

Supply chain trade in East Africa: Prospects and challenges*

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Abstract

Deeper regional integration is the main objective of the recently launched Africa Continental Free Trade Area (AfCFTA). Supply chain trade both at the level of the Regional Economic Communities (RECs) and across RECs are to spearhead the AfCFTA. Indicators of Global Value Chains (GVC) participation show that even though the EAC and other African RECs have increased their participation in GVCs over the period 1990-2015 surpassing MERCOSUR they still lag behind the ASEAN region. There has also been little improvement in the participation of African RECs in Regional Value Chains (RVCs). This outcome is not due to a lack of ambition. Indeed, African Regional Economic Communities (RECs) have prioritized strengthening deeper RVC integration as a stepping stone to their development. The EAC has gone as far as targeting specific value chains: cotton, wood and paper, food and beverages among others, but with very little to show for it so far; only 1.7% of total gross exports of the EAC are related to RVCs. This is in contrast to ASEAN (17.2%), MERCOSUR (4.6%) and SADC (3%); within the EAC, Rwanda has made impressive progress while Uganda has underperformed.

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... /... Overall, over the period 1990-2015, the EAC and other African RECs have participated mostly in non-regional value chains along forward rather than backward participation (i.e. their value-added exports are mostly on intermediates that enter exports of other trade partners while the share of foreign exports in their exports is low) activities. This paper singles out for discussion three obstacles hampering greater inclusion in global value chains: (i) high tariffs on imports of intermediates; (ii) restrictive rules of origin, an obstacle to intra-regional trade; (iii) high ad-valorem equivalents of barriers to connectivity and more generally to trade in services. Lastly, controlling for per capita income, correlations for the sample of 149 countries over the period 1995-2015 confirms that overall GVC participation is negatively associated with increases on the tariffs on imports and exports of intermediates as well as on trade costs. However, forward GVC participation (i.e. the share of intermediates of foreign origin) is positively associated with the number of mobile phone subscribers a proxy for digital connectivity.

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1. Introduction

Deeper regional integration under the newly created Africa Continental Free Trade Area (AfCFTA) is the main theme of this year's Africa Economic Outlook (AEO) of the Africa Development Bank and other reports by multilateral development banks. A key objective of the AfCFTA is to develop Regional Value Chains (RVCs) to help grow and diversify the manufacturing sector. The East African Community (EAC), arguably Africa's most integrated Regional Economic Community (REC) is currently negotiating a revision of its Common External Tariff (CET)- the tariff structure of the EAC. There has been progress on finding consensus; negotiators have agreed to deepen the current tariff structure by moving from its current 3-band structure (0% for raw materials-15% for semi-finished products-25% for finished products) to a 4-band structure that uses the United Nations Broad Economic Classifications (BEC)-a more accurate description of differentiated products. A suppression of the Sensitive Item (SI) List (66 products exempt from the three-band tariff schedule with tariffs up to 70 per cent) and of the Duty Remissions Scheme is also on the table¹.

One of the objective of revising the CET is to reduce trade costs among members and encourage supply chain trade at the REC level. Shepherd et al. (2018) evaluate the performance of the EAC by comparing its trade costs with those of other customs unions in other regions of the developing world. Taking into account pre-existing trends, they were unable to detect a structural change in broad measures of trade costs following the implementation and expansion of the customs union in 2005 or 2009 respectively. Although they show that the CET has helped harmonize trade policies among EAC members, there is little to suggest that it has supported a process of progressive liberalization and uniformization of incentives across sectors.

Their conclusion resonates in view of the current EAC negotiations where member states are contemplating the introduction a fourth tariff band to protect promising sectors and in part boost the EAC's participation in RVCs; a move that will lead to greater distortion of the CET. Under the current CET negotiations, the following sectors have been singled out as promising for the development of RVCs through the adoption of longer tariff bands to "facilitate production processes with strong forward and backward linkages, in particular products of 'strategic' regional interest" [EAC 2018, p.xii]. The list of strategic sectors - *cotton, textiles and apparel; leather and footwear; agro-processing: food and beverages; wood and wood products; iron & steel; automobiles*- is an ambitious list of candidate sectors to develop supply chain trade, and it raises the question of the prospects for a sustained development of RVCs in the EAC and other African RECs.

Against this backdrop, this paper evaluates the state of the EAC's integration into regional and global value chains and looks at the challenges the EAC faces in deepening integration into supply chain trade. Section 2 covers measures of supply chain trade and data sources used in the paper. The sections following detail three complementary approaches used to assess prospects for growth in supply chain trade.

First, we start by comparing measures of integration in supply chain trade for the EAC with those of other Regional Trade Agreements (RTAs): comparator groups in Africa are the Economic Community of West African States (ECOWAS); the Southern African Development Community (SADC); the Common Market for Eastern and Southern Africa (COMESA). Beyond Africa the two comparators are the Association for Southeast Asian Nations (ASEAN), and the Southern Common Market (MERCOSUR). The comparisons are carried out using an

¹ Criteria for goods on the Sensitive (SI) list include: revenue protection; protection from unfair competition from subsidized and counterfeit import goods; goods that fall under the imported second hand goods category; protection of agriculture production and value addition where the EAC has a comparative advantage. Duty Remissions Scheme (DRS) allows individual companies within EAC member states to apply for an exemption on a tariff if the imported good is an industrial input used for production.

updated dataset by Borin and Mancini (2019) that builds on the UNCTAD Eora database of trade in value-added over the period 1990-2015.² Methodology and measures are presented in section 2.

These estimates, reported in sections 3-5, show that the EAC has followed worldwide trends of a rising share of trade in value-added (relative to gross trade), an indication of growing participation in GVCs. Similarly, the EAC has moved away from participation in simple global value chain trade (trade in intermediates crossing only one border) towards more participation in complex global value chain trade (defined as trade in intermediates crossing at least two borders).³ However, compared with other RTAs, the EAC has participated more in forward GVC than backward GVC. Moreover, the EAC has the lowest RVC participation of around 1.7% among comparator groups (the highest in ASEAN stands at 17.2%). This indicates that less than 2% of total exports from the EAC region are related to regional (EAC) value chains.

In the second approach, detailed in section 6, we focus on three obstacles to the development of RVCs: (i) relatively high tariffs on imports of intermediate goods; (ii) the need to harmonize RoO as part of implementing the AfCFTA; (iii) the high restrictions to Services trade and the high costs of connectivity. The comparisons suggest handicaps for the EAC (and other RECs) for indicators of these policy-related costs.

The third and last approach reports on panel regressions for the three GVC measures (overall, backward and forward shares of GVC-related trade) for a sample of 146 countries over the period 1995-2015. The objective is to see if there are distinct correlation patterns for policy-related (trade costs, tariffs, connectivity) and non-directly policy-related (market size, FDI, manufacturing share) indicators. Results are detailed in section 7.

Section 8 concludes. An appendix with four annexes complements the main text.

2. Measures and Data

The paragraphs that follow provide an introduction to the terminology used in the literature on supply chain trade as well as the quantitative measures used in this paper; measures that carefully follow methodology developed by Borin and Mancini (2019) using the UNCTAD EORA database. Annexes A1 and A2 respectively provide more details on formulas and country composition regional groups used in the paper. Extra figures and tables are reported in annex A3.

Global value chains (GVCs): GVCs is the terminology used to describe the fragmentation of production stages across different countries where typically parts and components are produced in different countries and are then assembled sequentially along the chain or in a final location. Borin and Mancini (2019), and others, define GVC trade as “trade flowing across at least two borders”⁴. The literature uses four measures, of which we use three in the paper, to characterize participation by country s in supply chain trade. Annex A1 gives the corresponding formulas for the measures below.

² . The comparisons largely follow the presentation in the recently published *World Development Report 2020: Global Value Chains: Trading for Development* with an emphasis on RVCs among RTA members.

³ This paper analyses trends in complex global value chains. After a discussion on simple vs complex global value chain participation, the paper characterizes “complex global value chain participation” as “global value chain participation” in line with existing literature.

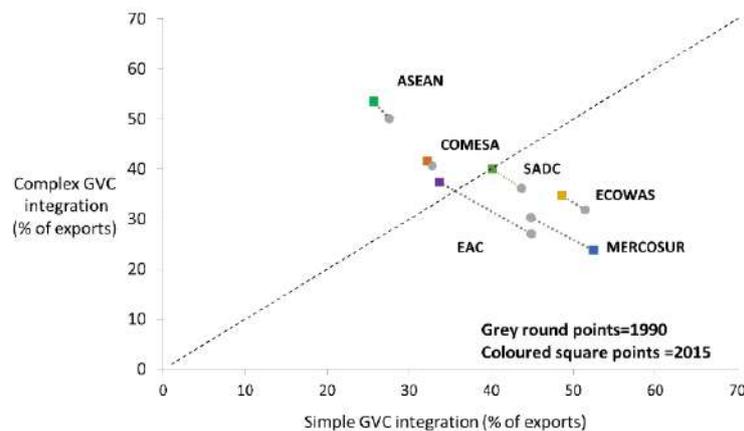
⁴ Wang et al. (2017b) distinguish between simple GVC where value-added only crosses the border once during the production process with no indirect exports via third countries or re-exports and re-imports and complex GVCs where value-added crosses borders at least twice. The evolution of both indexes is very similar over the period 1995-2015. See World Bank (2017, figure 1). This paper adopts the general definition of “global value chain participation” used in Borin and Mancini (2019): “trade flowing across at least two borders”

- **Backward GVC participation (GVC_{bs}):** measures the share of country s' exports that include value-added previously imported from abroad. For example, if Rwanda imports maize from Uganda for the production of fortified foods for export then Rwanda is said to be engaging in backward GVC participation.
- **Forward GVC participation (GVC_{fs}):** measures the share of a country's exports that are used by an importing country to produce for export. In the example of fortified foods exports, Uganda is engaging in forward or downward GVC participation because its exports are used as intermediates by Rwanda for the production of its fortified food exports.
- **GVC participation rate (GVC_s):** This measure is the share of country s' exports that either makes use of value-added imported from another country (backward GVC participation) or is exported to another country (forward GVC participation) for further processing expressed as a share of gross exports. The participation rate is the sum of the backward (GVC_{bs}) and the forward (GVC_{fs}) participation rates:

$$GVC_s = GVC_{bs} + GVC_{fs} \quad (1)$$

- **Length of the production chain.** Changes in technologies or in consumption markets allows for finer divisions of labor measured by the average number of production stages in a production process in a region (or world) i.e. the average propagation length.⁵ For our purposes, what matters is the length of the international part of supply chains captured by the number of border crossings, a measure of the importance of tariffs and transport costs. Here we only distinguish between simple GVCs where value-added crosses borders at least once and complex GVCs where value-added crosses borders at least twice but we use the more encompassing complex definition throughout our paper. Except for figure 1, all measures are for complex value chains. Also, at times we characterize the type of value chain by using measures of regional value chains to measure the extent to which the fragmentation of production is taking place at the regional level.

Figure 1: Evolution of complex vs simple GVC participation for African RECs



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019).

Note: GVC participation is the average of GVC_s across REC members, i.e. the sum of backward and forward linkages. Simple GVCs trade is where value-added only crosses the border once during the production process with no indirect exports via third countries or re-exports and re-imports and complex GVCs are where value-added crosses borders at least twice. Dots is the 45° line.

⁵ Wang et al. (2017a) define a GVC position index that measures the distance from any production stage between the final demand and the initial factor inputs in a production line. Using measures of the length of a production chain, one can measure how a country's position in a production network evolves. For example, for the production networks in East Asia over the period 1995-2009, China stayed in the most downstream segment of the lengthening networks (Inomata (2017) see figure 1.10). Measures in this paper do not report on the lengthening of networks over the 1990-2015 period.

In this paper, we do not measure the lengthening (shortening) of supply chains over the period. However using data from Borin and Mancini (2019) we find the changes in the measures of the average complexity of supply chains at the regional level (figure 1).⁶ For all RECs, except MERCOSUR, the average number of border crossings between 1990 and 2015, an indication of more complex supply chains. The reduction in border crossings for MERCOSUR could reflect stronger agglomeration forces (information technology like robots and 3D printing) than dispersion forces (communication technology like broadband). Increases in productivity would then have dominated the fall in trade costs.

- **Regional Value Chains (RVCs).** For RVCs, exports are defined as exports that cross at least two borders within the same defined region. (e.g. EAC, SADC, ASEAN). In this setting, backward participation measures the regional import content of exports from a member of region A and forward participation measures the value-added in A directly exported to a member then re-exported.

To measure supply chain participation, we use GVC measures from Borin and Mancini (2019) which builds on the EORA Multi Region Input Output (MRIO) national and global input-output tables. The database covers the period 1990-2015 for 189 countries and 26 sectors. This source has the largest country coverage available and produces estimates that are globally comparable with those derived from more reliable input-output databases for a smaller sample of countries.^{7/8} Many papers in the GVC literature use the EORA database to estimate the value-added embedded in a country's exports because of a larger country and sector coverage.⁹

3. Trends in Global Value Chains: Comparisons by Geographic regions

Before diving into a study of the EAC, we start our analysis by taking a look at the GVC participation of Sub-Saharan Africa in relation to other major geographic regions. We then turn to comparisons across regional blocs, EAC included, as well as across sectors (sections 5 and 6).

Over the past decades, reductions in transport and communication costs along with reductions in barriers at the border (tariffs and non-tariff barriers) and behind-the-border measures (regulations, registration procedures, and other cost-raising measures) have contributed to the unbundling of production across countries at different levels of development. These developments are closely linked to the growth of Global Value Chains (GVCs).

Under GVCs, production stages are fragmented: parts and components are produced in different countries and are then assembled sequentially along the chain or in a final location. This is in contrast to the horizontal industrialization strategy followed under the inward-looking industrialization strategies of the 1960s; in all developing countries outside of East Asia the stages of production progressively took place in a single country and no intermediates were exported.

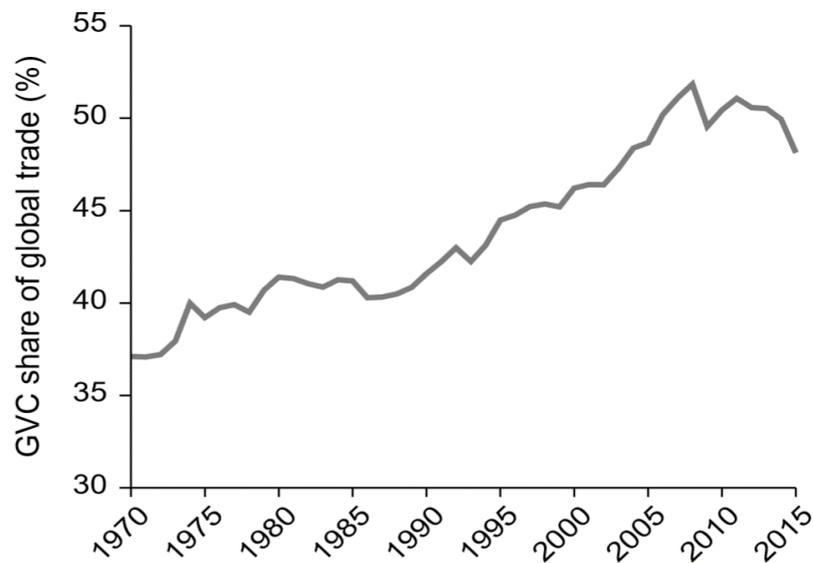
⁶ Annex A2 gives the definition of regional membership used in the paper.

⁷ Aslam et al. (2017) compare estimates from the Eora data base with those obtained from the OECD-WTO TIVA data base covering OECD countries. Their comparisons reported in tables 7-13 at 5 year intervals over the period 1995-2010 show a reasonably close fit between estimates from the two databases.

⁸ Despite its coverage the EORA database can be unreliable for some countries. Annex A2 discusses criteria used to exclude countries from the analysis because of data quality issues in EORA.

⁹ Examples of papers that use the EORA Multi Region Input Output (MRIO) include Johnson and Noguera, 2012; Wang et al., 2013; Koopman et al. 2014; Borin and Mancini, 2015; Nagengast and Stehrer, 2016; Los and Timmer, 2018 and WDR 2020 which makes use of database constructed by Borin and Mancini (2019).

Figure 2: Global GVC participation from 1970 to 2015



Source: WDR 2020 report (p. 2) which uses data from Eora26 database and Johnson and Noguera (2017).

Figure 2 shows a steady increase in global GVC participation from 1970 to 2015. However, between 2009 and 2015, following the financial crisis of 2008, growth in overall trade was weak and GVC trade actually contracted. At the time of the crisis, world trade fell more sharply than GDP and investments needed to fuel GVCs dried up (WDR 2020). A tally of trade measures applied by countries shows that discriminatory trade measures have been growing more rapidly than liberalizing measures since the crisis and that these measures have impacted trade.¹⁰

Trade uncertainty, as measured by perceptions in the press, also increased during the period 2009-15.¹¹ In addition to these factors, the growth of robotics combined with the continued growth of economies like China and India where the stages of supply chain are increasingly carried in the domestic economy, has contributed to a slowdown in GVC activity¹².

