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Powering structural transformation and productivity gains in Africa: The role of global value chains and resource endowments

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Powering Structural Transformation and Productivity Gains in Africa: The Role of Global Value Chains and Resource Endowments[1]

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Abstract

Sixty years ago, many countries in Africa implemented various industrial policies to promote structural transformation and industrialization, all aimed at generating productivity gains. Today, the consensus seems to be that the region has since recorded moderate productivity gains and industrialization remains elusive. Participation in global value chains (GVC) has recently been highlighted as a pathway to fast-track development in terms of productivity gains and structural change in the region. This paper builds on these arguments and investigates how participation in GVC affects aggregate labour productivity growth and its two sub-components: within and structural change. It further examines how this relationship differs with the extent of country's natural resource endowments. The results show that participation in GVCs has a significant positive effect on productivity growth in Africa. This gain is largely through backward participation and is stronger for countries that are further from the productivity frontier. The analysis using the sub-components of productivity growth also shows that GVC participation has a positive and significant effect on productivity growth by inducing an efficient reallocation of resources within sectors (intra-sector reallocation) but not across sectors (inter-sector reallocation). Moreover, these benefits arise mostly in non-resource intensive and non-oil resource intensive countries. Overall, the results indicate that GVC participation matters for productivity growth in Africa but highlights differences in the channel of impact across countries with different natural resource endowments.

Keywords: Global value chains, structural change, productivity, resource endowment, Africa

JEL Codes: C67, F15 O11, O13, O14, O47, O55

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1. Introduction

This paper focuses on the impact of Global Value Chain (GVC) integration and resource endowments on structural change and productivity growth in Africa. Structural change and productivity growth are key and long-recognized features of economic development. In conventional development economics, modern economic development implies changes in the production structure of the economy that allows for the reallocation of resources from less productive traditional sectors to more productive modern sectors (Lewis, 1954; Chenery & Taylor, 1968; Kuznets, 1966; Park, 1989; Foster-McGregor & Verspagen, 2016; Szirmai, 2015). For this reason, in the post-independence era, African political leaders embarked on a structural transformation and industrialization agenda. Policies such as Import Substitution strategies (IS), Structural Adjustment Programs (SAPs) and the UN Economic Commission for Africa (ECA) African Alternative to Structural Adjustment Programs (AASAP) among others were put in place to realize this aim (Geda, Senbet, & Simbanegavi, 2018; Geda, 2018b; Mkandawire, 2001; ECA, 1989). More than five decades later, the consensus seems to be that industrialization in the region remains elusive. Many of the countries in the region have yet to shift enough of their manpower to manufacturing and modern tradable services to the point where these sectors account for relatively high shares of national employment and output (Mensah et al., 2018; De Vries et al., 2015; Rodrik, 2016; Diao et al., 2017; Owusu et al., 2020).

Given these trends in the structure of production of African economies, the recent high growth across the region has demonstrated vulnerability to the risk of reversal (Fosu, 2018; Rodrik, 2018; Diao & McMillan, 2015; Diao, Harttgen, & McMillan, 2017). This in turn has presented challenges to governments in the region in terms of devising policies for promoting the growth-enhancing structural changes needed in order to shift workers from productivity resistant sectors to more productive and dynamic sectors and to diversify exports away from primary commodities. Recent policy discussion in this direction has focused on exploring the potential of global value chains (GVCs) to fast-track this development. In many regards participating in GVCs is seen as an easier route to industrialization in developing countries, particularly in Africa. With global production increasingly sliced into different stages of value-creating activities or tasks that are performed in different cost-saving locations across the world (Grossman & Rossi-Hansberg, 2008), integration into global value chains is providing new windows of opportunity to generate more jobs and increase productivity in dynamic sectors (World Bank, 2020).

This paper is linked to an evolving strand of literature focusing on the relationship between GVC integration and jobs and productivity growth. Writing for the OECD, Jouanjean et al., (2017) report that integration into GVCs can act as a catalyst for the process of economic transformation and productivity growth by hastening the reallocation of resources to higher productivity tasks and sectors. Sen (2019) finds that trade integration positively impacts on employment in developing countries via the scale and composition of production effect but has a negative impact via the labour intensity effect[2]. Lopez-Gonzalez (2016) finds a positive effect of intermediate imports on employment and

[2] Sen (2019) defines the scale effect as the increase in manufacturing employment that occurs purely as a result of the increase in aggregate manufacturing output. The composition effect on the other hand is defined as the increase in

value added, with particularly strong effects in services, albeit only in the short-run. In his contribution, Baldwin (2014) finds evidence of an initial productivity-enhancing and employment creation effect of GVC integration, but a possible stunted development in the long run as GVC integration makes industrialization less meaningful since capacity building and upgrading through GVCs is not guaranteed as most value-added in the supply chain is captured by large multinationals in developed countries.

Contrary to the relatively positive but mixed picture painted above, UNIDO (2017a, 2017b) reports that integration in GVCs will not unambiguously strengthen growth-enhancing structural change and that for some countries integration in GVCs could accelerate the de-industrialization process, as was evident in the case of non-central European countries. Stöllinger (2017) reports statistically weak support for a positive impact of GVC related trade on structural upgrading. Additionally, Rodrik (2018) asserts that the technologies associated with GVC participation are providing diminishing possibilities to substitute other factors of production with unskilled labour, suggesting that developing countries such as those in Africa may not be able to take advantage of GVC participation to create employment opportunities in modern and productive sectors. In a recent study, Pahl & Timmer (2019) find strong evidence for the positive effects of GVC integration on productivity growth in the formal manufacturing sector. The authors, however, found no evidence on employment creation.

In their study, Criscuolo and Timmis (2017) and Pahl and Timmer (2019) argued that little is known about the link between the broader aspects of GVC integration, structural change, and productivity, especially in developing countries, such as those in sub-Saharan Africa (henceforth SSA). The crucial role of resource endowments is also largely ignored in these extant studies. Accounting for the role of resource endowments in this relationship is important for several reasons. Resource endowments are often an important determinant of a country's comparative advantage in trade, participation in GVCs, the type of GVC activity undertaken (in terms of the sector and positioning within the GVC) and are consequently a potential factor in the scale, timing or pattern of a country's industrialization or any other form of structural transformation that it might undergo at particular stages of its development (IMF, 2012; World Bank, 2015). The Heckscher-Ohlin theory also suggests that a country's factor endowments determine the relative costs of production and hence the pattern of specialization in GVC integration and exports. Consequently, the pattern of a country's GVC integration and the resultant productivity growth and structural change it may undergo are a function of its resource endowments (Krugman, 1980; Schott, 2008).

As highlighted in Pahl and Timmer (2019: 14-16) and also stressed, for example, in Havranek & Irsova (2011) and Ivarsson & Alvstam (2010) resource-intensive countries, particularly from developing countries are likely to experience different dynamic upgrading in GVCs. They engage differently in GVCs as forward suppliers, selling raw materials or basic inputs in the value chain which limits their opportunity for upgrading through GVC. Conversely, non-resource intensive countries on the other

manufacturing employment that results from the shift in the composition of output from capital-intensive sectors to labour-intensive sectors. The labour intensity effect occurs when there is an increase in the demand for labour without a corresponding increase in output.

hand participate more through backward participation. These sets of countries are therefore able to import essential intermediates needed for quality upgrading, boosting productivity, and economic diversification.

For many years, economists have also held the strong view that resource-intensive countries, particularly oil resource-intensive countries, could suffer negative long-term growth effects due to the so-called Dutch Disease phenomena, which brings about the appreciation of the exchange rate. Based on this, Sachs and Warner (2001) considered natural resources to be a 'curse' for development rather than a potential driver of development. For this reason, the rapid expansion of an economy's resource-intensive industries and the export of goods from these industries in the value chain was thought to lead to an increasing 'commoditization' of the production structure, supplying basic inputs in the value chain (Venables, 2016), with a subsequent slowdown of the transition to other more technologically dynamic and productive industries and fields of production.

In a recent paper, however, Katz and Pietrobelli (2018) argued that over the past two decades, resource-intensive industries, particularly non-oil resource-intensive industries, have become an important source of growth and innovation due to the technological transformation going on in the sector, primarily due to a rapid expansion of world demand and the drastic transformation in the way in which these commodities are being produced, exported and consumed which nowadays involves several agents comprising manufacturing enterprises producing the basic commodity – minerals, timber and forestry products, soybean oil among others – their suppliers of production equipment and engineering services and the public sector regulatory agencies monitoring their environmental impact. The above discussion shows that the impact of resource endowments on the GVC-productivity growth relationship remains unclear.

Existing studies have also paid little, if any, attention to countries in SSA due to data limitations. The use of proxy measures of GVC further adds to the limitation in extant studies. For this reason, little if anything is known of the mechanisms benchmarking the non-conclusive findings of what drives potential GVC associated productivity changes and structural change. This gap in the literature calls for improvements in the measurement of GVC integration and its subsequent impact on productivity and structural change in SSA and the mechanisms underlying such a potential relationship.

GVCs can stimulate productivity gains through different channels. First, integration into GVCs provides firms and countries with important opportunities to access international markets, access higher quality and sophisticated intermediate inputs, and benefit from knowledge spillovers and pro-competitive effects of global competition to stimulate productivity gains and expand the scale of exports (Criscuolo & Timmis, 2017; Constantinescu et al., 2019; Collier & Venables, 2007; Schott, 2008; Ndubuisi & Owusu, 2021). There are a number of ways through which GVCs may impact upon productivity, some of which would be captured by (or impact on) the within effect and others the between effect (structural change effect). In terms of the former, to participate in GVCs, global lead firms require their suppliers (entrant firms) to have certain technological and managerial capabilities to enter and remain competitive in the value chain. Firms need specific capabilities for the specific GVC functions and activities they perform in the value chain. To remain competitive in the value

chain, firms have to introduce new technologies, adopt a mix of innovations, change their organizational structure and engage in the skill upgrading of their workers to utilize equipment and information efficiently. A great deal of industrial upgrading is involved in this process.

