How do South-South Integrations Affect Trade in Processed Goods? Evidence for Sub-Saharan African Countries

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Working Paper 003 -2025

Bringing Rigour and Evidence to Economic Policy Making in Africa

AFRICAN ECONOMIC RESEARCH CONSORTIUM

CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

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AERC Working Paper 003-2025
African Economic Research Consortium, Nairobi
May 2025

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are, however, those of the author and do not necessarily reflect the views of the Consortium, its individual members, or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 – City Square
Nairobi 00200, Kenya

Abstract

We examine the effects of regional integrations on processed goods exports for sub-Saharan African countries from 1990 to 2018. We use a structural gravity model estimated via a Poisson and Bernoulli pseudo maximum likelihood estimators to assess respectively the effects on intensive margins (increase in the value of existing trade) and extensive margins (increase in the number of export products). The results show that integrations in sub-Saharan Africa positively affect trade margins (intensive and extensive) for processed goods, and mainly at the extensive margins. We also find that the effects are more pronounced between countries with similar standards of living. Finally, we show that integrations in sub-Saharan Africa contribute to increased trade in intermediate goods and confirm at a sectorial level that intermediate inputs liberalization contribute significatively to industrialization of sub-Saharan African integrations. These results may have important implications for the establishment of the African Free Trade Area.

JEL classification: F14, F15

1. Introduction

The structural changes observed over the last two decades in emerging economies actively involved in international trade have prompted the development of both theoretical and empirical literature on the role of trade in industrialization. An important and directly related question is whether the phenomenon of liberalization observed among southern countries favours production and export of manufacturing goods in these countries. Almost against traditional theories, the theoretical developments of geographic economics initiated by Krugman and Venables (1995) answer in the affirmative. For example, Puga and Venables (1998) show that, in presence of economies of scale, integrations have the capacity to boost infant industries in developing economies. The relatively rich empirical literature confirms these predictions and shows that intra-regional trade in manufactured goods in Asia and Latin America has benefited greatly from the integration policies pursued in these regions (Bas, 2012; Bustos, 2011; Dahi & Demir, 2013; Iwanow & Kirkpatrick, 2009; Mukwaya, 2019).

What about the effects of these integrations on the rise in value chains of traditional products? This is a crucial question for developing countries that are usually producers of raw materials, but it is not addressed in the literature. For countries with a natural disadvantage in manufacturing activities, and specifically for African countries, commodity processing is the best option for initiating industrialization (Elbadawi, 1993; Owen & Wood, 1997; Roemer, 1979). The 2020 World Development Report clearly underlines that African countries' participation in value chains is at much lower levels (raw materials and light processing), in contrast to East Asian and even Latin American countries.) Consequently, although presenting a general view of the contribution of South-South integration to trade in manufactured goods, the existing empirical literature does not allow us to appreciate the structural changes observed on the African continent. As Owen and Wood (1997) show, by relying on fairly restrictive international definitions of "standardized manufactured goods", these studies exclude several agro-industrial products representing the main products of industrial activities in these countries.

While it is important to assess the effects of integration on African countries' trade in processed goods, it seems equally important to understand the mechanisms that may underlie the observed effects. Indeed, although the industrializing effects of South-South integration can be attributed to size effects and the exploitation of economies of scale, geographic economic models emphasize that liberalization in the South can contribute to manufacturing activities through intermediate inputs. Puga and Venables

(1998) show that, in a context of integration, some initially non-performing manufacturing industries can benefit from the availability of "intermediate" inputs. A large body of empirical literature on liberalization effects clearly shows the role of imported inputs in the industrialization observed in Asian and Latin American countries (Kasahara & Lapham, 2013; Amiti & Konings, 2007; Kasahara & Rodrigue, 2008; Bas, 2012). A study along these lines could prove necessary in the current context of the implementation of the African Free Trade Area.

In response to the challenges raised above, this study analyzes the effect of integrations in sub-Saharan Africa on trade in processed goods. More specifically, it addresses two questions: How do African integrations affect trade in processed goods? What are the mechanisms by which these effects are manifested? We address the first question in the light of the theory of heterogeneous firms (Melitz, 2003), which shows that liberalization leads to reallocations via intensive margins (reinforcement of previous specializations) and via extensive margins (diversification of products and export markets). We answer the second question by emphasizing the importance of differences in living standards. While it is acknowledged that South-South integrations stimulate trade in manufactured goods mainly through market expansion (Puga & Venables 1998), there is no evidence of the effect of living standards in achieving economies of scale. However, since Linder (1961), it has been shown that trade in manufactured goods is greater between countries with similar standards of living (Hallak, 2010; McPherson et al., 2001). Moreover, these differences generally reflect differences in the capital/labour ratio (Baier et al., 2011), which can stimulate trade in intermediate goods within integrated zones.

To test these hypotheses, we estimate a gravity model of exports from 45 sub-Saharan African countries, we use both Poisson and Bernoulli pseudo-maximum likelihood estimators (labelled PPML and FLEX). These estimators allow to us estimate both the effect of integrations on the value of trade conditional on positive flows (intensive margins) and the number of exported products (extensive margins). Our model is estimated using traditional binary variables linked to trade preferences. However, in addition to the binary variables relating to integrations, we follow Vicard (2010), Cheong et al. (2015) and Baier et al. (2018) and introduce interaction terms between the said variables and variables capturing differences in living standards. Following the literature (Baier & Bergstrand, 2007; Baier et al., 2018) and in order to account for trade policy implementation lags, we estimate our model for 5-year intervals from 1976 to 2015.

To our knowledge, this study is the first to address crucial aspects of structural effects of African regional agreements both empirically and conceptually. This enables us to make some contributions to the literature.

Firstly, the consideration of products resulting from the transformation of primary products instead of standardized manufactures enables us to empirically assess the industrialization process in African countries. While it seems obvious that integrations contribute to trade in standard manufactured goods (Mukwaya, 2019), it seems equally important to know whether these trade flows are likely to generate sustainable growth by helping sub-Saharan African countries moving up the value chain ladder of their traditional production. By focusing on processed goods, this study, unlike many others relating to the industrialization of developing countries, shows that African integrations do indeed contribute to moving up the value chain ladder, and that the effects are relatively heterogeneous across the continent. For example, the integrated zones of West African Economic and Monetary Union (WAEMU), Southern African Customs Union (SACU) and Common Market for Eastern and Southern Africa (COMESA) show much better results in terms of promoting trade in processed goods.

Secondly, this study focuses on the mechanisms that enable sub-Saharan African integrations to effectively promote industrialization (economies of scale, availability of inputs, etc.). We demonstrate the efficiency and effectiveness of the intermediate input channel in sub-Saharan African integrations. Our empirical results are confirmed at both aggregated and disaggregated level. As stated by Borchet et al. (2021) trade policies are designed and implemented at product level. Understanding effects at a more disaggregated level provide more insights for economic policies. In our study, the issue of intermediate inputs of processed goods implies identifying properly the products involved the chain value.

Thirdly, from an empirical point of view and following a growing body of literature, we decompose trade into intensive and extensive margins. This allows us to reduce the biases due to the exclusion of many zeros in traditional estimates arising from the use of logarithmic values. The empirical literature shows that, due to the economic meaning of certain zeros, exclusion can bias results (Egger & Larch, 2011; Helpman et al., 2008). We first use a Poisson pseudo maximum likelihood (PPML) estimator and find that integrations in sub-Saharan Africa have significantly and positive effects on trade in processed goods, and that these effects occur mainly through extensive margins. We then quantify this extensive margin effects by estimating the number of exported goods with a Bernoulli Pseudo Maximum Likelihood (FLEX) and show that on average African countries export 17 new processed

products following their entry into regional integration, compared with three for other types of trade agreement.

