Yes
Europe	San Marino	N/A	No
Europe	Slovak Republic	N/A	Yes
Europe	Slovenia	N/A	Yes
Europe	Spain	N/A	Yes
Europe	Sweden	N/A	Yes
Europe	Switzerland	N/A	Yes
Europe	Ukraine	N/A	Yes
Europe	United Kingdom	N/A	Yes
Europe	Yugoslavia	N/A	No
LAC	Antigua and Barbuda	N/A	Yes
LAC	Argentina	N/A	Yes
LAC	Aruba	N/A	Yes
LAC	Bahamas	N/A	Yes
LAC	Barbados	N/A	Yes
LAC	Belize	N/A	Yes
LAC	Bolivia	N/A	Yes
LAC	Brazil	N/A	Yes
LAC	British Virgin Islands	N/A	No
LAC	Cayman Islands	N/A	Yes
LAC	Chile	N/A	Yes
LAC	Colombia	N/A	Yes
LAC	Costa Rica	N/A	Yes
LAC	Cuba	N/A	No
LAC	Dominican Republic	N/A	Yes
LAC	Ecuador	N/A	Yes
LAC	El Salvador	N/A	Yes
LAC	Guatemala	N/A	Yes
LAC	Guyana	N/A	No
LAC	Haiti	N/A	Yes
LAC	Honduras	N/A	Yes
LAC	Jamaica	N/A	Yes
LAC	Nicaragua	N/A	Yes
LAC	Panama	N/A	Yes
LAC	Paraguay	N/A	Yes
LAC	Peru	N/A	Yes
LAC	Suriname	N/A	Yes

LAC	Trinidad and Tobago	N/A	Yes
LAC	Uruguay	N/A	Yes
LAC	Venezuela	N/A	No
NAFTA	Canada	N/A	Yes
NAFTA	Mexico	N/A	Yes
NAFTA	United States	N/A	Yes

* China and India appear independently in the graphs and tables of section 2. In that case, they are not included in “Asia”.

Notes: in regressions LAC and NAFTA are considered together as ‘Americas’.

References annexes

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“Sur quoi la fondera-t-il l’économie du monde qu’il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l’ignore.”

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