For instance, a typical GVC could involve process upgrading whereby production systems are made more efficient through the adoption of superior technology and through product upgrading in which firms move into more sophisticated product lines. The process involved in GVC participation could also involve functional upgrading in which firms within an industry acquire new functions such as moving from performing assembling activities to product design and redesign, logistics, after-sales services and repairs that facilitate the movement of workers into more sophisticated business functions in GVCs over time. (Humphrey & Schmitz, 2002; De Vries et al., 2019). All these processes and activities in GVCs involve industrial shifts in employment shares and value-added creation within industries, particularly in more knowledge and capital-intensive industries. This efficient reallocation of resources within sectors ultimately affects the performance of these firms (Lall, 1992; Morrison, Pietrobelli, & Rabellotti, 2008; Newman et al. 2016).

In terms of the latter, participating in GVCs can act as a catalyst for growth-enhancing structural change, allowing for the shifting of resources into more productive and dynamic sectors of the economy (movement of resources across sectors) (Baldwin, 2012, 2016; Allard et al., 2016; UNIDO, 2017b, 2017a; Criscuolo & Timmis, 2017; Jouanjean et al., 2017)[3]. This happens through chain or inter-sectoral upgrading, whereby firms move into completely new categories of production altogether (cf. Humphrey & Schmitz, 2002).

To understand better the relationship between GVCs, productivity gains, and structural change in countries in SSA, the paper first computes indicators of GVC participation using the Eora Input-Output (IO) database. In our analysis, an aggregate GVC participation index is the main explanatory variable of interest. However, to present more comprehensive evidence on the relationship above and because we are interested in the mechanisms through which participation in GVCs can impact productivity growth, we also consider the independent effects of backward and forward participation. Second, the paper decomposes labour productivity growth using a structural decomposition model (shift and share method) and examines the extent to which GVC participation affects productivity growth through the two channels—i.e., the contribution from structural change (between) and from the within effect. We also test if participation in GVCs offers more opportunity for learning, particularly for laggard countries as in Pahl and Timmer (2019).

In addition to the above, the need to understand how GVC integration could power structural change and productivity gains in SSA is crucial given the gains from trade and recent trends in GVC participation on the one hand and against the backdrop of the recent globalization backlash in advanced economies and growth of automation on the other. The World Bank WDR (2020) reports that value chains have matured, making further specialization more challenging. The push toward

[3] UNIDO (2018) Forum on Globalization and Industrialization: https://www.unido.org/news/driving-structural-change-through-global-value-chains-integration: accessed on 10/04/2018.

trade liberalization has also stalled. These concerns have raised the question of whether an important route for Africa's industrialization take-off is now all but closed (The Economist, 2017), or whether in all this there is a reason for optimism, with Africa retaining a significant potential for long-term productivity gains in more dynamic and non-productivity resistant sectors through GVC integration, especially at a time when the region itself is moving towards becoming a free trade area under the African Continental Free Trade Area (AfCFTA).

To this end, the paper contributes to the literature by examining for the first time the impact of GVC participation on labour productivity growth and its two components—the within and structural change components—across countries in SSA with different natural resource endowments using a representative sample of SSA countries that together contribute about 80 percent of the region's gross domestic product, for the period 1990 to 2015. Previewing our results, we find evidence that participation in GVCs has had a positive and significant effect on productivity growth in Africa, but strongly through backward participation, with the effects being stronger for countries in the region that are further from the productivity frontier. Results from the analysis of the two components also show that GVC participation has a positive and significant effect on the within component by inducing an efficient reallocation of resources within but not across sectors. These benefits arise mostly in non-resource based and non-oil resource exporting countries. Overall, the results indicate that GVC participation matters for productivity gains in Africa, but points to potential variation in the channel of impact across countries with different natural resource endowments.

The remainder of the paper is structured as follows. Section 2 discusses the data and adopts a framework to group countries according to their natural resource endowments. The section then documents and examines SSA's integration into GVCs across the framework of country groupings. Section 3 discusses the econometric model, methodology and data. The section also discusses patterns of structural transformation and productivity growth across the framework of country groupings. Section 4 discusses the main econometric results. Section 5 rounds up with conclusions and policy implications of the paper.

2. Constructing Global Value Chains Data

To compute the GVC indicators, we draw on the latest release of the Eora MRIO I-O database of the University of Sydney[4] which is a set of input-output tables covering 26[5] sectors in 187 countries for the period 1990-2015, providing the largest coverage of countries (including developing countries and countries in SSA) that we are aware of. The database is widely used (see World Bank WDR, 2020; UNCTAD, 2013; Islam et al., 2017 for the IMF; Ndubuisi & Owusu, 2021) and the reliability and accuracy of the Eora database are discussed in detail in Lenzen et al. (2013) where it compares very well with comparator databases such as the GTAP database, OECD–WTO data and the WIOD database (UNCTAD, 2013).

[4] Data is downloadable here https://worldmrio.com.
[5] In our study we use 25 sectors over the period 1990-2015.

The columns of the MRIO table reports information on the sources (both foreign and domestic) of a sector's intermediate goods whiles the rows report where a sector supplies intermediates to. The difference between the gross output produced in a country and the sum of the domestic and foreign inputs necessary for its production yields the value-added generated in a country (UNCTAD, 2013). The information given by an MRIO can be translated into a standard IO matrix form by stacking all industries and countries, such that we have (n x i) rows and columns with n and i representing the number countries and industries repectively (Miller & Blair, 2009; Foster-McGregor et al., 2015). Borrowing the notation in UNCTAD (2013), gross output is as follows;

$$X = T + y$$

$$X = Ax + y$$

$$X = (I - A)x = y$$

$$X = (I - A)^{-1}y \quad = \quad Ly \qquad (1)$$

Where X is gross output, T is intermediate demand, y is final demand[6], I is the identity matrix, A is the technical coefficient matrix measured as the ratio of intermediate use to gross output and L is the Leontief inverse.

We follow Hummels et al. (2001), Koopman et al. (2011, 2014), Foster-McGregor (2015) and Aslam et al. (2017) to calculate trade in value-added, defined as the value-added embodied in gross trade flows. Three components are needed to calculate trade in valued-added (Tva), namely; the Leontief inverse matrix (L), a row vector or matrix, (V), with each element showing the share of value-added[7] per unit of output by country and industry, and a row vector or matrix, (E), with each element reporting aggregate gross exports (i.e., sum of intermediates inputs exported abroad and exports of final goods). The Leontief matrix is recovered from the technical coefficients matrix (A) and obtained by summing across rows of the (A) matrix and subtracting all the elements on the diagonal of the square matrix from an identity matrix.. Tva is arrived by multiplying the two components L and V, and the diagonalized row vector of the total gross exports matrix (E)[8] (Aslam et al., 2017; Foster-McGregor et al. 2015) and is given as:

[6] In Eora, 6 components make up final demand (FD): Household final consumption, Non-profit institutions serving households, Government final consumption, Gross fixed capital formation, Changes in inventories, Acquisitions less disposals of valuables.

[7] There are 6 components that makes up the value added in Eora—compensation of employees, taxes on production, subsidies on production, net operating surplus, net mixed income, consumption of fixed capital.

[8] Each element on the diagonal of the gross export matrix gives the gross exports (sum of intermediate inputs exported and final demand exports) for corresponding country and industry.

$$\begin{bmatrix} Tva^{11} & \cdots & Tva^{1n} \\ \vdots & \ddots & \vdots \\ Tva^{n1} & \cdots & Tva^{nn} \end{bmatrix} = \begin{bmatrix} V^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & V^n \end{bmatrix} \begin{bmatrix} L^{11} & \cdots & L^{1n} \\ \vdots & \ddots & \vdots \\ L^{n1} & \cdots & L^{nn} \end{bmatrix} \begin{bmatrix} E^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & E^n \end{bmatrix} \quad (2)$$

with V^n and E^n as (i x 1) diagonalized row vectors of value-added shares per unit of output and gross exports for each industry and country n, respectively. L^{nn} is the (i x 1) Leontief inverse of country n. Given Tva, we decompose and compute the indicators for GVC participation. First is the indirect value-added (DVX), which is the row sum of the Tva matrix divided by gross exports, excluding diagonal terms, and is defined as the share of value-added used in the exports of third countries. DVX is used to measure forward participation. The second indicator is foreign value-added (FVA) in exports, which is the column sum of the Tva matrix, excluding diagonal terms, divided by gross export and is defined as the share of foreign value added used in a country's exports of the same GVC. FVA is used to measure backward participation. A country's overall rate of linkages to a GVC is the sum of the share of FVA and the share of DVX. The indicators are constructed at the country-industry level[9]. This is a standard measure of GVC participation (UNCTAD, 2013; Foster-McGregor et al., 2015; Kummritz et al., 2017; Nduduisi & Owusu, 2021). It acknowledges that countries and firms participate in GVC either as "buyers" or "sellers" or both (see for example in UNCTAD, 2013; Foster-McGregor et al., 2015; Kummritz et al., 2017)[10].

2.1 Classification of Countries by Natural Resource Endowment

The study adopts the classification used in Allard et al. (2016) in grouping countries according to their natural resource endowments. Resource intensive countries are those for which non-renewable resource exports are 25 percent or more of goods exports on average (Allard et al., 2016: p. 2). The classification first divides countries in SSA into countries that are resource-intensive and countries that are not. It then differentiates within the first group, resource intensive countries that are oil exporters and those that are not. This results in three non-overlapping groups of countries represented in Table 1 below.

[9] For purposes of exposition equation 3 is at the country level, but in the analysis, the indicators are constructed at the industry level.

[10] More generally, some studies either focus on backward participation (Pahl and Timmer, 2019) or forward participation (Baldwin and Lopez-Gonzalez, 2015) as a proxy measure for GVC participation. In most cases, studies that use either of these measures, as opposed to the standard measure we use in our study, often cite a dearth of data and the objective of the study as the rationale for adopting these proxy measures. For example, Pahl and Timmer (2019) used only backward linkages (FVA in our case) as a proxy measure of GVC. In their paper (see page 5) the authors acknowledge the limitation of using this approach. Using their approach only captures a country's backward participation into GVC and ignores completely the country's forward participation in GVC and therefore gives a less than complete picture of a country's overall GVC participation. The authors mentioned that their measure of GVC is not well suited for analysis that involves many countries that are mostly involved with upstream activities in the value chain as sellers. In our case, we are interested in the benefits of participation in GVC, which can either be through backward and/or forward integration.