Finally, we show that industrialization effects of African integration are highly dependent on differences in living standards. Our study does not confirm Linder's hypothesis and rather shows that relatively advanced countries become new providers of sophisticated products for the less advanced ones. We thus provide one among other explanations of the heterogeneity of effects observed within sub-Saharan Africa, and between them and unilateral liberalization.

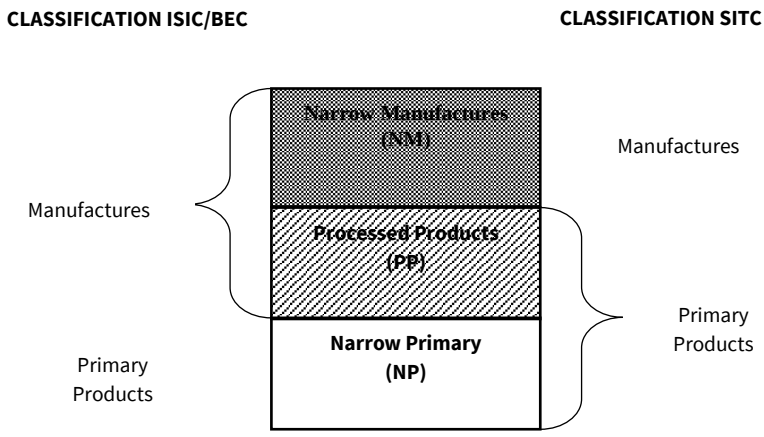
The remainder of this article is structured as follows. The next section describes the design and background to this study, while Section III presents a brief review of the literature. Section IV presents the empirical strategy. Section V presents the results, and section VI presents the specification checks. Section VII concludes.

2. Design and Background to the Study

Definition of processed goods

As mentioned above, the United Nations' standardized classifications consider industrial goods derived from the transformation of primary products to be agricultural. These same goods are considered as manufactured in the International Standard Industrial Classification (ISIC) (Figure 1). A body of literature on the industrialization raises the issue of the limitation of international trade statistics' definitions of manufactured goods in terms of economic policy and shows the important of considering processed goods specifically (Berge & Wood, 1997; Wood & Mayer, 2000). These goods are defined as industrial goods whose cost structure is largely composed of raw materials. Thus, processed products seem much more accessible to African countries whose main production is made up of primary products. In addition, unlike substitution manufacturing activities initiated in the 1980s, which failed, the processing of primary goods is fairly compatible with an export-led industrialization strategy. For African countries these activities offer means to diversify and move up production value chain.

Figure 1: Definition of manufactured and processed products



Inspired by a series of papers proposing more precise ladder of processing within industries (Yeats, 1981; CEPAL, 1986; Berge & Wood, 1997; Wood & Mayer, 2000), one may also classify goods into primary and processed products at a sectoral level. For some goods, there are intermediate products between the primary and finished product. Consequently, intermediate goods can be viewed as primary products that have already been processed (semi-processed) but serve as inputs for higher-level processed products. The analysis of processed products on a disaggregated scale also implies a distinction between processed products of agricultural origin (e.g., coffee, cocoa, peanuts) and those of non-agricultural origin (e.g., zinc, copper, oil). The products concerned by our study will therefore be classified as primary, processed and intermediate products of agricultural or non-agricultural origin. The products used for the disaggregated analysis represent 60% of trade relations and almost 50% of the trade value of sub-Saharan Africa (The list of products included in the sectoral analysis is presented in appendix Table A1).

Sub-Saharan African regional integrations

Our study covers 45 countries in sub-Saharan Africa (listed in appendix table A2) for which regional integration is not the first experience of trade agreements. Like most developing countries they trade level has always been weak toward traditional export markets from whom their received preferential treatment since independence. The political will of African countries was reflected in the 1980 Lagos Plan of the Organization of African Unity's African Economic Commission, a continental plea for regional cooperation zones as

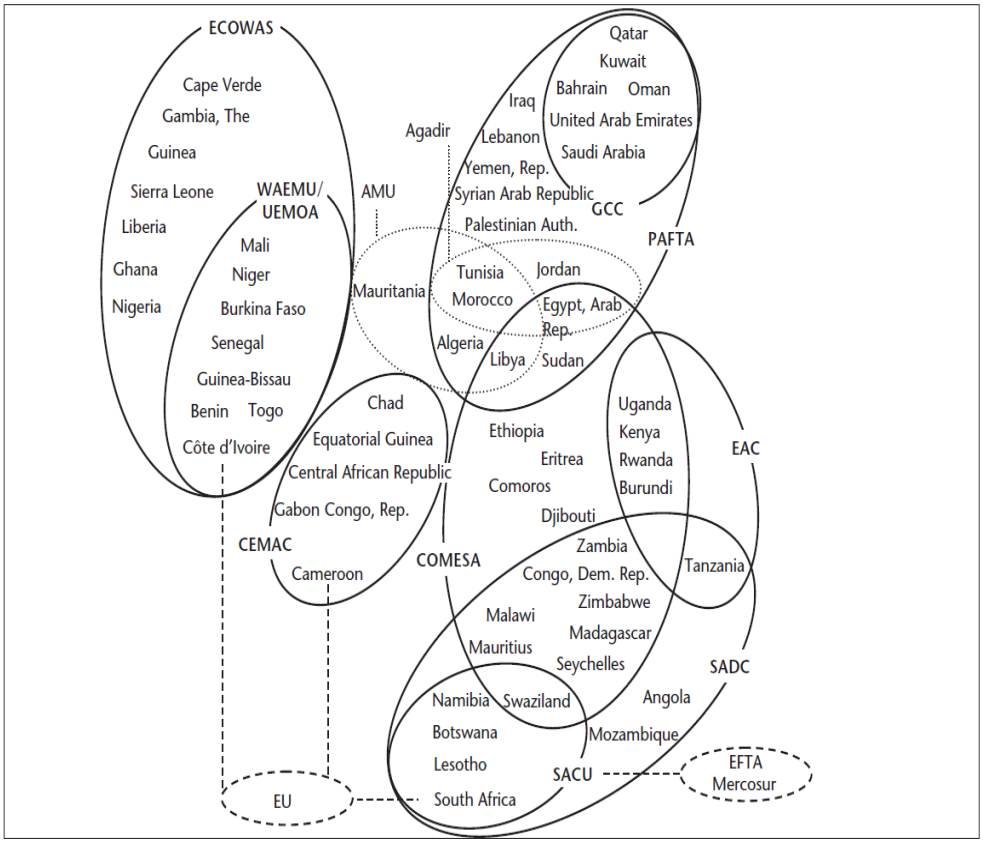
the keystone of the continental integration process. More than 40 years after this plea, the sub-Saharan African continent has several regional agreements (Figure 2), the seven most important being Economic Community of West African States (ECOWAS), , West African Economic and Monetary Union(WAEMU), Central African Economic and Monetary Community (CEMAC), Southern African Customs Union (SACU), Southern Africa Development Community (SADC), Common Market of Southern Africa (COMESA) and , Eastern African Community (EAC). Without documenting the details of the formation of these integrations, we present the main phases of the integration movement.

The integration process in sub-Saharan Africa has unfolded in two main phases, culminating in the establishment of a continental free trade zone launched in 2018 in Kigali, Rwanda. The first phase corresponds to the post-independence years, culminating in the Lagos Plan of the early 1980s. This period saw the establishment of the first regional institutions. West Africa saw the creation of Economic Community of West African States (ECOWAS) in 1975, which under Nigeria's influence became one of the continent's best examples of integration, especially in the fields of political cooperation and the international movement of people. Alongside ECOWAS, the colonial legacy of the countries of French West Africa led to the creation in 1973 of West Africa Community (WAC), an organization grouping together the countries of West Africa that shared the Franc of the French Colonies (except for Togo but including Mauritania). In Central Africa, the CEAC was created in 1983 under the impetus of the sub-region's leader, Cameroon, based on the same colonial heritage as the CEAO. In East and Southern Africa, the Southern African Development Coordination Conference (SADCC) was set up in 1980, with the aim of reducing dependence on South Africa. In 1983, Eastern and Southern African countries agreed to create a Preferential Trade Area (PTA).

