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The Effects Of Global Value Chains (Gvc) On Employment In Nigeria

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Abstracts

This study was conducted to examine the impact of GVC participation on employment in Nigeria between 1991Q1 and 2015Q4. Specifically, we examined the GVC participation employment impacts along different sectors of the economy which include the agricultural sector, industrial sector and services sector. To implement our study, we used Dynamic Ordinary Least Squares. Our findings showed that only backward GVC participation contributes positively to total employment. At sectoral levels, industrial sector employment benefited from the total, forward and backward GVC participation while agricultural sector employment only benefits in total and forward GVC participation. However, we did not find evidence that services sector employment benefits from any GVC participation. Giving our findings, we recommended that government should encourage greater participation in GVC activities through appropriate policy formulation and implementation. Also, the requisite skills needed by workers in different sectors or industries of the economy must be developed and harnessed to be better off when participating in GVC activities.

1.0. Introduction

The global value chains (GVC) has continued to shape the production process and how trade occurs. It is therefore important to examine its implication for employment, especially in developing countries. A value chain is simply the full gamut of all stages a good being produced usually passes through from when it is conceived to when it is distributed and finally consumed by the end-users (UNCTAD, 2010). As the good passes through each stage, a particular value is added; and all the values are summed up in a final product (ESCAP, 2015). GVC, therefore, occurs when different stages of production of a good at which different values are added are carried out by different firms in different countries. Due to the major problems of double counting, the GVC has therefore rendered inappropriate the traditional method of capturing the effect of integrating into value chains using trade data (Deardorff, 2001; Banga, 2016).

The degree of participation in GVC by a country is measured by the GVC index which is divided into forward GVC participation index and backward GVC participation index. The forward GVC participation index, also known as upstream participation index, shows the extent to which a county exports intermediates for the production of exports of other countries; while the backward GVC participation index, which generates a higher value addition than the forward GVC participation and can also be referred to as downstream participation index, indicates the degree to which a country imports intermediates in order to produce exports (Hummels et al., 2001). The addition of both the backward participation index and forward participation index gives the total GVC participation index.

The general belief in the GVC approach to industrial upgrading is that GVC can have a negative effect on employment, and this can have a detrimental effect on society (Jiang and Milberg, 2013). However, Farole (2016) asserts that the employment impact of GVC participation depends on the nature of a country. As most high-income countries with higher-skilled labours derive benefits in terms of rising wages, while job losses by lower-skilled labours increase more, the presence of large surpluses of labour and low wages make a country witness rise in jobs creation as a result of GVC participation. An upgrading in GVC by a country or a sector will result in an increase in wages, higher gain to skilled labour, but a fall in net employment.

Pan (2020a) maintains that total GVC participation contributes to employment generation in more advanced economies; but backward GVC participation creates jobs in the domestic economy than the forward GVC participation, especially in the less developed economies. In the opinion of Nasser dine (2019), backward GVCs integration has a more positive impact on employment, but forward GVC participation makes labours in some sectors of a country lose their jobs. The major observation is then that participation in GVC, either forward or backward, can have a different impact on employment depending on the country being considered. It is therefore important to empirically examine the effect of forward and backward GVC participation on employment to identify the nature of their effect on employment, particularly for Nigeria.

The effects of GVC on employment has been empirically examined by some studies. However, almost all the studies employ panel regression technique and mostly with fixed effect, except for Feenstra and Hanson (1996) that use the reduced form regression estimation technique. However, a panel regression technique does provide country-specific or sector-specific results despite that some of the studies claim to be on a single country. However, this study will fill this gap by providing a true country-specific study on the effect of GVC participation on employment using the data of Nigeria. The provision of this country-specific with sectoral analyses is, therefore, the contribution of this study. This is possible because it is possible to calculate the GVC participation index for each country that can be used for a single country study using Eora MRIO.

After this introduction, the rest of this paper proceeds as follows. Section 2 presents the background of the study. Section 3 provides the literature review. Section 4 describes the theoretical framework and model specification. Section 5 provides the empirical results while section 6 concludes and offers recommendations.

2.0. Background of the Study

Nigeria has been participating in GVC due to the belief that it can drive economic transformation, solve the problem of inclusive growth, and contribute to employment generation (Ogunleye, 2014). In this section, the relationships between total and sectoral GVC indexes and employment in Nigeria are discussed.

Figure 1 presents the movements of Nigeria's total GVC participation index (TGVCPA), total backward GVC participation index (TBWDP), total forward GVC participation GVC index (TFWDP), and total employment to population ratio (TETP) during the period 1991:Q1-2015Q:4.[3] From Figure 1, it can be observed that both the TGVCPA and TFWDP display a minor general upward trend from 1994Q4 up till 2015Q4, while the TBWDP shows a slight downward trend around the same period. The trend of TETP is down from 1991:Q1 to 2011:Q1 before it suffers a huge decline till 2015:Q4. It can be observed the TFWDP is higher than the TBWP. This indicates that Nigeria exports more intermediates for the production of exports of other countries than its imports for the production of its exports. As regards employment, Figure 1 shows that as both the TGVCPA and TFWDP are rising, the TETP is falling. This shows that there are negative relationships between TGVCPA and TFWDP on one hand and the TETP. Contrarily, the figure shows that as TBWDP is falling, the TETP is also falling indicating a positive relationship between the two.

