Research article

Regional economic integration and economic upgrading in global value chains: selected cases in Africa

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ABSTRACT

This study examined the impact of regional economic integration on economic upgrading in global value chains (GVCs), of the East African Community (EAC), Southern African Customs Union (SACU) and the Economic Community of West African States (ECOWAS), from 2000 to 2015. Using the Least Square Dummy Variable (LSDV) technique, the results showed that regional economic integration is not a significant driver of the economic upgrading of their Members, in GVCs but one-period lagged backward participation in GVCs is. Considering labour productivity as an alternative measure of productivity in the place of productivity linked with participation in GVCs (economic upgrading), regional economic integration turned out to be a weak positively significant determinant. At a disaggregated level, regional economic integration significantly determined labour productivity in both EAC and SACU but not in ECOWAS. More regional efforts are needed to sufficiently aid the contribution of these African RECs to their Members' economic upgrading in GVCs.

1. Introduction

Conditional upon the respective comparative advantages of different countries, GVCs enable countries to engage profitably in the global network of production without needing to have the resource requirements for the entire stage of the production of a product. In essence, even developing countries can now leverage their comparative advantage and specialise in a specific segment of a chain consequently capturing value added from that segment. Countries (or firms) may act as suppliers of intermediate inputs at the upstream stage to other firms that perform mid-stream and downstream activities such as packaging, branding, marketing and distribution to final consumers.

Participation in GVCs may be in terms of forward or backward participation, the former referring to the supply side and the latter the demand side of GVCs. Studies on GVCs harp on the importance of upgrading along the value chain to be able to enhance such gains as employment and income. Increasing employment and income outcomes stemming from participating in GVCs are dubbed 'social and economic'

upgrading respectively. For upgrading, GVC studies including African Development Bank, Organization for Economic Cooperation and Development, and United Nations Development Programme (2014) and the United Nations Economic Commission for Africa - UNECA (2015) noted that domestic firms in particular need access to finance to invest in quality and to link up with lead firms. To prevent what is referred to as an 'immiserising effect', that is, a situation in which economic upgrading (changes in income, value added or output) is associated with such issues as employment and wage declines (social 'downgrading'), social upgrading is needed to make upgrading in GVCs more inclusive (UNECA, 2015). However, data on social upgrading in GVCs is not readily available (AfDB et al., 2014), hence the focus of this current study is economic upgrading.

Humphrey and Schmitz (2002) defined economic upgrading in terms of process, product, functional and chain upgrading. But Kowalski et al. (2015) argue that economically speaking, the process upgrading in GVCs, measured by the per capita domestic value added content of exports, is more encompassing because it is a value added measure of benefits of

productivity changes as a result of participating in GVCs as compared with the other three definitions of upgrading. This other three are basically concerned with targeting more sophisticated products or changing functions in a value chain or completely swapping from a value chain to another in order to capture more value added share (Kowalski et al., 2015). Yet, owing to the resource endowments and comparative advantages of developing economies such as those of Africa, the objectives of the other three may be difficult to achieve in a long time.

Sequel to the foregoing, this current study focuses on process upgrading definition of economic upgrading. Here, the importance of the productivity of domestic factors, accruing from participating in GVCs, come to the fore. As documented in Kowalski et al. (2015), increases in the volume of domestic value added embodied in exports (as is the case with China between 1995 and 2009) are evidences in support of the use of more domestic resources and improvement in their productivity, hence increasing sales and profits for domestic firms, and increasing wages for employed local workers. In a nutshell, without downplaying the need for proper insertion into GVCs in terms of backward and forward participation, pursuing increasing domestic value added embodied in exports of developing economies seem a plausible objective to pursue for developing economies. To enhance domestic value addition in GVCs, access to the location of demand (market access) and input supply (supply of intermediate inputs) are expedient. Given the implications of the efficiency of the upstream activities for the subsequent productivities of the downstream activities in GVCs, firms need to carefully select their inputs. In this light, regional economic integration is known to be a principal instrument of helping to connect firms within the regional economic community to sources of relatively cheap quality inputs which may be unavailable within the shores of a particular domestic economy. Increasing returns to scale and enhanced productivity are expected outcomes of a well-functioning REC and should facilitate economic (process) upgrading in GVCs.

Allard et al. (2016) noted that sub-Saharan African countries are still in the start of their integration process into GVCs and have relatively lower levels of income than other regions in the world. Members of the East African Community (EAC) – Kenya, Tanzania, Uganda, Rwanda and Burundi, particularly Kenya, Tanzania and Uganda, have been observed to be among the best performers in terms of witnessing considerable progress in backward integration in GVCs. This performance is a reflection of the benefits of economic integration and their intentions to deepen their economic and monetary ties further (Sutton, 2012). Allard et al. (2016) also observed that the Members of the Southern African Customs Union (SACU) – Botswana, Namibia and Lesotho experienced relatively stronger depth of integration within 1990 and 2010. Contrarily, the Members of the Central African Economic and Monetary Union – CEMAC (consisting of Gabon, Cameroon, Central African Republic, Chad, the Republic of the Congo and Equatorial Guinea) and the West African Economic and Monetary Union- WAEMU (consisting of Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo) have exhibited low depth of integration in GVCs. These RECs[3] are either in the customs union phase or gone past it. At the customs union stage, it is expected that tariff and non-tariff barriers to trade within the Community would have been cleared, and so member states of a REC should be able to penetrate one another's market at relatively low cost and be able to obtain necessary inputs, *inter alia*, for their production processes.

Given the expected roles of regional economic integration, this study is motivated by the need to investigate the extent to which regionally-sourced inputs within selected RECs in Africa have contributed to economic upgrading of their Members in GVCs. Specifically, we investigate the impact of regional economic integration (using intermediate inputs sourced within each REC as an indicator of regional economic integration) on economic upgrading in GVCs, in the case of EAC, SACU and ECOWAS. EAC and SACU are chosen because they are RECs believed to have aided their Members' integration into GVCs as noted by Allard et al. (2016). The choice of ECOWAS alongside EAC and SACU is informed by the fact that ECOWAS constitutes nearly 30 percent of the African population. ECOWAS also embeds WAEMU whose Members were observed to have low integration in GVCs (Allard et al., 2016). As a secondary objective, we use labour productivity as an alternative measure of productivity in order to understand whether the determinants (regional economic integration inclusive) of productivity associated with the participation of domestic factors in GVCs (economic upgrading) affect labour productivity in a similar manner. This understanding is important for fashioning appropriate policies targeted at enhancing the productivity of Member States.

To the best of our knowledge, this research seems to be the first to not only examine the impact of regional economic integration on economic upgrading in GVCs but also specifically comparing the performances of EAC, SACU and ECOWAS RECs in this respect. The use of labour productivity as an alternative measure of productivity is another unique contribution of this research. The work of Kowalski et al. (2015) is acknowledged to be similar to this current study as it investigates, among other objectives of that study, the determinants of economic upgrading in GVCs in the case of developing countries. The empirical study of Olayiwola et al. (2015) examined the role of economic integration and trade facilitation on agricultural exports' performance in ECOWAS sub-region but had no GVC outlook.

2. Review of empirical studies

Despite the importance of upgrading in GVCs, the state of the literature suggests that only few empirical studies on economic upgrading in GVCs exist till now. Studies are however replete on the roles of regional trade agreements on participation in GVCs. For the sake of clarity, this current study examines the impact of regional economic integration (using regionally sourced intermediate imports divided by total intermediate imports of that country as an indicator of regional economic integration). Hence this study should be differentiated from those that assessed the impact of the formation of RTAs (usually using dummy variables taking the values 0 and 1) on GVCs[4].