Table 1: Classification of countries by natural resource endowment

Natural Resource Endowment Group	Country
Oil-Exporters	Angola, Cameroon, Chad, Congo (Republic of), Equatorial Guinea*, Gabon and Nigeria
Non-Oil resource intensive countries	Botswana, Burkina Faso, Central African Republic, DRC, Ghana, Guinea, Mali, Namibia, Niger, Sierra Leone, South Africa, Tanzania, Zambia, Zimbabwe
Non-resource intensive countries	Benin, Cabo Verde, Comoros*, Cote d'Ivoire, Ethiopia, Eswatini, Gambia, The, Guinea-Bissau*, Kenya, Lesotho, Senegal, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Togo, Uganda

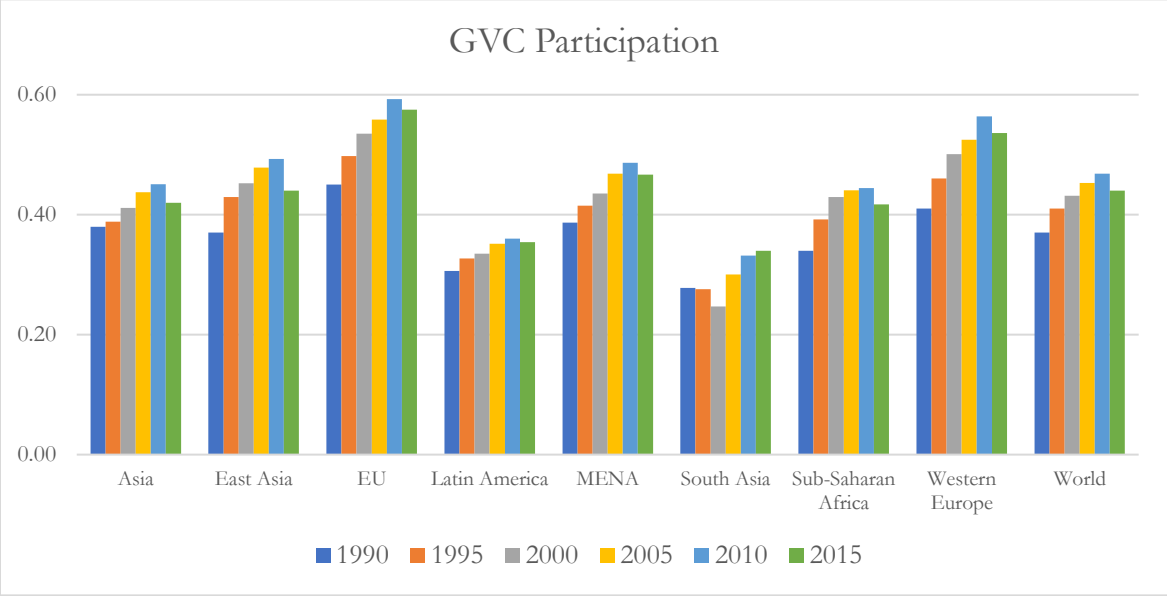
Note: *Data is not available for these countries.

2.2 Participation in GVC: Africa Compared to the World

Countries participate in international trade by sourcing intermediate inputs to be used in their exports (backward participation or foreign value added in exports) or by supplying intermediates inputs to be used in the exports of third countries (forward participation). Combining these two components gives an indication of countries overall GVC participation and a clear picture emerges. The picture emerging from Figure 1 is clear and it suggests that the world has become more integrated in trade. Between 1990 and 2010, participation in GVCs in the world increased by 10 percentage points, from 37 percent in 1995 to 47 percent in 2010. In terms of regions, Sub-Saharan Africa's GVC participation is very encouraging. The region is heavily involved in GVCs, generally as high as those of their counterparts in other developing countries in South Asia, East Asia, and Latin America. Our finding is in line with the finding of Foster-McGregor et al (2015) and World Bank (2020). Overall participation in GVCs, however, has been highest in the countries of EU[11] while it has been lowest in South Asia and Latin America, although increasing. GVC participation in the EU increased from 45 percent in 1990 to 59 percent in 2010. In South Asia, GVC participation increased from 28 percent in 1990 to 33 percent in 2010.

[11] Four factors could explain these variations, namely, size, geography, economic openness, and transport infrastructure. In contrast to countries in other regions, typically, many countries in Europe are small (in terms of population), open economies geographically close to each other and closer to larger European markets such as Germany and linked by very good transport infrastructures. These factors are undeniably pre-conditions for higher integration into GVCs and explain Europe's strongest and highest participation in GVCs compared to other regions of the world allowing countries in the region to easily source inputs from each other to be used their exports. At one extreme Criscuolo & Timmis, (2017: 63) reported a GVC participation rate of 71% for Luxembourg and 31% for New Zealand and argued that small open economies such as Luxembourg that are close to larger foreign markets in the EU are more likely to be more integrated into GVCs compared to large and remote countries in other regions (OECD, 2013a).

Figure 1: Participation in GVC: Africa compared to the World (1990-2015)



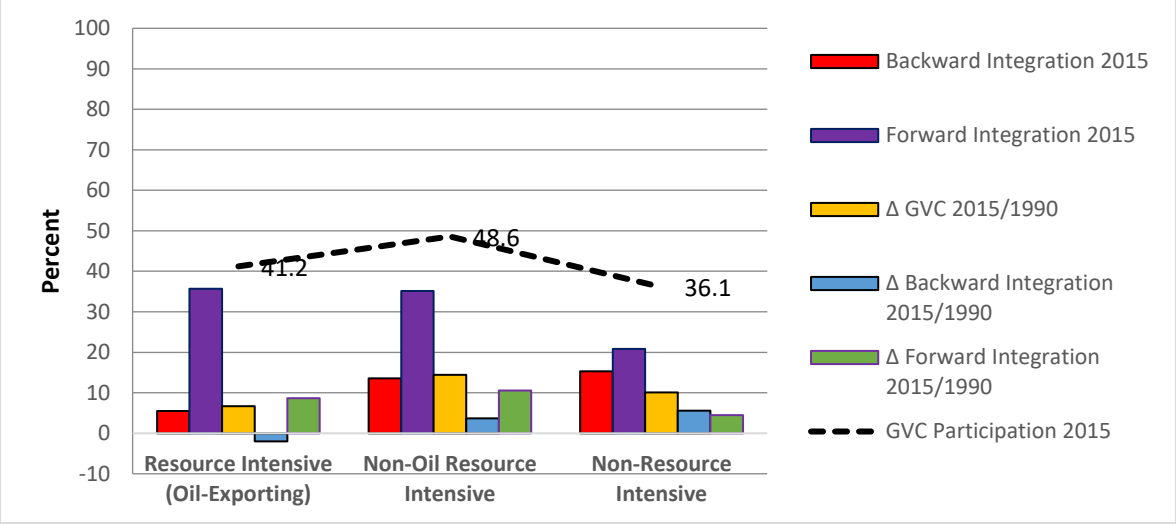
Source: Author's calculation based on UNCTAD-Eora GVC Database

Emerging evidence, however, suggests that the proliferation of GVCs overall may have stalled since 2010 after a brief recovery from the dip during the global financial crisis of 2008-9. Between 2010 and 2015, GVC participation at the global level dropped by 3 percentage points, 2 percentage points in sub-Saharan Africa and Western Europe, 3 percentage points in Asia, 4 percentage points in East Europe, and a percentage point in Latin America (see Figure 1). Other studies have confirmed this. Hoekman (2015) finds that world trade, particularly, trade in intermediate inputs has stagnated since 2011. Criscuolo & Timmis (2017), Timmer et al (2016), UNCTAD, (2018), and recently the World Bank WDR (2020) have all confirmed this. The slowdown of GVC activities is a reflection of what is going on with global trade in general. "In the aftermath of the global financial crisis of 2008-09, global trade has not grown at the same rate as in previous years"(Georgieva et al., 2018: 1). Between 1985 and 2007, global trade grew at an average of 6 percent, but since 2012 this growth has reduced to 3.1 percent. Factors such as a shift towards increasing protectionism, limited progress in multilateral and bilateral trade policy negotiations, automation and the possiblility of increased reshoring, weak demand in response to the crisis, declining commoditiy prices, macroeconomic rebalancing in China and the fact that existing chains may have matured making further expansion difficult are cited as among potential explanations for the decline or reversal in the international fragmentation of production. Investigating the driving factors influencing these trends in GVC participation is beyond the scope of this paper although it remains an interesting area for future work. For a comprehensive overview of the factors and policies behind global trade slowdown see (Georgieva et al., 2018, World Bank, 2020).

2.2. Resource Endowment and GVC Participation in Africa

This section presents the findings of the analysis of the association between natural resource endowments and the participation of countries in GVCs. We compare trends in resource-intensive countries as a group to those in non-resource intensive countries. Despite being relatively well-integrated into GVCs, similar to the levels of comparator developing countries, the level and dynamics of linkages to the regions' GVCs participation vary substantially between the resource-intensive and non-resource intensive country group. Specifically, GVC participation is substantially higher in the resource-intensive group than in the non-resource intensive group. For this group and the region in general, the comparative advantage in GVC participation predominantly lies in forward participation in the value chain (Figure 2).[12] However, the strong forward participation of the resource-intensive countries, particularly in the oil resource-intensive country group, is associated with predominantly upstream activities of the value chain such as extraction and the export of raw materials (such as crude oil, natural gas, minerals) as basic inputs in the value chain. This comes with a risk as it exposes countries in this resource group to global commodity price volatility. Also, given that GVC participation of oil-resource intensive countries in the region via backward integration is the lowest amongst all resource groups in the region (see Figure 2), and declining, means this set of countries risks missing out on importing essential intermediates needed for quality upgrading, productivity, and economic diversification. Similar to the global trend, we see a decline in the proliferation of GVC activities across all resource groups since 2010 (see Figure 3A and Figure 3B and 3C in appendix).