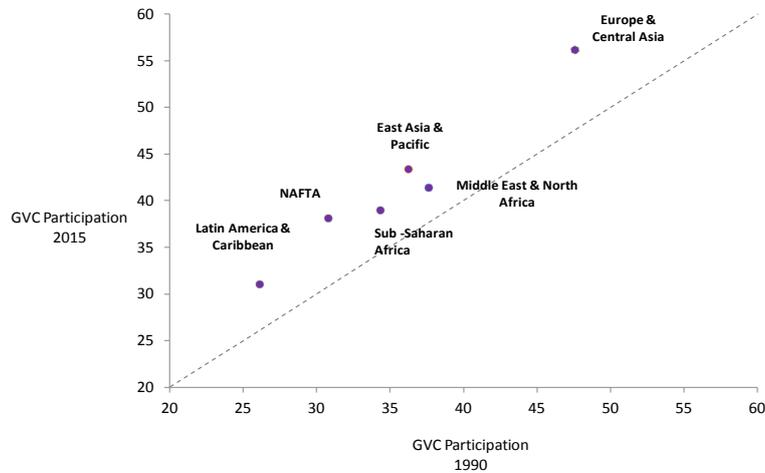
Figure 3 plots the GVC participation rate by major geographic regions, including SSA, in 1990 and 2015. In spite of the recent decline in GVC participation, all regions have increased GVC participation over the period 1990-2015 (all points are above the 45^o line). Europe and Central Asia leads has about close to double the GVC participation rate of Latin America and the Caribbean. Along with NAFTA, Europe and Central Asia is the region that registered the largest increase in participation. SSA has a relatively high participation rate, nearly as high as the MENA region in spite of being geographically further away from Europe, a large market for both regions.

¹⁰ See <https://www.globaltradealert.org/> for the count of trade measures reported to the WTO and Evenett and Fritz (2015) on how these measures discriminated most against LDCs.

¹¹ See Ahir, Bloom, and Furceri (2019) "The Global Economy hit by Higher Uncertainty", VOXEU <https://voxeu.org/article/global-economy-hit-higher-uncertainty>

¹² The 2008 crisis was followed by a sharp fall in the prices of primary products since 2011. Since GVC measures are calculated at current prices, with backward linkages falling because of the price effect, overall GVC measures like those displayed in figure 2 will fall. The fall of the Euro relative to the dollar reduces the weight of the EU in the supply chains could be another factor at play in the fall shown after 2010 in figure 2.

Figure 3: GVC participation by major geographic regions



Source: Authors calculation using GVC database from Borin and Mancini (2015, 2019).

Note: GVC participation measures the share of country's exports that either makes use of value-added imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper. See Annex 1 for full countries in regional groups. Mexico is included in North America grouping. Points above the 45° indicate an increase in GVC participation.

3.2 Supply Chains: Regional (RVC) vs non-regional (GVC) and by type (backward vs. forward)

Because of transaction costs associated with border crossings, GVCs usually develop along geographically proximate production chains- regional value chains where production linkages are concentrated within a geographic region. Indeed, this geographic concentration at the REC and continental levels is the objective of the AfCFTA. East Asia and Europe are two examples of regions with strong regional value chains whereas North America tends to rely on value chain linkages outside of its region with strong connections to China and East Asia productions chains (figure 4a). Figure 3 above showed that Sub-Saharan Africa (SSA) has increased its integration into GVCs since the 1990s, but integration into African RVCs has seen little change over the period (horizontal movement in figure 4a).

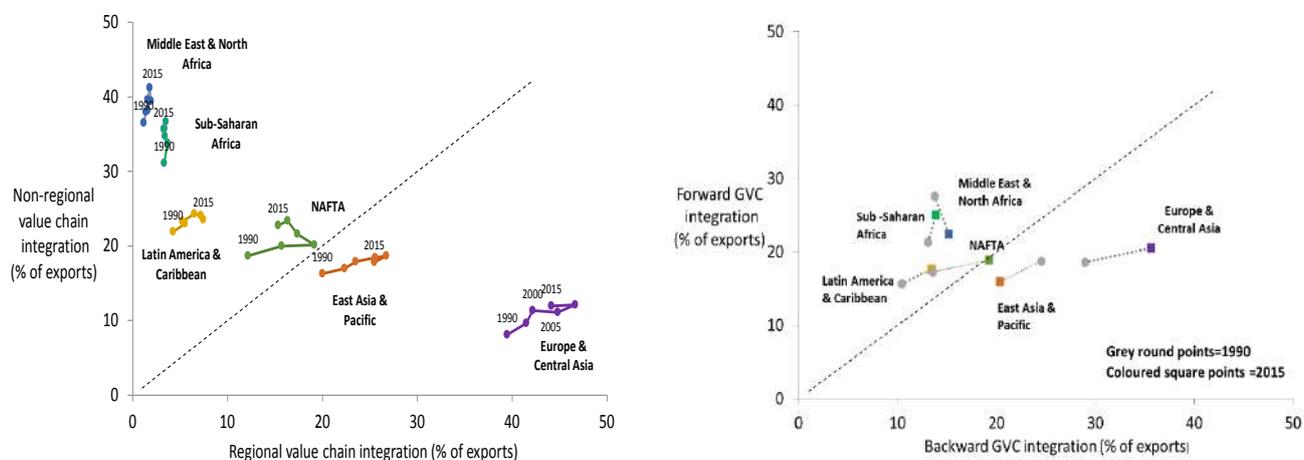
Figure 4a displays three distinct patterns of supply chain trade. First is the very low growth of regional supply chain trade for SSA and MENA. Second, is the divergent experience between MENA and SSA compared to other RECs: most supply chain trade is non-regional, i.e. it takes place outside of the defined regional blocs. These patterns may reflect a weak governance and regulatory environment that hamper the development of RVCs.¹³

¹³ North America displays a pattern in which supply chain trade developed around NAFTA during the 1990s, followed by a switch starting around 2000 towards non-regional supply chains.

Figure 4: Decomposition of GVC participation by major geographic regions (4a) and by type (4b)

a. Regional vs non-regional GVC participation

b. Backward vs forward GVC participation



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019). Breakdown of regional and non-regional value chain participation provided by Borin and Mancini using a novel extension of dataset available on request.

Note: GVC participation measures the share of country’s exports that either makes use of value-add imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chains participation. Points above the 45° indicate an increase in GVC participation.

Third is the pattern for East Asia and Pacific and Europe and Central Asia, both already emerging hubs in 1990s with growth over 1990-2015 mostly focused on RVCs. This pattern--dubbed the ‘Asia factory’ by Baldwin (2006) --reflects several forces at work. First is strong agglomeration economies (external economies and the development of specific skills in the work force). Second is the widespread trade facilitation policies, characterized by Vezina (2014) as-a ‘race-to-the bottom’- tariff cutting in the region to attract Japanese FDI. Other trade facilitation measures include simple and transparent rules of origin to facilitate cross-border trade in the region (Cadot et al. (2010)). Third, is the importance of institutions that have high indicator values for the Asia and Pacific region. Dollar and Kidder (2017) show in a cross-section that much of the uneven participation in GVCs across countries and regions within countries is related to indicators of the quality of institutions at the national level.¹⁴

Figure 4b measures whether participation in supply chains is mostly backward (concentrated in importing foreign intermediates) or forward (mostly selling intermediates for further processing). Two stylized patterns emerge. East-Asia and Pacific and Europe and Central Asia moved towards greater intra-regional trade in parts and components where, in the language of Baldwin and Forslid (2013), the ‘factory economies’ were both makers and buyers of components and parts. For this to be possible, intra-regional trade must not be interrupted along the production chain. The downstream pattern, is one in which exports of intermediates are

¹⁴ Dollar and Kidder (2017) and the WDR 2020 also report evidence from firm-level data. Patterns of revealed comparative in manufacturing for contract-intensive activities have also been shown to be closely related to the quality of domestic institutions. Melo and Olarreaga (2020) survey the role of institutions in international trade.

destined outside the region, thereby obviating having to rely on a smooth coordination across regional partners.

We also find that in 2015, only 3.5% of total SSA exports were connected to supply chain trade within the SSA region (figure 4a.). This stands in contrast to the 25.5% RVC integration for East Asia and the Pacific-almost 8 times the integration of SSA. On the other hand, SSA is more integrated into non-regional GVCs (35.6% of exports in 2015) than all regions except the Middle East and North Africa. Europe and Central Asia is the most integrated into RVCs followed by East Asia and the Pacific.

Looking at GVC trade overall (figure 4b), SSA has the highest forward GVC participation rate- around 25% of total exports-, a share that has grown by about 4 percentage points since 1990. SSA's forward GVC participation rate is higher than the one for East Asia and the Pacific (18.8%) and Europe and Central Asia (20.5%) (figure 4b). In contrast, the backward GVC participation rate for SSA has grown by less than 1 percentage point since 1990 and stands at around half the share of its forward GVC participation (figure 4b). Correlations in this pattern are also evident from the evolution of GVC participation in figure 11 below.

These findings simply mean that a large share of SSA's GVC integration consists of forward GVC integration: most of SSA's GVC exports are used by the importing countries to produce final goods for export. This is to be expected since SSA countries are heavily reliant on the export of raw materials -40% of exports in 2018 (AEO, 2018). These raw material are exported to other countries for the production of higher value-added final goods; a lower share of GVC related exports involves SSA countries importing intermediates for production of final goods for exports.

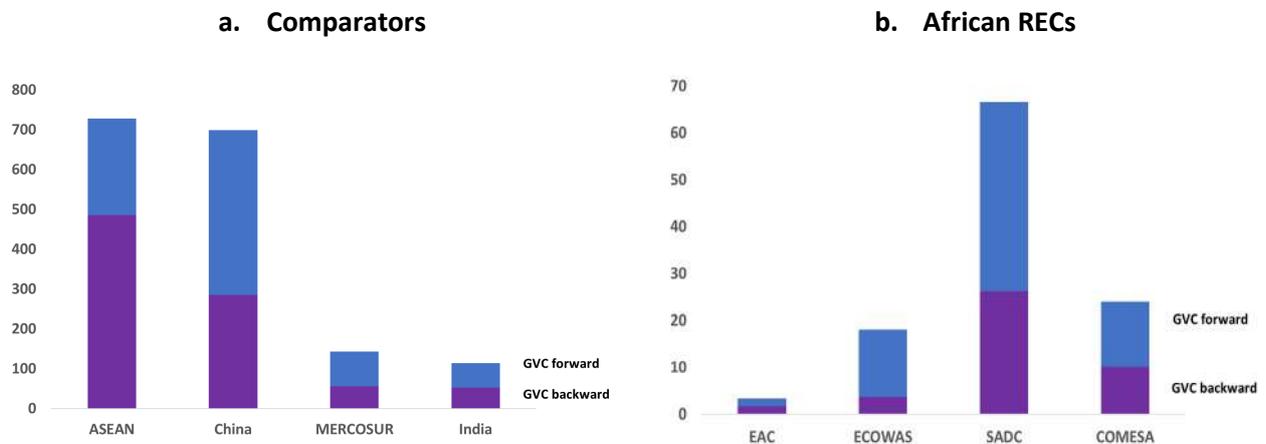
4.0 Supply chains by region and by strategic sectors.

Until the launch of the AfCFTA in May 2019, much of past regional integration in Africa took place around the eight RECs recognized by the Africa Union. These RECs have been important engines of trade for the continent and will continue to be important even as African countries move towards even more continental integration. Thus, it would be useful to understand how GVC participation has evolved across these different RECs against the backdrop of differences in economic and policy contexts. We are unaware of any studies that attempt to present systematic comparisons of GVC participation across the different African RECs. Neither are there studies focussing on GVC participation measures for the EAC and its member states. Similar to our initial analysis above, we start with descriptive measures of overall GVC participation across four main African RECs and the two comparator FTAs: ASEAN and MERCOSUR. We then compare participation across sectors of strategic interest for the EAC.

4.1 A REC perspective of GVC-related Trade

Figure 5 compares the importance of forward and backward GVC participation for the two largest developing countries relative to the largest RECs, then across African RECs. The two panels illustrate differences in orders of magnitude. In the left panel, ASEAN and MERCOSUR are compared to China and India. In the right panel, the GVC related trade volumes of the EAC is compared with three other African RECs. ASEAN and China have about ten times more GVC-related trade as the closest comparators, India and MERCOSUR with a much larger share of backward GVC participation in ASEAN than in China. MERCOSUR is comparable with SADC in terms of the volume of GVC related gross exports, probably reflecting the presence of a large economy in each trading bloc: Brazil in MERCOSUR and South Africa in SADC. Even when compared with the other African RECs, the EAC stands out as having a small volume of GVC related trade. For the four African RECs, SADC has the highest volume of GVC related exports with the EAC's GVC trade amounting to about around 3.5 billion USD in 2015.

Figure 5: GVC related trade volumes for African RECs and comparators, 2015, billions USD



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019).

Note: GVC participation measures the share of country's exports that either makes use of value-add imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation.

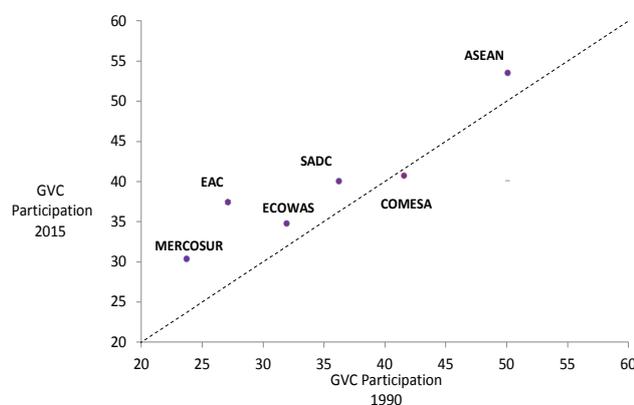
It should be noted that Figures 5a and 5b express volumes of GVC-related trade without taking the total trade volume into account. Indeed, a better way to compare across RECs is to look at GVC related trade as a share of each country's gross exports (i.e. GVC participation measure) to detect whether, as expected, smaller economies participate more intensely in fragmentation of production (figure 6a). We see that contrary to the picture in Figure 5, EAC's GVC participation has been rising over the period 1990-2015 even exceeding the GVC participation of ECOWAS and MERCOSUR. In fact, the EAC has experienced the largest increase in overall GVC participation over the 25-year period (figure 6a), now surpassing COMESA and closing in on SADC.¹⁵

Figure 6b shows the breakdown of GVC participation rate by forward and backward GVC participation for two periods: 1990 and 2015. We see that the EAC's growth in GVC participation is moving towards greater "backwardness". By 2015, the contribution of backward and forward participation was about the same. This shift towards greater backward GVC participation is compatible with the EAC's relatively open trade regime and a simple 3-band tariff structure that does not protect activities producing intermediates as shown by the move towards greater "forwardness" in the other African RECs. As expected, ASEAN's backward GVC participation is much higher than that observed for all the other RECs, a reflection of 'factory Asia'.

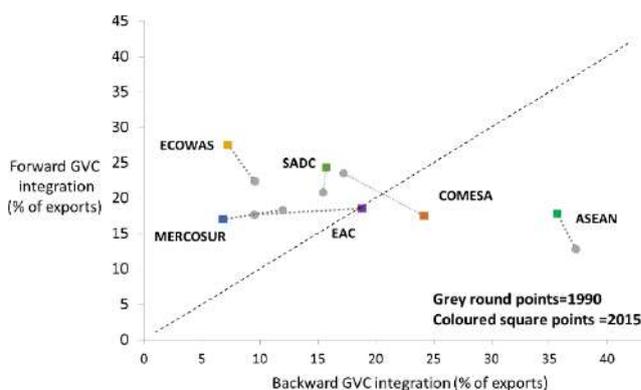
¹⁵ As noted earlier GVC is defined here as "complex" GVC participation i.e. trade crossing at least two borders. Figure 1 shows the shift of most RECs towards more complex GVC participation. In this paper we analyse complex GVC participation in line with WDR 2020.

Figure 6: GVC participation for African RECs and comparators, billions USD

a. GVC participation rate, 1990 and 2015



b. Backward and forward GVC participation rate, 1990 and 2015



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019).

Note: GVC participation measures the share of country's exports that either makes use of value-add imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation. Points above the 45° indicate an increase in GVC participation.