The study of Kowalski et al. (2015), amongst different specific objectives, examined the determinants of economic upgrading in GVCs for developing countries. The study specified a static model and used the least square dummy variable technique. They used an augmented gravity model, but the dependent variable (trade) was substituted with an indicator of economic upgrading. Dyadic variables used in a traditional gravity model, variables such as contiguity and common official language, were also dropped. As independent variables, the sophistication of manufactured intermediate imports, its squared term, the sophistication of primary intermediates, foreign direct investment inflows, distance to economic activity, lagged value of backward participation in GVCs, regional trade agreements (proxy by imports covered by RTA) and GDP per capita were used. They observed that lagged backward participation in GVCs, sophistication of manufactured intermediates and per capita GDP are positive and significant determinants of economic upgrading while the squared term of sophistication of manufactured intermediates

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[3] EAC is in its monetary union phase (Trade Mark, 2016). This REC was re-established in 2000 and established a customs union in 2005 (Fredriksson, 2009). ECOWAS is in the customs union stage of economic integration (Ayalogu, n.d.), it was established in 1975. SACU is the oldest customs union, it was established in 1910. The stages of economic integration are: a free trade, customs union, common market, economic union/monetary union and full economic integration. For the definitions of each stage, see Balassa (1961).

[4] In this current study, countries of each REC are already involved in the same RTA and there does not arise the need to use dummy variables as an indicator of RTA in our case.

and the distance to economic activity are negative and significant determinants of economic upgrading. FDI inflows, RTA and sophistication of primary intermediates were positive but insignificant determinants of economic upgrading in GVCs.

Allard et al. (2016) assessed trade integration and global value chains in sub-Saharan Africa. They used a gravity model to assess the scope for further integration in this region. Their analysis show that even after accounting for economic determinants and other determinants of trade flows, trade flows are on the average lower in this region than in other parts of the world. They noted that this relatively low trade flows is not unconnected to the lower levels of income, relatively longer distances and more number of landlocked countries in the region. Augmenting the gravity model with some determinants such as the rule of law, levels of tariff, quality of infrastructure and the level of credit to private sector, they find that these factors are less conducive for trade in this region relative to other regions. This study further assessed the factors that are likely to promote further insertion of developing regions in GVCs.

They (Allard et al. 2016) used an econometric technique analogous to the gravity econometric setting by replacing bilateral trade flows with foreign value added in exports – a GVC measure of backward integration- and dropping the dyadic variables used in the basic gravity formulation. Their key findings include that oil exporters happen to be the least integrated in GVCs in respect of the backward integration. They also observed a decline in backward integration of oil countries including Angola and Nigeria, but not in the case of Cameroon and Congo. They remarked that this trend is due to the stagnation of the diversification of trade away from natural resources over the past 20 years in those countries.

Olayiwola et al. (2011) and Olayiwola et al. (2015) combined descriptive statistics, the fixed effect model and systems GMM in examining the relationships amongst economic integration, trade facilitation and the performance of agricultural exports in ECOWAS. The study used a country's exports within ECOWAS as a share of total ECOWAS export as an indicator of economic integration. They observed that economic integration and trade facilitation significantly affect agricultural exports in the region. Their descriptive statistics also showed that on the average, the level of trade facilitation in ECOWAS was below the average in the world. Agricultural exports and not participation in GVCs was the dependent variable in that study.

More related to this current study is Obasaju et al. (2019). They investigated the impact of regional economic integration on the backward insertion of ECOWAS in global value chains. As an indicator of regional economic integration, the authors used a country's intermediate imports sourced within the region as a share of total intermediate imports of that country. Using the systems generalized method of moments, they found that regional economic integration did not significantly impact the backward integration of ECOWAS in global value chains within the study period.

A number of empirical studies investigated the impact of regional trade agreements on GVCs, including those that covered famous RTAs such as the European Union (EU), North American Free Trade Agreement (NAFTA) and the Association of Southeast Asian Nations (ASEAN). Choi (2019) investigated whether or not deeper regional integration contributes to the organisation of GVCs along regional clusters, taking Asia, Europe and America into consideration. The GVC (dependent) variable was used in a bilateral setting, that is between two countries, thus the RTA variable assumed dummy values and was used to control for the role of regional trade agreements in GVCs. The results showed that a deep RTA has varying effects on GVCs depending on the regional clusters. The study also found that Asia imports more intermediate goods than both Europe and America while the member countries of an RTA tend to import more intermediate goods from Europe than Asia and America.

Rubinova (2017) contributed to the GVC literature by analysing the impact of new regionalism on the participation in GVCs. The study also used bilateral trade flows, in this case, of manufactured goods. To capture economic integration agreements, dummy variables for membership of the World Trade Organisation, existence of a free trade agreement, conclusion of a deeper agreement, and membership of European Union were employed in a multiplicative gravity model. The estimates revealed that FTAs enhance GVC-driven trade between developed and developing economies in which case developing economies assemble imported intermediates to later export them as final goods. The empirical findings also showed that liberalisation of trade in services plays a crucial role in the insertion of less developed economies in GVCs.

From the foregoing, it is clear that several empirical works assessing the impact of RTAs on GVCs exist, but this current study seeks to fill an existing gap in the literature. Specifically, it investigates whether or not the platforms provided by regional economic integration in selected RECs in Africa have yielded fruits in terms of substantial trade flows in intermediate goods within the regions and consequently engendered the economic upgrading of Member States in GVCs.

3. Stylised facts

Stylised facts are provided on the values of regional economic integration for ECOWAS, EAC and SACU. Intermediate imports are considered because of the role of intermediate goods in GVCs. Table 1 presents intra-regional intermediate import shares (measure of regional economic integration) from 2010 to 2015 for ECOWAS, EAC and SACU.

It is observed from Table 1 that trade integration is stronger in SACU, then EAC, with ECOWAS having the weakest. The countries that supply the most intermediates to each of these RECs - Cote d'Ivoire in ECOWAS, Kenya in EAC and South Africa in SACU- tend to have weak backward integration with other Members. This perhaps is due to the orientation of some bigger (supply) economies in the RECs towards consumer or final goods; Nigeria in ECOWAS is an example in this regard. Bigger economies also tend to have relatively weak trade integration with other Members of the REC. Nigeria, Kenya and South Africa are classic examples.

Changes in the dependent variable - per capita domestic value added in exports (economic upgrading) is described next in Figure 1.

Most countries experienced positive economic upgrading in 2010 with Liberia in ECOWAS being the best performer. As at 2014, Liberia (in ECOWAS), Kenya (in EAC) and both Lesotho and Swaziland (from SACU) witnessed the highest economic upgrading with values greater than 8 percent. In 2015, this trend changed as every other country recorded negative changes other than Liberia. Considering the average changes per REC, for ECOWAS, the values of economic upgrading were 52.98, -6.92, 2.38, 1.37, 4.28 and -4.99 percent respectively from 2010 to 2015. For EAC, the values stood at 51.98, -13.31, -7.32, 0.02, -0.04 and -7.36 percent respectively within the same period. Those for SACU were 57.32, -4.25, -1.35, -2.37, 5.57 and -7.03 percent respectively from 2010 to 2015. Thus, the ECOWAS group experienced more positive changes while EAC experienced the stronger negative changes between 2010 and 2015. Some clues on the levels of regional economic integration and changes in economic upgrading have been garnered, yet, the impact of the former on the latter is reserved till the analytical section.

4. Data and estimation strategy

4.1. The baseline model and data description

AfDB *et al.* (2014) and Kowalski et al. (2015) noted that economic upgrading is a dynamic process. Hence, while specifying the

Table 1. Values of regional economic integration from 2010 to 2015.