[3] The method for computation of GVC indexes are put in appendix

Figure 1: Movements of Nigeria's Total GVC Indexes and Total Employment to Population Ratio, 1991Q1-2015Q4
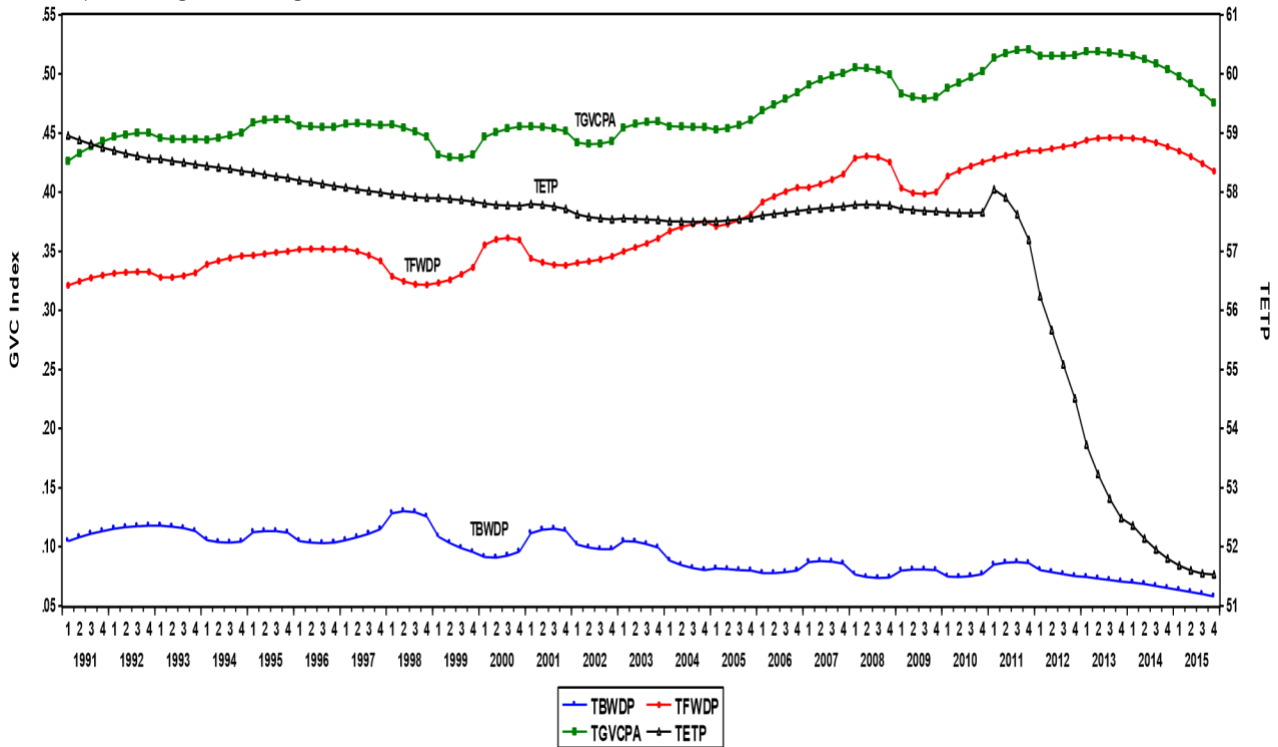
Source: Graphed by the authors using Eora MRIO for GVC Indexes, and Data from World Development Indicators (WDI) for Total Employment to Population Ratio.