Table 1 expands on our analysis at the REC level and shows the worldwide trend on the intensity of backward and forward integration. At the world level, both measures of integration increased over the period 1990-2005 then stabilized from 2005 until 2015. For the EAC (and other African RECs), trends in backward integration have followed world trends, but they have remained about a third below those for other regions and at half the rate for ASEAN, "factory Asia". Section 4.3 shows that for the EAC, the low backward GVC related trade in the region's exports is accounted for by Kenya, Burundi and Uganda's low shares. On the hand, forward integration shares for the EAC follows closely world averages. This low level of backward GVC participation is compatible with the high tariff rates on intermediates observed in Africa (see figure 12) combined with high tariffs on final goods that blunt the competitiveness of final goods on world markets.

Table 1 : Trends in backward and forward integration rates: African RECs and comparators

	Backward integration				Forward integration			
	1990	2005	2015	Trend	1990	2005	2015	Trend
World	0.24	0.29	0.28	↔	0.18	0.20	0.20	↔
China	0.05	0.18	0.14	↔	0.17	0.18	0.21	↗
India	0.08	0.15	0.16	↔	0.17	0.20	0.19	↔
ASEAN	0.37	0.40	0.36	↔	0.13	0.17	0.18	↗
EAC	0.09	0.16	0.19	↗	0.18	0.20	0.19	↔
ECOWAS	0.09	0.09	0.07	↔	0.22	0.25	0.28	↗
MERCOSUR	0.07	0.12	0.12	↔	0.17	0.18	0.18	↔
SADC	0.15	0.16	0.16	↔	0.21	0.24	0.24	↔
COMESA	0.24	0.20	0.17	↔	0.17	0.22	0.24	↗

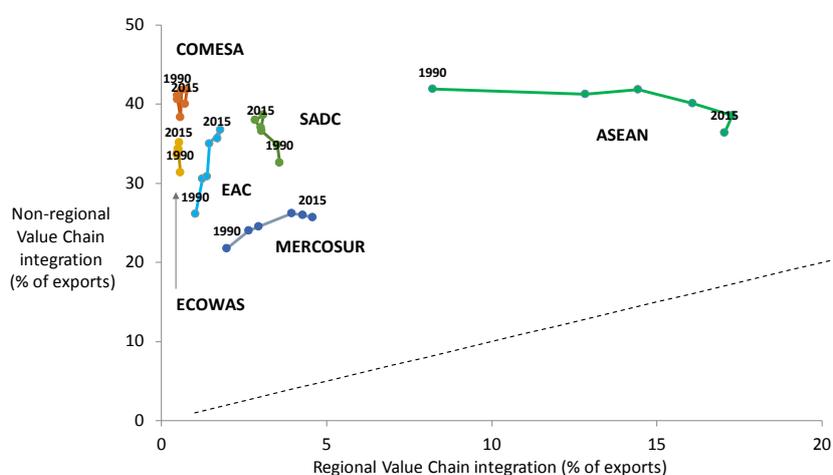
Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019).

Note: GVC participation measures the share of country's exports that either makes use of value-add imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation

A comparison of backward and forward integration patterns in table 1 confirms that the EAC and other RECs have lagged in their participation in supply chain trade. Intermediate imports are destined for the production of goods sold on the domestic, rather than on foreign markets. On the export side, increased participation has followed world trends of increased trade in value-added. As mentioned above, this pattern is consistent with the high tariff rates on imports of intermediates across the region compared with global trends.

Finally, Figure 7 shows a decomposition of GVC integration by regional and non-regional GVC integration as defined by the geographic definition of the RECs (see annex A2). Three patterns stand out. First, non-regional GVC dominates RVC (all points are above the 45° line for all RECs). Second, the non-African trading blocs have moved towards RVC supply chain trade. Third, there is a striking absence of RVC growth for all African RECs.

Figure 7: Regional vs non-regional participation African RECS and comparators



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019). Breakdown of regional and non-regional value chain participation provided by Borin and Mancini using a novel extension of dataset available on request.

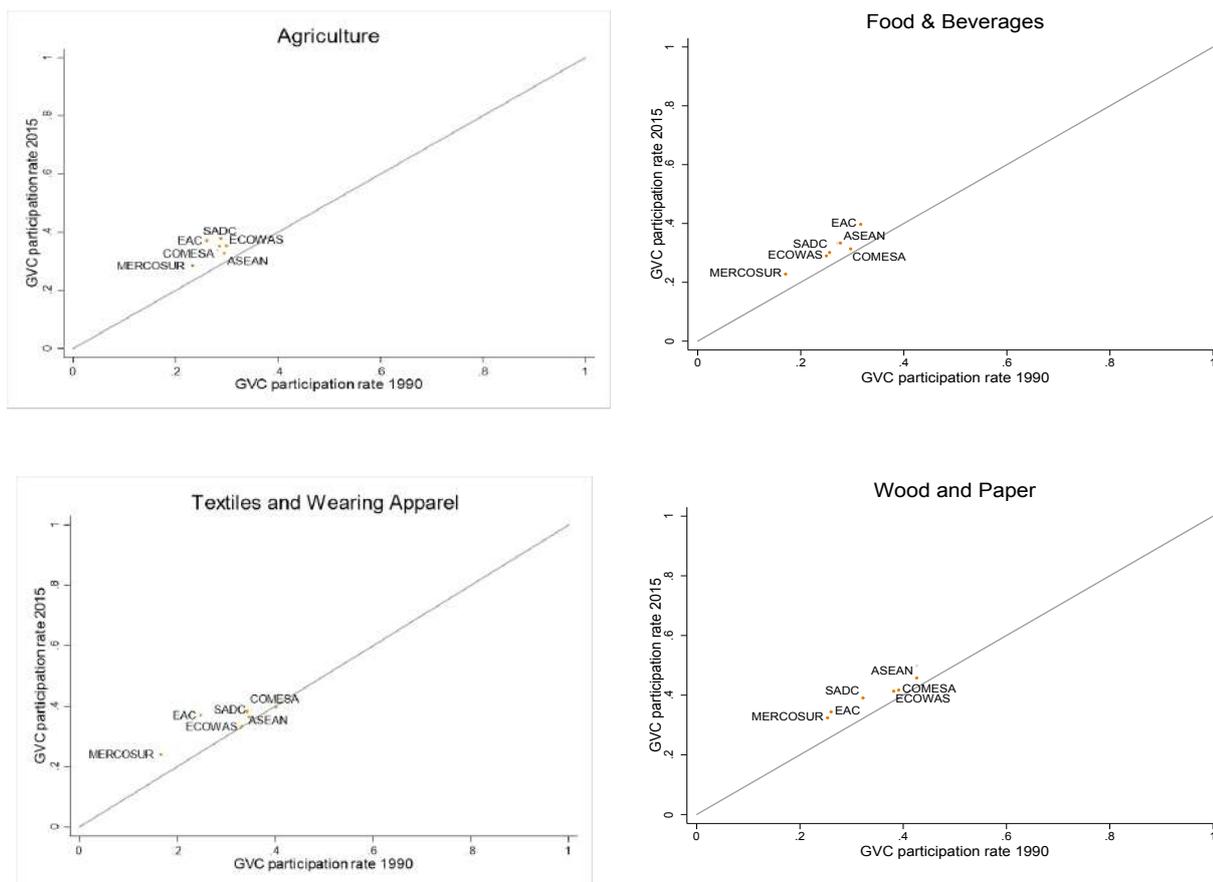
Note: GVC participation measures the share of country's exports that either makes use of value-add imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation. For each region and intervals of 5–6 years between 1990 and 2015, the figure plots the share of GVC trade involving only production partners in the same region in total GVC trade (regional GVC integration) against the share of GVC trade involving only partner countries outside the region in total GVC trade (non-regional GVC integration). Regional and non-regional GVC participation measures are computed as weighted averages over the countries in each group. The weights are the share of each country in the corresponding region total trade. Points above the 45° indicate an increase in GVC participation. Points above the 45° indicate an increase in GVC participation.

Within the group of African RECs, COMESA has the highest integration into non-regional GVC participation (excluding regional value chain integration) followed by SADC and then the EAC which has been catching up with SADC. ECOWAS trails the group but individually African RECS, in 2015, exhibited a higher level of non-RVC (i.e. of non-regional GVC) integration relative to MERCOSUR and ASEAN. However, both MERCOSUR and ASEAN have higher RVC integration rates than African RECs. In fact, ASEAN's RVC participation rate is about close to 6 times that of SADC, the African REC with the most RVC integration.

4.2. GVC participation patterns in sectors of strategic interest

The introduction listed six strategic sectors of regional interest discussion during the ongoing CET negotiations in the EAC. Among the six identified, four correspond quite closely to the 26-sector aggregation in available in Borin and Mancini (2019). The sectors are: textiles and wearing apparel; agro-processing –food and beverages; wood and paper products and agriculture. Figure 8 shows the evolution of participation rates for the 4 African RECs and the two other comparators. On average, the African RECs are more integrated into GVCs for the agriculture and textile sector than they are for the food and beverage industry and the wood and wood products industry.

Figure 8: GVC Participation in sectors of strategic interest: African RECs and comparators

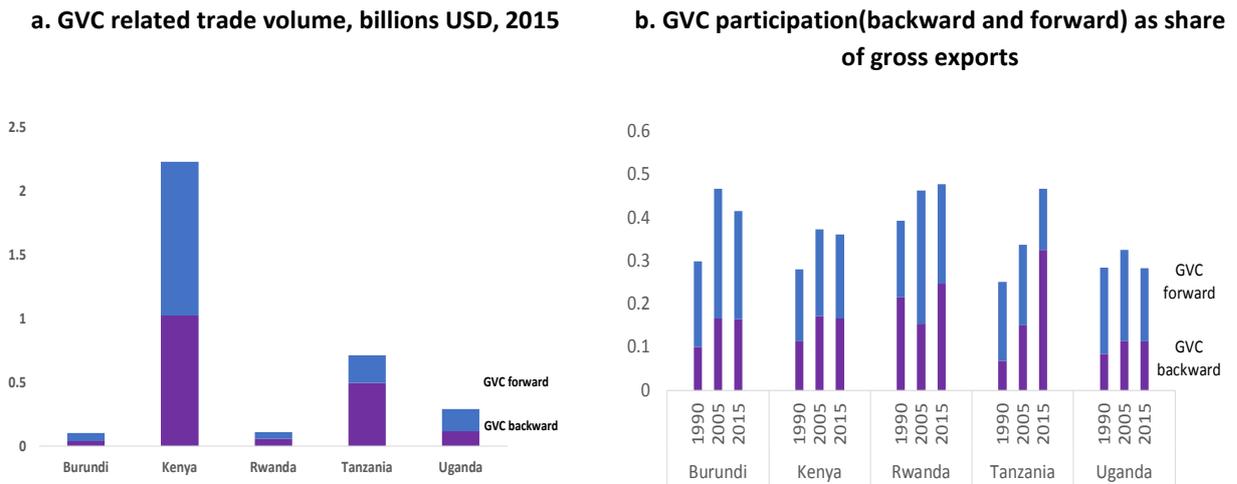


Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019). Breakdown of regional and non-regional value chain participation provided by Borin and Mancini using a novel extension of dataset available on request. Points above the 45° indicate an increase in GVC participation

4.3 EAC GVC participation by member state

Figure 9 shows GVC-related trade volumes and shares in gross exports for each EAC member. Figure 9a shows that Kenya has, by far the highest volume of GVC related trade followed by Tanzania and Uganda. However, when expressed as a share of gross exports, in Figure 9b, Kenya and Uganda have the lowest shares with Rwanda showing the largest increase over the period. As to the breakdown between forward and backward shares, the least developed members- Burundi and Rwanda-have a higher share of forward rates.

Figure 9: Decomposition of GVC participation for EAC member states



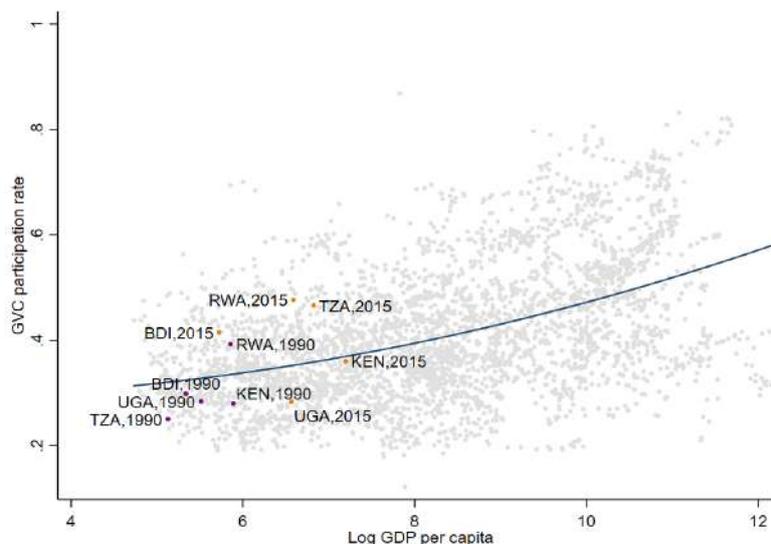
Source: Authors calculations using GVC database from Borin and Mancini (2019).

Note: GVC participation measures following equations (1) - (3) GVC trade expressed as a share of total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation.

5. A Taxonomy of GVC participation

Next, we compare participation by EAC along two dimensions: per capita income and following a taxonomy of GVC participation. Starting with the comparison according to the level of development, figure 10 shows that EAC members perform quite well and tend to have relatively higher GVC participation rates at the end of period. This was not the case in 1990 when all of the EAC's member states were participating in GVCs at rates lower than peer economies (as defined by per capita GDP in 2015). Even though the EAC as a whole has progressed since the 1990s, Uganda stands out. As of 2015, Uganda had not caught up with the GVC participation rate of its peers. In fact, both Rwanda (with a GDP per capita close to that of Uganda) and Burundi (with a substantially lower GDP per capita) have higher GVC participation than Uganda.

Figure 10: GVC participation of EAC member states compared to similar economies



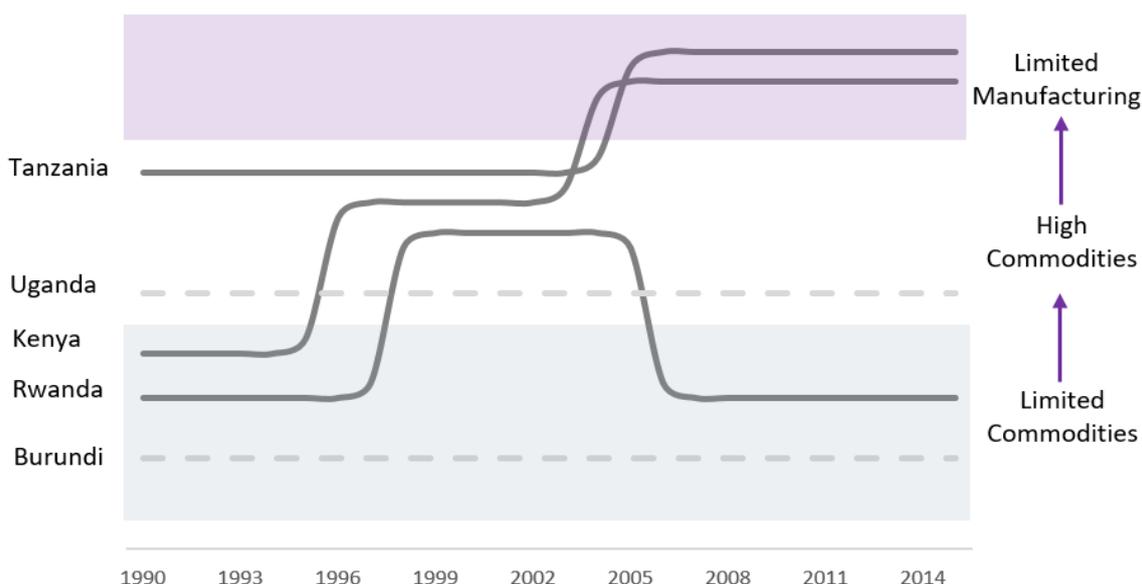
Source: Authors calculations using GVC database from Borin and Mancini (2019). Breakdown of regional and non-regional value chain participation kindly provided by Borin and Mancini. Dataset available on request.

Note: GVC participation measures the share of country's exports that either makes use of value-add imported from another country or is exported to another country for further processing. Points above the line of fit represent an increase in GVC participation.

Next, we consider the taxonomy of GVC participation proposed in the WDR 2020. The taxonomy classifies countries into three categories based on (1) the goods and services exported, (2) the extent of GVC participation, and (3); measures of innovation.¹⁶ This classification leads to four distinct types of GVC participation a) commodities; b) limited manufacturing; c) advanced manufacturing and services; and d) innovative activities. According to this classification, EAC countries fall in the limited commodities and limited manufacturing categories (See figure 11).