	2010	2011	2012	2013	2014	2015
ECOWAS						
BENIN	0.37	0.42	0.35	0.37	0.33	0.44
B/FASO	0.36	0.34	0.33	0.34	0.38	0.28
COTE D.	0.01	0.03	0.04	0.04	0.03	0.02
GHANA	0.11	0.23	0.24	0.16	0.20	-
GUINEA	0.05	0.05	0.04	0.05	-	-
GAMBIA	-	-	-	0.04	0.05	0.05
LIBERIA	0.05	-	-	-	-	-
MALI	0.29	0.32	0.40	-	-	-
NIGER	0.19	0.41	0.43	0.37	0.34	0.26
NIGERIA	0.01	0.00	0.01	0.01	0.01	-
SENEGAL	0.06	0.06	0.05	0.04	0.05	0.04
S/LEONE	0.05	-	-	-	0.01	0.01
TOGO	0.04	0.04	0.05	0.06	0.08	0.08
CAPE VERDE	0.02	0.01	0.02	0.01	0.01	0.02
ECOWAS AVERAGE	**0.12**	**0.17**	**0.18**	**0.14**	**0.14**	**0.13**
EAC						
KENYA	0.03	-	-	0.02	-	-
TANZANIA	0.03	0.03	0.04	0.03	0.08	0.02
UGANDA	0.18	0.20	0.17	0.15	0.15	0.13
RWANDA	0.47	0.44	0.48	0.45	0.42	0.42
BURUNDI	0.34	0.37	0.28	0.41	0.41	0.42
EAC AVERAGE	**0.21**	**0.26**	**0.24**	**0.21**	**0.26**	**0.25**
SACU						
BOTSWANA	0.80	0.73	0.82	0.79	0.77	0.76
LESOTHO	0.72	0.94	0.79	-	-	-
NAMIBIA	0.69	0.66	0.62	-	-	-
S/AFRICA	0.06	0.05	0.06	0.06	0.06	0.06
SWAZILAND	0.80	0.79	0.78			
SACU AVERAGE	**0.61**	**0.63**	**0.61**	**0.42**	**0.42**	**0.41**

Source: Authors' calculations based on World Integrated Trade Solutions database.
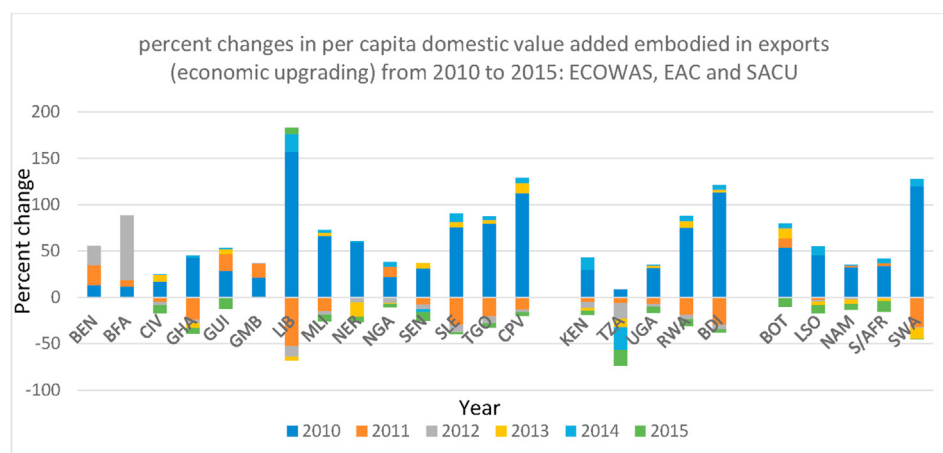

Figure 1. Economic upgrading in GVCs from 2010 to 2015. Note: 2013 to 2015 values for Benin and Burkina Faso are unavailable. Source: Authors' design, compiled from Eora GVC database.

determinants of economic upgrading Kowalski et al. (2015) noted that the variables should be in terms of changes rather than in levels. They however specified the model in levels but allowing the fixed effects to absorb the changes over time while also replacing the dependent variable in a bilateral gravity setting (log of trade) with the indicator of economic upgrading.

In similar vein, we specify a double-log equation. Dyadic variables are not included and the variable of interest – regional economic integration – is incorporated into the model. The fixed effects (year and country) are incorporated to account for time-varying factors (e.g. say number of RTAs a country belongs) and to account for country-specific factors (e.g. when a country is landlocked) that may affect the dependent variable but which are not explicitly in the model. We adapt the specification of Kowalski et al. (2015). The regional economic integration variable[5] is of interest and is incorporated while also controlling for the role of human capital (using government expenditure on education as a proxy). The access to internet facilities is also included to serve as a proxy for the quality of infrastructure[6].

The baseline model is specified as:

$$\ln(PDV_{it}) = \gamma_1 + \gamma_2 REI_{it} + \gamma_3 \ln(FDI_{it}) + \gamma_4 \ln(EDUC_{it}) + \gamma_5 \ln(DCPS_{it})$$
$$+ \gamma_6 \ln(DEA_{it}) + \gamma_7 \ln(INTN_{it}) + \quad \gamma_8(QINS_{it}) + \gamma_9 \ln(GDPpc_{it})$$
$$+ \gamma_{10} \ln(FVA_{it-1}) + U_{it} \quad\quad\quad\quad\quad\quad\quad\quad\quad (1)$$

PDV: It is the dependent variable. It is per capita domestic value added in exports (a measure of economic upgrading in GVCs). It is calculated as changes in domestic value added embodied in exports divided by population. The numerator is a measure of forward integration in global value chains[7] which implies the domestic value added of a product that enter themselves into the exports of other countries (Allard et al., 2016). The domestic value added in exports is obtained from the Global Eora Multi-region Input-Output database constructed by Lenzen et al. (2013) while the data on population was sourced from the CEPII database.

REI: is regionally sourced intermediate imports divided by total intermediate imports of that country (the regional economic integration indicator). This is the independent variable of interest. It was sourced from the World Integrated Trade Solutions (WITS) database.

FDI: is the inflow of foreign direct investment, obtained from World Development Indicators (WDI) database.

EDUC: is government expenditure on education as a share of GDP – used as a proxy for human capital[8]. It was sourced from WDI.

DCPS: is domestic credit to the private sector as a share of GDP. It was sourced from WDI.

DEA: is distance to economic activities. It is measured as the weighted average distance to the capital of a country – taken to be the hub of economic activities. It was sourced from the CEPII database. It is a variable included in the spirit of the gravity equation to control (at least partly) for the role of distance in trade.

INTN: is the individuals using the internet (percentage of population) used as a (narrow) proxy for the quality of infrastructure. It was sourced from WDI.

QINS: is the quality of institution. It is a composite index derived from principal component analysis (PCA). The variables subjected to PCA are voice and accountability, political stability, government effectiveness, regulatory quality, control of corruption and the rule of law. They were sourced from the Worldwide Governance Indicators (WGI) database. The criteria for concluding in favour of the PCA include that: 1) The Eigenvalue of that component should be greater than or equal to 1. (2) The principal component must account for at least 60 percent of the variance in the entire series. (3) The test should pass the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, a measure which lies between 0 and 1. Specifically, the value should be greater than 0.70. Small values depict that the variables do not have much in common to warrant a principal component analysis. Kaiser (1958) gave the following labels: 0.00 to 0.49 – unacceptable; 0.50–0.59 – miserable; 0.60–0.69- mediocre; 0.70–0.79 – middling; 0.80–0.89 – meritorious, and 0.90–1.00 – marvellous. The principal component analysis test yielded a positive result for the quality of institution. For instance, the Kaiser-Meyer-Olkin (KMO) overall measure of adequacy gave a value around 0.82 which falls in KMO's 'meritorious' range.

GDPpc: is GDP per capita, sourced from WDI.