Figure 2 presents the movements of Nigeria's agricultural sector total GVC participation index (AGVCP), agricultural backward GVC participation index (ABWDP), agricultural forward GVC participation GVC index (AFWDP), and percentage employment in the agricultural sector to total employment (EAGR) during the period 1991Q1-2015Q4. It can be observed from Figure 2 that both the AGVCP and AFWDP maintains a minor upward trend while the trend of ABWDP is somehow stable throughout the period 1991Q1-2015Q4. The graph of AFWDP is higher than the graph of ABWDP, and this indicates Nigeria participates more in forward GVC than backward GVC during the period being considered. The graph of EAGR exhibits a downward trend throughout the period, implying that employment in the agricultural sector falls during the period. Since there is a minor upward trend in AGVP and AFWDP while there is a downward trend in EAGR, this indicates a negative relationship between each AGVP and AFWDP on one hand and the EAGR on the other hand. The stable trend of ABWDP shows that there is no relationship between it and the EAGR that falls throughout the period under consideration.
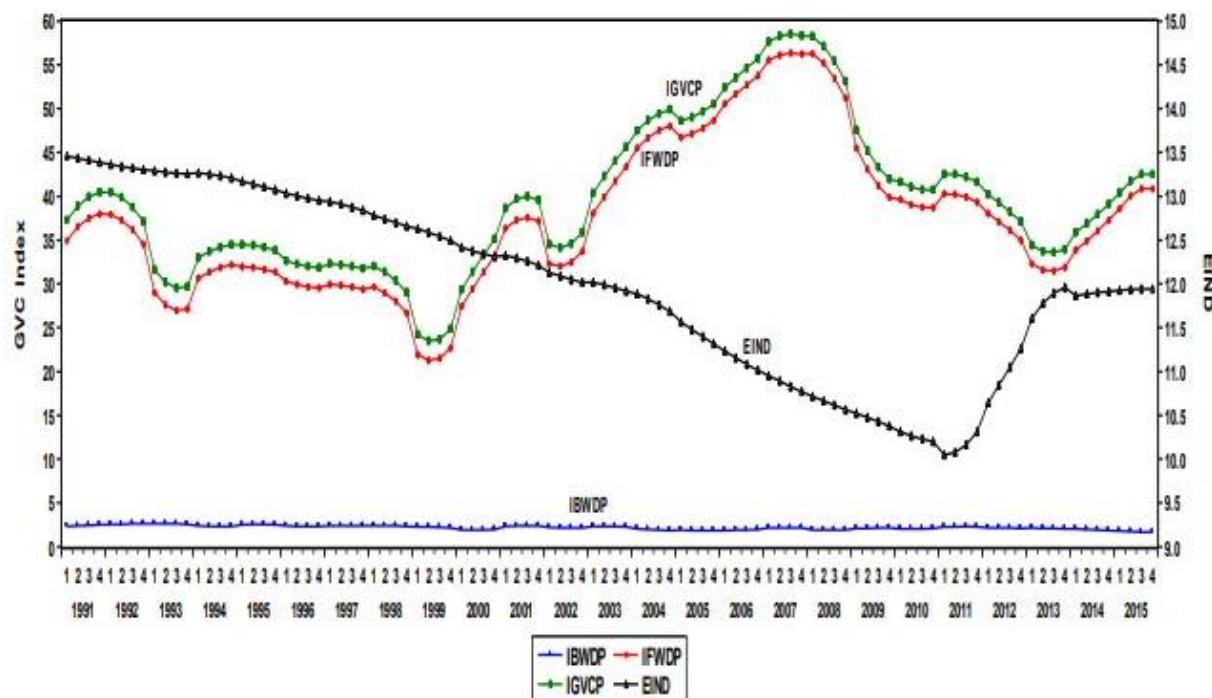
Figure 2: Movements of Nigeria's Agricultural Sector GVC Indexes and Employment in Agricultural Sector, 1991Q1-2015Q4
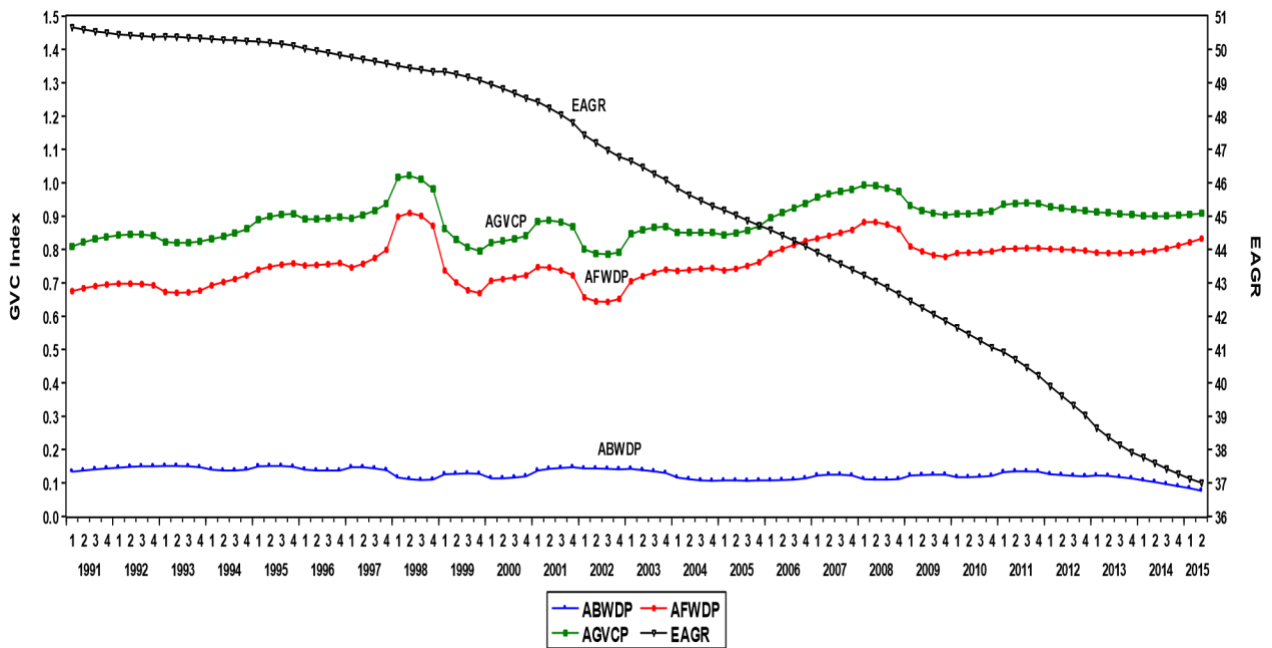
Source: Graphed by the authors using Eora MRIO for GVC Indexes, and Data from World Development Indicators (WDI) for Percentage Employment in Agricultural Sector to Total Employment.