Two countries, Burundi and Uganda, remained in the same categories during the period 1990-2014. Since the 1990s, Uganda has stayed in the *high commodities* category and Burundi in the *limited commodities* classification meaning both countries have maintained a) a manufacturing share of total domestic value add of less than 60 percent and b) a backward manufacturing share of less than 20% (figure 11). However, Uganda is classified higher than Burundi because it has maintained a higher primary goods' share of total domestic value (equal to or greater than 40%). Over the period, Kenya and Tanzania have made their way into the *limited manufacturing* category, meaning both countries have higher shares of manufacturing in domestic value add as well as higher shares of backward manufacturing. Rwanda has had more of a bumpy ride, ascending into the *high commodities* classification and descending back into the *limited commodities* category over the last decade.

Figure 11: Evolution of GVC participation for EAC members



Source: Authors presentation of GVC participation proposed in WDR 2020.

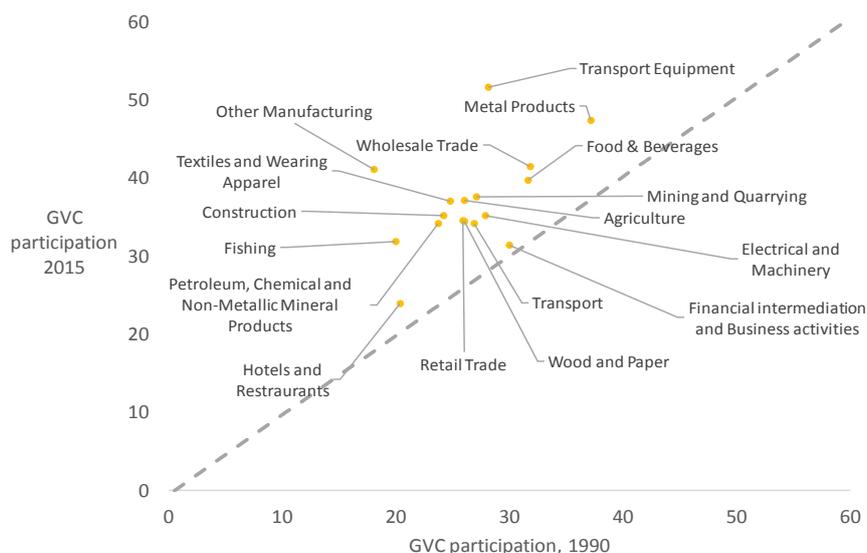
Note: The type of a country's GVC linkages is based on the country's extent of backward GVC participation, measured as the portion of imports embodied in manufacturing exports as a percentage of a country's total exports, combined with the country's sector

¹⁶ "Limited commodities: Primary goods' share of total domestic value added in exports is equal to or greater than 20 percent but less than 40 percent. High commodities: Primary goods' share of total domestic value added in exports is equal to or greater than 40 percent. Limited manufacturing is the set of countries excluding low and high commodities countries and countries where the share of manufacturing and business services in total domestic value added in exports is equal to or greater than 80 percent," WDR 2020 (Box 1.3).

specialization of domestic value added in exports and measures of innovation. Countries in the commodities group have a small share of manufacturing exports and limited backward GVC integration. Their share of commodities exports can be low, medium, or high. Countries specialized in limited manufacturing GVCs engage in some manufacturing exports, often alongside commodities exports, and exhibit medium backward GVC integration. In reading the figure, there is no distinction where a country is within any one of the three categories in the figure. A dashed line (for Burundi and Uganda) indicates that the country has not changed category during the period.

Finally, Figure 12 highlights GVC participation rates for 1990 and 2015 by sector. Overall, GVC participation has increased from 1990 to 2015 for all sectors. Transport equipment is the sector with the largest increase, a reflection of increased intra-regional trade. 'Other manufacturing' is the second sector registering the largest increase. Metal products and Food & beverages also show a strong participation in supply chain trade.

Figure 12: Sectoral breakdown of GVC participation for EAC



Source: Authors calculations using GVC database from Borin and Mancini (2019).

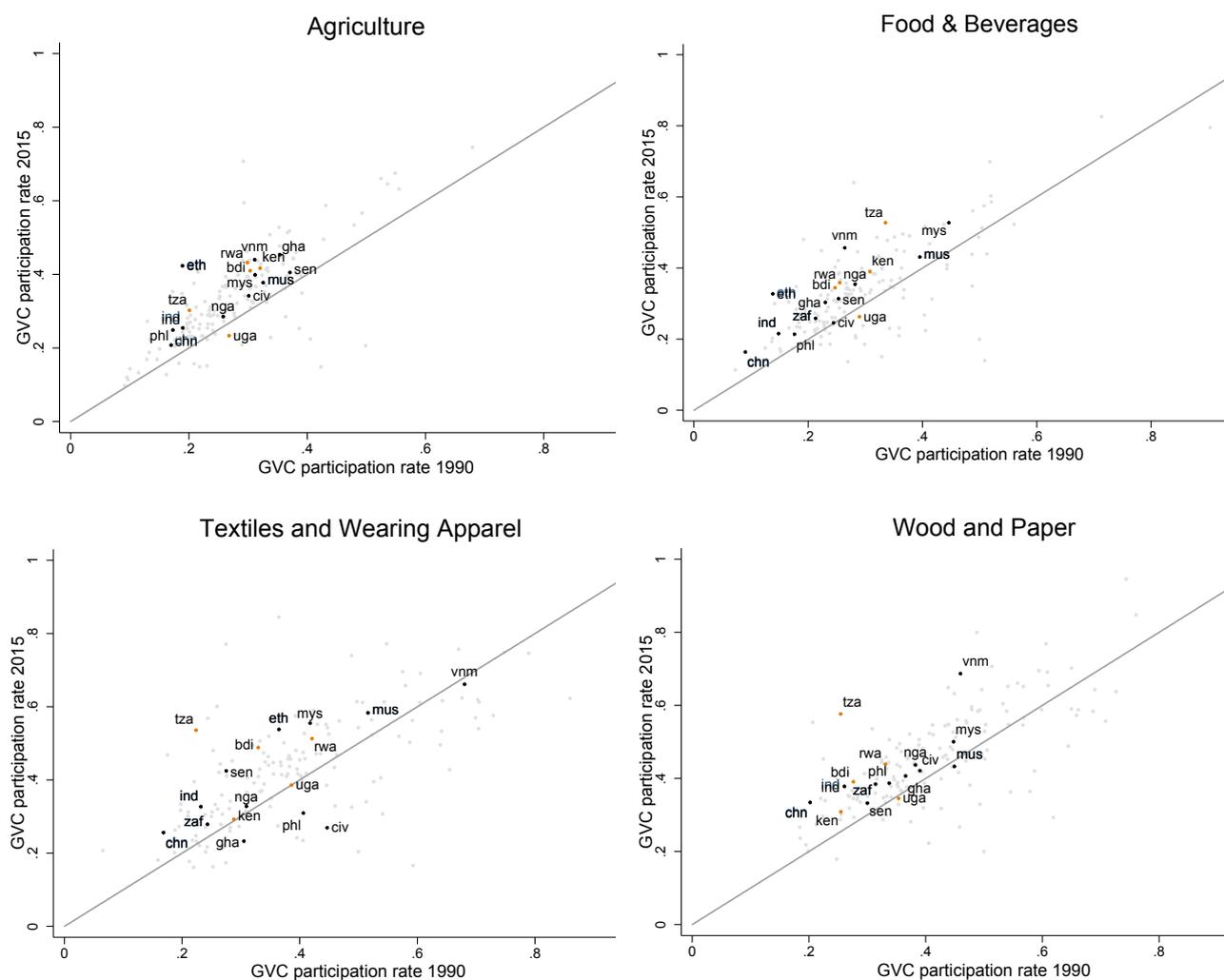
Note: GVC participation measures the share of country’s exports that either makes use of value-add imported from another country or is exported to another country for further processing. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation

Next we highlight four sectors: Agriculture, Food and Beverages, Wood and Paper, and Textiles and Apparel. As mentioned in the earlier sections we picked these sectors because of their centrality in the ongoing EAC negotiations on the CET. The selection of these strategic sectors is in part based on the EAC’s Industrialization Strategy published in 2012 but also a product of evolving regional economic priorities. Figure 13 shows the performance of EAC member states in each sector alongside a few comparator countries. These comparator countries span all the comparator RECs examined in this paper including India and China.

Once again, we see Uganda underperform over the 1990-2015 period with a reduction in GVC participation for 3 out of the 4 strategic sectors; for Textiles and Wearing Apparel, Uganda’s GVC participation has not changed over the period. Tanzania clearly outperforms other EAC member states in all sectors except Agriculture. Kenya, Burundi and Rwanda have all increased their GVC participation rates over the period. However, these comparisons suggest that there is still room for increased GVC participation. Annex A7 is a supplement to figure 13 and provides a detailed breakdown of intra- EAC exports for sectors not directly covered in EORA and more in line with the EAC’s RVC strategy; sectors covered are cotton, leather, iron and

steel, wood and wood products¹⁷. The role of major exporter shifts depending on the sector. For leather, Rwanda is the major supply of exports to the EAC region, in contrast, Uganda and Tanzania are major suppliers for cotton exports while Kenya, is a major exporter for iron and steel. There are also differences in which stage of processing is dominant intra-EAC exports for these sectors. Annex A7 also contains a breakdown of exports by stage of processing. Trade in all four sectors is dominated by exports of raw materials and intermediate products.

Figure 10: EAC member GVC performance for strategic industries



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019).

Note: GVC participation measures the share of country's exports that either makes use of value-add imported from another country or is exported to another country for further processing. It is the share of GVC related trade for a country over its total gross exports. See Box 1 for details on GVC measures used in this paper: backward, forward, regional and non-regional value chain participation. Points above the 45° indicate an increase in GVC participation.

¹⁷ Exports value shown are from ITC and does not use the methodology by Borin and Macini (2015,2019) therefore it may not fully capture the RVC of these sectors. However, it does represent the flow of exports and at a broad level provides insights into the nature of trade among EAC member states: i.e. stage of processing and dominant exporters. These are insights that cannot be gleaned from Borin and Mancini dataset.

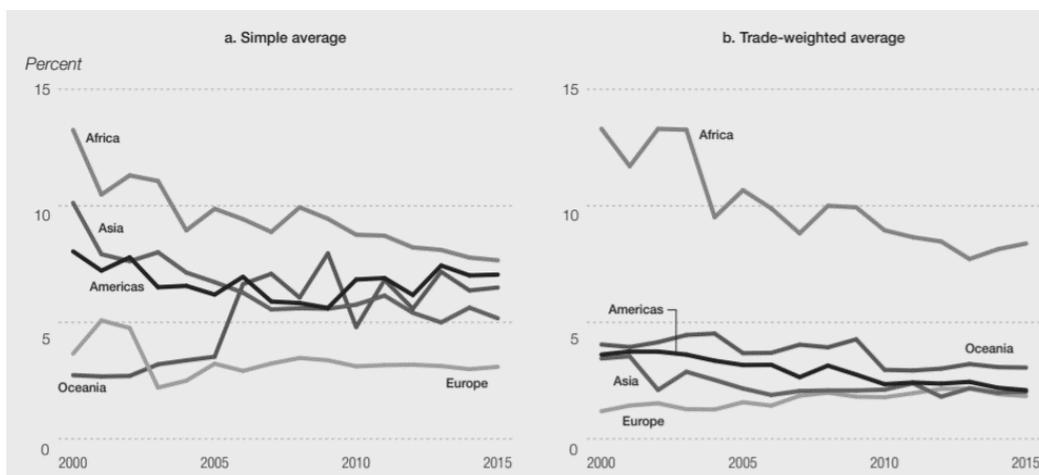
6. Obstacles to the development of GVCs: both global and regional

Fragmentation of production within the EAC calls for seamless borders among member states. We focus on three obstacles to the development of RVCs in the EAC. All three are amenable to policy reform. First is the tariff structure—the subject of the ongoing negotiations of a new CET for the EAC. Second is the design of Rules of Origin (RoO) that govern trade intra-regional trade. These are under negotiation at the AfCFTA level. The third obstacle focuses on barriers to trade in services. This is to recognize that value-added trade requires logistics which depend on low barriers to trade in services because services are embodied in goods that are complementary to (and are embodied with) the products that are traded.

6.1 Obstacle 1: High tariffs on intermediates

Today's relatively high tariffs on intermediates is a legacy of Africa's (including North Africa and Sub-Saharan Africa) pursuit of an inward-looking industrialization strategy behind high trade barriers and a limited exchange of market access within the Regional Economic Communities (RECs). This strategy was ultimately abandoned, but Africa still lags in the reduction of tariff protection relative to other regions, notably for intermediate inputs (see figure 14 below).¹⁸ The average tariff on intermediates across African countries is still around 10 percent and has fallen slowly over the last 15 years.¹⁹ This rate is still around twice the average rate for other developing-country regions. Importantly, relative to the average rates in the other regions, the trade-weighted average is much closer to the simple average. This is prima facie indication of little substitutability towards domestic intermediates. In other words, with poor domestic substitutes, imported intermediates are "essential" so that tariffs on imported intermediates are passed down the production chain.

Figure 11: Tariffs on intermediate goods by region



Source: African Economic Outlook, Figure 3.11.

Notes: WITS. Intermediate goods defined according to BEC classification. Number of African countries: 46 for trade weighted average, 53 for simple average.

¹⁸ The shortcomings of this inward-looking industrialization strategy via vertical specialization have been amply documented since the early 1970s and progressively accepted during the 1980s when the success of the export-led development strategies of East Asian became accepted across regions. South America started first during the 1980s 'lost decade' of implementation of structural adjustment reforms. By the early 1990s, South America had 'caught up' with East Asia (see WTO reports) with Africa following suit later on, though tariffs are still generally higher.

¹⁹ This is in sharp contrast with the experience of unilateral tariff reductions in East Asia, where a 'race-to-the bottom' in tariff reductions took place to attract FDI from Japan. See Vezina – (2014)

High tariffs are a brake on participation in GVCs. Tariffs (and other trade costs) have a higher impact on the cost of vertical specialization as compared with regular trade. Take the example in Rouzet and Miroudot (2013) where a 5% tariff is repeated across borders in a GVC with 5 stages and where an equal contribution to the value of the final good takes place at each stage. With 5 stages of production in different countries, this tariff leads to a 10.5% increase (and with 10 stages the price increase would be 25.8%). The cost of delivery to the final consumer increases exponentially with the number of stages. A second source of amplification comes from the fact that tariffs are levied on gross output and not on value-added so that even small tariffs can have a large effect on costs when FVA is high.²⁰ In conclusion, because intermediate goods produced along the supply chain are, at least somewhat substitutable, the cumulative effect of cascading tariffs is bound. GVCs collapse when the gains from specialization in tasks and economies of scale become less than the tariffs collected along the supply chain. These two magnification effects of tariffs on the extent of fragmentation of production across countries also explains why the number of stages across borders is still limited.

6.2 Obstacle 2: restrictive rules of origin (RoO)

RoO are necessary to prevent trade deflection in FTAs (arbitraging external tariff differences in FTAs) and to prevent superficial assembly.^{21/22} Determining common RoO is a sticking point for the completion stage I of the AfCFTA because of the current diversity of both regime-wide and product-specific Rules of Origin (PSRO) across the RECS. The disparity in rules across RECs described in table 3 and the protracted negotiations on the RoO for the Tripartite FTA COMESA-EAC-SADC attest to the difficulty in reaching agreement. Consider first the main origin criteria. Column 1 shows that all RECs have a value content requirement, in many cases a maximum of 35% non-originating materials. PSRO are also common, but details at the product level vary tremendously at the product level (the EU has over 500 PSRO) but the specifics are not available. For regime-wide rules, practically all RECs allow for cumulation, although the degree varies from bilateral to full which is less stringent. Tolerance and absorption rules (cols. 4 and 5) are also common, but again they are different across RECs. Likewise, the rules governing certification and verification (cols. 6-8) are very different across the RECs.

In practice, because of their complexity, RoOs have been a headache for producers and customs officials alike. For example, in the case of the EAC, in spite of revisions easing the rules to satisfy the 'substantial transformation' requirement for intra-EAC trade, the Common Market Scorecard (2016) reports that the number of cases of non-recognition of Certificates of Origin remained the same as in 2014.²³

²⁰ Yi (2003) was the first to note that a small decrease in tariffs can induce a tipping point at which trade in tasks takes place. Ferrantino (2012) showed that when trade costs apply in proportion to the value of the good, the total cost of delivering it to the final consumer increases exponentially with the number of production stages.

²¹ Rules of Origin is a system of determining the origin of a product using an agreed set of criteria. Trade and tariff policy is implemented based on the assigned origin of a product which has implications for the cost of a traded goods.