FVA_{it-1}: is the lagged value of foreign value added embodied in exports (i.e. the lagged value of backward integration into GVCs). But the inclusion of this variable must not be confused with the lag of the dependent variable (in which case the so-called Nickell bias becomes a thing of concern) and so the model is not a dynamic one. FVA data was obtained from the Global Eora GVC database, and:

U_{it}: is idiosyncratic error term.

An auxiliary regression will be run using labour productivity as the dependent variable with the same set of explanatory variables. This is in order to investigate whether the explanatory variables affect the productivity linked with the participation of domestic factors in GVCs (i.e. economic upgrading) in a different manner from how they affect labour productivity. It is available in WDI database in constant 2011 PPP $. To unify its measure with those of PDV, REI, FDI and GDPpc which are all measured in current (million) dollars, the US GDP deflator – annual inflation rate – is added to the constant series of labour productivity for corresponding years.

In terms of *a priori* expectation, the distance variable, for the 'distance puzzle' reason, are expected to be negatively related to per capita domestic value added in exports. Education, domestic credit to the private sector, inward FDI, GDP per capita, internet usage and the quality of institution are all expected to positively aid economic upgrading. The value of regionally sourced intermediate imports as a share of total imports (measure of REI) is

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[5] The possibility of reverse causation between RTAs and participation in GVCs have been noted in the literature. Countries or firms that participate in GVCs may decide to form trade agreements and conversely, trade agreements may engender higher participation in GVCs. However the type of RTA in this current study is specifically that amongst members of a particular REC and so the indicator of regional economic integration is used here rather than dummy variables which is commonly used when dealing with bilateral trade flows amongst countries that may belong to different RECs. In the event of potential endogeneity of a regressor (e.g. RTA indicator), the instrumental variable techniques (e.g. systems generalized method of moments may be used to address this). Sometimes, the lag of the suspected right hand side endogenous variable is used rather than its current value. Owing to the relative shortness of some of the panels e.g. EAC and SACU with just 80 observations, we do not use instrumental variables. In auxiliary regressions (not presented here), we experimented with the lag of regional economic integration (REI) but observed no significant difference in results. Hence we stick with its current rather than its lagged value in subsequent estimations. And experimenting with systems GMM on the full sample does not yield significantly different outcomes.

[6] Auxiliary regressions carried out use mobile cellular subscriptions per 100 people as a proxy for the quality of infrastructure. These proxies are admittedly narrow definitions of the quality of infrastructure but are adopted following the fruitless attempts at obtaining a principal component for the quality of infrastructure.

[7] This should be differentiated from the domestic value added consumed directly in the exporting country.

[8] Data on research and development is scarce for most of the countries used for this study hence we use government expenditure on education as a proxy for human capital development.

expected to positively stimulate changes in per capita domestic value added in exports. All variables are measured in current US dollars. The fixed effects (year dummies in this case) are allowed to absorb the changes in prices overtime in line with Baldwin and Taglioni (2007). Thus, the time/year effects are depended upon to account for changes in the variables which are entered in their level forms and also to account for changes in prices over time.

The auxiliary regression is specified as:

$$\ln(LABP_{it}) = \gamma_1 + \gamma_2 REI_{it} + \gamma_3 \ln(FDI_{it}) + \gamma_4 \ln(EDUC_{it}) + \gamma_5 \ln(DCPS_{it})$$
$$+ \gamma_6 \ln(DEA_{it}) + \gamma_7 \ln(INTN_{it}) + \quad \gamma_8(QINS_{it}) + \gamma_9 \ln(GDPpc_{it})$$
$$+ \gamma_{10} \ln(FVA_{it-1}) + U_{it} \qquad (2)$$

where LABP is labour productivity[9]. All other variables retain their meanings. The *a priori* expectations are the same as is the case with economic upgrading.

The scope of the study is 2000–2015. The choice of the beginning year (2000) follows from the reasoning that all the selected regional economic communities have been in existence then. The end year (2015) is chosen to ensure the availability of data on most of the variables used. Rwanda and Burundi joined the East African Community (EAC) in 2007, hence, their REI values for 2000 to 2006 are not included in the analysis. This implies that we are dealing with an unbalanced panel data. In the case of ECOWAS, data on Guinea Bissau for the dependent variable is not available in the UNCTAD-Eora database, hence this country is excluded from the analysis leaving the number of countries in this REC at 14.

4.2. Estimation strategy

To analyse the relationship between regional economic integration and economic upgrading in global value chains, we use panel data. The entire sample consists of 24 countries from 3 regional economic communities. The scope is 2000–2015. Thus the cross sections – N (24 countries) is larger than the time series T (16 years). To this end, the least square dummy variable (LSDV) technique will be used. The sub-samples consist of 14, 5 and 5 countries in ECOWAS, EAC and SACU respectively. The full sample consists of 384 observations, ECOWAS - 224 observations) and EAC and SACU each has 80 observations. With T being greater than N in each of the sub-samples, the feasible generalised least square (FGLS) technique will be used. The choice of LSDV when N is greater than T and FGLS when T is greater than N is in line with Ashley (2012).

In the case of FGLS, three different assumptions in respect of the error process is first made in order to choose the appropriate structure for the error in the data. The assumptions are: (i) the existence of contemporaneous correlation/cross-sectional dependence in the cross sections; (ii) serial correlation; and (iii) heteroskedasticity. (i) is tested using the LM test of Breusch and Pagan (1980), (ii) is tested with the serial correlation test of Wooldridge (2002) and (iii) is tested using the Modified Wald test proposed by Greene (2008). The null hypotheses respectively are no contemporaneous correlation/no cross-sectional dependence, no serial correlation and no heteroskedasticity (i.e. the existence of homoscedasticity). The three assumptions are tested in the case of model 1 with economic upgrading (LPDV) being the dependent variable of interest. For all the sub-samples, the results, presented in Table 3, show that the null hypotheses cannot be rejected at the 1% level of significance in the cases of serial correlation and heteroskedasticity. Consequently, the FGLS estimation was implemented with an error process that assumed the existence of serial correlation and heteroskedasticity.

For a sensitivity test, the standard errors, robust to an heteroskedastic error structure, autocorrelation up to some lags, and correlation between the panels, was applied, as proposed by Driscoll and Kraay (1998). The

Driscoll and Kraay test follows the Newey-West type correlation and applies the procedure of a non-parametric covariance matrix estimation.

For both LSDV and FGLS, the fixed effects (country and time) were included to account for space- and time- related shocks, and also to mitigate the possibilities of any reverse causations. Fixed and random effects model are also run to serve as robustness check.

5. Empirical results and discussion

The summary statistics of the variables (for the full sample) is first presented, in their non-transformed forms. Table 2 presents the summary statistics of variables.

The summary statistics, among other information it conveys, shows that the variables are wide apart in terms of their minimum and maximum values because of their different units of measurement. This suggests the need to log-transform them to unify their values. However, log-transforming regional economic integration (*rei*), which is an index, and the quality of institution (*qinst*)[10] result into large number of missing values - 75 and 227 missing values respectively. This explains why these two variables are not logged as shown in models 1 and 2.

With a time series dimension of 16 (i.e. 16 years), there arises the possibility of non-stationarity of variables which may result into non-spurious regressions if non-stationary variables are regressed on themselves. The Fisher test as developed by Maddala and Wu (1999) does not require a balanced panel unlike the Im et al. (2003) test. Table A in the Appendix presents the panel unit root test using the Maddala and Wu (1999) test. Both the Dickey-Fuller and Phillips-Perron versions of the test are employed. The results show that all the variables are stationary (integrated of order zero) except domestic credit to the private sector (LDCPS) which is non-stationary but integrated of order one. Sequel to this outcome, the first difference of LDCPS is included in the regressions[11].