Figure 3 presents the movements of Nigeria's industrial sector total GVC participation index (IGVCP), industrial backward GVC participation index (IBWDP), industrial forward GVC participation GVC index (IFWDP), and percentage employment in the industrial sector to total employment (EAGR) during the period 1991Q1-2015Q4. Figure 3 reveals that both the IGVCP and IFWDP do not exhibit a particular trend, while the IBWDP is stable throughout the period. It can also be seen in Figure 3 that EIND exhibits a downward trend till 2011:Q2 before exhibiting an upward trend till 2015:Q4. Figure 3 clearly shows that there is an inverse relationship between each of the IGVCP and IFWDP and EIND. That is, when the IGVCP and IFWDP rise, the EIND falls; and when the IGVP and IFWD falls, the EIND rises. However, no relationship between IBWDP and EIND can be seen in Figure 3.
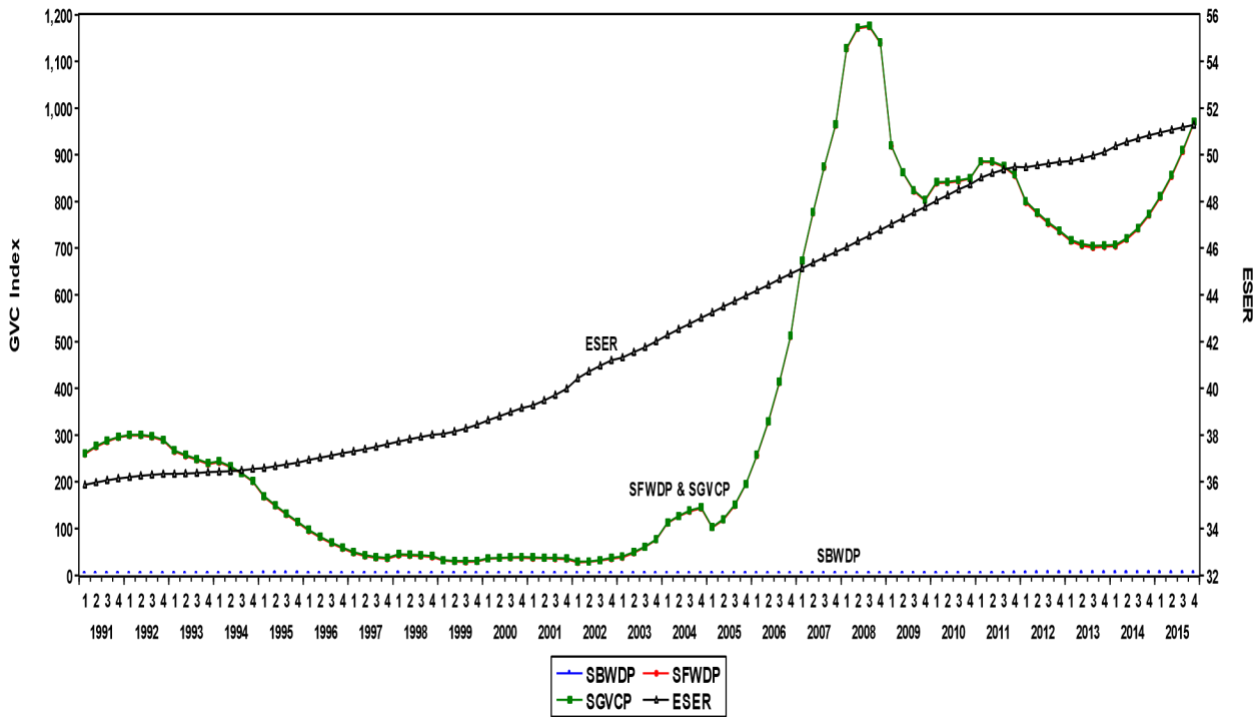
Figure 3: Movements of Nigeria's Industrial Sector GVC Indexes and Employment in Industrial Sector, 1991Q1-2015Q4

Source: Graphed by the authors using Eora MRIO for GVC Indexes, and Data from World Development Indicators (WDI) for Employment in Industrial Sector.

Figure 4 presents the movements of Nigeria's service sector total GVC participation index (SGVCP), service backward GVC participation index (SBWDP), service forward GVC participation GVC index (SFWDP), and percentage employment in the services sector to total employment (ESER) during the period 1991Q1-2015Q4. It can be seen that both SGVCP and SFWDP are almost equal while SBWDP is also zero. This shows that Nigeria mostly participates in the service sector GVC with little or no participation in the services sector backward GVC. In Figure 4, ESER exhibits an upward trend throughout the period 1991Q1-2015Q4 without showing a relationship with any of the GVC indexes. This can be interpreted to mean that GVC participation does not have any relationship with employment generation in the service sector throughout the period considered.

Figure 4: Movements of Nigeria's Industrial Sector GVC Indexes and Employment in Service Sector, 1991Q1-2015Q4

Source: Graphed by the authors using Eora MRIO for GVC Indexes, and Data from World Development Indicators (WDI) for Employment in Service Sector.

Summarily, it can be observed from the above that there is a negative relationship between total or overall GVC participation and total forward GVC participation and total employment to the total population, while there is a positive relationship between total backward GVC participation and total employment to the total population. For the agricultural sector, the relationship between each of the agricultural total GVC participation and agricultural forward GVC participation and employment in agriculture is inverse, while no relationship can be identified between the agricultural backward GVC participation and employment in agriculture. The same thing applies to the industrial sector as there is a negative relationship between each of the industrial total GVC participation and industrial forward GVC participation and employment in industry, while no relationship between industrial backward GVC participation and employment in the industry could be identified. However, employment in the service is observed to have no relationship with any of the GVC indexes.

These analyses imply that GVC participation can have a positive, negative, or no relationship with employment generation depending on the GVC measurement and sector. It should however be noted that the findings under this section do not indicate causal relationships between GVC participation and employment. A causal relationship can only be confirmed by employing an empirical analysis. This is therefore the main objective of this study as it examines the effects of GVC participation on employment using the data of Nigeria.

3.0. Literature review

Ma, Liang and Zhang (2019) study the impact of the position of an industry in a country in GVCs on employment during the period 1995-2011 using the World Input-Output Database (WIOD) which has 41 countries and regions' input and output data at industry level. A panel regression model is employed by the study as the method of analysis. The position of a country in GVCs is measured by the domestic value-added (DVA) ratio of intermediate inputs (DVAR). The results of the study reveal that the employment level and structure of the country are significantly impacted positively by the GVCs position of the country. Larger high-skilled labour demand and a more perfect employment structure are attracted by countries located in higher GCVs positions. The results also show that the impacts of GVCs on employment are more statistically significant for capital-intensive industries than for labour-intensive industries. In addition, the results reveal that the impacts of domestic value chains are larger than the impacts of foreign value chains.

Nasser dine (2019) examines the impacts of the integration of Global Value Chains (GVCs) through backward and forward linkages on the employment in Turkey during the period 20002014 using the world input-output data (WIOD) table of 2016. Trends analyses and fixed effects estimation technique which controls for the spillovers effects of GVCs indicators using a spatial weight matrix approach is employed by the study. The trends analyses show that manufacturing sectors post faster growth through backward linkages, while the service sectors through forward linkages. The empirical results show that it is not only the GVCs integration that affects jobs creation but also the changes in GVCs participation in neighbouring sectors, and this implies significant spillovers effects across sectors. In addition, backward GVCs integration has a more positive impact on employment, but the effect of the backward GVCs integration on the neighbouring sectors is negative. Labour in service sectors seems to lose their jobs as a result of integration in the forward GVCs.