²² RoOs have two recognized main objectives. First, to prevent arbitraging of external tariff difference in FTAs since in the absence of RoO, FTAs could lead to a 'race-to-the-bottom' as members would compete for tariff revenue by choosing to lower their MFN tariffs. Provided participants can agree on a formula to share tariff revenue among members, RoO are redundant in Customs Unions (CUs) since they share the same trade policy (CET and other border-related measures) with non-members. Second, RoOs are to prevent superficial assembly operations with little or no value-added (e.g. packaging) that would de facto extend the benefit of preferential access to non-eligible intermediate producers' upstream assembly of those operations.

²³ The number of cases was 13 in both years for all countries except Burundi. Simplifications included dropping the across-the-board 35% value-addition, allowing global sourcing of raw materials for industries with insufficient regional supply and movement to a change of tariff heading for several products. See EAC (2016, p. 85).

Table 2: Main Characteristics of rules of Origin: EAC and comparators

Agreement	Main origin criteria		Regime-wide rules			Authority certification (validity)	Average amount for exemptions	Direct verification (Importer) [Indirect verification (Exporter)]
Columns	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ad valorem percentage	Specific Manufacturing Processes	Cumulation	Tolerance	Absorption	Certification		Verification
EAC	YES(AB)	N.A	No explicit terms in text	No	No	Yes(6,0)	0(No)	No[Yes]
SADC	No	24	Yes	Yes	Yes	Yes(0,5)	1000(Yes)	No[Yes]
ECOWAS	YES(AB)	N.A	No explicit terms in text	No	No	Yes(6,0)	0(No)	No[Yes]
COMESA	YES(NAB)	91	Yes	No	Yes	Yes(12,5)	600(Yes)	No[Yes]
TRIPARTITE	No	28	Yes	Yes	Yes	?	?	?
ASEAN	YES(AB)	?	Yes	Yes	Yes	Yes(12,3)	200(No)	No[Yes]
MERCOSUR		?	Yes			Yes(6,2)	0(No)	No[Yes]

Notes: Southern African Development Community (SADC); The Economic Community of West African States (ECOWAS); East African Community (EAC); Common Market for Eastern and Southern Africa (COMESA); Association of Southeast Asian Nations (ASEAN); Southern Common Market (MERCOSUR).

Col (1) Percentage calculations combined with change of tariff heading. Across the board (Yes, AB), not across the board (Yes, NAB). (No): criterion not applied

Col (2) Number of PSRO approximated by number of pages in appendices on legal text

Col (3) Cumulation: Bilateral, diagonal, or full

Col (4) Tolerance/de minimis. Maximum percentage of non-originating materials that do not affect origin of final product (e.g. 15% in SADC)

Col (5) Absorption/roll-up. Part of non-originating materials that have acquired originating status by meeting specific manufacturing processes can maintain originating status.

Col (6): Certification by competent authorities of the exporter including designated private ones. No possibility of self-certification by any FTA here. In parenthesis: time limit in months for the importer/exporter to conclude the importation of goods under certificate followed by record keeping in years of good claiming preferential tariff treatment.

Col (7): Exemption provision on maximum amount not requiring origin certification. In parenthesis allowance for minor amendments to certificate if it contains errors

Col (8): Importing country directly controls the exporter/producer in the territory of the exporting country. [Exporting country undertakes verification upon request from the customs authority of the importing country]

Source: Cols. (1) -(5) and Tripartite from UNCTAD (2019a, chp, 2, table 2. Cols. (6) -(8). Authors' compilation from OECD-WB database

During the AfCFTA negotiations so far, West and Central Africa have preferred general RoO. These would probably resemble those in East Asia and the Pacific (EAP). On the other side, Egypt, South Africa and Kenya pushed for Product Specific Rules of Origin with South Africa lobbying for the adoption of the SADC RoO where negotiations are at a sector or product-specific basis. Under this scenario, the political-economy mechanism would resemble that which has prevailed in the North-South agreements of the EU and the US that led to restrictive PSRO. Taking South Africa as the North, the result would be costly RoO that would “deny preferences” to the low-income partner (e.g. Ethiopia, Mozambique, Tanzania, Zambia). Moreover, when the Northern partner would have comparative advantage in the upstream capital-intensive sector like weaving in textiles and apparel or the making of engines in the automobile sector, RoOs create a captive market in the low-income partner where under bilateral cumulation assemblers have no choice but to source from the Northern partner. This denial of preferences combined with a captive market for the upstream activities of the Northern partner have been documented in the case of the EU and US FTAs.

The opacity of the current rules is evident from the description of the current rules in table 3. These rules impact the development of RVCs and also favor capture by special interest groups. The challenge facing the AfCFTA negotiations on RoO is to design rules that are simpler and easier to apply than the current ones described in table 3. These rules will satisfy no one partner, but they are necessary for the development of RVCs if this continues to be an overarching objective of the AfCFTA.

6.3 Obstacle 3: Services for greater Connectivity

Services are essential to the production process of goods and difficult to substitute within the production chain; high costs for services reduce a country's competitiveness for trade in goods. So far, liberalization of trade in services in the multilateral arena has been slow with few commitments under the GATS during the Uruguay round. During 2000-15, 64 percent of the 194 preferential trade arrangements (PTAs) notified to the WTO included provisions for trade in services (Egger and Shingal (2017)). Producer services in finance, consulting, accounting and information and communications technologies have been largely covered in the RECs, but legal enforceability has been low (Melo et al. 2018). The Ad Valorem Equivalent (AVEs) of NTBs in professional services sectors are generally still high among the RECs, although compared to other RECs, they are lower for most categories of services in the EAC.

Table 3: Trade Restrictiveness index for Services

	Financial	Professional	Retail	Telecommunications	Transportation
EAC	26.5	46.9	15.0	30.0	25.7
COMESA	34.9	52.7	30.8	41.3	36.8
SADC	24.7	45.8	27.1	42.7	32.0
ECOWAS	19.5	52.3	5.0	30.0	20.0
ASEAN	34.9	65.8	33.3	37.5	47.9
EU	4.2	54.0	25.0	0.0	37.1
China	34.8	66	25	50	19.3
India	48.1	87.5	75	50	62.4
	Financial	Professional	Retail	Telecommunications	Transportation
Kenya	23.4	73.0	0.0	25.0	31.0
Tanzania	22.7	51.5	25.0	25.0	29.4
Uganda	27.7	38.0	50.0	25.0	21.1
Rwanda	19.5	32.0	0.0	75.0	36.7
Burundi	39.0	40.0	0.0	0.0	10.5

Source: Borchert, Gootiiz, and Mattoo (2014)

Notes: The database covers 103 countries that represent all regions and income groups of the world. For each country, five major services sectors are covered that encompass a total of 19 subsectors: 1) Financial services: retail banking (lending and deposit acceptance) and insurance (automobile, life and reinsurance) 2) Telecommunications: fixed-line and mobile. 3) Retail distribution 4) Transportation: air passenger (international and domestic), maritime shipping, maritime auxiliary, road trucking and railway freight 5) Professional services: accounting, auditing, and legal services (advice on foreign/international law, advice on domestic law, and court representation).

Over the past decade, EAC member states have made impressive improvements around digital connectivity as well as access. In Kenya, for example, the cost of sending remittances dropped by up to 90 percent after the introduction of M-Pesa, a digital payment system. Kenya, Uganda and Rwanda have operationalized the Electronic Cargo Tracking system (ECTS) to track cargo across internal EAC borders and in the process improve efficiency and reduce cases of corruption. Most recently, the EAC announced plans to set up an EAC Information Access Centre (IAC) to encourage digital entrepreneurship and promote business development. On e-commerce, Jumia has succeeded in operationalizing digital markets in East Africa but it has faced major challenges in ensuring quality stock of supplies as well as difficulty in keeping costs low.

Yet, according to the most recent data from the African Regional Integration index, roaming costs in the EAC are significantly higher than those for other major African RECs: ECOWAS, COMESA, and SADC where roaming costs are almost half the costs in the EAC (ARII, 2016). This problem is compounded by significant tariff differentials among EAC member states while roaming on different networks and landlocked countries pay higher fees for access to the Internet (World Bank (2018)).

SMEs are also at a disadvantage. Foster et al. (2017) report on the results of qualitative interviews with firms in three sectors (tea, tourism and business process outsourcing) in Kenya and Rwanda. They find that small firms are only thinly integrated digitally in GVCs leading them to conclude that, in spite of some successes,

small firms are having difficulties to adapt to shifting modes of value chain governance. Support for complementary capacity is needed to help these firms cater to niche customers and to local or regional markets.

From their interviews covering 264 firms, Foster et al. report that digitization has helped improved management and monitoring of GVCs with digital platforms and information systems enabling more arm's length interaction in value chains reducing the need for regional coordination. Even though firms in Rwanda and Kenya are insufficiently "digitally integrated" into global value chains, they conclude and when connectivity is improved more reliable and cheaper Internet access has facilitated increased flows of digital data. But new digitalization is typically allowing GVCs to be more flexible and strengthening the management of the value chains. For the Tourism industry, all firms felt that Internet connectivity had provided efficiency gains and access to more information

Another initiative worth noting is the Electronic World Trade Platform (eWTP), launched by Jack Ma in 2018 which aims to boost digital access for SMEs. eWTP is twofold- it is a forum to push policy that favours transparent and inclusive platforms for SMEs to harness electronic trade for growth. It is also focused on setting up infrastructure to facilitate electronic trade with African countries. Rwanda was the first African country to join the initiative. Alibaba offers firms access to over 600 million active customers and 8.7 million active sellers across the globe with significant transaction volumes for both B2B and B2C. This presents East African firms with an opportunity to not only build stronger GVCs but also bolster regional value chains by leveraging this new e-commerce initiative to obtain cheap inputs and access regional and global markets.

Policy dialogue also has a big role to play in pushing for greater digital connectivity. The share of the digital economy is predicted to increase from the current share of global GDP of 15% in less than a decade (World Bank, 2018, p.14). The East Africa Single Digital Market (SDM) Initiative aims to bring East Africa on board by: (i) a single connectivity market;(ii) a single data market; (iii) single online market to access digital content and information seamlessly. A recent report estimates that a successful development of SDM would add between 0.57% and 1.6% to GDP growth, create between 1.6 million and 4.5 million new jobs. Existing internet users would capture between \$1.2 billion and \$4billion in consumer surplus as the result of falling broadband prices. (World Bank, 2018, p.14).

Despite this overall progress, challenges still remain primarily around the financing of telecommunication infrastructure to provide low cost and accessible roaming services for faster connectivity. There are also issues around managing and monitoring steps towards full implementation of ONA (see box 2), particularly around the issue of eliminating taxes on roaming transactions because roaming charges are significant for government revenues.

Box 1: One Network Area: East Africa

In 2015, the EAC set up the One Network Area (ONA) to harmonise mobile markets across the EAC. The first phase aimed to harmonise markets in Kenya, Rwanda, South Sudan and Uganda with an agreement to reduce and ultimately eliminate roaming charges for calls from other ONA member countries. ONA also included stipulations for waivers of excise taxes and surcharges on incoming ONA voice traffic while establishing wholesale and retail price caps on outbound ONA traffic. To further facilitate reductions in retail prices, ONA required Mobile Network Operators (MNOs) to reduce wholesale tariffs. The rollout of this initiative was well-received by consumers and the private sector. In mid-2015, ONA was extended to data and mobile money transactions both of which are key to facilitating cross border trade and developing RVCs.

A report by the World Bank found positive impacts of ONA following its implementation. Inbound roaming calls to Kenya from Rwanda increased by over 950 per cent, and in Uganda there was an eight-fold decrease in retail roaming rates to around 0.10 cents per minutes (World Bank, 2016). Another report by the International Telecommunications Union estimated that cross- border traffic had tripled in both Kenya and Uganda with a nearly five-fold increase in Rwanda and a thirty-fold increase in South Sudan (ITU, 2016).

Since 2016, the EAC has made progress around fully implementing ONA with Burundi and Tanzania looking to join ONA, a move lauded by the business community in both countries. On the policy front, the EAC agreed to complete cross-border frequency coordination efforts which are critical to ensuring low roaming costs and to eliminating the issue of forced roaming for communities and business around borders. Success on this front would be good news for cross-border traders across the EAC. There have also been developments on internet roaming charges albeit outside of ONA. Most notably, Liquid Telecom, a major internet services provider in the EAC, reduced internet roaming costs in Kenya, Rwanda, Uganda, Zambia and Zimbabwe by setting up an Africa WI-FI hub that allows customers to connect to internet hotspots across the EAC.

Full implementation of ONA across all EAC member states as envisaged by the SDM initiative described in World Bank (2018), would provide a boost to EAC RVCs. Firms would face lower costs to finding and communicating with suppliers as well as customers across EAC borders. It would also allow businesses to take advantage of e-commerce platforms and confidentially fulfil cross-border orders at competitive rates. Finally, full implementation of ONA would streamline payments through mobile money thereby allowing firms to capture markets outside of their host country.

7. Correlates of GVC participation rates

Participation in supply chain trade (backward and forward participation) has been associated with non-policy and policy factors ((OECD (2013,2015), Del Prete et al. (2019), World Bank 2018), World Bank (2020)). Identified non-policy factors include market size, level of development, location (close to hubs in Europe, North America, Asia), manufacturing share in GDP (a high share of manufacturing is associated with strong high backward engagement and low forward engagement), logistics and trade facilitation (as captured by LPI and LSCI composite indicators). The FDI stock, dependent on past trade policies, is also strongly associated with supply chain trade.

The discussion in section 6 highlighted the importance of three policy-related factors: (i) tariffs and their structure (consumer, intermediate goods and capital goods), (ii) access to services including IT services that are complementary to trade in goods; (iii) trade facilitation as captured by the complexity of rules of origin. We report correlations of policy and non-policy variables for the three measures of GVC participation: total GVC participation, backward, and forward after controlling for non-policy factors. The same specification is used for the three indicators of GVCs. Because of missing variables over the early period (no estimates of trade costs prior to 1995), we report estimates to the period 1995-2015. After cleaning, our sample includes 146 countries with population above 1 million in 2015 year.²⁴ Estimates from the double log specification produce elasticity estimates. To represent a period representative of an equilibrium, we take 3 year averages over the sample as recommended by Baier and Bergstrand (2007). Taking the overall GVC-related share as example, the estimated equation is.

²⁴ The EORA sample includes 189 countries. The annex A11 explains the criteria used to reduce the sample to 146 countries.

$$\ln GVCs_{it} = \beta_0 + \beta_1 \ln GDP_pc_{it} + \beta_2 \ln MANSHR_{it} + \beta_3 \ln FDI_pc_{it} + \beta_4 \ln tarZM_{it} + \beta_5 \ln TRCOST_{it} + \beta_6 \ln MOBS_{it} + \omega_i + \mu_t + \varepsilon_{it} \quad (2)$$

$$i = 1, \dots, 146; t = 1 \dots, 8 \text{ (3 year average periods 1995, } \dots, \text{2015)}$$

The first three regressors capture the time-varying non-policy variable and the second three, the policy variables discussed in section 6. The variables are (see annex A1):

- $GVCs_{it}$ GVC related trade share from equation (A1)
- $GVCbs_{it}$ GVCbackward (equation (A2)) as a share of gross exports
- $GVCfs_{it}$ GVCforward (equation (A3)) as a share of gross exports
- GDP_pc_{it} . GDP per capita. Source: WDI indicators
- $MANSHR_{it}$ Manufacturing share in GDP. Source: WDI
- FDI_pc_{it} FDI stock per capita. Source: UNCTAD trade statistics database ²⁵
- $TRCOST_{it}$ Calibrated trade costs. Source: Arvis et al. (2016) ²⁶
- $tarZM_{it}$ Tariffs on imports and exports of intermediates Source: WITS
- $MOBS_{it}$ Number of mobile phone subscribers per 100 inhabitants: Source: International Telecommunication Union (ITU)
- ω_i Country fixed effect that controls for time-invariant omitted variables
- μ_t Time fixed effect controlling for time-related common shocks

GDP_pc_{it} is the proxy for market size with expected positive coefficient. $MANSHR_{it}$ is expected to carry a positive sign for the backward indicator, GVC_b . FDI has been shown to be strongly correlated with levels of GVC participation. We include FDI_pc_{it} , expecting a positive estimate. ²⁷ The next three variables are proxies to detect the effects of policy variables. Low tariffs, both at home and faced in export markets, should facilitate backward and forward GVC engagement by allowing firms access to cheaper intermediate inputs and capital goods, the opposite expected for high tariffs.

Tariff data is from the World Bank World Integrated Solution database (WITS) with tariffs defined as the effectively applied trade weighted tariffs. To keep the focus on supply chain trade, we focus on tariffs on imports exports of intermediates captured by $tarZM_{it}$. We also considered tariffs on capital and consumer goods but omitted them because of high correlation with the tariff variable on intermediates. $TRCOST_{it}$ is the proxy indicator for trade facilitation whereas the usual proxy indicators, LPI and LSCI are not available every year, these calibrated trade costs include which include all factors accounting for differences between fob and the average of CIF prices of partners are available on a yearly basis over the period. Finally $MOBS_{it}$, captures the ease of offshoring. One would expect a positive coefficient for backward integration.