Table 3 presents the results for the baseline regression model in which economic upgrading in GVCs is the dependent variable. Columns labelled (1) to (3) contain estimates for ECOWAS, EAC and SACU respectively using FGLS while the column labelled (4) contains the estimates for the full sample using the LSDV technique. The Driscoll and Kraay (D-K) estimates are presented beside the FGLS and LSDV estimates. Overall, the results of FGLS and LSDV are quite very similar to those of D&K[12] both in terms of economic (*a priori* expectations) and statistical significance, though not in all cases. The models are all statistically significant at the 1 percent level as given by the F statistics.

Considering regional economic integration (REI) as the independent variable of major interest, the estimates for ECOWAS and SACU follow *a priori* expectations while those of EAC and the full sample do not follow *a priori* expectations. At any rate, for all the groupings, there is no case in which REI positively significantly contribute to economic upgrading in GVCs. This means that the intermediates imported within each of the group do not contribute significantly to the per capita domestic value added in exports of the Members of the considered RECs. Within ECOWAS, on the average, between 2012 and 2015, Cote d'Ivoire tends to be the biggest supply hub in terms of intermediates followed by Togo and Ghana respectively.

The countries with the highest share of intra-regional intermediate imports are Benin, Niger, Mali and Burkina Faso, with Benin having the highest share amounting to about 37 percent. For EAC, Kenya and Uganda supply the most intermediates respectively and Kenya could be

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[10] Each variable that forms the composite variable *qinst* is an index that lies between -2.5 and 2.5.

[11] In auxiliary regressions not reported here but available upon request, dropping LDCPS completely from the model does not lead to significant change in the significance or otherwise, of other variables, i.e. the results remain stable.

[12] The D& K estimates are only used here for comparison and not for interpretations.

[9] Total factor productivity can also be used as an alternative, but data is sparse on this variable for the selected RECs.

Table 2. Summary statistics of variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
pdv	375	145.42	265.86	4.10	1730.85
rei	309	.25	.27	9.70e-07	.99
fdi	380	898.71	1792.04	73.76	9885.00
dcps	383	23.05	27.43	1.62	160.13
dea	384	210.92	141.85	53.59	585.46
mocel	380	39.57	38.24	.02	159.16
intnt	381	6.27	8.80	.02	51.92
fva	375	780.51	2929.03	6.12	21500
qinst	360	1.26e-07	2.15	-4.37	5.35
educ	296	4.69	2.33	.71	13.22
labp	384	.01	.01	.00	.04
gdppc	384	.00	.00	.00	.01

Source: Authors' computation using STATA software.

taken as the major supply hub in that REC. But Rwanda had on the average, the highest trade integration between 2012 and 2015 amounting to about 43 percent. In SACU, South Africa was clearly the key supply hubs of intermediates while Lesotho was the most integrated in terms of intermediate demands, her REI value averaging about 86 percent. The observed trade integration within each group notwithstanding, considered from the perspective of changes in productivity of domestic factors (such as labour and capital) in global value chains – economic upgrading – regional economic integration has not contributed positively significantly to economic upgrading of the Members of the selected RECs in GVCs.

The insignificance of REI may not be unconnected to two factors. First, the trade integration in intermediate goods (i.e. in terms of volume) may simply be insufficient as to contribute to economic upgrading in GVCs. Secondly, if the quality of inputs obtained within the region is relatively low, this is likely to have negative consequences for domestic value addition and productivity in global value chains. Being the oldest custom union, the finding here is somewhat surprising- that regional economic integration has not contributed significantly to economic upgrading of its Members in GVCs. Descriptive statistics from Engel (2015) however lends credence to our finding as Engel (2015) noted that SACU as a whole has a lower share of intermediates in both imports and exports when compared to selected countries[13]. In furtherance, it was also noted that with the exception of imports in South Africa and exports in Namibia, intermediates as a share of imports and exports declined between 2000 and 2011 which was the scope of that study. This is a pointer to the biased nature of trade integration in that region towards the exports of commodities and imports of consumption thus signalling a rather limited potential for participation in GVCs (Engel, 2015).

Foreign direct investment, in the case of ECOWAS, is not a significant driver of economic upgrading in GVCs but it is at the 10 percent level of significance for both EAC and SACU. For the full sample, the effects of ECOWAS tend to dominate and foreign direct investment is insignificant in driving economic upgrading in GVCs. With inflows of FDI being representative of investments of multinational enterprises, then the inflows of FDI in ECOWAS is yet to significantly bolster the performance of her Members in GVCs in terms of economic upgrading. This finding is similar to that of Kowalski et al. (2015) in the case of their entire sample (developing areas) but not for the low -and high- income countries in which case they got negative but insignificant impact of FDI inflows on per capita domestic value added in exports. They however got a positive and significant impact of the latter on the former for the middle-income countries which led them to the conclusion that per capita domestic value

added in exports is more responsive to FDI inflows in middle-income countries than is the case with others.

Education (as a share of GDP) is a positive but insignificant determinant of economic upgrading in GVCs for ECOWAS and the full sample. A cursory look at the summary statistics shows that the maximum value of education as a share of GDP is just about 13.22 percent – a value only marginally above the average of the United Nations Educational, Scientific and Cultural Organization (UNESCO)'s prescribed minimum of 26 percent. Investments in education being at the heart of human capital development, the low investment of the represented economies in this variable manifests in its miniscule contribution to economic upgrading in GVCs.

The domestic credit to the private sector (as a share of GDP) is also not an important positive determinant of economic upgrading in GVCs for all the sub samples and the full sample. This may ensue either because countries in this RECs do not offer enough credit incentives to the private sector or that the private sector does not judiciously utilise funds made available to them. Considering the weighted average distance to economic activities (LDEA), a variable meant to control for the role of distance, it is in line with *a priori* expectation only in the case of ECOWAS. It is expected that the farther the distance from the capital city (assumed to be the hub of economic activities), the lower should be the per capita domestic value added in exports. A negative and significant sign shows that it is a significant driver of economic upgrading in GVCs, of ECOWAS Members. Access to intermediate inputs from near-bye sources reduces the costs of transportation and transactions, in line with the gravity theory. The positive signs on this variable for other groups is contrary to *a priori* expectations.

Access to internet (as percentage of population) is quite abysmal in the selected RECs particularly in ECOWAS where only Cape Verde has about 40 percent of her population having access to internet between 2012 and 2015. Most of the other Members of this REC had below 20 percent of their population having access to the internet. In EAC, Uganda's access to internet was relatively better than those of others, Uganda's access being just about 16 percent. SACU Members had more access to internet facilities, South Africa having the highest with a percent access of about 47 percent between 2012 and 2015. Access to internet[14] is pivotal to obtaining vital information and updating actors' knowledge which can consequently aid their productivities. The insignificance of this variable shows that it is not sufficient as to significantly bolster economic upgrading in GVCs.

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[13] The selected countries are Argentina, Brazil, Chile, Peru, Thailand, Turkey and Mauritius.

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[14] Using mobile cellular subscription as a proxy for the quality of infrastructure (rather than access to internet facilities) also yielded the same conclusion that it is not a significant driver of economic upgrading in GVCs.

Table 3. Empirical results, with logged per capita domestic value added (LPDV) as the dependent variable.