The second phase in the integration of sub-Saharan Africa took place between the 1990s and 2000s. The existing organizations underwent profound changes, with their commercial and economic ambitions more clearly expressed. In West Africa, the WAEMU replaced the CEAO, with a clear economic and monetary function and the establishment of a customs union in 2000. Togo joined the WAEMU as soon as it was created, as did Guinea Bissau in 1997. In East Africa, the SADCC conference gave rise to a regional organization in 1992, with South Africa joining in 2004. In 1994, the Preferential Trade Area became the COMESA common market. The latest integration in East Africa took place in 1999. The Eastern African Community (EAC) brings together Kenya, Tanzania and Uganda. Like many South-South integrations, sub-Saharan African integrations were created based on geographical proximity, with political and

non-trade issues initially taking precedence. This increases the likelihood of overlapping integrations, even within the same region (as shown in figure 2). For example, the eight members of the West African Monetary Union are also members of ECOWAS. In Central Africa, the six members of CEMAC are also members of Economic Community of Central African States (ECCAS). At the same time, and despite the entries and exits within SADC and COMESA, seven countries belong to both regional groups. On a continental scale, half of all African countries belong to at least two regional groupings, and a third belong to three.

Figure 2: African regional integrations



A preliminary analysis of our data reveals that, since the 1990s, trade in processed goods has become increasingly intensive on the continent. This trend seems to be evident for the continent. As shown in Panel 1 of Figure 1A in the appendix, these goods accounted in 2020 for around 40% of exports from the whole of sub-Saharan Africa, compared with 26% in 1980. At sub-regional level, these goods account for more than half of intra-Southern Africa

exports. West Africa and Central Africa are the sub-regions with the most stable and spectacular growth respectively. In West Africa, from less than 10% in 1980, these goods represent almost half of exports in 2020, while in Central Africa the share of these goods rose from less than 7% to 26% between 2000 and 2020 (Panels 2 and 4). In addition to highlighting the relative importance of processed goods in African exports, the various graphs show the contrast that can arise when considering manufactured goods as defined by standard classifications. Except for the South African sub-region, the graphs show that the share of manufactured goods (according to the standard International Trade classification) appears to be declining, despite the increase in processed goods exports. As pointed out above, this is because most processed products are considered in international classifications as agricultural products.

While it seems clear that processed products are gaining in importance in sub-Saharan African countries, one may wonder whether this importance is reflected in intra-regional trade. In table 1, we explore the evolution of processed goods exports by destination. Intercontinental trade in processed goods is changing. In 2010, over 20% of processed goods exports were destined for the African market, compared with 5.5% in the 1980s. The trend is rather reversed for Europe and North America, which receive fewer and fewer (around 30% in the 2010s, compared with 85% in the early 80s).

Table 1: Trends in the destination's share of processed goods exports

	1980s	1990s	2000s	2010s
Africa	5.51	11.08	17.29	21.24
Asia	18.19	17.42	25.81	32.54
Europe	57.38	52.07	39.23	27.75
North America	16.86	10.70	7.96	5.66
Other destinations	2.06	8.72	9.72	12.81
Total	100.00	100.00	100.00	100.00

Table 2 focuses on value and trade relationships, and shows that in all sub-regions, the share of processed goods trade has grown considerably since the 1980s. It shows that in all sub-regions, the share of sub-regional trade in processed goods has undergone considerable evolution since the 80's. For the West African sub-region, from 6% in the 80's, the share of trade in processed goods reached 10% in the 90's and more than 20% in the 2010's. Southern Africa is the sub-region with the most speculative evolution. From less than 1% in the 80s, the share of sub-regional trade in processed goods reached 18% in 2010. In parallel with the value of trade, the share of trade relations is also

evolving.

The statistical trends described above do not shed any light on the role of integrations in these trends, which justifies an in-depth econometric analysis. An important question that our study seeks to answer is whether there is any heterogeneity in the effects of integrations on trade in processed goods in African sub-regions. In line with the empirical literature on Linder's hypothesis (1961), the question more spherically is whether differences in income and/or living standards can play a role in the expected effects of integrations in terms of the structural transformation of African economies. Mc Pherson et al (2001), for example, have shown that this hypothesis appears to be true in East Africa. In such a context, we would expect the most homogeneous regional integrations in terms of living standards to see their manufactured goods trade volumes increase much more than those of more heterogeneous integrations.

Table 2: Share of processed goods in sub-Saharan African exports

		1980s	1990s	2000s	2010s
West Africa	Volume	0,18	2,83	0,23	3,22
	Relations	7,09	11,03	17,37	19,99
East Africa	Volume	0,51	1,13	1,29	4,33
	Relations	5,17	7,36	9,99	7,50
Central Africa	Volume	0,02	0,19	0,29	0,38
	Relations	1,54	3,20	6,72	10,49
South Africa	Volume	0,23	0,86	5,22	6,00
	Relations	3,67	13,75	20,91	28,89
sub-Saharan Africa	Volume	1,24	3,48	3,66	7,50
	Relations	10,33	17,50	31,65	35,10

To support the intuition on the role of living standards, we analyze trade within the four sub-Saharan African sub-regions. Taking the year 2000 as a reference, we divide the countries in each zone into two categories according to standard of living (relatively rich countries with GDP/head above the regional average, and relatively poor countries with GDP/head below the regional average). Table 3 gives the trade shares between the two categories for the West and Central sub-regions. In the West African zone, rich countries source more of their final goods from other rich countries (before 2010). This contrasts with Central Africa, where on average 90% of processed goods imports from relatively wealthy countries come from below-average-income countries. For intermediate goods, in contrast to Central Africa, the relatively wealthy countries of West Africa obtain their supplies from relatively poor ones.

Table 3: Trade between rich and poor countries in West and Central Africa

		Importer Group Share in Exports (Final Products)						Importer Group Share in Exports (Intermediate Products)					
		1990s		2000s		2010s		1990s		2000s		2010s	
Exports		poor	rich	poor	rich	poor	rich	poor	rich	poor	rich	poor	rich
West Africa	Poor exporters	8	4	23	58	32	53	18	18	46	35	35	24
	Rich exporters	92	96	77	42	68	47	83	82	54	65	66	76
	Total	100	100	100	100	100	100	100	100	100	100	100	100
Central Africa	Poor exporters	66	85	20	76	73	37	83	97	96	98	97	94
	Rich exporters	34	15	80	24	28	63	17	3	4	2	3	6
	Total	100	100	100	100	100	100	100	100	100	100	100	100

3. Literature Review

The question raised by this study concerns the effects of integration in sub-Saharan Africa on trade in processed goods, and the mechanisms through which these effects manifest themselves.

Effects of South-South integrations on trade in manufactured goods

Although the literature on the trade effects of African integration is extensive, there are very few studies focusing on trade in manufactured goods. These use gravity models and show that liberalization contributes to the industrialization process in the developing world. Iwanow and Kirkpatrick (2009), for example, show for 25 countries and 2 years (2003 and 2004) that the positive effects of infrastructure and institutional improvements substantially increase the potential for trade in manufactured goods between African countries. Without, however, contrasting this result, Seck (2017) shows that trade facilitation seems to benefit agricultural products more than manufactured goods. Mukwaya (2019) presents relatively more interesting results. His study covers 45 countries and 25 years (1990-2015) and uses a Pseudo Poisson Maximum Likelihood estimator deemed better for estimating structural gravity models. The author shows a positive effect of integrations on trade in manufactured goods (of the order of 72% in the 12 years following accession). However, these results cannot be effectively attributed to sub-

Saharan integrations, since the author uses a single variable to encompass all trade preference agreements.