The resulting correlations are for an unbalanced sample with about half of non-zero observation (A full sample would include 1184 observations. Because we are only looking to validate a potential role for the policy variables discussed in section 5, we report cross-sectional OLS estimates with year fixed effects. Tests for model choice reported in the annex favor a fixed effects estimation that would allow for different within-

²⁵UNCTAD defines FDI stock as the “value of capital and reserves attributable to a non-resident parent enterprise, plus the net indebtedness of foreign affiliates to parent enterprises” (UNCTAD,2019b).

²⁶ Computed as the GDP-weighted average of bilateral trade costs from the data in Arvis et al. (2016).

²⁷ A report by the OECD, found that FDI can increase GVC participation by over 20 percentage points for some economies meaning increases in FDI could plausibly result in higher FVA and DVX values or both.

country effects. Table A12 in the annex reports these results. Because of the presence of confounding factors, the results displayed in table 4 are associations, not correlations.²⁸

Table 4 reports four sets of regressions for each one of the three GVC measures. Start with the global GVC measure results reported in cols. 1,4,7, 10. For the three 'non-policy' variables, FDI is the only variable that has consistently the expected positive effect on participation. Per capita income and manufacturing share are not significant across the three columns after adding the policy variables. Turning to the policy variables, except for the mobile subscription indicator, $MOBS_{it}$, the estimated coefficients have the expected sign and are stable across specifications: a higher tariff on imports and exports of intermediates, $tarZM_{it}$, is a brake on GVC participation, usually significant at the 1% level. Higher trade costs, $TRCOST_{it}$, also acts as a brake on GVC participation.

For the backward integration correlations in cols. 2,5,8,11, the coefficient for tariffs on intermediates displays consistently a negative sign. This result casts doubts on the future of RVCs in the EAC, if the negotiations for the new CET structure from the current 3-band structure (0% for raw materials-15% for semi-finished products-25% for finished products) to a 4-band structure results in higher protection of intermediates.

Mobile subscription is positively and significantly associated with backward integration supporting the importance of ICT for production unbundling.²⁹ Notably, the coefficient is insignificant for the forward integration measure. For the forward integration correlations in cols 3,6,9,12, the FDI coefficient is unstable and the tariff coefficient loses significance. This is not surprising for developing countries that engage mostly in the downstream part of supply chains where they export mostly raw materials. High trade costs (col. 12) are associated with low participation in downstream trade.

²⁸ Similar cross-section estimates are reported in WDR 2020 Box 2.2.

²⁹ Baldwin and Forslid (2013) develop a TOSP (Tasks, Occupations, Stages, Product) framework to show how ICT improvements, here coarsely captured by mobile subscriptions, fosters production unbundling here captured reflected on a positive effect on backward integration.

Table 4: Correlates of GVC participation rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	lnGVCs	lnGVCbs	lnGVCfs	lnGVCs	lnGVCbs	lnGVCfs	lnGVCs	lnGVCbs	lnGVCfs	lnGVCs	lnGVCbs	lnGVCfs
lnGDP_pc	-0.00513 [0.033]	-0.0890 [0.082]	0.116* [0.047]	-0.0214 [0.034]	-0.117 [0.10]	0.116* [0.054]	-0.0418 [0.033]	-0.310*** [0.076]	0.122* [0.050]	-0.0482 [0.036]	-0.453*** [0.078]	0.166** [0.055]
lnMANUSHR	0.0654 [0.052]	0.316* [0.13]	-0.239** [0.074]	0.0518 [0.049]	0.316* [0.15]	-0.195* [0.078]	-0.0123 [0.050]	0.317** [0.12]	-0.302*** [0.077]	-0.0199 [0.051]	0.218* [0.11]	-0.272*** [0.076]
lnFDI_pc	0.0825** [0.025]	0.235*** [0.063]	-0.106** [0.036]	0.0544* [0.026]	0.172* [0.079]	-0.0890* [0.041]	0.0444 [0.025]	0.198*** [0.057]	-0.114** [0.038]	0.0408 [0.027]	0.174** [0.057]	-0.125** [0.040]
IntarZM				-0.118*** [0.034]	-0.220* [0.10]	0.0151 [0.053]	-0.115*** [0.033]	-0.388*** [0.076]	0.0306 [0.051]	-0.0984** [0.033]	-0.295*** [0.071]	0.00895 [0.050]
lnTRCOST							-0.388** [0.14]	-0.634 [0.33]	-0.462* [0.22]	-0.377** [0.14]	-0.577 [0.30]	-0.433* [0.21]
lnMOBS										0.0318 [0.050]	0.408*** [0.11]	-0.0777 [0.074]
_cons	0.0739 [0.81]	9.455*** [2.01]	-5.199*** [1.15]	0.166 [0.54]	1.524 [1.65]	-2.917** [0.86]	2.323* [1.00]	6.026* [2.31]	-0.124 [1.53]	2.029* [0.97]	6.596** [2.06]	-1.459 [1.45]
N	648	648	648	565	565	565	542	542	542	479	479	479
adj. R-sq	0.400	0.495	0.183	0.412	0.297	0.079	0.453	0.681	0.235	0.443	0.728	0.252
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Standard errors in brackets
 =** p<0.05 ** p<0.01 *** p<0.001"

Note: Regression coefficients are from a between estimate regression specifications. The dependent variables are three kinds of GVC measures: backward, forward and overall GVC participation. Regression is based on a three-year average of variables from 1995 to 2015 and includes country and year fixed effects. Annex A12 shows results for fixed effects regressions as well as details on the paper's menu of regression specification test

8. Conclusions and policy recommendations

Recent reductions in transport and communication costs along with policy measures to facilitate trade has resulted in the fragmentation of production across countries and the growth of connection between firms. This means that African countries can now participate in supply chain trade through both for backward (importing components/intermediates) and forward (selling components/intermediates that enter into further processing before reaching the consumer) GVC participation. No longer do African countries have to develop whole industries from scratch to industrialize.

The Africa Union's Action plan on Boosting Intra-African Trade (BIAT) launched in 2013 and the recently launched AfCFTA in May 2019 speak to the desire of African countries to integrate into supply chain trade using deeper regional integration as a stepping stone. A key objective of the AfCFTA is to develop Regional Value Chains (RVCs) at the level of the Regional Economic Communities (RECs) and also across the communities directly at the continental level. Global Value Chains (GVCs) involve trade in value-added between countries in an RTA group or in a region and countries not belonging to the group or region while RVC is about trade in value-added among members in a group. The East African Community (EAC) is keen to develop RVCs among members.

This paper provides detailed comparisons of GVC/RVC measures over the period 1990-2015 at the aggregate and sector levels with those for 146 countries at regional and country levels. These measures help us assess the prospects and challenges for Africa to expand participation in supply chain trade.

At the regional level, over the period 1990-2015, all growth in supply chain for SSA was at the non-regional level while for East Asia and Pacific and Europe and Central Asia--already emerging hubs in the 1990s--growth was mostly focused along RVCs. This pattern of strong RVC growth reflects several forces at work. First are strong agglomeration economies (external economies and the development of specific skills in the work force) boosted by the fall in communication costs in already large markets. Second are widespread trade facilitation policies to attract FDI. Third, is the importance of institutions that have high indicator values in those regions.

Decomposition of GVC integration by regional and non-regional GVC components uncovered three patterns. First, for all RTAs (SADC, ECOWAS, EAC, COMESA, MERCOSUR and ASEAN) non-regional GVC dominates RVC. Second, among African RECs, the EAC is second to SADC in RVC integration. However, both SADC (3% of gross exports) and the EAC's (1.7% of gross exports) RVC participation rates are much lower than that of ASEAN which is around 17.2% of gross exports. Indeed, non-African trading blocs: MERCOSUR and ASEAN have made significant improvements in RVC participation from 1990-2015. Third, shifting the focus to the EAC, the paper finds mixed performance among the EAC member states. Notably, Uganda has underperformed relative to peer economies in overall GVC participation; similar results hold for the sectoral breakdown of GVC participation for the agriculture, textiles, food and beverages and wood and paper sectors. On the other hand, Rwanda has outperformed peer economies and Tanzania stands out for relatively high GVC participation for the textiles, food and beverages and wood and paper sectors.

Overall, for the EAC region and African continent as a whole, there is room to increase overall GVC participation as well as RVC participation. Discussion in the paper supplemented by correlations show that the following variables are critical policy levers: (i) tariffs on imports of intermediates; (ii) rules of origin; (iii) digital connectivity and trade in services.

Based on this paper's discussion and empirical analysis together with international evidence, the following policy recommendations should inform policymakers in their quest to encourage further GVC participation:

- Resist the pressure to impose high tariffs on intermediates products. Intermediate inputs at world prices are vital for the growth of manufacturing and ultimately for further integration into supply chains within the region and globally.
- Move towards simpler and more transparent Rules of Origins to encourage trade in both inputs and final goods.
- Harness digital connectivity for greater integration into global and regional value chains. Affordable mobile technology and internet access combined with access to reliable e-commerce platforms will help facilitate cross-border supply chains and trade networks.

Annexes

Annex A1: Measures of supply chain participation

Borin and Mancini (2019) develop decompositions at the aggregate, bilateral and sectoral levels using measures to avoid double-counting that give identical estimates of double counting for the two approaches in GVC analysis: (i) the country where value-added originates (source based), and; (ii) the country that ultimately absorbs it in final demand (sink-based). In the source-based approach, value-added is accounted for the first time it leaves the country or origin while in the sink-based approach, it is considered the last time it crosses national borders. Borin and Mancini develop indices of GVC trade for both approaches at the aggregate, bilateral, and sectoral levels (see figures in sections 3 and 4). They show that double-counting estimates are the same under both approaches This paper uses the source-based approach.

The source-based approach gives indicators that extend the ‘vertical specialization’ index first introduced by Hummels et al. (2001) on the basis of national input-output tables. is suitable to study the processes in which export flows are involved. With the source perspective, an item is counted as value-added at the first stage of production while in the sink-based approach, it is accounted for at the last shipment Below are the decompositions used for the figures and tables in sections 3 and 4 in the main text.

For a sample of N countries where U_N is the identity matrix of rank N, the GVC related trade for source country (s) exporting to destination country (r):

$$GVCX_{sr} \text{ (GVC related trade)} = U_N E_{sr} - DAVAX_{sr} \quad A1(a)$$

$$GVC_s \text{ (GVC participation rate)} = \frac{\sum_{r \neq s} GVCX_{sr}}{U_N E_{s*}} \quad A1(b)$$

$$u_N E_{sr} \text{ (bilateral exports)} = DVAsource_{sr} + DDCsource_{sr} + FVAsource_{sr} + FDCsource_{sr} \quad A2$$

where;

E_{sr} : bilateral exports ;

$DAVAX_{sr}$: the domestic value added in exports from exporter (s) absorbed by importer (r);

$DVAsource_{sr}$ and $FVAsource_{sr}$: domestic value added and foreign value added exports from country s to country r;

$DDCsource_{sr}$ and $FDCsource_{sr}$: domestic double counted and foreign double counted exports from country s to country r.

$GVCX_{sr}$ in equation A1(a) is the GVC share in bilateral exports. It is the sum of domestic and foreign value-added exports ($U_N E_{sr}$) excluding the domestic value added in exports absorbed directly by its importer ($DAVAX$). $DAVAX_{sr}$ is the sum of i) the portion of production that is produced entirely in country s and exported to country r with no intermediates from outside its borders and ii): the intermediates inputs that are entirely produced in country s and exported to country r for the production of final goods that are entirely consumed by the domestic market of the importing country, r^{30} . GVC_s expressed total GVC related trade from country s as a share of its total gross exports.

³⁰ GVC measures are also available at a sectoral level. In this case equations 1(a-b) will be adjusted to account for the sectoral – bilateral perspective. We do not show the underlying equations in this paper, however the reader can find them in Borin et al. 2019 (section 4.2 p. 31)

GVC_s in A1(b) is the GVC participation rate. It avoids double counting of trade flows of intermediates. The measure can be decomposed into backward and forward GVC participation components:

$$GVC_s = GVC_{backward_s}(GVC_{bs}) + GVC_{forward_s}(GVC_{fs}) \quad A3$$

Backward GVC related trade (GVC_{bs}) measures country's exports that include value added previously imported from abroad. For example, if Rwanda imports maize from Uganda for the production of fortified foods for export, then Rwanda is said to be participating in backward GVC participation when it exports fortified foods.

Forward GVC related trade (GVC_{fs}) measures the country's exports that are used by the importing country to produce for export. In the example of fortified foods exports, Uganda is engaging in forward GVC participation because its exports are used as intermediates by Rwanda for the production of its fortified food exports. We use the Borin and Mancini indicators of GVC related trade presented in (1) and (3) in the sections 3 and 4 to explore the participation of African RECs, and the EAC in particular, in supply chain trade.³¹

Length of the production chain. GVCs also evolve along the dimension of tasks (which can be carried out domestically or abroad). The length of a supply network, say in textiles and apparel, is the result of the forces of agglomeration (better robots reduce the benefits of specialisation, i.e. reduce the number of separate tasks or the propagation length) and the forces of dispersion (better communication costs lower the marginal cost of coordination and hence favour outsourcing).³² Average propagation length measures the number of production stages in a production process in a country, a region (or the world).³³

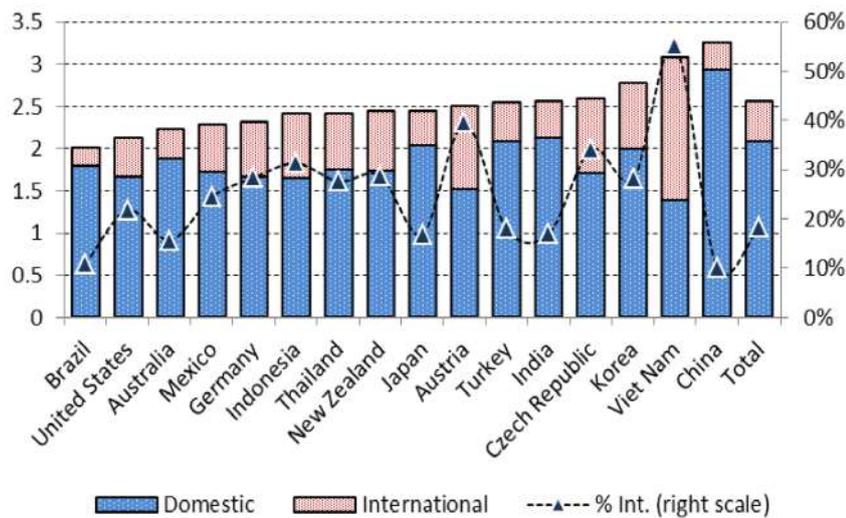
As an illustration, take Figure A1 which shows the total number of production stages (i.e. the length of the production network for the textile, leather and footwear sector). This is a prominent sector of GVC entry for lesser-developed countries. The data are from the OECD-WTO TiVA data base for 2008. The figure shows that the total number of production stages is less than 2 when all industries are covered with 12% taking place in a foreign country (Diakantoni and Escaith (p.6)). In figure A1, Brazilian firms are relatively concentrated with only 11% of the stages sourced internationally. China and Vietnam have much longer supply chains. For Vietnam, 55% of sourcing is foreign while for China, 90% of sourcing is domestic.

³¹ Here vertical is used in the sense that all the stages of the supply chain are carried out domestically as shown for the T&A example in figure 1.

³² Baldwin and Forslid (2013) discuss how a change in automation (improved information technology) combined with a change in coordination costs (improved communication costs) determines a firm's optimal number of stages and hence the propagation length.

³³ Antras and Chor (2019) and Wang et al. (2016) define a GVC position index that measures the distance from any production stage between the final demand and the initial factor inputs in a production line. If a country's representative production chains towards final products are longer than those towards primary products, the country is considered to be operating in a relatively upstream position. As an example, Inomata (2017, figure 1.10) shows that for an aggregate of the production networks in East Asia over the period 1995-2009, China stayed in the most downstream segment of the lengthening network in East Asia. This is an indication that China held a dominant role as a final assembler of regional products. See discussion in annex A1.

Figure A1: Supply chains in Textile, Leather and Footwear (2008)



Source: Diakantoni and Escaith (2014, figure 1) computed from the OECD-WTO TiFVA data base for 2008.