Figure 2: Performance in GVC by resource groups in Sub-Saharan Africa



Source: Author's calculation based on UNCTAD-Eora GVC Database
Note: Chart is based on weighted average data.

[12] Except for countries in the EU where backward linkages dominate, this phenomenon is also observed in other developing countries where forward participation remains the highest contributor to GVC participation (see Table 1A and 1B).

While substantial differences exist between the resource groups in their participation rates and changes in these rates, both sets of indicators vary substantially across countries within each group. Observations in the non-oil resource group show, for example, that DRC has greater participation rates in GVCs than South Africa and Zambia (see Figure 2). Likewise, within the same group, participation rates are higher for South Africa than for Zambia. The participation of South Africa and Zambia in GVCs is heavily through backward participation (see Figure 2A). In non-resource intensive (resource poor countries), participation also varies across countries within the group. Similar to some countries in the non-oil resource-intensive group (South Africa, Zambia), countries within this group participate largely through backward participation (see Figure 2B). These sets of countries are therefore able to import essential intermediates needed for quality upgrading, productivity improvements and economic diversification. This is not the case in oil-resource intensive countries where forward participation dominates the GVC participation of countries within the group, which may limit the opportunity for upgrading in these countries (see Figure 2C).

Figure 2A
Non-Oil Resource Intensive Group

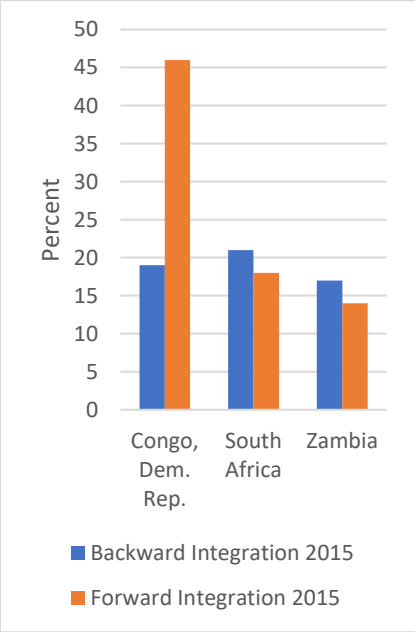


Figure 2B
Resource-Poor Group

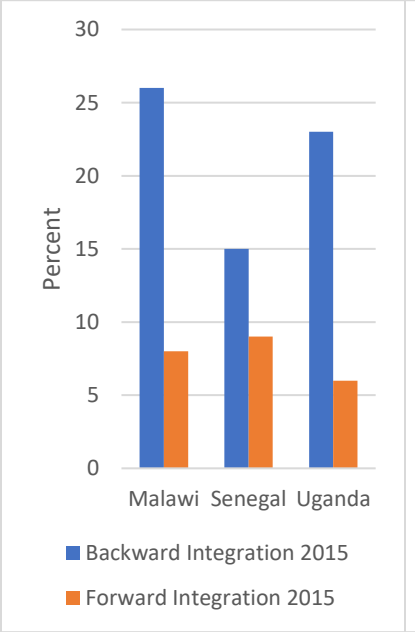
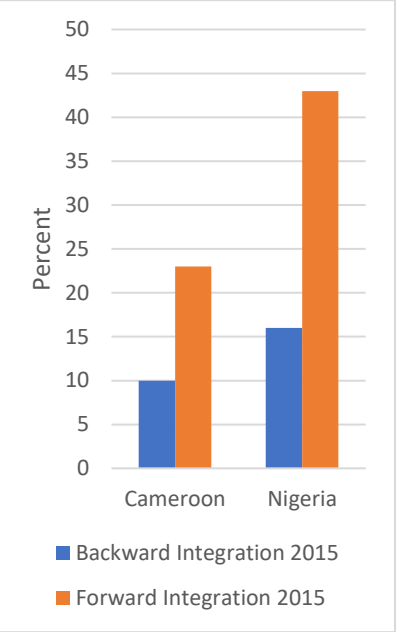


Figure 2C
Oil Resource Intensive Group



Source: Author's calculation based on UNCTAD-Eora GVC Database
Note: Chart is based on weighted average data.

3.0 Methodology and Data

3.1 Shift and Share Decomposition

This section of the paper examines the extent to which participation in GVCs affects productivity growth in SSA through the channels discussed above by regressing the three dependent variables (productivity growth, contribution to productivity growth through the within effect, and through the

structural change effect) on GVC participation. To do this, we first employ the well-known productivity growth (shift and share method) decomposition (Fabricant, 1942; Mensah et al., 2018; De Vries et al., 2015; McMillan & Rodrik, 2011) to decompose productivity growth into the contribution from the within and the structural change effect. The structural shift and share model is given as follows:

$$\dot{lp} = \sum_{i=1}^{N}\left[\frac{lp_i^t - lp_i^0}{lp^0}\right]x_i^0 + \sum_{i=1}^{N}\left[\frac{(x_i^t - x_i^0)\times(lp_i^0 - lp^0)}{lp^0}\right] + \sum_{i=1}^{N}\left[\frac{(x_i^t - x_i^0)\times(lp_i^t - lp_i^0)}{lp^0}\right] \quad (3)$$

Where $\dot{lp}$ is labor productivity growth of sector i in time t, given by $lp_{it} = {}^{z_{it}}/_{c_{it}}$, z_{it} is sector i's value-added, c_{it} is the number of persons engaged in sector i and x_{it} is the sectoral share of employment in sector i at time t, with N being the number of sectors. The first component on the right-hand side is the sum of each sector's within-sector labour productivity growth, weighted by the sector's initial labour share in the economy. In other words, it is that part of overall productivity growth that is attributed to, among other things, the introduction of new technology, changes in organisational structure, downsizing, reallocation of resources within sectors and increased competition (Disney, Haskel, & Heden, 2003). The second component is the structural change or between effect. It has two components. The first term captures whether workers move to sectors with above-average productivity. The second term—the interaction/dynamic reallocation effect—measures whether productivity growth is higher in sectors that are expanding in terms of employment shares. Employment and value-added data for the decomposition is based on a newly constructed dataset, the Extended Africa Sector Database (Mensah & Szirmai, 2018).

Based on the above, it is instructive to further test whether the effect of GVC on productivity growth and structural change differs depending on whether a country/sector is engaged in forward or backward participation. In this regard, the nascent literature has reported high positive productivity and upgrading gains to firms and industries through backward linkages and less so for other channels (Ndubuisi & Owusu, 2021; Pahl & Timmer, 2019; Iršová & Havránek, 2013). A case study of the textile and garment industry in Bangladesh has suggested that increasing the share or content of foreign intermediate inputs (backward integration) can be a good source of increased productivity (see Mottaleb and Sonobe, 2011; Pietrobelli and Rabellotti 2011).

3.2 Econometric Model

The resulting regression model takes the following form:

$$\dot{lp}_{ist} = \beta_0 + \beta_1 GVC_{ist} + \beta_2 C'_{ist} + \gamma_i + S_s + u_t + \varepsilon_{ist} \quad (4)$$

$$\dot{lp}_{ist} = \beta_0 + \beta_1 FVA_{ist} + \beta_2 DVX_{ist} + \beta_3 C'_{ist} + \gamma_i + S_s + u_t + \varepsilon_{ist} \quad (5)$$

where $\dot{lp}$ is labour productivity growth or depending on the specification labour productivity growth attributable to the within or structural change/between effect, GVC is the global value chain integration indicator, FVA is the share of foreign value-added component used in a country's exports, and DVX the share of a country's value-added used in the export of third countries. The subscript i refers to country, s to sector, and t to time period, while γ_i capture country fixed effects, S_s sector fixed effects, u_t period fixed effect, and ε_{it} is the idiosyncratic error term. C'_{it} is a vector of control variables that includes human capital, measured by the gross secondary school enrolment rate, the quality of institutions (regulatory quality), and inflation rate (Pahl & Timmer, 2019; Zhu & Fu 2013), with data on these variables sourced from the World Bank's World Development Indicators. We use cluster-robust standard errors to control for serial correlation and heteroscedasticity.

Given the fact that integration into the global production network could have divergent impacts on the structural developments and productivity growth of countries in different resource endowment groups as discussed in section 1, we run a baseline regression for all country groups in our sample and separately for the split samples of the natural resource groups according to the definition in Table 1. For instance, it is found in the literature that the association between GVC participation and labour productivity growth is lower in the resource-based exporting countries (Pahl & Timmer, 2019: 14-16; Havranek & Irsova, 2011; Ivarsson & Alvstam, 2010). Also as shown in Figures 2, 2A, 2B and 2C, similar to some countries in the non-oil resource-intensive group (South Africa, Zambia), resource-poor countries participate more through backward participation. These sets of countries are therefore able to import essential intermediates needed for quality upgrading, boosting productivity, and economic diversification. This is not the case in oil-resource intensive countries where forward participation dominates GVC participation of countries within the group which limits the opportunity for productivity growth and upgrading for these countries.

For the estimation strategy, we first utilize panel fixed-effects models (FEM). One of the empirical challenges we face is that GVC participation may be endogenous. We anticipate our model to suffer from potential endogeneity, particularly because of reverse causality. Higher productivity growth may be a pre-requisite for higher GVC integration and vice versa. Our GVC indicators may also be endogenous due to other confounding factors such as omitted variable bias. As a caveat, therefore, the results we obtain using the FEM show an association between GVC integration and the outcome variables rather than a causal effect. To reduce the scale of this concern, we lag the GVC participation variables by one period. Moreover, besides mitigating the reverse causality concern, this empirical approach enables us to account for the time needed for knowledge and technology acquired through GVC participation to be used in industrial activities that would lead to productivity gains. To completely address this empirical challenge and claim a causal relationship from our estimates, we complement the FEM estimation with an instrumental variable (IV) method and report the results alongside those of FEM.