Although providing robust results, these studies define manufactured goods according to international classifications, the most famous of which is the Standard International Trade Classification (SITC). In sections 5 to 8, the SITC defines manufactured goods as know-how- and technology-intensive goods (shoes, cars, computers, etc.) that are difficult for most start-up countries to produce. This definition, like many others, does not allow us to assess the structural transformation efforts underway in developing countries. As explained in section II, our definition of processed goods seems appropriate for assessing the effects of liberalization on the move up value chains in sub-Saharan African countries.

More recent literature shows the importance of participation in value chains for poor countries and the contribution of trade policies. This literature shows empirically that liberalization is making a strong contribution to the rise of the industrial ladder in Latin America and Asia. Although sub-Saharan Africa's participation in value chains has increased over the last 20 years (World Bank 2020), Abudu and Nguimkeu (2019) show that tariff barriers represent a real constraint to the development of value chains in sub-Saharan Africa. Our study, inspired by this literature, is to our knowledge the first to focus on the effects of liberalization on trade in processed goods. Moreover, in line with the objectives of integration, it seems equally important to know whether liberalization is sparking the emergence of new industrial sectors or reinforcing existing specializations. The decomposition of trade effects into intensive and extensive margins helps to answer this question.

Liberalization and industrial activities in developing countries

The idea that integrations can promote industrialization in the South contrasts with traditional theories that predict greater potential for North-South liberalization. Puga and Venables (1998) are among the pioneers who provide a theoretical foundation for this idea. They show that South-South integration can have an industrializing effect, mainly thanks to economies of scale. When economies of scale are present, the size of the integrated market makes manufacturing activities fairly viable, enabling southern countries to begin their industrial take-off. Liberalization also has the capacity to promote manufacturing activities through the channel of intermediate inputs which become available, of better quality and relatively more affordable to manufacturing firms. Puga and Venables (1998) consider this second mechanism highly unlikely in South-South integrations, due to similarities in

production structures. Nevertheless, Amiti and Konings (2007), Kasahara and Rodrigue (2008), Bas (2012) show that following liberalization, imports of intermediate inputs contribute to the improvement of the industrial fabric in Asian and Latin American countries. Although imports of intermediate inputs seem to play in favour of industrial activities in Africa (Bbaale et al. 2019), there is no evidence of the effectiveness of this mechanism in the context of African integrations.

In the context of South-South integrations, geographical economy models raise agglomeration issues arising from the heterogeneity of attractiveness or profitability of different countries within the union. In the environment of Puga and Venables (1998), input-output links encourage industrial firms to locate near customers or suppliers of intermediate goods. This phenomenon can make industrialization asymmetrical when all firms choose to locate in the largest countries (or cities) in the integrated zone. Venables (2003), for example, finds an agglomeration effect in Côte d'Ivoire and Senegal within the ECOWAS framework. On the other hand, forces stimulating competition (e.g. reduced tariff barriers on intermediate inputs) make the concentration of industrial activities less and less profitable and play in favour of a dispersion of these activities between the members of the integration. Consequently, the gains linked to the formation of an integration between southern countries depend on its capacity to reduce the disproportions between the forces of agglomeration and dispersion.

The liberalization of inputs seems to be just as decisive as that of outputs in the regionalization of value chains. Dependencies between upstream and downstream firms imply the international fragmentation of production processes. This globalization of value chains (GVC) has given rise to a body of literature naturally inspired by the predictions and mechanisms of geographical economics. For example, Borin and Mancini (2019) clearly show that market size, factor endowments and geography affect the positioning of each country on the value scale. To these three factors, discussed at length in theoretical models (Krugman and Venables 1995, Puga and Venables 1998), the authors add the quality of institutions. In a regional context, this last factor, unlike the others, can work in favor of the weakest countries in the integrated zone, or contribute to the balance of power between integrated countries. Quality institutions attract input flows and, above all, creates a favorable environment for attracting Foreign Direct Investment (FDI) (World Bank 2020). The literature shows, for example, that liberalization in Asia has substantially contributed to the regionalization of value chains, unlike in Latin America. By testing the intermediate inputs channel, our study enables us to assess the contribution of integration to the regionalization of value chains.

4. Empirical Strategy

Gravity framework for trade of processed goods

Our study attempts to assess the effects of integration in sub-Saharan Africa on trade margins for processed goods. Considering the relatively recent theoretical developments, we conduct our empirical assessment within a gravity model framework that we augment according to our main hypothesis.

In traditional analyses, the gains from liberalization are realized via the terms of trade, and due to the homogeneity of goods, all sectors participate more intensively in trade; this corresponds to intensive margins. Using increasingly detailed data, some authors have shown that even within the same sector, not all companies are exporters. For example, Bernard and Jensen (1999) have shown that only the most productive companies are involved in exporting. It was Melitz (2003) who emphasized the heterogeneous nature of firms and the importance of (fixed) export costs in a model of monopolistic competition à la Krugman (1979). Studies inspired by models of heterogeneous firms show that, following liberalization, in addition to firms already exporting, new firms previously unable to export are gaining market share abroad, which corresponds to extensive margins. Broadly speaking, models like Melitz (2003) generally show that liberalization has a positive impact on both the value and number of goods traded and there is a need of making this distinction in empirical analysis of liberalization effects.

Our study also aims to understand the mechanisms by which integration affects trade in processed goods in African countries. In Puga and Venables' (1998) model, industrialization is triggered by market enlargement, which enables economies of scale to be achieved. There is no evidence that market size drives industrial activity. For example, if there are considerable differences in preferences or living standards between countries, or if the production structure is not favorable to industrial activities (due to rigidities in the production system), reducing customs duties alone cannot produce the desired effects. In this case, liberalization may even stimulate trade in intermediate inputs within the zone, due to differences in the capital/labor ratio among member countries. In line with our hypotheses, we follow Baier et al. (2018), Cheong et al. (2015) and Vicard (2011) and introduce into the gravity model interaction terms between the binary variables relating to integrations and variables of interest (in this case the living standards gap) to test whether the variables of interest influence the trade effects of integrations. So, our main gravity equation is as follows:

$$\boldsymbol{T_{ij,t}^{k}} = \left(\exp\left[\beta_0^k + \beta_1^k \mathrm{KLratio}_{i,t}^k + \beta_2^k RTA_{ij,t} + \beta_3^k RTA_{ij,t} \times \left|gdpcap_{i,t} - gdpcap_{j,t}\right| + \beta_4^k gdp_{ij,t} + \gamma_{ij}^k\right] + \varepsilon_{ij,t}^k\right) \quad \textbf{(1)}$$

where $gdpcap_{i,t}$and $gdpcap_{j,t}$ represent respectively the exporter and importer's per capita GDP (so that our Linder's term $\left|gdpcap_{i,t} - gdpcap_{j,t}\right|$ captures living standard difference). $\mathrm{KLratio}_{i,t}^k$ represents exporter Labor/Capital ratio and represents the production capacity of exporter's country. $gdp_{j,t}$, represents the GDP of importer j at date t, k represents the broad sector considered in the analysis (processed/intermediates or broad manufactures for comparison).

One of the challenges in empirically testing the Linder hypothesis is defining the appropriate Linder term, as the literature proposes several indicators to measure differences in living standards. These are mainly, $\ln\left|gdpcap_{i,t} - gdpcap_{j,t}\right|$, $|\ln gdpcap_o - \ln gdpcap_d|$. Although we have chosen the absolute value of per capita income difference, Linder's hypothesis stipulates that whatever Linder's term is chosen, the greater its value, the further apart the partners are in terms of standard of living, and its estimator should have a negative sign.