Variable	(1) ECOWAS		(2) EAC		(3) SACU		(4) FULL SAMPLE	
	FGLS	D&K	FGLS	D&K	FGLS	D&K	LSDV	D&K
REI	0.138 (0.285) [0.48]	0.576 (0.547) [1.05]	-2.793*** (0.865) [-3.22]	-3.890 (2.579) [-1.51]	0.047 (0.103) [0.46]	0.008 (0.119) [0.07]	-0.126 (0.164) [-0.77]	-0.121 (0.140) [-0.86]
LFDI	-0.020 (0.022) [-0.91]	-0.026 (0.036) [-0.71]	0.050* (0.034) [1.78]	0.088 (0.072) [1.23]–	0.030* (0.017) [1.81]	0.027 (0.018) [1.52]	-0.006 (0.016) [-0.40]	-0.006 (0.021) [-0.27]
LEDUC	0.019 (0.056) [0.34]	-0.222 (0.058) [-0.38]	-0.150 (0.122) [-1.23]	-0.285 (0.213) [-1.34]	-0.110 (0.100) [-1.09]	-0.104 (0.232) [-0.45]	0.045 (0.063) [0.72]	0.034 (0.057) [0.59]
LDCPS	0.032 (0.063) [0.52]	0.046 (0.058) [0.79]	-0.271 (0.199) [-1.36]	-0.425 (0.611) [-0.70]	-0.185*** (0.050) [-3.71]	-0.162* (0.089) [-1.82]	-0.056 (0.065) [-0.86]	-0.061 (0.047) [-1.29]
LDEA	-4.843*** (1.697) [-2.85]	0.618** (0.286) [2.16]	1.313 (6.153) [0.21]	0.927 (0.530) [1.75]	0.608*** (0.110) [5.52]	2.139*** (0.621) [3.44]	-	0.934*** (0.217) [4.29]
LINTNT	-0.003 (0.039) [-0.09]	-0.028 (0.066) [-0.42]	0.075 (0.06) [1.15]	0.082 (0.147) [0.55]	0.006 (0.055) [0.11]	0.010 (0.092) [0.10]	-0.002 (0.037) [-0.06]	-0.006 (0.046) [-0.12]
QINST	0.017 (0.020) [0.83]	0.021 (0.036) [0.58]	-0.075 (0.059) [-0.77]	-0.003 (0.181) [-0.02]	0.051 (0.031) [1.64]	0.052 (0.042) [1.24]	0.037 (0.025) [1.46]	0.042** (0.018) [2.36]
LGDPPC	0.246*** (0.094) [2.62]	0.240 (0.180) [1.34]	-0.056 (0.940) [-0.70]	-0.054 (0.145) [-0.37]	0.974*** (0.214) [4.56]	0.995** (0.458) [2.17]	0.044 (0.108) [0.41]	0.041 (0.186) [0.22]
LFVA(-1)	0.258*** (0.082) [3.16]	0.375** (0.157) [2.39]	0.166 (0.232) [0.72]	0.017 (0.424) [0.04]	-0.078 (0.065) [-1.20]	-0.086 (0.146) [-0.59]	0.217*** (0.079) [2.74]	0.175** (0.071) [2.45]
C	29.736*** (8.195) [3.63]	-	-2.327 (25.466) [-0.09]	-	9.928*** (1.561) [6.36]	-	3.746*** (0.806) [4.65]	-
Observations	224	224	80	80	80	80	384	384
Number of Countries	14	14	5	5	5	5	24	24
p-val of F or chisquare test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-val of Wooldridge test	0.000	-	0.006	-	0.007	-	-	-
p-val of Modified Wald test	0.000	-	0.000	-	0.001	-	-	-
p-val of LM test of contemporaneous correlation	1.000	-	1.000	-	1.000	-	-	-
R squared	-	0.978	-	0.973	-	0.998	0.987	0.987

Note: ***, ** and * denote significant at the 1%, 5% and 10% level respectively. Values in () and [] denote standard errors and t (or z) statistic respectively. Time and country fixed effects included all through. – means omitted or not applicable.

Table 4. Empirical results, with logged labour productivity (LLABP), as the dependent variable.

Variable	(1) ECOWAS		(2) EAC		(3) SACU		(4) FULL SAMPLE	
	FGLS	D&K	FGLS	D&K	FGLS	D&K	LSDV	D&K
REI	0.035 (0.095) [0.37]	0.198 (0.124) [1.61]	0.240* (0.125) [1.92]	0.174 (0.108) [1.61]	0.223*** (0.055) [4.07]	0.139*** (0.039) [3.52]	0.132* (0.079) [1.66]	0.119 (0.079) [1.51]
LFDI	0.012*** (0.004) [2.97]	0.016*** (0.006) [2.52]	-0.003 (0.006) [-0.53]	0.000 (0.006) [0.02]	0.025*** (0.008) [2.93]	0.010 (0.008) [1.18]	0.008 (0.005) [1.58]	0.010** (0.003) [2.91]
LEDUC	0.006 (0.019) [0.30]	0.013 (0.032) [0.40]	0.018 (0.014) [1.30]	0.044 (0.027) [1.62]	0.096** (0.049) [1.96]	0.126 (0.092) [1.36]	-0.009 (0.022) [-0.43]	-0.008 (0.030) [-0.29]
LDCPS	0.031 (0.022) [1.44]	0.034 (0.041) [0.81]	0.010 (0.033) [0.29]	0.012 (0.054) [0.23]	0.025 (0.026) [0.98]	-0.017 (0.025) [-0.67]	0.017 (0.024) [0.73]	0.012 (0.033) [0.37]
LDEA	-6.777*** (0.564) [-12.01]	-4.652*** (0.090) [-5.18]	-1.413 (1.172) [-1.21]	-1.010*** (0.088) [-11.53]	0.078 (0.057) [1.38]	-0.529** (0.221) [-2.39]	-	-0.518*** (0.069) [-7.56]
LINTNT	0.045*** (0.013) [3.38]	0.059*** (0.012) [4.76]	0.057*** (0.010) [5.41]	0.075*** (0.012) [6.49]	0.102*** (0.028) [3.68]	0.068** (0.033) [2.07]	0.060*** (0.016) [3.77]	0.066*** (0.009) [7.25]
QINST	0.043*** (0.009) [4.79]	0.053*** (0.012) [4.35]	0.062*** (0.014) [4.33]	0.044*** (0.107) [4.09]	0.058*** (0.015) [3.79]	0.041** (0.019) [2.12]	0.049*** (0.011) [4.51]	0.050*** (0.010) [5.25]
LGDPPC	0.236*** (0.033) [7.24]	0.306*** (0.044) [6.93]	0.044* (0.025) [1.77]	0.059 (0.071) [0.84]	0.114 (0.108) [1.05]	0.100 (0.199) [0.50]	0.240*** (0.035) [6.84]	0.228*** (0.051) [4.51]
LFVA(-1)	0.047* (0.026) [1.81]	0.092* (0.047) [1.98]	0.122*** (0.038) [3.17]	0.165*** (0.034) [4.90]	-0.041 (0.034) [-1.23]	0.026 (0.024) [1.06]	0.070** (0.031) [2.29]	0.073** (0.032) [2.27]
C	30.541*** (2.741) [11.14]	-	-0.438 (4.709) [-0.09]	-	-3.787*** (0.790) [-4.79]	-	-3.923*** (0.324) [-12.11]	-
Observations	224	224	80	80	80	80	384	384
Number of Countries	14	14	5	5	5	5	24	24
p-val of F or chisquare test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-val of Wooldridge test	0.000	-	0.004	-	0.006	-	-	-
p-val of Modified Wald test	0.000	-	0.000	-	0.000	-	-	-
p-val of LM test of contemporaneous correlation	1.000	-	1.000	-	1.000	-	-	-
R squared	-	0.995	-	0.999	-	0.999	0.997	0.998

Note: ***, ** and * denote significant at the 1%, 5% and 10% level respectively. Values in () and [] denote standard errors and t (or z) statistic respectively. Time and country fixed effects included all through. – means omitted or not applicable.

Table 5. Empirical results for robustness tests, with logged per capita domestic value added (LPDV) as the dependent variable.