Pan (2020a) evaluates the effect of GVC on employment using the World Input-Output Database (WIOD) covering 56 industries in 43 economies, which include 28 EU countries and 15 other major countries, covering the period 2000-2014. In the study, GVC Ratio is measured as the ratio of the forward participation index to the backward participation index, and a country is said to participate more in the upstream production activities in the GVC the higher value of the ratio. The study employs a fixed effect panel regression estimation technique and the results show that when the forward and backward GVCs are combined in estimation, the effect of GVC participation on employment in more advanced economies is positive but small. In addition, backward GVC participation creates jobs in the domestic economy that the forward GVC participation, especially in the less developed economies.

Long et al (2019) investigate the impacts of integration into GVCs on formal and informal employment in Viet Nam using the Viet Nam Household Living Standard Surveys and the

Organisation for Economic Co-operation and Development's Trade in Value Added database for the years 2010, 2012, and 2014. The study employs a fixed effects estimator to examine the effects of participation in GVCs on the, while a probit estimator is employed by the study to examine the likelihood of being a formal employee. The results of the study show that participation in GVC has a

positive effect on the share of formal employment at the provincial level but the effect is not statistically significant. The effects of forward GVC participation and backward GVC participation on employment are found to be in a different direction. The results also show that GVC does not have a direct effect on the probability of being a formal employee at the provincial level, but the probability of being a formal employee is indirectly affected through the local labour market.

Pan (2020b) examines the impact of both the US forward and backward GVC participation on US employment employing data from the World Input-Output Database (WIOD) for the period 19952011. A dynamic panel data (DPD) model which is based on Arellano and Bond's GMM estimator is used in the model specifications of the study. The results of the study show that overall US employment is significantly impacted positively by GVC activities. It is found that a one-point increase in only the backward GVC participation of the US results in 0.60 percentage point increase in the overall employment mediums-killed labour force of the US. However, the general forward GVCs has a minor significant negative effect on the employment of the low-skilled labour of the US. Finally, the impact on the low-skilled labour segment of the general forward GVCs is negative, significant but minor.

Helg and Tajoli (2004) examine the effect of international fragmentation of production on the labour market in Europe using the international trade data of Germany and Italy obtained from the Eurostat Comext database covering the 1990s. The study employs the least square dummy variable estimator (LSDV) and the Arellano-Bond GMM estimator because both N and T of the study are small and of the same magnitude. The results of the study show that Italy's international fragmentation of production index is consistently significantly positive, and this indicates that international fragmentation of production has a significant effect on the relative demand for skilled labour in Italy. However, international fragmentation of production is not found to have a significant effect on the relative demand for skilled labour in Germany. Following the predictions of the theory, the reason for the contradictory results are explained to be because Germany has been involving in international fragmentation of production earlier and to a larger extent than Italy. As a result, the current organisation of production in Germany has become skilled intensive because of the past change.

Jiang (2013) examines the effect of participation in GVC on employment generation using the World Input-Output Database (WIOD) for a panel of countries that account for 85 per cent of world GDP during the period 1995-2009. The study uses an input-output method to decompose the impacts of a country's trade on employment into five components which are labour content in exports, labour in imports, labour in the import content of exports, labour in the export content of imports, and labour in intermediates contained in imports from a third country. Participation in GVC is said to be the only cause of the last three components. The results of the study reveal that participation in GVC generates about 88 million jobs which represent about 14% contribution to the total number of jobs that international trade generated throughout the world in 2009. There were also about 44 million demand jobs as a result of the import content of exports. In addition, about 5 million demand for jobs were generated by the export content of imports; while about 39 million demand for jobs were created third-country intermediates contained in imports.

Feenstra and Hanson (1996) examine whether outsourcing has had a positive effect on the relative demand for skilled labour using the revised National Bureau of Economic Research (NBER) trade data which contains import data for the U.S. manufacturing industries for the period 1972-1994. A regression estimation technique which is a reduced-form relationship between outsourcing and the unit of skilled labour required as input is employed by the study. The study presents regression results for two periods 1972-1979, and 1979-1994 when the nonproduction wage share changed. The results reveal, against the expectation, that change in outsourcing does not have a statistically significant impact on the change in the nonproduction wage share in the period 1972-1979. However, the results are different for the period 1979-1994 as the change in outsourcing and change in the import share have a positive statistically significant correlation with the change in the nonproduction wage share. In terms of magnitude, the results further show that there is a huge contribution of outsourcing to the rise in the nonproduction labour relative demand in the period 1979-1994. Only the result of the period 1979-1994 is in line with the expectation of the study because as outsourcing rises, the relative demand for skilled labour rises in all periods.

Amiti and Wei (2005) investigate the effect of service outsourcing on employment using total employment data on 78 sectors which include 69 manufacturing industries and 9 service industries in the United Kingdom for the period 1995-2001. The study employs industry fixed effect panel regression that controls for any unobserved effect, for example, changes in the cost of capital, common across all industries. The results of the study reveal that outsourcing has not resulted in net jobs exports to developing countries from industrials countries. The study rather finds that growing industries help in employing workers who lose jobs in other industries. The study concludes that there is an over-exaggeration of the negative effect of service job outsourcing growth in advanced economies.