As the previous equation is estimated for aggregated sectors, we argue that the number of exported products seems to be a reliable indicator of the overall extensive margin. Thus, to quantify the effects of integrations on extensive margins, we estimate the number of processed goods exported between trading partners. Extensive margins are therefore estimated with the same explanatory variables as intensive margins, using the following equation:

$$\boldsymbol{N_{ij,t}^{k}} = \left(\exp\left[\beta_0^k + \beta_1^k \mathrm{KLratio}_{i,t;t-1}^k + \beta_2^k RTA_{ij,t} + \beta_3^k RTA_{ij,t} * Linder_{ij,t} + \beta_4^k gdp_{ij,t} + \gamma_{ij}^k\right] + \varepsilon_{ij,t}^k\right)_{|T_{ij,t}^k > 0} \quad \textbf{(2)}$$

where N represents the number of goods exported by exporter i to its partner j in category k.

Since most economic policies are implemented at sector level, we propose to carry out a sectoral analysis that can improve the empirical contribution of this study as well as its political scope. At a product level, our theoretical framework helps to highlight the contribution of intermediate inputs market and regional value chains. Following the literature (Bas, 2012; Feng et al., 2016; Kasahara & Lapham, 2013) we conduct a more disaggregated analysis and try to assess the link between intermediate inputs liberalization and industrialization. However, inclusion of intermediate inputs imports as regressor of processed goods raises causality issues. Input imports, which are supposed to influence exports of manufactured goods, may themselves be

affected by the latter. Generally, more efficient exporting firms are more likely to import intermediate inputs because of their connections to foreign markets. We follow Amiti and Koning (2007) and Bas (2012) and use tariffs on intermediate goods as a variable that is supposed to affect exports of manufactured goods without being affected by them. In most sub-Saharan African sub-regions, tariff reductions are made on a reciprocal basis, which does not necessarily consider the initial position of a sector in a given country. The basic model is thus formulated as follows:

$$\boldsymbol{T_{ij,t}^{m}} = \mathbf{exp}\big(\delta_0^m + \delta_1^m Input\mathrm{T}_{i,t;}^{k} + \delta_2^m RTA_{ij,t} + \delta_3^m RTA_{ij,t} \times \left|gdpcap_{i,t} - gdpcap_{j,t}\right| + \delta_4^m gdp_{j,t} + \eta_{ij}^m \geq \omega_{ij,t}^m\big) \quad (3)$$

Estimation strategy and data

In an influential paper, Santos Silva and Teneryero (2006) show how gravity model estimation with level trade value produces better estimators than the usual logarithmic form. In addition, the authors point out that the Pseudo Poisson Maximum Likelihood estimator solves problems associated with the heteroscedasticity of the error term observed in trade data. Finally, the technique of Santos Silva and Teneryero (2006) allows us to abstract from the nuisance parameters generated by the introduction of numerous fixed effects in structural gravity models.

To estimates the extensive margins, we use a Bernoulli Pseudo Maximum Likelihood estimator as proposed by Santos Silva and Wei (2014). The estimator is suitable for count models when the dependent variable has both a lower and an upper bound. Indeed, depending on the chosen classifications, the number of export candidate sectors is limited by the maximum number of lines for that classification and not considering this constraint can expose the estimation results to potential bias.

To carry out our estimations, we use trade data from UN COMTRADE under both the BEC and the SITC Rev.2 classifications. Data on regional or preferential agreements are from Baier and Bergstrand (2021), while data on GDP and GDP per capita are from the World Bank's World Development Indicators database. Data on production factors, notably capital stock and labour, are from Penn World Table 10.

5. Results and Analysis

Basic gravity and the Linder hypothesis

Before presenting our main model, an estimated gravity model with various fixed effects (exporters, importers, and country-pairs), we provide preliminary results to draw basic conclusions on the effect of Sub-Saharan integration on

total trade and to assess the validity of our initial hypotheses. These naïve specifications are estimated for overall trade, primary and processed products (BEC classification) and agricultural products and manufactures (SITC Rev.2 Classification) and the results are presented in Appendix A4. Columns 1,3,5 and 7 show the results of estimations with a single dichotomous variable, EIA equal to one if the partners are linked by any preferential arrangement and 0 otherwise. This naive aggregation of regional integrations and other trade agreements is corrected in specifications 2,4,6 and 8 where two dummies SSA and RTA capture the effects of regional integration, and other EIA for all the other preferential agreements whether they are unilateral or bilateral.

The basic results show signs and significance that seem consistent with traditional gravity results. Colonial ties, common border, and sharing official language have positive and significant effects on trade volume for both processed and manufactured goods. Countries with a large capital labor ratio (i.e. a capacity to produce relatively sophisticated goods) have a higher level of trade. Exporter's GDP has expected sign and value, showing the importance of economies of scale in the performance of regional integrations. In the absence of fixed year and country pair effects, preferences between sub-Saharan African countries and the Northern countries (either unilateral or reciprocal) have positive and significant effects. The coefficient of the Linder term, which measures the effect of differences in living standards between partners, is negative and significant at the 1% level in all specifications. This result validates Linder's hypothesis for total trade. The greater the differences in living standards between countries, the less they tend to trade.

Effects of African integrations on intensive margins of processed products

As highlighted by Bergstrand et al. (2007), adding country-pair fixed effects help in controlling for endogeneity of regional integrations dummies. So, our main estimations will be carried-out with importers, exporters fixed effects as well as country-pair fixed effects. Table 4 present respectively the estimation results for processed goods (final consumption processed goods as well as for intermediates processed) and manufactures. We estimate the model separately for all trade data including the subdivision of products according to their end-of-use is provided by the BEC classification. Hallack (2010) has shown that the more aggregated the trade data, the more difficult it is to test Linder's hypothesis. Since the latter highlights the potential effects of living standard gap between trading partners, separating processed goods into final consumption and intermediate products seems appropriate. Manufactures (i.e. SITC Rev.2 5-8) are included for comparison.

Table 4: PPML estimates of processed products trade, five-years intervals data (1990-2018)

	Processed Products						Narrow Manufactures	
	All		Intermediate Consumption		Final Consumption			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample
Exporter K/L ratio (log)	0.355**	0.334**	0.328**	0.295*	0.008	0.066	-0.041	-0.059
	(0.159)	(0.160)	(0.162)	(0.164)	(0.107)	(0.100)	(0.114)	(0.104)
Importer GDP (log)	1.406***	1.358***	1.404***	1.365***	1.114***	0.717***	1.041***	0.885***
	(0.245)	(0.269)	(0.247)	(0.269)	(0.145)	(0.150)	(0.149)	(0.161)
Linder Term	-0.157	-0.191*	-0.136	-0.174	-0.350***	-0.289***	-0.056	-0.191***
	(0.102)	(0.112)	(0.103)	(0.112)	(0.094)	(0.085)	(0.080)	(0.062)
Other EIA	-0.507	-0.598*	-0.535	-0.624*	0.106	0.049	0.416	0.251
	(0.335)	(0.337)	(0.354)	(0.354)	(0.212)	(0.237)	(0.257)	(0.188)
SSA RTA	0.672***	0.038	0.617**	-0.028	0.991***	0.366	0.514	-0.387**
	(0.244)	(0.233)	(0.252)	(0.244)	(0.294)	(0.261)	(0.350)	(0.189)
Other EIA*Linder Term	0.168*	0.227**	0.192*	0.248**	-0.062	-0.006	-0.039	0.059
	(0.097)	(0.098)	(0.102)	(0.103)	(0.067)	(0.069)	(0.113)	(0.096)
SSA RTA*Linder Term	-0.027	0.015	-0.042	0.013	0.376***	0.335***	-0.035	0.187**
	(0.091)	(0.092)	(0.091)	(0.096)	(0.103)	(0.103)	(0.087)	(0.074)
Constant	-11.199**	-9.913*	-18.029***	-16.804***	-10.556***	-3.260	-7.492**	-3.785
	(4.891)	(5.339)	(4.993)	(5.395)	(2.795)	(2.872)	(3.243)	(3.390)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

N	22,172	11,068	21,304	10,449	13,499	5,175	24,812	13,374
ll	-6.93e+10	-5.47e+10	-6.84e+07	-5.49e+07	-6.53e+06	-4.49e+06	-3.90e+07	-2.91e+07

Standard errors in parentheses

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

The size of the destination measured by its GDP has the expected effect and the value of the estimates are not far from one as suggested in the literature. Capital/Labor ratio has positive and significant effect on processed goods but not on manufactures exports of African countries. This means that African countries with a relatively higher capital intensity are much more oriented towards light processing industries and not towards highly elaborate manufacturing production. The variables of interest in our estimations are trade preference variables, the Linder term and their interaction. The results show that African integrations do not contribute significantly to trade of manufactures unlike processed products.