Variable	(1) ECOWAS		(2) EAC		(3) SACU		(4) FULL SAMPLE	
	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random
REI	0.205 (0.261)	0.205 (0.280)	-0.907*** (0.238)	-0.907*** (0.302)	0.119 (0.096)	0.119 (0.111)	-0.188 (0.213)	-0.188 (0.229)
LFDI	-0.059 (0.036)	-0.059 (0.038)	0.118*** (0.032)	0.118*** (0.041)	0.018 (0.020)	0.018 (0.023)	-0.014 (0.022)	-0.014 (0.024)
LEDUC	-0.010 (0.103)	-0.010 (0.111)	0.021 (0.292)	0.021 (0.369)	-0.150 (0.142)	-0.150 (0.164)	0.047 (0.104)	0.047 (0.111)
LDCPS	0.046 (0.085)	0.046 (0.091)	-0.728 (0.625)	-0.728 (0.791)	-0.139 (0.166)	-0.139 (0.192)	-0.027 (0.089)	-0.027 (0.095)
LDEA	-	-6.889*** (2.600)	-	-1.457 (1.157)	-	0.639*** (0.158)	-	0.226 (0.239)
LINTNT	-0.042 (0.067)	-0.042 (0.072)	0.184* (0.088)	0.184* (0.112)	-0.043 (0.073)	-0.043 (0.084)	-0.008 (0.055)	-0.008 (0.059)
QINST	0.026 (0.022)	0.026 (0.024)	-0.002 (0.069)	-0.002 (0.087)	0.122 (0.076)	0.122 (0.088)	0.033 (0.026)	0.033 (0.028)
LGDPPC	0.200* (0.104)	0.200* (0.111)	-1.533** (0.627)	-1.533** (0.793)	1.277*** (0.251)	1.277*** (0.290)	0.050 (0.026)	0.050 (0.141)
LFVA(-1)	0.500** (0.176)	0.500** (0.188)	0.822 (0.749)	0.822 (0.948)	-0.240 (0.135)	-0.240 (0.156)	0.221* (0.123)	0.221* (0.132)
C	3.506** (1.309)	39.110*** (12.613)	-14.560** (6.726)	-7.111** (3.086)	15.478*** (1.515)	12.863*** (1.941)	3.740*** (1.076)	4.019*** (0.909)
Observations	224	224	80	80	80	80	384	384
Number of Countries	14	14	5	5	5	5	24	24
F-Stat. Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R squared	0.565	0.975	0.656	0.966	0.634	0.998	0.551	0.997

Note: ***, ** and * denote significant at the 1%, 5% and 10% level respectively. Values in () and [] denote standard errors and t (or z) statistic respectively. Time and country fixed effects included all through. – means omitted or not applicable.

The quality of institution is a positive but insignificant contributor to economic upgrading in GVCs in the cases[15] of ECOWAS, SACU and the full sample. For EAC, the result shows that it impacts economic upgrading negatively, contrary to theoretical expectation. The estimate for EAC is perhaps partially explained by the principal component analysis that shows that most of the EAC Members fell in the negative domain, with Rwanda having more positive values. The insignificant impact of this variable is a reflection of the state of such factors as voice and accountability, government effectiveness, regulatory quality, political stability, control of corruption and the rule of law – all of which are sub-sets of the quality of institution[16].

The per capita GDP term – proxy for the level of development- is a positive and significant determinant of economic upgrading in GVCs in respect of the ECOWAS and SACU RECs but not for EAC which has, relative to other RECs, the lowest average GDP per capita. Burundi, of the EAC REC, has the lowest GDP per capita within the sample period. It is expected that as the GDP per capita of domestic labour employed by firms engaged in GVCs increases, the per capita domestic value added embodied in exports should increase owing to the important roles of income in productivity. The GDP per capita term for both SACU and ECOWAS are significant at the 1 percent level, with the former having the higher z-statistic of 4.56. This outcome is not surprising as SACU Members have relatively higher GDP per capita than those of the ECOWAS and EAC RECs[17].

The past value of backward participation in GVCs (LFVA(-1)) is a positive and significant determinant of economic upgrading in GVCs in ECOWAS and for the full sample. The import of this is that being linked via the demand side to GVCs is important to economically upgrade in GVCs. In other words, access to intermediate inputs from anywhere in the globe (not necessarily restricted to a REC) is important to experience positive and significant changes in per capita domestic value added in exports. Engel (2015) noted that foreign value added in exports

Table 6. [18]Empirical results for robustness tests, with logged agricultural labour productivity (LLABP)as the dependent variable.

Variable	(4) FULL SAMPLE	
	Fixed	Random
REI	0.184* (0.096)	0.184* (0.102)
LFDI	0.008 (0.007)	0.008 (0.008)
LEDUC	-0.008 (0.020)	-0.008 (0.021)
LDCPS	0.016 (0.028)	0.016 (0.030)
LDEA	-	-0.104 (0.021)
LINTNT	0.061*** (0.019)	0.061*** (0.020)
QINST	0.049*** (0.017)	0.049*** (0.018)
LGDPPC	0.240*** (0.051)	0.240*** (0.055)
LFVA(-1)	0.070 (0.045)	0.070 (0.048)
C	-3.933*** (0.432)	-2.531*** (0.422)
Observations	384	384
Number of Countries	24	24
F-Stat. Probability	0.000	0.000
R squared	0.910	0.997

Note: ***, ** and * denote significant at the 1%, 5% and 10% level respectively. Values in () and [] denote standard errors and t (or z) statistic respectively. Time and country fixed effects included all through. – means omitted or not applicable.

(backward participation) and domestic value added in exports (forward participation) can be seen as complements, when viewed from a dynamic perspective. This follows from the reasoning that access to imported quality and cost-effective inputs can help to raise the competitiveness of firms, exports and nominal DVA. Technological spill-overs from imported inputs may also help raise the share of DVA with time. Backward participation also aids downstream competitiveness (Engel, 2015). Tinta (2017) found that lagged backward participation in GVCs positively and significantly impacted on trade openness and Kowalski et al. (2015) found that backward participation positively and significantly aided economic upgrading in GVCs for low, middle and high-income countries.

This current study, for the sake of comparison, also investigates whether or not regional economic integration and other selected determinants of the productivity of domestic factors in GVCs, i.e. economic upgrading in GVCs (as contained in model 1) impact labour productivity in a similar fashion. If they do impact both economic upgrading in GVCs

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[15] In GVCs, the output of a task may become the input for the next stage which is more downstream in that value chain.

[16] Those for LLABP (labour productivity) are available upon request; the results remain consistent when fixed and random effects are used.

[17] The fixed and random effects were presented as a robustness test. The Hausman test supported the random effects over the fixed effects as the chi-square probability was insignificant, but the conclusions are the same as shown in Tables 5 and 6. The results of the Hausman tests are available upon request.

and labour productivity in the same manner, then policies geared towards enhancing one outcome automatically enhances the other.

Table 4 presents the results using labour productivity as the dependent variable. The results presented in Table 4 shows that the determinants do not necessarily affect both economic upgrading and labour productivity in the same manner. For regional economic integration, the variable of key interest, the LSDV estimate for the full sample shows that regional economic integration positively statistically impact labour productivity at the 10 percent level of significance. For the EAC sub-sample, REI significantly impacts labour productivity at the 10 percent level. In the case of SACU, the oldest customs union, REI is found to positively and statistically significantly impact labour productivity even at the 1 percent level of significance. In ECOWAS, REI contributes positively but statistically insignificantly to the labour productivity of her Members as a group. Thus, regional economic integration has contributed significantly to labour productivity of both EAC and SACU but not to their economic upgrading in GVCs. The policy implication of this is that more intensified efforts are needed to further clear barriers to trade ties in intermediate goods amongst Members in order to enhance the addition of value in fragmented production processes. For ECOWAS, regional economic integration has not contributed sufficiently to any of labour productivity and economic upgrading in GVCs. Hence, it may be inferred that the measures put in place by ECOWAS (measures which include but not limited to the West African Agricultural Productivity Programme, the West African Quality Systems Programme, ECOWAS Trade Liberalisation Scheme, among others) are yet to yield sufficient results.