As instruments for GVC participation, we propose two instruments: a remoteness index and the weighted average GVC participation index for other countries. Beginning with the former, the remoteness index has been argued in the literature to be a theoretically consistent approximation for

relative trade costs which hugely affects a countries' participation in international trade (Head 2003; Brun et al 2003; Santos Silva & Tenreyro, 2006). In particular, countries that are more remote from the rest of the world are likely to participate less in the global trade network but will trade more with close neighbours that are also remote from the global trade network (Brun et al. 2005). In a recent study, Antras and de Gotare (2020) also showed that the participation of countries in GVCs is determined by their remoteness from the rest of the world. Consistent with this view, we argue that a country's remoteness from the rest of the world affects the extent to which it participates in GVCs but not the country's productivity and structural change, at least not directly.

To compute the remoteness index (RT), we use the CEPII gravity dataset that shows the annual GDP of different countries and the universe of distance (in kilometres) between country-pairs (Meyer & Zignago, 2011). Our computation of the index then follows Head (2003) and Brun et al. (2005), who compute the index as: $RT_{it} = \sum_j z_{jt} D_{ij}$, where $z_{jt} = Q_{jt} / \sum_j Q_{jt}$, D_{ij} is the distance in kilometers between country *i* and partner country *j* (other countries in the world), and $Q_{i(j)t}$ is GDP of country *i*(*j*) at time *t*.

The second instrument, the weighted GVC participation for other countries is computed as $w\_GVC_{it} = \sum_{j \neq i} GVC_{jt} D_{ij}$ where GVC_{jt} is the level of GVC participation of every other country *(j)* in the world in time *t* weighted by the distance in kilometres between country *i* and *j* given by D_{ij}. The latter is done to avoid our indicator being constant across countries. In other words, we use a distance weighted GVC indicator as our second instrument. For the relevance of this instrument, we build on the policy diffusion argument which is that countries learn from their neighbours. In which case, to the extent that high GVC participation reflects the existence of GVC friendly policies, other things equal, closely related countries are more likely to adopt similar policies, but this policy adoption effect decays with distance. Consistent with this view and to claim the validity of our chosen instrument, we assume that such trade costs affect a country's participation in GVC but not productivity and structural change, at least not directly.

3.3 Patterns of Structural Transformation and Productivity Development in Africa

Table 2 below shows the results of the shift-share decomposition showing patterns of structural transformation and productivity developments across the natural resource groups in Africa over the period 1960s-2015. The analysis is broken into periods to reflect the role of economic policies in post-independence Africa in explaining the observed patterns and why recent policies have focused on GVCs as an alternative path to bring about growth-enhancing structural change. The post-independence era in Africa was greeted with very much euphoria and optimism as most African political leaders embarked on structural transformation and industrialization agenda. As Geda, Senbet, & Simbanegavi (2018), Geda (2018b) and Mkandawire (2001) have highlighted, the leaders were eager both in intent and practice to transform the region into an industrial hub by putting policies in place that will guide this process. An outcome of this intent at the policy level was the import substitution strategy (IS) that was pursued by almost all the economies in the region between the period 1960 and

1975. Whiles it is usually argued in the literature that the IS was a policy failure (see Geda, 2018a; Mkandawire, 2001), our results, however, gives a contrary account. The region and all the resource groups recorded one of the best productivity growth rates during this period with a substantial contribution from structural change, particularly in non-resource intensive and non-oil resource intensive countries (see also de Vries et al. 2015; Mensah et al. 2018). Ellis (2002) described the period between 1960 and 1975 as the golden age of Africa's growth performance—with an annual average GDP growth rate of 6%.

Table 2: Contribution to Productivity Growth in Sub-Saharan Africa, by Resource Endowment Groups: Results from Shift and Share Method

Natural Resource Endowment Group	Period/Era	Total Productivity Growth	Within	Between Static	Between Dynamic	Structural Change
Oil exporters	1960-1975	5.3%	4.7%	0.8%	-0.1%	0.6%
	1975-1990	2.3%	2.0%	0.4%	-0.1%	0.3%
	1990-2000	1.3%	-0.1%	1.6%	-0.2%	1.4%
	2000-2015	1.8%	0.9%	0.9%	0.0%	0.9%
Non-Oil resource intensive countries	1960-1975	2.9%	0.8%	2.4%	-0.3%	2.1%
	1975-1990	1.2%	1.0%	0.4%	-0.3%	0.2%
	1990-2000	1.4%	1.1%	0.5%	-0.2%	0.3%
	2000-2015	2.9%	1.9%	2.0%	-1.0%	1.1%
Non-resource intensive countries	1960-1975	1.6%	0.6%	1.2%	-0.3%	1.0%
	1975-1990	-0.4%	-1.1%	0.9%	-0.2%	0.7%
	1990-2000	2.7%	1.5%	1.3%	-0.1%	1.2%
	2000-2015	3.0%	1.6%	1.7%	-0.3%	1.4%

Source: Author's calculation using data from the Extended Africa Sector Database (EASD) (Mensah & Szirmai, 2018).

The period between 1975 and 1990 has been tagged as the lost decades in SSA. Individual economies in the region recorded the worst figures for productivity growth for any of the periods. In all the resource country groups, productivity growth declined. The period also marked the turning point of industrialization in the region, with most countries in the region starting to experience early deindustrialization (Cadot et al., 2016; Rodrik, 2016). In the African policy discourse, the implementation of the Structural Adjustment Programs (SAP) in the region during this period is usually blamed for this abysmal growth performance (see Geda, et al., 2018; Geda, 2018b; Mkandawire, 2001; Elbadawi, 1992; ECA, 1989; World Bank, 1989 for a comprehensive discussion).

Since the post SAPs era (1990-onwards) growth has steadily rebounded in the region (de Vries et al., 2015, Mensah et al., 2018). Productivity growth returned to all the natural resource country groups, except for the resource-intensive oil-exporting countries (to 1.3% from 2.3%), with growth increasing

to 1.4% from 1.2% in resource-intensive non-oil exporting countries, and to 2.7% from -0.4% in non-resource intensive countries. For most of the period before 1990, resource-intensive countries have performed better than non-resource intensive. The exception is the last 30 or so years, which could represent the importance of the GVC era to productivity growth in the region. The moderate to high contribution of structural change to productivity growth within this period is also evident. The period also coincided with the beginning of the intensification of the fragmentation of global production and the time in which countries in the region increasingly connected to the global production network (Figure 3A). Below we present econometric results to highlight the impact of this increased GVC integration on productivity growth and structural change in the region since the region rebounded to growth in the 1990s to 2015.

4.0 Main Results

We first discuss the results for labour productivity growth. The baseline results for the entire economy are reported in Tables 3 and 4 (column 1-3). Starting with the main variable of interest, in all the models, the estimated coefficients on GVC participation is positive and statistically significant, suggesting that GVC participation increases productivity gains. Next columns 5-7 report regression results using the IV-2SLS estimator, our preferred estimator. In all columns, the estimated coefficient remains positive and statistically significant. Results in column (5) do not include any controls, (other than time, country and sector fixed effects), and indicate a positive and statistically significant relationship between GVC integration and labour productivity growth. On average, a one percent increase in the GVC participation index is associated with a 0.244 percent increase in labour productivity growth. The result is robust and consistent across the different models. Following Pahl and Timmer (2019), in column 7, we add the initial labour productivity level at the beginning of each period (measured relative to the global productivity frontier) and the interaction of it with GVC participation to investigate whether the productivity growth effect of GVC participation is dependent on the distance to the productivity frontier. This captures the idea that GVCs may offer scope for learning, particularly for laggard countries. Specifically, all else constant laggard countries that have a backlog of existing and unexploited knowledge are expected to benefit more from the free flow of technology through trade to grow faster than countries that are nearer to the frontier because they have a wider scope for further learning. Consistent with Pahl and Timmer (2019), the coefficient of the interaction between GVC participation and labour productivity is negative, suggesting that the effect of GVC participation is stronger for countries that are further from the productivity frontier as shown in Figure 3, reporting the marginal effects of GVC participation on labour productivity growth.

Countries and sectors participate in GVCs through either backward or forward participation. To this end, columns 4 and 8 show the regression results when we independently consider the effect of backward and forward GVC participation. In columns 4 and 8, the positive labour productivity growth effect of GVC participation accrues strongly through backward participation. Focusing on column 8, our preferred results, we find that on average a one percent increase in GVC participation index via backward participation increases labour productivity growth by 0.335 percent. The result is consistent with the broader GVC integration and labour productivity literature arguing that through backward

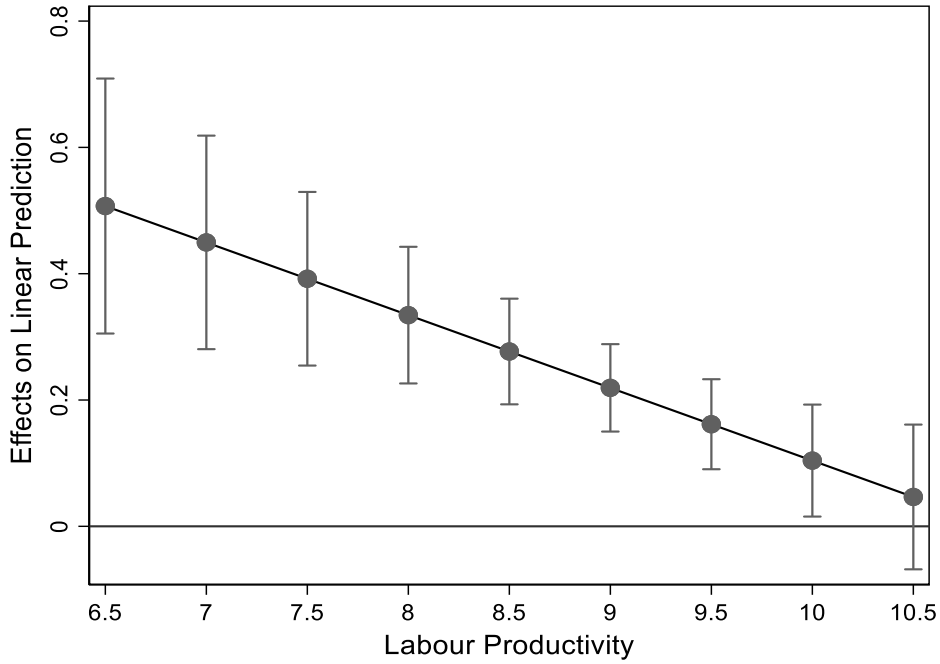
participation, firms – or in more general terms, countries – are provided with important opportunities to access higher quality and sophisticated intermediate inputs, and benefits from new ideas, technology transfer, and spillovers to stimulate productivity growth (Pahl & Timmer, 2019; Constantinescu, Mattoo, & Ruta; 2019; Kummritz et al., 2017; Halpern, Koren, & Szeidl, 2015; Collier & Venables, 2007; Criscuolo & Timmis, 2017; Schott, 2008). The validity of our instruments is also achieved. The first stage regression shows that the instruments are significantly correlated with the endogenous variable. The associated F-statistics of the first stage regression is greater than ten, a statistical proof that our instrument is also strong. The Hansen J statistic test of overidentification reported in the respective columns of Tables 3-8 is statistically insignificant at all conventional levels, implying that the instruments are exogenous and uncorrelated with the error term.