Specifications 1 and 2 show that integrations increase trade in processed goods by around 80 % ($(exp\ (0.672.) - 1) \times 100$). When we consider only positive trade data, we find that the effect, though positive, is not significant. This means that the contribution of integrations to intensive margins is insignificant and that the main effects are attributable to the extensive margins. Differences in living standards seem to be an important driver of the level of more elaborated products. The Linder term has a negative sign as expected for processed final consumer goods and manufactures. This implies that countries with wide disparities in living standards do not trade enough sophisticated goods confirming a priori Linder's hypothesis. On the other hand, the interaction term between integrations dummies and the Linder term, is not significant when considering all the processed goods. When considering only final consumption goods, we find that the interaction term is significant (Columns 5 and 6). This shows that once African integration agreements have been concluded, member countries with similar standards of living seem to develop their trade in processed goods much more than the others. In a way, this result confirms that of Venables (2003), who shows that in African integrations, the most advanced countries are those that benefit most from the industrializing effects of integration.

Quantifying the extensive margins effects of African Integrations

While the previous section clearly shows that extensive margins are important in the trade creation observed in sub-Saharan Africa, this section attempts to quantify these effects using the FLEX model proposed by Santos Silva and Wei (2014) to estimate the number of processed products traded between partners. The results are presented in Annex Table C1 and clearly show that African integrations have significant effects on extensive margins of processed goods and the value of coefficient is almost 3 times that of other trade agreements. Although giving the direction of the effects of the different variables, these estimators are not very informative, as they are interpreted as the probability that a given sector will be an exporter. We therefore focus on their partial effects. These effects are shown in the Table 5 presenting only the partial effects of trade agreements dummies. The result shows that on average, African countries add 17 new processed products to their export baskets thanks to regional integration compared with around seven times less with their preferred partners outside Africa.

Table 5: FLEX marginal effects of integrations on the number of exported products

		Processed Products		**Narrow Manufactures**
	All	**Intermediate Consumption**	**Final Consumption**	
	(1)	(2)	(3)	(4)
Other EIA	2.744***	2.444***	0.410***	2.979***
	(0.902)	(0.778)	(0.146)	(0.883)
SSA RTA	17.78***	15.53***	2.234***	19.43***
	(2.224)	(1.942)	(0.318)	(2.540)
Year FE	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes
N	32,157	32,157	31,836	32,157

Standard errors in parentheses * p<0.1, ** p<0.05, *** p<0.01

Intermediate goods and regional value chains

In line with our last objective, we now test the idea that African integrations stimulate trade in intermediate goods. In their definition, these goods are those used as inputs into the production process. of manufacturing firms. They may be either raw or transformed. The results of PPML as well as FLEX models

are presented in Annex Table D1 and confirm that African integrations (grouped under SSA RTA variable) have positive and significant effect on trade in intermediate goods. This seems at first glance to confirm the effectiveness of the intermediate inputs channel in integrated zones. Since this result is obtained by aggregating trade value of intermediates, it does not allow to effectively assess the value chains created by integration, nor to isolate the contribution of intermediate goods in regional industrialization. To this end, this section presents the results of a sector-level analysis. As by definition processed goods value chains are easy to identify, we include in the gravity model the intermediate input tariff instead of the actual imports of intermediate. We present the results in Table 6. The results of the sectoral estimates in Table 6 are in line with the results obtained for aggregate sectors. Combined GDP, integrations have expected positive effects. As mentioned above, the main aim of this estimation is to verify at product level whether liberalization of intermediate inputs has a positive effect on industrialization and trade in processed goods in sub-Saharan Africa. The results confirm this intuition, the coefficient being negative and highly significant. The intermediate inputs channel seems to work for the selected products.

Table 6: PPML estimates of intensive margin of processed products at sector level, five-years average data and one rta dummies (1976-2015)

Independent Variable = Average Export over 5 years		
Country Pair GDP	1.320***	(0.489)
EIA	1.239***	(0.452)
EIA*Linder Term	0.014	(0.010)
Linder Term	-0.036*	(0.019)
Average Input Tariff	-0.129***	(0.047)
Constant	-11.330	(10.210)
Importer FE	Yes	
Exporter FE	Yes	
Sector FE	Yes	
Year FE	Yes	
Country Pair FE	Yes	
N	7,757	
ll	-2.39e+09	

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01

6. Specification Checks

The aim of this section is to test the sensitivity and robustness of the results in relation to the particularities of our specification. To ensure the reliability of our empirical findings, alternative estimates are conducted.

Although there's a tradition of using interval data to estimate structural gravity models, Egger et al. (2022) show that annual data estimates are much more reliable. We then replicate our main model with annual data. The results are presented in Appendix tables B2 and show relatively similar results, the only difference being that the integrations from sub-Saharan Africa have now a significant effect on manufactures, unlike the interval data. The signs of the Linder term and its interaction terms with trade agreements dummies are not significantly different.

7. Concluding Remarks and Policy Implications

Traditional gravity estimates of industrial product trade creation in African integrations are obtained, while more robust estimates come from a standardized definition of manufactures, which excludes processed goods—despite these being the main industrial activities in developing countries. Moreover, these studies focus solely on the effects of trade liberalization on exports, ignoring the mechanisms underlying the effects obtained. This study aimed to examine whether and how regional integrations in sub-Saharan Africa contribute to trade in processed goods to fill this gap. We use a structural gravity model estimated with both a Poisson and Bernoulli pseudo maximum likelihood estimators, for exports from 47 sub-Saharan African countries over the period 1976 to 2015 and find that integrations contribute significantly to trade in processed goods than in standardized manufactures and that the observed effects come mainly from newly traded goods (extensive margins). The validation of Linder's hypothesis in general and within integrated zones also shows that pairs of countries with a similar standard of living are those trading more within integrated areas. We also find that regional integrations contribute to trade of intermediate inputs. A more disaggregated analysis at a sectoral level leads to the same conclusions and stress the contribution of intermediate inputs liberalization in this industrialization effect of regional integrations in sub-Saharan Africa.

In the current context of the implementation of the African Free Trade Area, these results are of importance. In the past, most of regional integrations were implemented either on a political perspective to follow the trend. In the

current context of the implementation of the African Free Trade Area, these results have the following policy implications. First, policy makers must invest more in the processing industries instead of promoting traditional exports. This will be beneficial both in terms of exports revenue and structural changes. The bad experience of import substitution industries confirms the idea that industrialization may be a long process, and countries should move lightly the production ladder and invest in standardized industries on in the long run. Second, with the results presented in the study there is a need of making a sector-by-sector analysis for the regional value chains to be effective. Thirdly, policy makers must consider the income difference as well as demand complementarities in designing the liberalization scheme to have positive welfare contribution for all Africa. This can help both industries to easily source in regional or continental intermediates inputs and consumers to rely on local and cheaper processed products (mainly processed food items).