Explanatory notes: Vietnam (China) has 3 (3.2) production stages in the sector with 57% (10%) originating abroad. The left axis is the number of stages and the right axis is the percentage of intermediates sourced internationally

In practice, cross-border activities along a production chain are limited. This reflects three factors that influence the length and geography of production networks. First, for transaction costs, a task perspective operates like compound interest with transaction costs increasing more than proportionally with the number of stages.³⁴ Second, the effect of a marginal variation in trade costs along the chain is much larger when there is more than one international transaction.³⁵ Third, a small decrease in tariffs (or more generally border-related transaction costs) can induce a tipping point at which vertical specialization (i.e. cross-border trade in tasks) kicks in (Yi (2003)). These obstacle explain the low percentage of stages involving more than one country in figure 1.³⁶

Annex A2: Sample and definition of regional categories and RTA memberships

Selection of countries

The Eora data base covers 189 countries. In a first step, following the guidance provided by UNCTAD Eora, we drop the following countries because of issues with GVC data: Belarus, Benin, Burkina Faso, Congo, Eritrea, Ethiopia, Guinea, Guyana, Libya, Moldova, Serbia, Sudan, Yemen, Zimbabwe, Former USSR. In addition, South Sudan is dropped from the sample because of many outliers.

Next, we limit our set of countries to only those with a population over 1 million in 2015. Based on this criterion, we end up dropping 28 countries: Andorra, Antigua, Aruba, Bahamas, Barbados, Belize, Bermuda, Bhutan, British Virgin Islands, Cayman Islands, Djibouti, Fiji, French Polynesia, Greenland, Iceland,

³⁴ An example, taken from Diakantoni and Escaith illustrates the importance of lowering trade costs along a supply chain. Let trade costs apply in proportion to the value of the good. Ferrantino (2012) shows that the total costs of delivering the final good to the consumer increases exponentially with the number of production stages. With 5 [10] stages and an ad-valorem transaction cost of 10%, the ad-valorem tariff equivalent is 34% [75%].

³⁵ Rouzet and Miroudot (2013) estimate that EU pay an average tariff of 3.7% on imported products from India with only 51.5% being paid at the EU border. Because the cumulative effect of tariffs (and other border costs) is bound so long as intermediate goods of domestic origin along the supply chain are substitutable, to some extent at least, complex GVCs cannot develop when tariffs are above a certain threshold. The same applies to RVCs where tariffs are zero, but other border trade costs can be important.

³⁶ This measure depends on the level of aggregation in the data.

Liechtenstein, Luxembourg, Maldives, Malta, Monaco, Montenegro, New Caledonia, Samoa, San Marino, Sao Tome and Principe, Seychelles, Suriname, Vanuatu.

Finally, an inspection of the data for our three GVC measures led us to drop Oman and Algeria because their share of manufacturing to GDP was over 100% in the WDI database. Iraq and North Korea were dropped because of incomplete information on tariff lines.

The result is a group 146 countries for the results reported in the main text and in the econometric tests of table 4.

Table A1: Membership across Regional categories

East Asia & Pacific	Europe & Central Asia	Sub Saharan Africa	Middle East and North Africa
Brunei	Albania	Angola	Algeria
Australia	Andorra	Benin	Bahrain
Cambodia	Armenia	Botswana	Djibouti
China	Austria	Burkina Faso	Iran
North Korea	Azerbaijan	Burundi	Iraq
Fiji	Belarus	Cameroon	Israel
French Polynesia	Belgium	Cape Verde	Jordan
Hong Kong	Bosnia and Herzegovina	Central African Republic	Kuwait
Indonesia	Bulgaria	Chad	Lebanon
Japan	Croatia	Congo	Libya
Laos	Cyprus	Cote d'Ivoire	Malta
Macao SAR	Czech Republic	DR Congo	Morocco
Malaysia	Denmark	Egypt	Gaza Strip
Mongolia	Estonia	Eritrea	Oman
Myanmar	Finland	Ethiopia	Qatar
New Caledonia	France	Gabon	Saudi Arabia
New Zealand	Georgia	Gambia	Syria
Papua New Guinea	Germany	Ghana	Tunisia
Philippines	Greece	Guinea	UAE
South Korea	Greenland	Kenya	Yemen
Samoa	Hungary	Lesotho	North America
Singapore	Iceland	Liberia	Bermuda
Taiwan	Ireland	Madagascar	Canada
Thailand	Italy	Malawi	Mexico
Vanuatu	Kazakhstan	Mali	USA
Viet Nam	Kyrgyzstan	Mauritania	South Asia
Latin America & Caribbean	Latvia	Mauritius	Afghanistan
Antigua	Liechtenstein	Mozambique	Bangladesh
Argentina	Lithuania	Namibia	Bhutan
Aruba	Luxembourg	Niger	India
Bahamas	Monaco	Nigeria	Maldives
Barbados	Montenegro	Rwanda	Nepal
Belize	Netherlands	Sao Tome and Principe	Pakistan
Bolivia	Netherlands Antilles	Senegal	Sri Lanka
Brazil	Norway	Seychelles	
British Virgin Islands	Poland	Sierra Leone	
Cayman Islands	Portugal	Somalia	
Chile	Moldova	South Africa	
Colombia	Romania	South Sudan	
Costa Rica	Russia	Sudan	
Cuba	San Marino	Swaziland	
Dominican Republic	Serbia	Togo	
Ecuador	Slovakia	Uganda	
El Salvador	Slovenia	Tanzania	
Guatemala	Spain	Zambia	
Guyana	Sweden	Zimbabwe	
Haiti	Switzerland		
Honduras	Tajikistan		
Jamaica	TFYR Macedonia		
Nicaragua	Turkey		
Panama	Turkmenistan		
Paraguay	Former USSR		
Peru	Ukraine		
Suriname	UK		
Trinidad and Tobago	Uzbekistan		

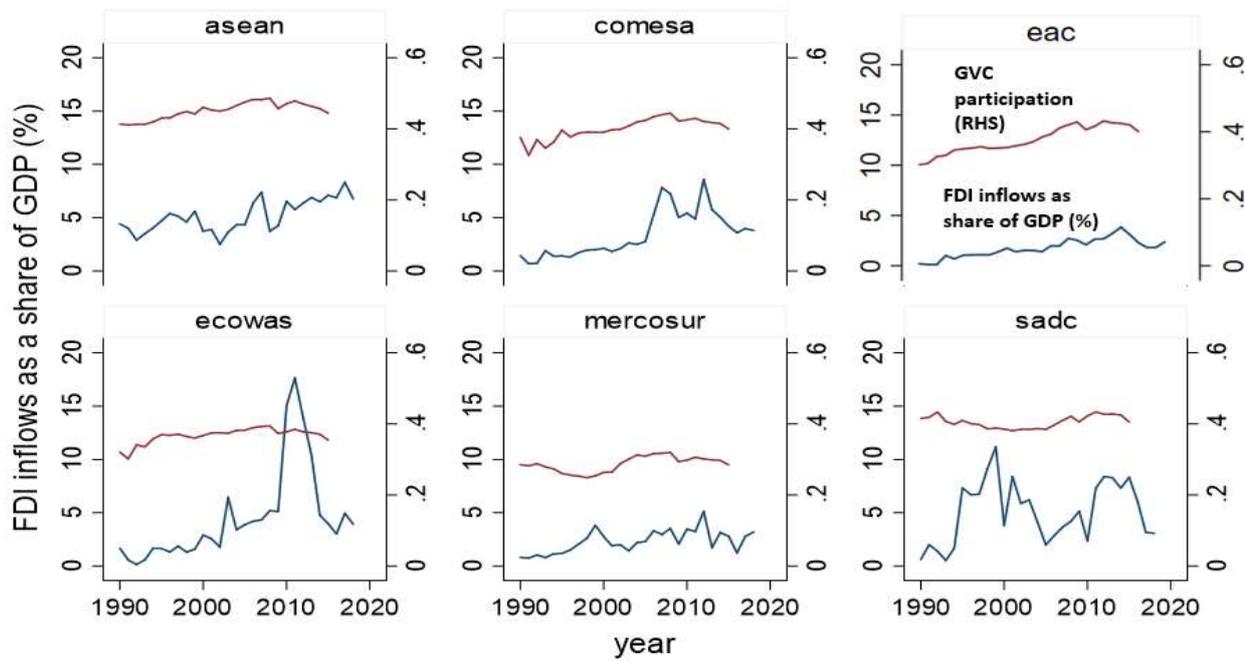
Table A2: Membership across Regional Economic Communities and comparators

ASEAN	COMESA	EAC	ECOWAS	MERCOSUR	SADC
Brunei	Burundi	Burundi	Benin	Argentina	Angola
Cambodia	Djibouti	Kenya	Burkina Faso	Brazil	Botswana
Indonesia	DR Congo	Rwanda	Cape Verde	Paraguay	Comoros
Laos	Egypt	Tanzania	Cote d'Ivoire	Uruguay	DR Congo
Malaysia	Eritrea	Uganda	Gambia	Venezuela	Lesotho
Myanmar	Ethiopia		Ghana		Madagascar
Philippines	Kenya		Guinea-Bissau		Malawi
Singapore	Libya		Guinea		Mauritius
Thailand	Madagascar		Liberia		Mozambique
Viet Nam	Malawi		Mali		Namibia
	Mauritius		Niger		Seychelles
	Rwanda		Nigeria		South Africa
	Seychelles		Senegal		Swaziland
	Somalia		Sierra Leone		Tanzania
	Sudan		Togo		Zambia
	Swaziland				Zimbabwe
	Tunisia				
	Uganda				
	Zambia				
	Zimbabwe				

Source: See table A1 for country selection.

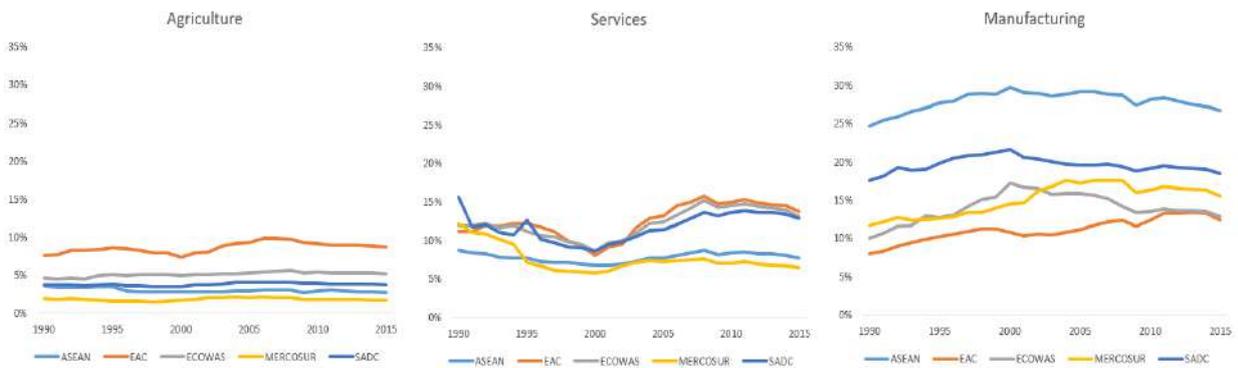
Annex A3: Extra Figures

Figure A2: GVC participation and FDI



Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019). FDI from WDI. See Box 1 for GVC definitions.

Figure A3: GVC participation by major economic sectors

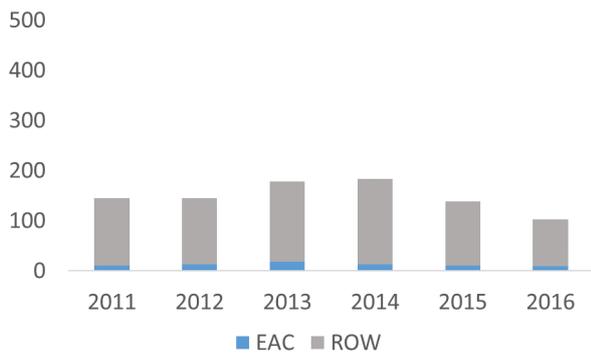


Source: Authors calculations using GVC database from Borin and Mancini (2015, 2019). See Box 1 for GVC definitions.

Figure A4: Breakdown of Intra- EAC trade for sectors of strategic interest

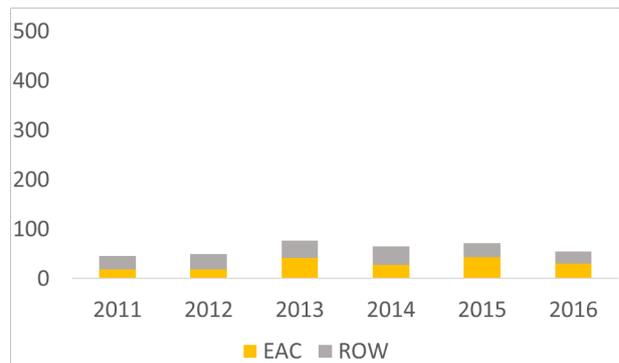
Intra-EAC vs exports to ROW of leather inputs and products (HS code 41)

(millions of USD)



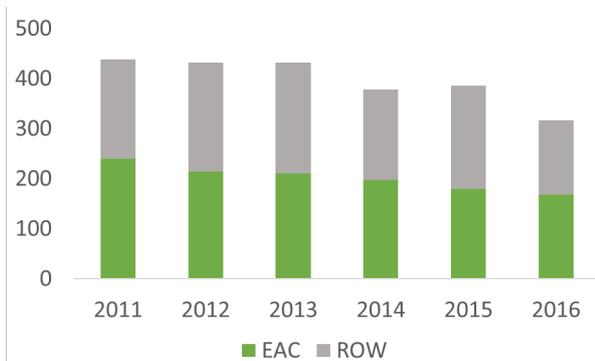
Intra-EAC vs. exports to ROW of wood inputs and products (HS code 44)

(millions of USD)



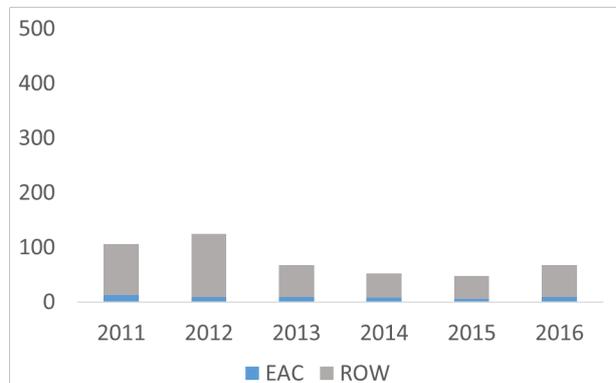
Intra-EAC vs. exports to ROW of iron and steel (HS code 72))

(millions of USD)



Intra-EAC vs. exports to ROW of cotton inputs and products (HS code 52)

(millions of USD)



Source: Authors using International Trade Center Data accessed through Trademap. Data for 2017 and 2018 is not complete for all member states so graphs are only shown for the period 2011-2016

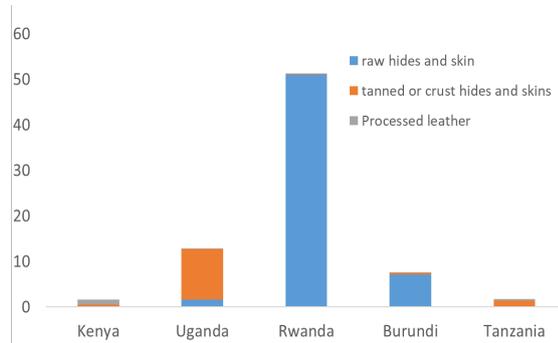
Intra-EAC exports of leather and leather goods by level of processing, 2011-2017

(percent)



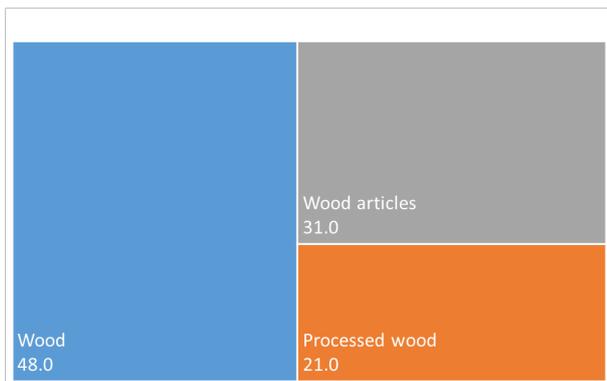
Intra-EAC exports of leather and leather goods by level of processing, 2011-2017

(millions of USD)



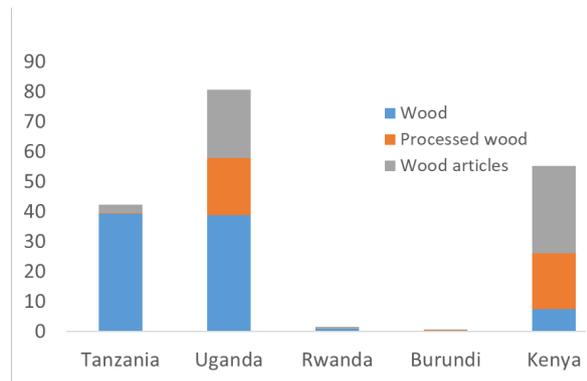
Intra-EAC exports of wood and wood articles by level of processing, 2011-2016