Table 3. GVC Participation and Labour Productivity Growth in Africa

	Panel Fixed Effect				IV-2SLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GVC participation (ln)	0.2068***	0.1991***	1.2557***		0.2440**	0.2399**	0.1865*	
	(0.0884)	(0.0824)	(0.3327)		(0.1025)	(0.10242)	(0.1126)	
Backward participation (ln)				0.2472*				0.3349**
				(0.1297)				(0.1557)
Forward participation (ln)				0.1707				-1.9253
				(1.0754)				(5.4298)
Labour productivity (ln)			-0.8031				-0.0182**	
			(0.6038)				(0.0079)	
GVC participation x labour productivity			-0.1152***				-0.0196*	
			(0.0359)				(0.0120)	
Institutional Quality		-0.1031		-0.0963		-0.1954		0.0906
		(0.2014)		(0.2016)		(0.2406)		(0.3577)
Inflation		0.0017		0.0011		0.0002		0.0065
		(0.0025)		(0.0027)		(0.0028)		(0.0156)
Human Capital		1.1414		1.2267*		0.3308		-3.7690
		(0.7027)		(0.6849)		(0.6045)		(4.3141)
Constant	0.2775	-1.5688	9.5267	-1.0934	0.0789	-0.5240	0.1801**	-3.3179
	(0.2256)	(1.1196)	(6.2198)	(1.1515)	(0.2497)	(1.0006)	(0.0729)	(10.9265)
Observation	1,756	1,756	1,419	1,752	1,617	1,617	1,416	1,326
Adjusted R-squared	0.032	0.034	0.119	0.035	0.036	0.037	0.028	0.020
Weak ID F-test					8512.04***	9059.12***	8464.24***	3100.47***
Hansen-J test (p-value)					0.594	0.860	0.469	0.303
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses: *** Significant at p<0.01, ** Significant at p<0.05, * Significant at p<0.10.

Figure 3: Marginal Effects of GVC Participation on Labour Productivity Growth



Source: Author's calculation based on Table 4 column 7.

4.1 Results: Resource Groups

Next, we explore the impact of GVC participation on productivity growth across the resource groups. As discussed above, the concentration of GVC activities differs across resource groups. Hence, while the results in Tables 3 suggest an overall positive effect of GVC participation on productivity growth, we also explore heterogeneities across resource groups. Results for this exercise are presented in Table 4. For the three resource groups identified in section 2.1. Relatedly, columns 1, 4, 7 and 9 report results for resource-intensive oil-exporting countries; columns 2 and 5 report results for non-oil resource-intensive countries and finally, columns 3, 6, 8 and 10 report results for non-resource intensive (resource-poor) countries. Similar to the baseline results, the estimated coefficients on GVC participation generally show that the productivity growth effect of GVC participation benefits non-resource intensive and non-oil resource-intensive countries compared to resource-intensive oil-exporting countries. The effect is also found to be stronger through backward participation. The result is consistent with our expectations and findings of the broader literature. In their study, Pahl and Timmer (2019 used only backward linkages (FVA or backward participation in our case) as a proxy measure of GVCs and find an unambiguously positive effect of backward participation in GVC on productivity growth. Further supporting our finding, we show in Figures 2, 2A, 2B and 2C that GVC participation of non-resource intensive and non-oil resource-intensive countries in Africa via backward participation is the highest and increased between 1990 and 2015 compared to oil-exporting resource-based countries where backward participation is lowest and declining.

Unlike non-resource intensive countries that participate more in GVCs through backward participation and are therefore able to access essential intermediates needed for quality upgrading, productivity improvements and economic diversification, the negative change in backward participation in oil-exporting resource-based countries in the region implies that these sets of countries risk missing out on importing essential intermediates needed for the quality upgrading and productivity enhancement of their produce and exports. The strong forward participation of exporting resource-based countries in GVCs is associated with predominantly upstream activities of the value chain such as extraction and the export of raw materials as basic inputs in the value chain and seems to have no significant positive impact on productivity gains as the opportunity for learning is limited. The result is consistent with studies that find that some countries in developing countries, and sub-Saharan Africa, in particular, despite their high integration in GVC could be locked into unproductive activities in low value-added stages of the value chain limiting the opportunity for upgrading (Foster-McGregor et al., 2015; Pahl and Timmer, 2019).

Table 4. GVC Participation and Labour Productivity Growth in Africa: Resource Group

	Panel Fixed Effects			IV-2SLS			Panel Fixed Effects		IV-2SLS	
	Resource intensive oil-exporting	Resource-intensive non-oil-exporting	Resource poor	Resource intensive oil-exporting	Resource-intensive non-oil-exporting	Resource poor	Resource intensive oil-exporting	Resource poor	Resource intensive oil-exporting	Resource poor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GVC participation (ln)	0.2708	0.3136***	0.2620***	0.1508	0.3436***	0.6653**				
	(0.1731)	(0.0712)	(0.0681)	(0.19012	(0.1198)	(0.3328)				
Backward participation (ln)							-1.121	0.354**	-3.312 ***	0.479*
							(1.183)	(0.157)	(1.207)	(0.276)
Forward participation (ln)							0.226	0.135	0.073	0.396
							(0.249)	(0.196)	(0.186)	(0.304)
Constant	-0.3630	0.1358	0.6894*	-0.5313	0.2791	0.9159***	-3.109	1.315*	-8.367***	1.425
	(0.5132)	(0.2413)	(0.3681)	(0.5246)	(0.2680)	(0.1888)	(3.165)	(0.702)	(2.918)	(0.948)
Observation	208	620	928	192	572	853	208	924	192	846
Adjusted R-squared	0.168	0.073	0.106	0.149	0.074	0.070	0.174	0.057	0.150	0.057
Weak ID F-test				6309.19***	10789.62***	24953.30***			1008.06***	2377.22***
Hansen-J test (p-value)				0.113	0.109	0.376			0.104	0.353
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses: *** Significant at p<0.01, ** Significant at p<0.05, * Significant at p<0.10

4.2 Results: GVC and Productivity Growth: Contribution from Within Effect (Intra-Sector Reallocation)

An important part of the exercise in this paper is to examine whether GVC participation affects productivity growth by inducing the efficient reallocation of resources within sectors, across sectors or both. To do this, we estimate the effect of GVC participation on these components of productivity growth using the baseline specification that controls for the country, sector, and time-fixed effects. The estimation results when we use the within component (intra-sector reallocation) variable as the dependent variable is presented in Table 5. In Table 6, we also explore the resource endowment group dimension of the same estimation. Tables 7 and 8 report results when we use the between component or the structural change component as the dependent variable. In Tables 5 and 6, in all the models, the estimated coefficient of GVC participation is positive and statistically significant suggesting that GVC participation increases productivity gains through intra-sector reallocation. In column 5, our preferred estimation, we find that on average and holding all else constant, the contribution of a one percent increase in GVC participation to productivity growth through the within-effect is 0.315 percent. Here also the results show that GVC participation has a positive and significant effect on within productivity but strongly through backward participation as shown in columns 3 and 6 respectively.

A potential explanation to the results is that not only does participation in GVC allows firms the opportunity to access quality intermediate inputs for productivity improvements, but also quality standardization requirements set by the global lead firms for their suppliers (i.e., firms wishing to enter and remain competitive in GVCs and reap the associated benefits thereof) induce these firms to improve the quality of their operations by investing in building specific technological and managerial capabilities for the specific GVC functions and activities they perform in the value chain including introducing new technologies, adopting a mix of innovations, changing the organizational structure and engaging in skill upgrading across the board of its workers. These investments made by firms and the resultant efficient reallocation of resources within the sector may ultimately affect their performance (Lall, 1992; Morrison, Pietrobelli, & Rabellotti, 2008; Newman et al. 2016). Similar to the baseline results, in all the models in Table 6, we find that the within productivity growth effect associated with GVC participation mostly benefits non-resource intensive countries. The effect is also stronger through the backward participation.