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9. Annexes

Table A1: List of products used for sector level analysis by degree of processing (SITC Rev. 2)

Sectors	Primary Products	Processed products	
		Semi-processed	Processed
Peanut	2221		4234
Wheat	0411; 0412	0460	0483
Wood	2460; 2471 ;2472 ;2479	2481,2482 ;2483 ;2511-19;6341-49 ;6411-19	6351-59 ;6421-6424 ;64281-289
Rubber	2320	6210	6251-6259 ;6281-6289
Cacao	0721	0722; 0723	0730
Coffee	0711		0712
Castor	2235		4245
Coton	2631;2632;2633; 2634	6513	6521-22 ;
Lin	2234		4241
Wool	2681-2687 ;65121	6512	6242-6243
Milk	0223	0224 ; 0240	0230
Barley	0430	0482 ;04841	1123
Palm	2232		4242
Fish	0341 ;0342-0344 ;0350 ;0360		0371 ;0372
Potato	0541		05643
Grapes	0575		11211 ;11212
Sisal	2654		65751-59
Leather	2111 ;2112 ;2114 ;2116	6112-6118	6121-6129
Soja	2222	08131	4232
Sugar	0611	0612	06201 ;06202

Tobacco	1211 ;1212 ;1213		1221-1223
Livestock	0111 ;0112-0116 ;0118		0141 ;0142 ;0149
Bauxite	28737; 28823	52256	6841 ; 68421-26
Coco	05771 ;2231	08137	4243
Rape	2226		42391
Crustaces	0360		0372
Copper	28711-12 ; 28821	68211-13	68221-26
Tin	2876 ;28826	6871	68721-24
Iron	2814-16	67131-33 ;67161-69 ; 67241-67275 ;6782	67311-942
Fertilizers	2711-14		52224;56211-99
Gas	34131;34139;3414		3415;
Coton seed	2223	08133	4233
Nickel	28721-22; 28822	6831	68321-24
Nuts	05772-75		05891-99
Oranges	05711		05851
Grapefruit	05722		05852
Oil	3330		33411-543
Lead	2874;28824	68511-13	68521-24
Rice	04211-12		04221-22
Sesame	2225		42392
Silk	2613-142	65111;65116-17	6541
Tomatoes	0544		05855
Sunflower	2224	08135	4236
Uranium/Thorium	2860		5241;52491-92;6880
Fruits	05712;05721-29;0573-79		05649;0582-86
Vegetables	0542-48		05645;05651;05659;09801
Zinc	2875;28825		68631-34
Cereals	0440;0451-52;04591-99	04811-12	04701-02

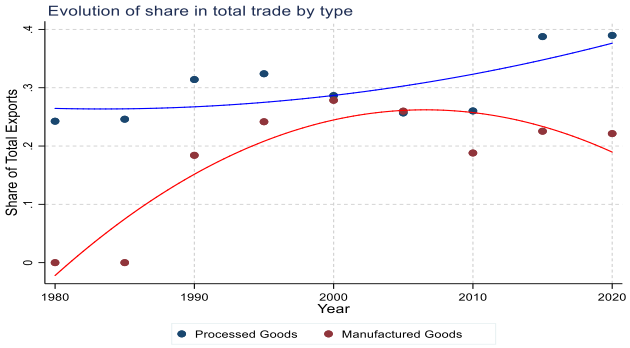
Table A2: Countries included in the study

Zone	Country	Main Regional Integration
East Africa	Burundi, Djibouti, Rwanda Érythrée, Tanzanie, Ethiopie, Seychelles, Madagascar, Ile Maurice, Comores, Kenya, Libye, Madagascar, Malawi,	East African Community - 2000 Common Market for Eastern and Southern Africa – 1994
West Africa	Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, Sao Tomé et Principe	Economic Community of West African States – 1993 West African Economic and Monetary Union WAEMU 1994
Central Africa	Gabon, Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Democratic Republic of Congo	The Economic and Monetary Community of Central Africa CEMAC 1999

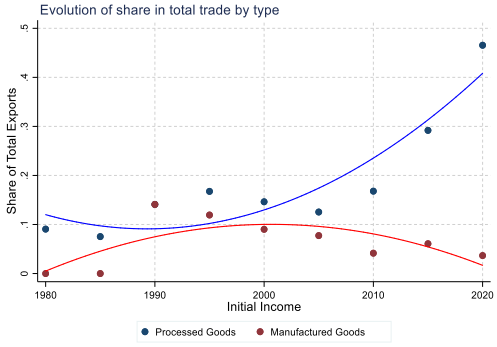
Southern Africa	South Africa, Swaziland, Tanzania, Zambia, Zimbabwe, Botswana, Lesotho, Namibia	Southern African Development Community – 1992 Southern African Customs Union – 2002

Figure 1A: Trend of processed products share in sub-Saharan Africa exports

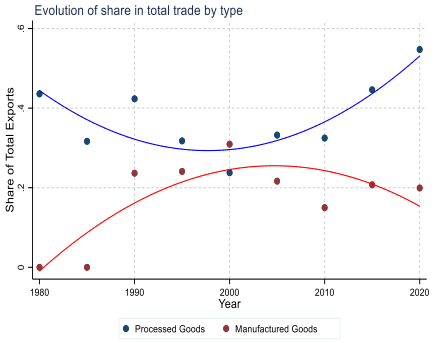
Panel 1: All sub-Saharan Africa



Panel 2: Western Africa

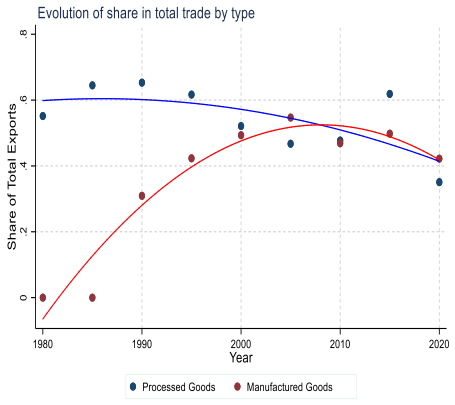


Panel 3: Eastern Africa



Panel 5: Middle Africa Panel

4: Southern Africa



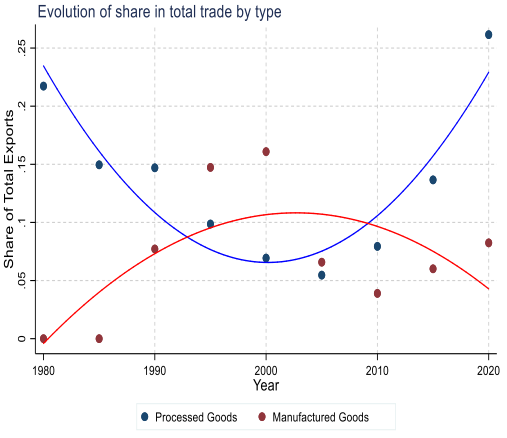


Table A4: PPML estimates for broad sectors, five-years interval data and without countries-pair fixed effects (1990-2018)