(percent)



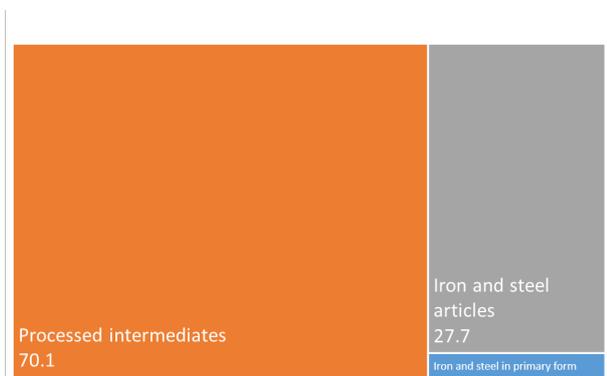
Intra-EAC exports of wood and wood articles by level of processing, 2011-2016

(millions of USD)



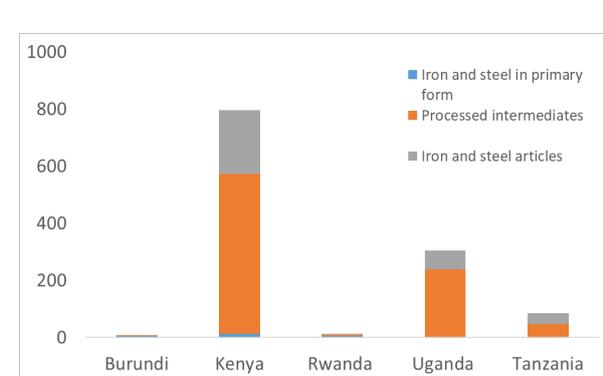
Intra-EAC exports of iron and steel by level of processing, 2011-2016

(percent)



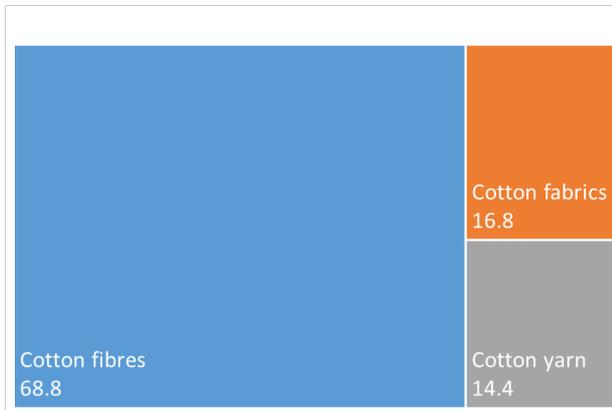
Intra-EAC exports of iron and steel by level of processing, 2011-2016

(millions of USD)



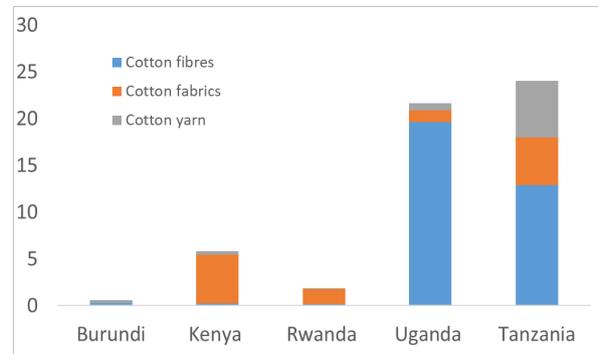
Intra-EAC exports of cotton by level of processing, 2011-2016

(percent)



Intra-EAC exports of cotton by level of processing, 2011-2016

(millions of USD)



Source: Authors using International Trade Center Data accessed through Trademap. Data for 2017 and 2018 is not complete for all member states so graphs are only shown for the period 2011-2016. Iron and steel is not included in the main body of the text because it is not a stand-alone sector in the Borin and Mancini database.

Figure A5: Evolution of GVC participation for the EAC

Reference lines for start of EAC customs union in 2005 and of accession of Burundi and Rwanda in 2007

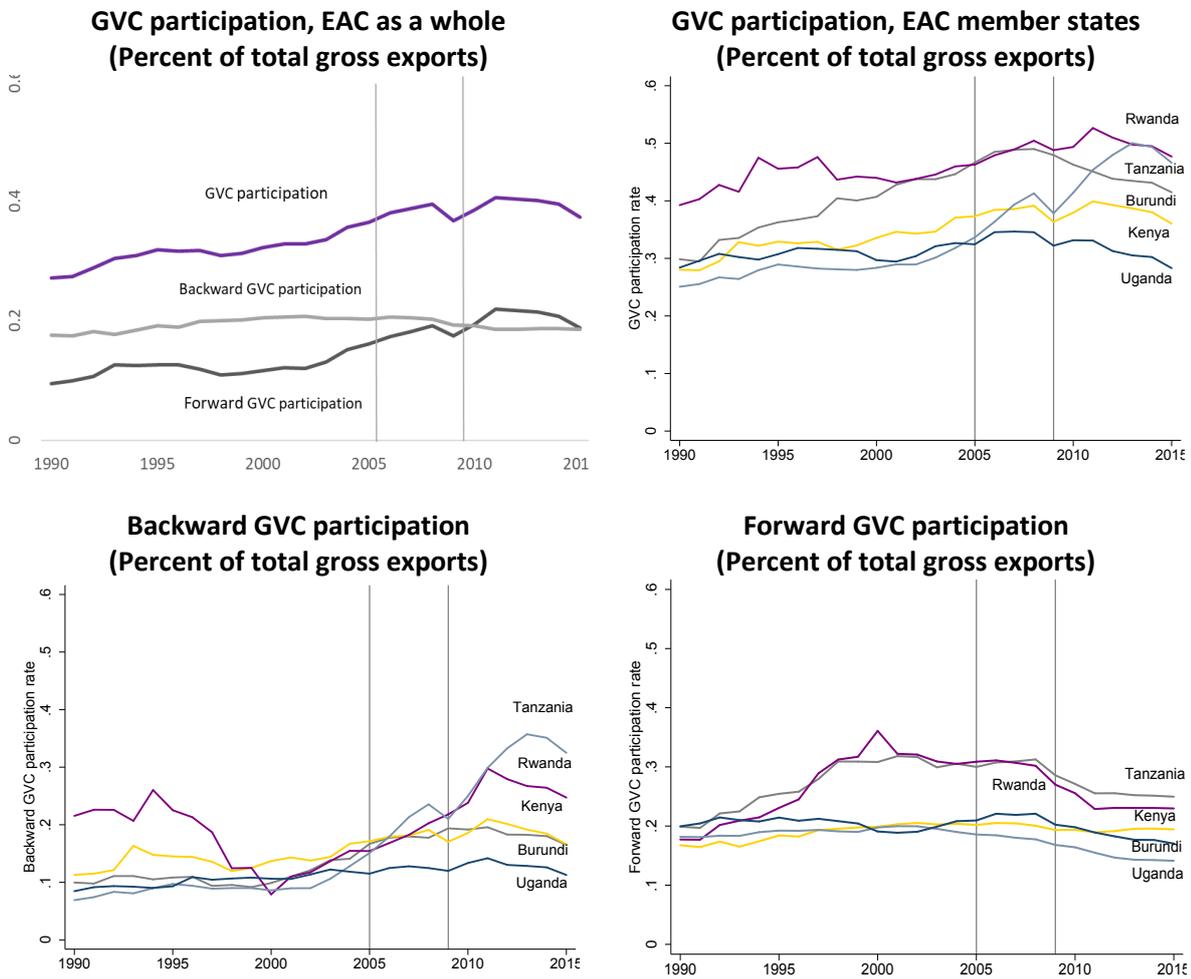
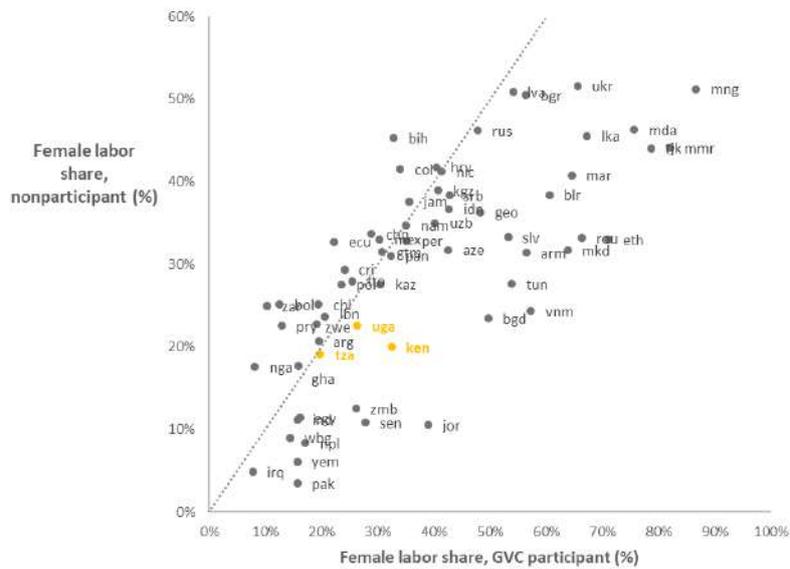
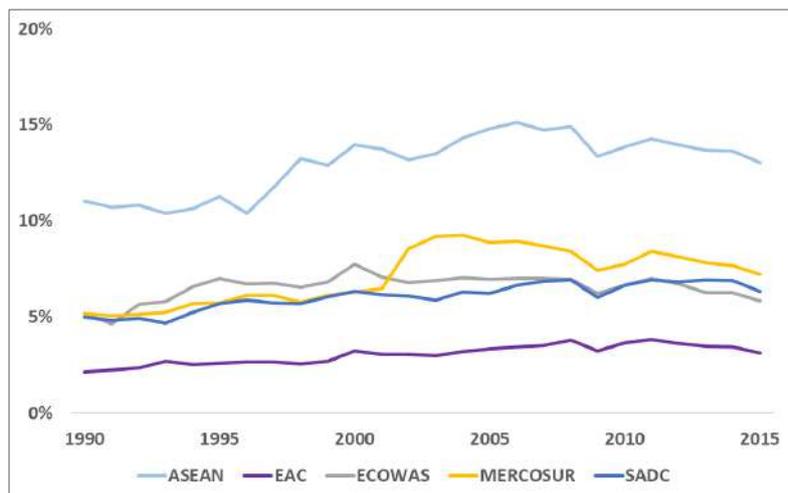


Figure A6: Female labor participation for firms that participate in GVCs vs non-GVC participating firms



Adapted from WDR 2020 (figure 3.8) to highlight EAC countries: Rocha and Winkler (2019), using data from World Bank’s Enterprise Surveys. Note from WDR 2020: Each dot represents a country-year observation. The x-axis plots the employment-weighted share of female workers of total workers in firms that both export and import (GVC participant). The y-axis plots the employment-weighted share of female workers of total workers in firms that do not export and import (nonparticipant). For country abbreviations, see International Organization for Standardization (ISO), <https://www.iso.org/obp/ui/#search>.

Figure A7: Intermediate exports as percent of output (%)



Source: UNCTAD EORA database, 1990-2015

Annex A3: Correlates of GVC participation

Selection of variables and data sources

Table A3: Variables and databases

Variable	Source
Foreign Value-added(FVA), Indirect Value-added (DVX),	UNCTAD-EORA GVC Database
FDI Stock per capita	UNCTAD Stats
GDP per capita	World Development Indicators
Tariffs on raw materials, intermediates, consumer goods and capital goods	World Bank WITS TRAINS database
Manufacturing share in GDP	World Development Indicators
Services share in GDP	World Development Indicators
Trade costs	World Bank- ESCAP database
Number of mobile phone subscriptions per 100 inhabitants	International Telecommunications Union

Specification Tests

To decide between random and fixed effects we run the Hausman Test to test whether the errors are correlated with the regressors where the null hypothesis is that they are not and thus Random effects would be preferred to fixed effects. The results below indicate that fixed effects is the preferred specification.

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
lnGDP_pc	-.2658604	-.1057652	-.1600951	.0299415
lnMANUSHR	.0684709	.0994516	-.0309807	.0223681
lnFDI_pc	.0656876	.095022	-.0293344	.0061154
lnTarZM	-.0086488	-.0247683	.0161195	.0042132
lnTRCOST	-.0576557	-.4301622	.3725065	.0547643
lnMOBS	.0392144	.0424477	-.0032333	.0022826
year				
2003	.0050246	-.0034771	.0085017	.0030661
2006	.1011041	.0186471	.082457	.0117668
2009	.1520051	-.0037082	.1557133	.0218873
2012	.1949566	-.0146592	.2096157	.0277919
2015	.1459398	-.0935582	.239498	.0308871

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(11) = (b-B)' [(V_b-V_B)^(-1)] (b-B)
 = 147.77
 Prob>chi2 = 0.0000

Next, we run a test to ascertain whether we need to include time-fixed effects when running a FE model. We use the command `testparm`, a joint test to see if the dummies for all years are equal to 0, in which case no time fixed effects are needed. From our results below, we confirm that we must include time fixed effects in our regression specifications.

```
. testparm i.year

( 1) 2003.year = 0
( 2) 2006.year = 0
( 3) 2009.year = 0
( 4) 2012.year = 0
( 5) 2015.year = 0

F( 5, 377) = 5.81
Prob > F = 0.0000
```

Lastly, we run a test to measure the presence heteroscedasticity. Under the test we use, the null is homoskedasticity (or constant variance). In the table below, we reject the null and conclude heteroscedasticity is present. To account for this, we estimate a FE model using Driscoll-Kraay standard errors which also account for auto-correlation and cross-sectional dependence.

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2(91) = 4.4e+05
Prob>chi2 = 0.0000
```

Table A4: Regression estimates for Fixed effects specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	lnGVCs	lnGVCbs	lnGVCfs	lnGVCs	lnGVCbs	lnGVCfs	lnGVCs	lnGVCbs	lnGVCfs	lnGVCs	lnGVCbs	lnGVCfs
lnGDP_pc	-0.0773*** [0.018]	-0.306*** [0.078]	-0.00371 [0.028]	-0.0768*** [0.021]	-0.291** [0.092]	-0.0132 [0.022]	-0.0777*** [0.023]	-0.214*** [0.061]	-0.0100 [0.023]	-0.0910*** [0.026]	-0.266*** [0.072]	0.00559 [0.028]
lnMANUSHR	-0.0179 [0.022]	-0.0364 [0.11]	-0.0325 [0.030]	-0.0162 [0.027]	-0.0834 [0.14]	-0.00628 [0.032]	-0.0115 [0.029]	0.0878 [0.076]	-0.0199 [0.035]	-0.0187 [0.034]	0.0685 [0.083]	-0.0184 [0.042]
lnFDI_pc	0.0154 [0.0090]	0.0694* [0.032]	-0.00648 [0.011]	0.0152 [0.0096]	0.0777* [0.036]	-0.0119 [0.011]	0.0179 [0.010]	0.0676* [0.029]	-0.0147 [0.011]	0.0158 [0.0096]	0.0657* [0.030]	-0.0193 [0.012]
IntarZM				0.00192 [0.010]	-0.00302 [0.026]	-0.00737 [0.0092]	0.000719 [0.0091]	-0.00216 [0.024]	-0.00527 [0.0090]	-0.00129 [0.013]	-0.00865 [0.035]	-0.00921 [0.011]
lnTRCOST							0.0302 [0.068]	-0.0109 [0.17]	0.0633 [0.094]	0.0146 [0.069]	-0.0577 [0.16]	0.0695 [0.091]
lnMOBS										0.0117 [0.0083]	0.0392 [0.023]	-0.0137 [0.0100]
_cons	-0.170 [0.20]	1.350 [0.94]	-1.716*** [0.26]	-0.196 [0.24]	1.416 [1.17]	-1.743*** [0.24]	-0.343 [0.47]	0.365 [1.18]	-2.113*** [0.57]	-0.178 [0.49]	0.944 [1.17]	-2.235*** [0.55]
N	648	648	648	565	565	565	542	542	542	479	479	479
adj. R-sq	0.402	0.195	0.269	0.433	0.183	0.328	0.436	0.211	0.328	0.436	0.238	0.263
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Standard errors in brackets
 =** p<0.05 ** p<0.01 *** p<0.001"

Note: The sample and dependent variables are those in table 4 in the main text. Regression is based on a three-year average of variables from 1995 to 2015 and includes country and year fixed effects.

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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.”

Pascal



Created in 2003 , the **Fondation pour les études et recherches sur le développement international** aims to promote a fuller understanding of international economic development and the factors that influence it.



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