Table 5. GVC Participation and Labour Productivity Growth: Contribution through Within Effect

	Panel Fixed Effect			IV-2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
GVC participation (ln)	0.2316***	0.2231**		0.3169***	0.3149***	
	(0.0863)	(0.0848)		(0.1167)	(0.1139)	
Backward participation (ln)			0.2869**			0.4213**
			(0.1203)			(0.1632)
Forward participation (ln)			0.1947			-2.6390
			(1.0843)			(5.6893)
Institutional Quality		-0.2533	-0.2548		-0.3137	-0.1983
		(0.2265)	(0.2302)		(0.2489)	(0.3748)
Inflation		0.0052*	0.0045		0.0033	0.0110
		(0.0027)	(0.0027)		(0.0027)	(0.0164)
Human Capital		1.1594*	1.2539**		0.0381	1.3184
		(0.6274)	(0.6193)		(0.4697)	(4.5203)
Constant	0.1422	-1.8503*	-1.2956	-0.00383	-0.2614	-5.2221
	(0.2178)	(0.9929)	(0.9610)	(0.24526)	(0.7739)	(11.4486)
Observation	1,756	1,756	1,756	1,617	1,617	1,326
Adjusted R-squared	0.028	0.032	0.033	0.031	0.033	0.032
Weak ID F-test				8512.04***	9059.12***	3100.47***
Hansen-J test (p-value)				0.469	0.108	0.199
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses: *** Significant at p<0.01, ** Significant at p<0.05, * Significant at p<0.10

Table 6. GVC Participation and Labour Productivity Growth: Contribution through Within Effect

	Panel Fixed Effects			IV-2SLS			Panel Fixed Effects		IV-2SLS	
	Resource intensive oil-exporting	Resource-intensive non-oil-exporting	Resource poor	Resource intensive oil-exporting	Resource-intensive non-oil-exporting	Resource poor	Resource intensive oil-exporting	Resource poor	Resource intensive oil-exporting	Resource poor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GVC participation (ln)	0.2635*	0.3452**	-0.0298	0.2166	0.4073**	0.5555*				
	(0.1572)	(0.1401)	(0.0656)	(0.1689)	(0.1844)	(0.2855)				
Backward participation (ln)							-0.041	0.322**	-1.649	0.567**
							(0.910)	(0.138)	(1.078)	(0.278)
Forward participation (ln)							0.226	0.114	0.161	0.292
							(0.124)	(0.190)	(0.166)	(0.306)
Constant	-0.7718*	0.1334	0.2736***	-0.6862	0.2442	0.6102***	-0.810	1.038	-4.549*	1.289
	(0.4659)	(0.3387)	(0.3601)	(0.4662)	(0.2155)	(0.1619)	(2.119)	(0.616)	(2.606)	(0.953)
Observation	208	620	928	192	572	853	208	924	192	846
Adjusted R-squared	0.202	0.058	0.094	0.177	0.059	0.011	0.199	0.052	0.171	0.048
Weak ID F-test				6309.19***	10789.62***	24953.30***			1008.06***	2377.22***
Hansen-J test (p-value)				0.097	0.204	0.127			0.477	0.100
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Resource Group

Standard errors in parentheses: *** Significant at p<0.01, ** Significant at p<0.05, * Significant at p<0.10

4.3 Results: GVC and Productivity Growth: Contribution from Structural Change (Inter-sectoral Reallocation)

The previous sections have examined the effect of GVC participation on productivity growth and intra-sector reallocation of resources (within effect). An important question yet to be answered is whether, in addition to increasing productivity growth and intra-sector reallocation, GVC participation also induces structural change or inter-sectoral reallocation of resources. This section investigates this relationship. Tables 7 and 8 report the results of this exercise and find no evidence of a positive and significant effect of GVC participation on productivity growth through the structural change channel (reallocation of resources across sectors). This finding holds for the baseline results in Table 7 and also holds in the analysis across the resource groups in Table 8. A potential explanation underlying this finding is advanced in Rodrik (2018) and confirmed in Pahl and Timmer (2019). The authors paint a pessimistic outlook on the potential of GVC participation for employment generation, particularly in developing countries. The authors assert that the technologies associated with GVC participation are providing diminishing possibilities to substitute other factors of production with unskilled labour, suggesting that developing countries such as those in Africa may not be able to take advantage of GVC participation to create employment opportunities, particularly in modern and productive sectors where the use of emerging technologies in GVCs (mostly labour saving) is very high. Also, the minimum threshold of skills and capabilities requirements needed to participate and remain competitive in GVCs will increasingly become so high that it may exclude most developing countries from using the opportunities afforded by GVCs to grow jobs in productive sectors for its relatively low skilled workforce to fast track structural transformation.

Another potential explanation for this finding is that, in general, structural change in Africa has been limited. While large and productive manufacturing firms and other tradable sectors in the region have a high probability to participate in GVCs (Abreha et al., 2020), they create fewer jobs in GVCs due to the potential use of labour-saving technologies in GVCs (Pahl and Timmer, 2019). In other words, GVCs offers these large and productive firms in the region the opportunity to improve productivity by inducing an efficient reallocation of resources within sectors. However, this comes at a cost as these firms and sectors shed workers and are limited in their capacity to absorb more labour.

Table 7. GVC Participation and Labour Productivity Growth: Contribution through Structural Change

	Panel Fixed Effect			IV-2SLS		
	(1)	(2)	(3)	(5)	(6)	(7)
GVC participation (ln)	-0.0247	-0.0240		-0.0729	-0.0750	
	(0.0784)	(0.0757)		(0.0589)	(0.0590)	
Backward participation (ln)			-0.0397			-0.0863
			(0.0715)			(0.0650)
Forward participation (ln)			-0.0239			0.7136
			(0.0469)			(2.2661)
Institutional Quality		0.1501	0.1585		0.1183	0.2889*
		(0.1893)	(0.1081)		(0.1169)	(0.1493)
Inflation		-0.0035	-0.0038**		-0.0031*	-0.0044
		(0.0025)	(0.0016)		(0.0017)	(0.0065)
Human Capital		-0.0180	-0.0273		0.2927	-5.0874***
		(0.4216)	(0.2671)		(0.2937)	(1.8005)
Constant	0.1354	0.2814	0.2022	0.08268	-0.2626	1.9041
	(0.1069)	(0.6363)	(0.4567)	(0.11371)	(0.4890)	(4.5602)
Observation	1,756	1,756	1,756	1,617	1,617	1,326
Adjusted R-squared	0.015	0.019	0.019	0.015	0.018	0.043
Weak ID F-test				8512.04***	9059.12***	3100.47***
Hansen-J test (p-value)				0.089	0.107	0.147
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses: *** Significant at p<0.01, ** Significant at p<0.05, * Significant at p<0.10

Table 8. GVC Participation and Labour Productivity Growth: Contribution through Structural Change

Resource Group

	Panel Fixed Effects			IV-2SLS			Panel Fixed Effects		IV-2SLS	
	Resource intensive oil-exporting	Resource-intensive non-oil-exporting	Resource poor	Resource intensive oil-exporting	Resource-intensive non-oil-exporting	Resource poor	Resource intensive oil-exporting	Resource poor	Resource intensive oil-exporting	Resource poor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GVC participation (ln)	0.0073	-0.0315	0.2919***	-0.0658	-0.0636	0.1097				
	(0.0872)	(0.0933)	(0.0467)	(0.0962)	(0.1032)	(0.2169)				
Backward participation (ln)							-1.079	0.033	-1.663***	-0.088
							(1.088)	(0.107)	(0.603)	(0.097)
Forward participation (ln)							0.0000343	0.021	-0.088	0.105
							(0.165)	(0.104)	(0.092)	(0.107)
Constant	0.4088	0.0025	0.4157**	0.1548	0.0349	0.3057**	-2.298	0.277	-3.818***	0.135
	(0.2587)	(0.2255)	(0.1889)	(0.2654)	(0.2308)	(0.1230)	(2.656)	(0.373)	1.457	(0.334)
Observation	208	620	928	192	572	853	208	924	192	846
Adjusted R-squared	0.040	0.024	0.025	0.033	0.025	0.061	0.075	0.026	0.058	0.031
Weak ID F-test				6309.19***	10789.62***	24953.30***			1008.06***	2377.22***
Hansen-J test (p-value)				0.134	0.428	0.417			0.622	0.954
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses: *** Significant at p<0.01, ** Significant at p<0.05, * Significant at p<0.10

5. Conclusion

Economic growth and development require pragmatic and efficiently executed policies that transform a country's economic structure. This relies on, among other things, the improvement in productivity, building internal capacity, and critically diversifying into more and new productive sectors. After six decades of rolling out policies to power structural transformation and industrialization in sub-Saharan Africa, the predominant narrative today is that this dream remains elusive. Many of the countries in the region have yet to build capabilities and shift enough of their manpower to more productive sectors to the extent that realizes this dream. Participation in GVCs has recently been highlighted as a pathway to fast-track development. Consequently, the current paper examines for the first time the impact of GVC participation on productivity growth and its two components—the within and structural change across countries in sub-Saharan Africa with different natural resource endowments. We specifically examine if the productivity growth and structural change effect of GVCs varies in resource-intensive and non-resource intensive countries in the region.

Using a representative sample of countries that together contribute about 80 percent of the region's GDP, for the period 1990 to 2015 we find evidence that sub-Saharan Africa's GVC participation is very encouraging. The region is heavily involved in GVCs, generally as high as those of their counterparts in other developing regions in South Asia, East Asia, and Latin America. Moreover, the level and dynamics of the regions' GVCs participation vary substantially between the resource groups and the countries within each group. Specifically, GVC participation is substantially higher in the resource-intensive group than in the non-resource intensive group. For the resource-intensive group, particularly for countries in the oil-resource intensive group, the comparative advantage in GVC participation predominantly lies in upstream activities of the value, providing mainly primary inputs for the value chain. There is therefore a need to strengthen participation through increasing value-added in exports and strategies to upgrade into knowledge-intensive industries in the value chain. The analysis shows that this is not happening at present, particularly among resource-based economies in the region.

These dynamics in GVC participation reflect in our econometric estimates which show robust evidence that integration into GVCs is providing new windows of opportunity to increase productivity gains in the region. However, the positive productivity gains effect of GVC participation accrues strongly through backward linkages and benefits mostly non-resource based and non-oil-resource intensive countries. The positive effect is also stronger for countries in the region that are further from the productivity frontier, a result interpreted as offering more scope for learning, particularly for the more laggard countries. Results from the analysis of the two components show that GVC participation has a positive and significant effect on the within component by inducing an efficient intra-sector reallocation of resources, but not across sectors. The key lesson emerging from this study is that while GVC participation is very important for productivity gains in Africa, the result underlines a potential variation in the channel of impact across countries with different resource endowments.