	Total Trade		BEC Rev. 4 Classification				SITC Rev.2 Classification			
			Primary		Processed		Agriculture		Manufactures	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample
Contiguity	0.706***	0.726***	1.511***	1.453***	0.735***	0.762***	0.782*	0.789*	1.141***	1.148***
	(0.264)	(0.262)	(0.468)	(0.447)	(0.269)	(0.266)	(0.422)	(0.412)	(0.297)	(0.309)
Common Language	0.318*	0.314*	0.422**	0.390**	0.869***	0.845***	0.577***	0.565***	0.915***	0.898***
	(0.179)	(0.179)	(0.183)	(0.179)	(0.157)	(0.158)	(0.162)	(0.163)	(0.220)	(0.217)
Log of Distance	-0.561***	-0.550***	-0.443	-0.386	-0.945***	-0.929***	-0.815***	-0.798***	-0.442***	-0.459***
	(0.176)	(0.177)	(0.293)	(0.295)	(0.218)	(0.220)	(0.226)	(0.227)	(0.172)	(0.173)
Exporter K/L ratio (log)	0.211***	0.203***	-0.030	-0.015	0.322*	0.327*	0.146**	0.151***	-0.022	-0.028
	(0.078)	(0.076)	(0.078)	(0.079)	(0.179)	(0.180)	(0.059)	(0.057)	(0.116)	(0.115)
Importer GDP (log)	1.033***	0.994***	0.974***	0.930***	1.346***	1.294***	1.012***	0.965***	1.051***	0.923***
	(0.128)	(0.138)	(0.157)	(0.168)	(0.251)	(0.282)	(0.121)	(0.141)	(0.168)	(0.187)
Linder Term	-0.156	-0.155	-0.068	-0.066	-0.086	-0.105	-0.103*	-0.113*	-0.089	-0.124**
	(0.103)	(0.100)	(0.073)	(0.074)	(0.078)	(0.082)	(0.058)	(0.059)	(0.057)	(0.057)
Other EIA	0.521**	0.489**	0.407**	0.360**	0.390*	0.342	0.450***	0.424***	0.636***	0.585***
	(0.215)	(0.214)	(0.182)	(0.179)	(0.221)	(0.235)	(0.151)	(0.152)	(0.150)	(0.157)
SSA RTA	1.248***	1.120***	1.399***	1.088***	0.738***	0.479**	0.919***	0.632***	1.007***	0.773***
	(0.185)	(0.201)	(0.280)	(0.362)	(0.224)	(0.234)	(0.196)	(0.210)	(0.255)	(0.266)
Other EIA*Linder Term	-0.190***	-0.170**	-0.081	-0.053	-0.108	-0.072	-0.153***	-0.135***	-0.196***	-0.149**
	(0.069)	(0.068)	(0.067)	(0.066)	(0.069)	(0.073)	(0.049)	(0.049)	(0.068)	(0.069)
SSA RTA*Linder Term	0.146	0.146	0.256	0.266	0.022	0.047	0.137*	0.135*	0.093	0.145
	(0.112)	(0.113)	(0.162)	(0.178)	(0.097)	(0.102)	(0.074)	(0.074)	(0.095)	(0.095)
Constant	-4.548	-3.747	-4.795	-4.391	-2.553	-1.550	-2.662	-1.788	-5.285	-2.441
	(3.171)	(3.378)	(4.207)	(4.196)	(5.176)	(5.646)	(3.578)	(3.833)	(4.142)	(4.406)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	33,115	16,625	33,047	10,965	33,076	12,215	33,076	12,523	33,292	14,466
ll	-5.11e+08	-4.83e+08	-1.66e+08	-1.50e+08	-1.90e+11	-1.74e+11	-1.43e+08	-1.31e+08	-1.00e+08	-8.93e+07

Standard errors in parentheses * p<0.1, ** p<0.05, *** p<0.01

Table B2: Specification check: PPML estimates for annual and five years average exports (1990-2018)

	Annual Trade data				Average Trade data			
	Processed Products		Intermediates		Processed Products		Intermediates	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample	Full Sample	T>0 Sample
Exporter K/L ratio (log)	0.396***	0.354***	0.397***	0.397***	0.150	0.146	0.258***	0.264***
	(0.119)	(0.117)	(0.060)	(0.060)	(0.098)	(0.099)	(0.093)	(0.093)
Importer GDP (log)	1.121***	1.032***	1.113***	1.074***	1.084***	1.040***	1.178***	1.162***
	(0.187)	(0.208)	(0.111)	(0.123)	(0.205)	(0.220)	(0.115)	(0.120)
Linder Term	-0.022	-0.033	-0.054	-0.063**	-0.155*	-0.146*	-0.129***	-0.130***
	(0.060)	(0.051)	(0.035)	(0.029)	(0.081)	(0.086)	(0.040)	(0.040)
Other EIA	-0.075	-0.113	-0.094	-0.091	-0.266	-0.301	-0.302	-0.311
	(0.199)	(0.201)	(0.130)	(0.124)	(0.207)	(0.210)	(0.203)	(0.202)
SSA_RTA	0.878***	0.227	0.788***	0.082	0.721***	0.190	0.679***	0.126
	(0.242)	(0.194)	(0.217)	(0.156)	(0.245)	(0.188)	(0.200)	(0.163)
Other EIA*Linder Term	0.054	0.091	0.045	0.062	0.090	0.117*	0.052	0.067
	(0.063)	(0.062)	(0.041)	(0.038)	(0.067)	(0.067)	(0.064)	(0.063)
SSA RTA*Linder Term	-0.099	-0.068	-0.015	0.009	0.041	0.073	0.021	0.041
	(0.071)	(0.076)	(0.046)	(0.048)	(0.082)	(0.086)	(0.067)	(0.075)
Constant	-6.050	-3.782	-12.350***	-11.467***	-3.106	-2.135	-12.270***	-11.953***
	(3.877)	(4.254)	(2.427)	(2.657)	(4.117)	(4.396)	(2.504)	(2.606)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	116,944	51,816	138,156	67,189	26,646	16,771	27,598	18,554
ll	-3.40e+11	-2.80e+11	-1.04e+09	-9.29e+08	-4.73e+10	-4.29e+10	-1.39e+08	-1.32e+08

Standard errors in parentheses

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

Table C1: FLEX estimates of the number of exporting sectors

	Processed Products			Narrow Manufactures
	All	Intermediate Consumption	Final Consumption	
	(1)	(2)	(3)	(4)
Exporter K/L ratio (log)	0.194***	0.198***	0.163***	0.160***
	(0.036)	(0.037)	(0.038)	(0.032)
Importer GDP (log)	0.361***	0.386***	0.262**	0.465***
	(0.107)	(0.111)	(0.105)	(0.092)
Linder Term	0.0477	0.0354	0.111**	0.0329
	(0.043)	(0.043)	(0.053)	(0.037)
Other EIA	0.585***	0.590***	0.681***	0.518***
	(0.119)	(0.117)	(0.161)	(0.108)
SSA_RTA	2.021***	2.028***	2.083***	1.816***
	(0.120)	(0.121)	(0.143)	(0.107)
Other EIA x Linder Term	-0.248***	-0.252***	-0.241***	-0.202***
	(0.039)	(0.039)	(0.048)	(0.036)
SSA_RTA x Linder Term	-0.168***	-0.163***	-0.215***	-0.113**
	(0.055)	(0.055)	(0.059)	(0.050)
Constant	-11.23***	-11.73***	-8.987***	-12.18***
	(1.706)	(1.746)	(1.857)	(1.488)
N	32,157	32,157	31,836	32,157
ll	-953.38	-887.89	-1,577.02	-940.48

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01

Table D1: PPML and FLEX estimates for intermediates

	PPML estimates		Flex Estimates
	(1)	(2)	(3)
	Full Sample	T>0 Sample	
Exporter K/L ratio (log)	0.222**	0.227**	0.165***
	(0.093)	(0.093)	(0.032)
Importer GDP (log)	1.267***	1.237***	0.415***
	(0.174)	(0.192)	(0.098)
Linder Term	-0.153**	-0.161**	0.054
	(0.069)	(0.069)	(0.040)
Other EIA	-0.381	-0.421	0.581***
	(0.388)	(0.379)	(0.108)
SSA_RTA	0.694***	-0.013	1.952***
	(0.214)	(0.223)	(0.117)
Other EIA*Linder Term	0.109	0.144	-0.231***
	(0.124)	(0.123)	(0.036)
SSA RTA*Linder Term	0.001	0.013	-0.156***
	(0.074)	(0.091)	(0.054)
Importer FE	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Country-Pair FE=0	Yes	Yes	No

Constant	-14.082***	-13.419***	-12.021***
	(3.538)	(3.873)	(1.528)
N	22,464	12,246	32,157
ll	-1.72e+08	-1.50e+08	-940.48

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01

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