For the full sample, FDI does not contribute significantly to labour productivity but does significantly drives labour productivity both in ECOWAS and SACU at the 1 percent level of significance. The same does not ensue when it comes to productivity associated with participation in GVCs. This variable manages to be significant in impacting economic upgrading only at the 10 percent level of significance, in EAC and SACU. This finding suggests that more investments of foreign multinational enterprises is needed to boost economic upgrading of local economies than needed to boost labour productivity. Education significantly aids labour productivity only in SACU but does not significantly aid the economic upgrading of SACU Members in GVCs. Domestic credit to the private sector contributes positively but statistically insignificantly to labour productivity across the sub-samples including the full sample. Its contribution to economic upgrading is also not positively significant for all the RECs. This is a clear indication that all these RECs lag behind in terms of the provision of credit to the private sector.

The distance to economic activity tends to fit the labour productivity model more than it does in respect of economic upgrading as this variable, in line with theoretical expectation, is expected to be negatively related to both labour productivity and economic upgrading. The coefficients and z statistics suggest that for most cases, it is a negative and significant driver of labour productivity. This implies that the lower the distance to capital city which is assumed to be the centre of economic activities, the higher is the productivity of labour. Kowalski et al. (2015) in their case obtained a negative and significant impact of this variable on economic upgrading for all the groups with the exception of low-income countries for which they obtained a negative but insignificant impact.

Access to the internet sufficiently aids labour productivity for all the groups but it does not aid the economic upgrading in GVCS, of any of the groups. This finding suggests that the levels of internet access across the RECs do not suffice when it comes to domestic productivity linked with GVCs. As noted by Grossman and Rossi-Hansberg (2008), when instructions can be delivered instantaneously, it becomes easy to move components and unfinished goods quickly and cheaply. In addition, when the output of many tasks can be electronically conveyed, firms may cash-in on the advantages of disparities in the cost of factors in different

locations while not sacrificing the gains from specialisation. Thus it may be inferred that better means of communication is needed to aid domestic value addition when trade in intermediates is very important. In essence, labour productivity is more sensitive to the levels of internet access than do economic upgrading in GVCs. The same conclusion goes for the quality of institution as it positively and significantly aid labour productivity in all the RECs but does not positively aid the economic upgrading of any REC in GVCs. It does seem that stronger institutions are needed to aid the addition of sufficient values to intermediate goods which form the core of GVCs.

GDP per capita is a positive and significant determinant of labour productivity for the full sample at the 1 percent level of significance. It significantly drives labour productivity in both ECOWAS and EAC but surprisingly not in SACU. The positive sign implies that higher income per head enhances the productivity of labour. Lagged backward participation in GVCs is also a positive and significant determinant of labour productivity for ECOWAS, EAC and the full sample. This buttresses the importance of being linked to international sources where needed inputs can be obtained. In SACU, although lagged backward participation in GVCs presents a negative sign, it is not a significant driver of either of economic upgrading or labour productivity. In this REC, statistics from WITS show that intermediates from South Africa accounts for over 90 percent of the imported regional intermediates by the other Members, within the sample period. In similar vein, Engel (2015) noted that South Africa accounts for over 60 percent of the foreign value added of Botswana, Namibia and Swaziland. Thus, it may be deduced that the observed impact of lagged backward participation on economic upgrading and labour productivity of SACU Members is largely a reflection of their huge dependence on South Africa for intermediate inputs.

5.1. Robustness tests

Fixed and random effects models for each REC are presented in the case of LPDV (economic upgrading in GVCs). A careful comparison of the estimates in Tables 3 and 5 show that the conclusions are largely unchanged, hence are not driven by the choice of technique employed. For instance, in ECOWAS, the level of development (LGDPPC), lagged backward integration into GVCs (LFVA(-1)) and distance to economic activity (LDEA) are the significant determinants of economic upgrading in GVCs, as adjudged by most of the techniques. For the full sample, most of the techniques support that only the past value of backward integration into GVC6 support economic upgrading of those selected RECs, in GVCs. In the case of labour productivity (which is used here only as a comparison with economic upgrading in GVCs), the estimates as presented in Tables 4 and 6 also show that the conclusions do not differ significantly. The techniques employed are unanimous in their decisions that internet (LINTNT), the quality of institution (QINST) and the level of development (LGDPPC) are significant drivers of labour productivity for the full sample.

6. Conclusion and recommendations

The insignificance of the REI indicator with respect to its effect on economic upgrading of ECOWAS, EAC and SACU suggests that not much intermediate inputs, needed to enhance economic upgrading in GVCs, is accessible within these RECs. When viewed from another perspective, an explanation for the insignificance of REI could be that there remains some obstacles to regional economic integration that inhibits Members' penetration of one another's market. The importance of creating more supportive environments for the inflows of foreign direct investment cannot be overemphasized. The empirical estimates show that FDI did not contribute significantly to economic upgrading in GVCs within the study period for the full sample. This is particularly more important to policy makers in ECOWAS given the insignificance of FDI in boosting the economic upgrading of Members of that REC, in GVCs.

Domestic credit to private sector and investments in education necessarily need to improve as these both are insignificant drivers of

[18] Only those for the full sample is presented, others are available upon request.

economic upgrading in GVCs. This requires efforts from both the national and regional fronts. The abysmal share of government expenditure on education in GDP does not bode well for economic productivity associated with participation in GVCs. UNESCO's recommendation in this respect may prove to be helpful. The quality of institution across the RECs is not in its best form. Not even at the 10 percent level of significance is this indicator a significant driver of economic upgrading in the case of SACU – the REC with the best performance in this indicator – as it narrowly missed statistical significance at the 10 percent level. Although the quality of institution significantly boosts labour productivity in all the RECs, the inability of this variable to significantly aid economic upgrading points to the need to strengthen each component of the quality of institution in order to sufficiently aid domestic value addition to intermediate goods within the region. The RECs may initiate incentives to reward Members who significantly improve their rankings in these indicators in order to encourage others who lag behind.

The East African Community (EAC) needs to harness the requisite resources to improve the level of development (proxied by GDP per capita) of her Members as this variable did not contribute significantly to improving the economic upgrading of the Members of this REC, in GVCs. Finally, although regional economic integration opens up opportunities to access inputs within the region at reduced costs, there is the need to patronise other international sources with improved inputs that can help in enhancing domestic value addition. This recommendation tends to be particularly more important to the Members of SACU who are largely dependent on intermediate inputs (and by extension foreign value added in exports[19]) from South Africa.

6.1. Suggestions for further studies

The analysis here is limited to the country level. The role of economic integration on economic upgrading in GVCs in these selected RECs may be examined at the sectorial level using information from the Eora GVC database. The analysis can also be extended to other RECs in Africa such as the Common Market for Eastern and Southern Africa (COMESA) and the Economic Community for Central African States (ECCAS). Further studies can also investigate how African RECs have fared in aiding backward integration in GVCs.

Declarations

Author contribution statement

B. Obasaju: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

W. Olayiwola and H. Okodua: Conceived and designed the experiments.

O. Adediran and A. Lawal: Contributed reagents, materials, analysis tools or data.

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Data will be made available on request.

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[19] The import of backward integration in aiding domestic value addition notwithstanding, backward integration must not be taken to the extreme. This is in order not to send a wrong signal to domestic industries striving to use indigenous resources and technology to enhance local content of exports and in worse case scenarios, lead to the eventual death of such industries as a result of unhealthy competition with foreign inputs.