Banga (2016) examines the implication of industry-level GVCs participation for employment growth using Indian manufacturing and service sectors data during the period 1995-2011. The study reveals that the impact of higher backward linkages on employment growth in India is negative especially in the manufacturing sector. However, there is no evidence that higher forward linkages affect employment. The study concludes that the net effect of GVCs participation in India is negative because the displacement of domestic labour by higher backward linkages makes higher forward linkages not have an impact on employment.

It can be observed that from this literature reviews that all the authors employ the World InputOutput Database (WIOD) to calculate the GVC participation and/or position indexes except for Long et al (2019) that use the Viet Nam Household Living Standard Surveys and the Organisation for Economic Co-operation and Development's Trade in Value Added database, Helg and Tajoli (2004) that the Eurostat Comext database, Feenstra and Hanson (1996) that use the revised National Bureau of Economic Research (NBER) trade data, and Banga (2016) that use Indian manufacturing and service sectors data. This implies that World Input-Output Database (WIOD) is currently the most used data in estimating GVC participation in the study of the effect of GVC on employment. However, the WIOD does contain data on any African country. This may be the reason no currently publicly available study examines the effect of GVC on employment in any African country. This study shall

fill this gap by employing a dataset in the global Eora MultiRegion Input-Output (MRIO) study of the effect of GVC on employment, particularly for Nigeria. The Eora MRIO covers 189 countries, including Nigeria, and 26 sectors for the period 1900-2015. However, this study converts to quarterly data that cover the period 1991Q1-2015Q4 based on the availability of data.

Another observation from the literature is that all the previous studies reviewed employ panel data regression technique and mostly with fixed effect, except for Feenstra and Hanson (1996) that use the reduced form regression estimation technique. However, a panel regression technique does provide country-specific or sector-specific results despite some of the studies claim to be on a single country. The reason they employ the panel regression technique is because of their method of using the WIOD to calculate the GVC indexes that have to be used as panel data. However, this study fills this gap by providing a true country-specific study on the effect of GVC participation on employment using the data of Nigeria. This is possible because it is possible to calculate the GVC participation index for each country that can be used for a single country study using Eora MRIO, and dynamic OLS as the estimation technique.

4.0. Theoretical framework and model specification

The theoretical framework and model specification on which this study is based are discussed in this section.

4.1. Theoretical framework

To provide the theoretical framework that motivates our study, we follow closely Amiti and Wei (2009) as adopted and extended by Pan (2019, 2020b). The theoretical framework is set up by deriving labour demand from a given production function of industry I. The production function is given as:

$$Y = A(fg, bg)L^{\alpha}K^{\beta} \tag{1}$$

Where Y is the output and it is a function of labour (L) and capital (K). A is referred to as the productivity shift which is a function of the industry I's forward global value chain (GVC) linkage (fg) and backward GVC linkage (bg). According to Pan (2019, 2020), the first decision the firm makes is to choose an output level to produced and then the degree of GVC participation after some market parameters, particularly the factor prices, cost of labour (w) and cost of capital (r). The second decision is to choose the factor demands conditioned on its prices, output level and degree of GVC participation to minimise the total cost given as: $wL + rK$. From the first order condition which is the cost minimisation problem, the conditional labour demand can be stated as follows:

$$L = \frac{\left(\frac{\alpha}{\beta}\right)^{\frac{\beta}{\alpha+\beta}} Y^{\frac{1}{\alpha+\beta}}}{A(fg,bg)^{\frac{1}{\alpha+\beta}} \left(\frac{w}{r}\right)^{\frac{\beta}{\alpha+\beta}}} \tag{2}$$

Where the labour demand (L) depends on labour compensation (w) and capital compensation (r), output and GVCs. It is expected that output should positively relate to labour demand and the factor price ratio to be negatively related to labour demand. There is no straight forward about the impact of GVC on labour demand. The effect of GVC on labour demand can occur through substitution effect or scale effect. According to Pan (2019, 2020), there are two substitution effects. The first substitution effect occurs as a result of the decline in the imported input prices. When the imported input prices decline, firms offshore part of their production base to other countries, that is the firms are participating in backward GVC, thereby leading to a fall in demand for domestic labour. Thus, the increase in backward GVC participation can lead to a decline in local demand for labour. The second substitution effect is termed the technology or productivity effect. This occurs as a result of improvement in productivity or in procuring or more capital inputs, leading to the reduction in labour demand. The productivity effect could take place among the firms engaging in both forward and backward GVC linkages. The scale effect also comes from productivity growth and improved sales which tends to raise labour demand. Thus, the final effect of GVC on labour demand on which effect is stronger-the substitution effect or scale effect. Assume that the profit-maximising output Y as a function of backward and forward GVC indices, then following Amiti and Wei (2009), the GVC's scale effect on labour demand is incorporated to equation () and the outcome is written as follows:

$$L = \frac{\left(\frac{\alpha}{\beta}\right)^{\beta\gamma} Y^{\gamma}(fg,bg)}{A^{\gamma}(fg,bg)\left(\frac{w}{r}\right)^{\beta\gamma}} \qquad (3)$$

Where $\gamma = \frac{1}{\alpha+\beta}$. The final effect of GVC is mixed. The substitution effect tends to reduce labour demand while the scale effect tends to improve labour demand.