Our findings have policy implications. Similar to findings in other related studies (see for example Havranek and Irsova 2011; Kummritz, et al., 2017), our analysis shows that different types of GVC

participation impacts productivity growth, and the two components of productivity growth, differently and demands different policy frameworks. Participation in GVCs as a buyer (backward participation) requires a focus on building the infrastructure and strengthening connectivity to global lead firms and global suppliers in the value chain to import world-class inputs. The inadequate supply of quality foreign intermediate inputs could be a constraining factor to productivity growth. Implementing the above policies together with other friendly input sourcing trade policies will contribute to the strategic integration of firms into GVCs to access these crucial foreign intermediate inputs. While GVC participation as a seller (forward participation) also hinges on a similar policy framework, the focus now shifts more towards policies that increase productivity to meet the global quality standards requirements set by lead firms for suppliers that want to enter and remain competitive in the value chain and the global marketplace (cf. Kummritz et al., 2017; Taglioni & Winkler, 2016).

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Appendix

Table 1A: Backward GVC participation, percent of gross export (1990-2015)

	1990	1995	2000	2005	2010	2015
Asia	0.22	0.19	0.18	0.19	0.19	0.18
East Asia	0.21	0.27	0.27	0.27	0.28	0.21
EU	0.29	0.30	0.32	0.33	0.36	0.35
Latin America	0.18	0.19	0.17	0.18	0.19	0.20
MENA	0.17	0.17	0.15	0.16	0.15	0.15
South Asia	0.15	0.10	0.10	0.12	0.13	0.15
Sub-Saharan Africa	*0.15*	*0.16*	*0.16*	*0.16*	*0.17*	*0.17*
Western Europe	0.23	0.3	0.27	0.28	0.31	0.30
World	0.20	0.21	0.21	0.22	0.22	0.21

Source: Author's calculation based on UNCTAD-Eora GVC Database.

Table 1B: Forward GVC participation, percent of gross export (1990-2015)

	1990	1995	2000	2005	2010	2015
Asia	0.16	0.19	0.23	0.25	0.26	0.24
East Asia	0.16	0.16	0.19	0.21	0.21	0.23
EU	0.17	0.19	0.21	0.22	0.24	0.23
Latin America	0.13	0.14	0.16	0.17	0.17	0.16
MENA	0.21	0.25	0.29	0.31	0.33	0.32
South Asia	0.13	0.15	0.15	0.18	0.20	0.19
Sub-Saharan Africa	*0.19*	*0.23*	*0.27*	*0.28*	*0.28*	*0.24*
Western Europe	0.18	0.21	0.23	0.24	0.26	0.24
World	0.16	0.19	0.23	0.24	0.25	0.23

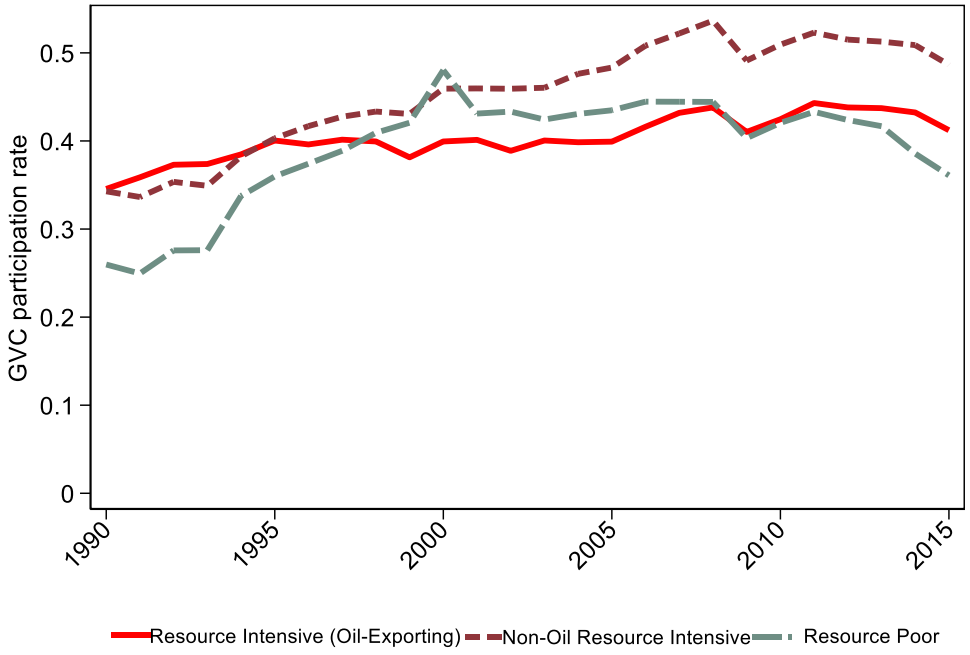
Source: Author's calculation based on UNCTAD-Eora GVC Database

Table 2A: Summary Statistics: 1990-2015

Variable	Obs.	Mean	SD	Min	Max
GVC participation rate	1760	0.40	0.09	0.13	0.94
FVA share (backward participation)	1760	0.18	0.11	0.02	0.91
DVX share (forward participation)	1760	0.22	0.07	0.15	0.44
DVA share (Domestic Value Added)	1760	0.82	0.12	0.08	0.97
Log of labour productivity	1760	9.33	1.68	5.49	12.94
Human capital	1760	1.78	0.44	1.02	2.83
Institutional quality (-2.5-2.5)	1148	0.25	0.52	0.03	1.00
Inflation (percentage rate)	1760	12.25	17.32	9.62	183.31

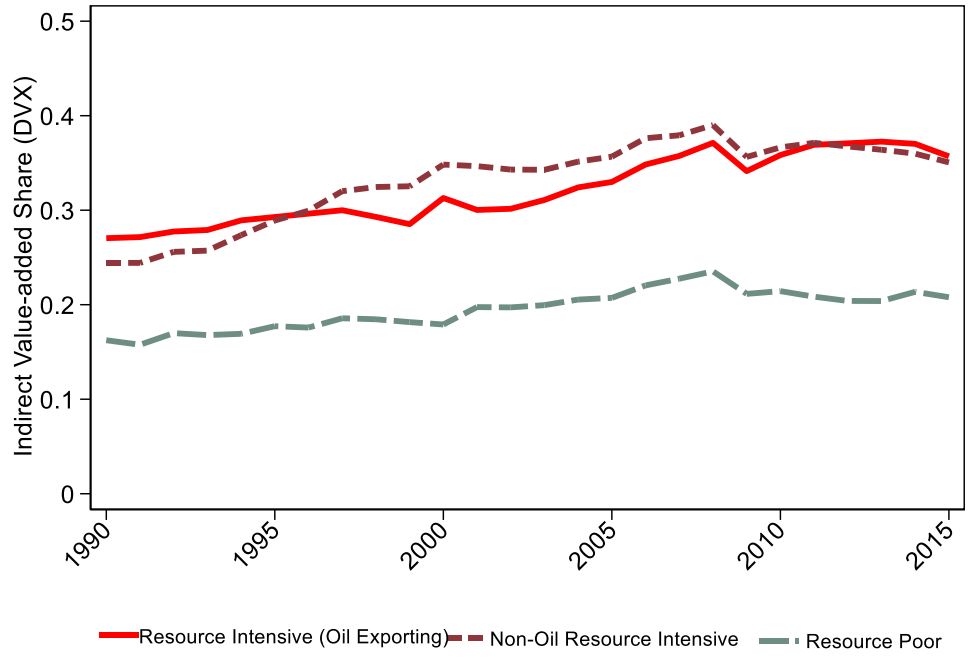
Source: Author's calculation based on the described dataset.

Figure 3A: Trend in performance in GVC by resource groups in Sub-Saharan Africa



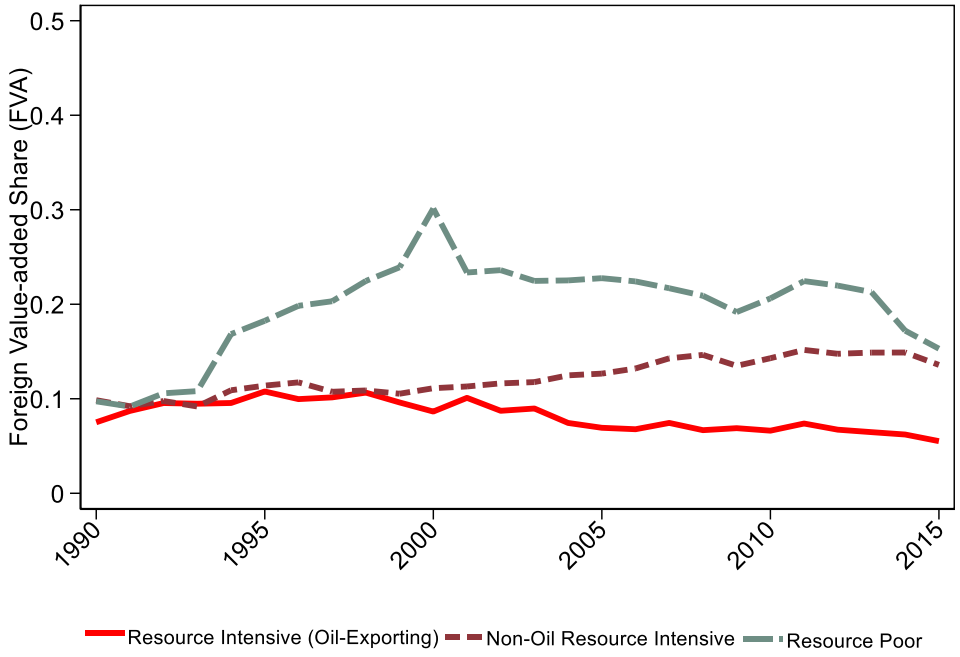
Source: Author's calculation based on UNCTAD-Eora GVC Database
Note: Charts is based on weighted average data

Figure 3B: Forward GVC participation, percent of gross export (1990-2015)



Source: Author's calculation based on UNCTAD-Eora GVC Database

Figure 3C: Backward GVC participation, percent of gross export (1990-2015)



Source: Author's calculation based on UNCTAD-Eora GVC Database

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