4.2. Model Specification

To examine the effect of GVC on employment, we employ Dynamic Ordinary Least Square proposed by Stock and Watson (1993). According to Masih and Masih (1996), DOLS has some advantages over OLS. First, it can be used to address the problem of endogeneity by using the leads and lags of independent variables. Second, it is also applicable when the variables are integrated of a higher-order unlike OLS and other cointegration methods which are only applicable when the variables are integrated of just order 1. Given these advantages of DOLS, we specify our model of labour demand as a function of GVC participation indices, output and compensation of employee and other factors denoted as X follows:

$empl_t = \beta_0 + \beta_1 gcv_t + \beta_2 y + \beta_3 w + \beta' X + d_{gvc}(L)\Delta gvc_t + d_y(L)\Delta y_t + d_w(L)\Delta w_t + d_X(L)\Delta X_t + \varepsilon_t$ (4)

Where *empl* serves as total employment in the economy, employment in the agricultural sector, employment in the industrial sector and employment in the services sector, *gvc* denotes total GVC and sectoral GVCs including their components-forward GVC and backward GVC participations. *w is* the wage proxied by compensation of employee. Theoretically, wage and employment are inversely related. This inverse relation occurs for two main reasons. First, a rise in the wage rate raises the costs of a firm's production. This forces the price of good produced to rise. As the price of goods rises, consumers demand less of such good and consequently less of output would be produced and sold in the next production. Given this, less labour would be demanded or used for production. Second, a rise in wage makes labour relatively expensive. As a result, the firm would try to substitute capital for expensive labour, meaning that less labour would be used in the course of production. Thus, we expected a negative nexus between wage and employment. We control for other variables that have a theoretical relationship with employment. The variables denoted as *X* includes gross domestic product for total employment and sectoral value-added for sector employment (agricultural sector value-added, industrial sector value-added and services sector value-added), inflation rate proxied by consumer price index, government consumption expenditure and trade openness. Theoretically, we expect a positive nexus between economic growth (sectoral value-added) and employment (sectoral employment) as suggested by theory. The more economy is productive, that is, there is an increase in output, the more employment is generated ceteris paribus.

We also expect a positive relationship to exist between inflation and employment. Although the Phillips curve hypothesis posits a negative relationship between inflation rate and unemployment, the reverse is possible in the sense that in the course of producing more goods and creating more employment, there is a possibility of increasing the price level. With regard to the nexus between trade openness and employment, we expect a positive effect of trade openness on employment as argued by the proponents of trade liberalisation. The proponents of openness of the economy had argued that trade openness promotes productivity and growth through imported innovative way of production and thereby leading to more employment which comes from improved productivity and growth (Nwaka, Uma and Tuna, 2015; Onifade, et al. 2020). Finally, we expect a positive relationship between government consumption expenditure and employment, especially in the case of a developing country where the majority of employment in the formal labour market is generated by the government (Folawewo and Orija, 2020). The effect of government consumption expenditure and employment could, however, be varied across the sectors under consideration.

4.3. Data Sources

This study uses input-output database provided by the Global Eora Multi-Region Input-Output (MRIO). The database consists of input-output data of 189 countries covering 26 sectors of the economy for the period 1991-2015. From the database, we compute the GVC indexes which comprise of Total GVC, forward GVC and backward GVC. These are the main independent variables. Employment data is selected from the World Development Indicators (WDI). The employment data comprises total employment and sectoral employment- industrial sector employment, agricultural sector employment and services sector employment. We also control for other variables that can serve

as determinants of unemployment. These variables include real GDO, agricultural value-added. Industrial value-added and services value-added (sectoral value-added are scaled by GDP), consumer price index, government consumption expenditure, compensation of employee (wages) and trade openness. These variables are extracted from the WDI.

5.0. Empirical Results

This section presents the results of the impact of the global value chain on employment in Nigeria. We consider the impact along the total employment and sectoral employment. However, before we present the main results, it is imperative to present the results of a preliminary investigation which consists of descriptive statistics, correlation and unit root test.

5.1. Preliminary Test Results

Descriptive statistics is conducted to examine the characteristics of the variables of interest. Correlation analysis is carried out for two purposes. The first is to determine the strength of the relationship between the variables, say employment and GVC. The second is to detect whether or not there is a problem of multicollinearity, especially among the independent or control variables. The unit root test is conducted to determine whether the variables are stationary at level or trend over time (stationary at first difference). This purpose is to avoid some sorts of spurious regression.

The results of descriptive statistic are presented in Table 2. As shown in the Table, total employment, on average, stood around 57% with minimum and maximum level of employment stood at 52% and 59% respectively. However, it is evident from the table that employment varies across the sectors. The agricultural sector remains the sector with employment generation, followed closely by the services sector and distantly by the industrial sector. Specifically, about 46% of total employed persons work in the agricultural sector, 43% in the services sector and 12% in the industry sector. The inability of the industrial sector to generate employment like agricultural and services sectors can be attributed to the appalling state of the sector occasioned by poor infrastructural facilities especially epileptic electricity supply and poor roads networks (Raifu, Aminu and Folawewo, 2020). With regard to GVC, the average total GVC stood at 0.470. The total forward and backward GVC participation stood at 0.377 and 0.093 respectively. this suggests that the country participates more in forward GVC than backward GVC. The GVC participation across sector varies with the highest in the services sector and least in the agricultural sector. The average agricultural sector GVC, industrial sector GVC and services sector GVC stood at 42.498, 39.669 and 0.888 respectively. The same pattern is observed in the sectoral forward GVC in which the services sector is the most favoured. However, in terms of sectoral backward GVC, the industrial sector is the most favoured. **Table 2: Descriptive Statistics**

Variables	Obs	Mean	Std.Dev.	Min	Max	p1	p99	Skew.
Total Employment	00	7.144	1.942	1.530	3.954	1.539	3.917	.012
Agric Employment	00	5.525	4.475	5.768	0.654	5.821	0.624	.510
Industry Employment	00	11.98	1.014	0.047	3.460	0.063	3.446	.286
Services Employment	00	2.498	5.273	5.877	1.272	5.925	1.225	270
Total GVC	00	0.470	0.027	0.426	0.521	0.427	520	531
Agric GVC	00	0.888	0.054	0.785	1.021	0.786	018	274

dustry GVC	)0	).669	8.500	3.484	3.499	3.583	3.418	557
:rvices GVC	)0	2.498	5.273	5.877	1.272	5.925	1.225	270
otal Forward GVC	)0	0.377	0.042	0.321	0.446	0.321	446	348
gric Forward GVC	)0	0.763	0.063	0.642	0.910	0.643	905	208
dustry Forward GVC	)0	7.492	8.620	1.247	56.35	1.373	5.325	559
:rvices Forward GVC	)0	)2.392	54.034	7.729	174.72	3.064	172.83	572
otal Backward GVC	)0	0.093	0.018	0.058	0.130	0.059	129	058
gric Backward GCV	)0	0.125	0.019	0.060	0.151	0.064	150	.866
dustry Backward GVC	)0	2.177	0.239	1.568	2.631	1.607	626	.109
:rvices Backward GVC	)0	1.894	0.612	1.244	3.389	1.257	378	557
eal GDP	)0	52e+11	07e+11	40e+11	60e+11	40e+11	60e+11	619
gric Value-Added_GDP	)0	1.946	4.001	).938	3.230	).944	3.134	314
dustry Value-Added_GDP	)0	3.859	5.114	).025	3.256	).352	3.184	350
:rvices Value-Added_GDP	)0	5.244	5.849	5.176	).106	5.206	3.826	195
onsumer Price Index	)0	).164	5.443	2.499	56.441	2.554	53.695	691
overnment Consumption Expenditure	)0	30e+10	29e+10	70e+08	40e+10	90e+08	40e+10	486
ompensation of Employee (Wage)	)0	2.654	).182	2.482	7.967	2.661	7.964	573
rade Openness	)0	3.927	8.183	).707	3.938	).062	3.862	.195

Note: Computed by the Authors. Obs. = Observations, Std.Dev = Standard Deviation, Min = Minimum, Max = Maximum, p1 = Lower Percentile, p2 = Upper Percentile. Skew = Skewness, Kurt= Kurtosis

Table 3 presents the results of the pairwise correlation analysis. Evidence from the Table reveals that, in most cases, GVC negatively and moderately correlated with employment except in the case of total backward GVC participation, agricultural backward GVC participation and industrial backward GVC participation which are positively and significantly correlated with employment. A similar correlation exists between GVC and sectoral employment, especially agricultural sector employment and industrial sector employment. However, the reverse is the correlation between
GVC and services sector employment with most of GVC participation positively correlated with

services sector employment. Among the regressors, we observed that there is no problem of multicollinearity as most of the variables are moderately correlated.

The unit root test results are presented in Table 4. As observed from the Table, most of the variables are integrated of order 1because they become stationary after the first difference. However, the inflation rate measured by CPI is integrated of order 0. This implies that CPI does not trend over time, that is, stationary at level. Agricultural sector employment is also integrated of order 0, especially when the assumption of constant and trend is taking into consideration. Services sector employment is integrated of higher-order greater than 1. Dynamic OLS adopted as a method of estimation is applicable even when the variable is integrated of higher order.

Table 3: Pairwise correlations

Variables	Ltetp lwag_gdp	Leagr ltopen	leind	Leser	ltgvcpa	lagvcp	ligvcp	leser	ltfwdp	Lafwdp	lifwdp	lsfwdp	ltbwdp	Labwdp	libwdp	lsbwdp	lgdp	lagv_gdp	liva_gdp	lsva_gdp	lcpi	lgce
tp	00																					
ar	12*	00																				
nd	86	08*	00																			
er	695*	980*	830*	00																		
vcpa	581*	870*	737*	76*	00																	
vcp	203*	428*	497*	63*	61*	00																
vcp	039	409*	630*	07*	46*	89*	00															
ser	695*	980*	830*	00*	76*	63*	07*	00														
vdp	654*	939*	787*	50*	51*	25*	18*	50*	00													
wdp	370*	568*	552*	94*	93*	62*	41*	94*	27*	00												
vdp	057	425*	638*	22*	55*	87*	00*	22*	32*	45*	00											
wdp	411*	712*	583*	97*	78*	54*	48*	97*	82*	98*	50*	00										
wdp	20*	06*	81*	904*	726*	273*	496*	904*	899*	466*	514*	676*	00									
wdp	04*	73*	58*	637*	391*	337*	339*	637*	558*	575*	358*	374*	64*	00								
wdp	78*	78*	47*	702*	418*	188	477*	702*	648*	426*	498*	332*	71*	79*	00							
wdp	827*	559*	00	01*	99*	38*	249*	01*	30*	82*	240*	58*	345*	320*	083	00						
lp	727*	989*	795*	97*	78*	46*	98*	97*	50*	78*	13*	25*	908*	643*	689*	45*	00					
	13*	53*	00	252*	397*	137	014	252*	375*	201*	019	550*	31*	90*	31	490*	288*	00				
v_gdp ra_gdp	46*	50*	88*	793*	514*	316*	450*	793*	627*	450*	462*	413*	02*	19*	68*	195	778*	171	00			
va_gdp	666*	862*	658*	54*	21*	98*	19*	54*	95*	48*	32*	27*	806*	696*	650*	09*	57*	519*	733*	00		
i	630*	864*	793*	09*	69*	01*	90*	09*	46*	26*	07*	02*	807*	621*	729*	05*	82*	004	785*	91*	00	
e	529*	883*	831*	16*	74*	50*	74*	16*	34*	55*	84*	26*	861*	577*	639*	84*	14*	381*	642*	38*	82*	00
ag_gdp	583*	886*	738*	85*	82*	16*	79*	85*	99*	99*	88*	81*	793*	513*	501*	29*	95*	484*	630*	85*	82*	38*
pen	71*	21*	234*	110	56	62	52	110	082	13	45	283*	30*	92*	15*	351*	154	26*	56*	320*	02	149

* Shows significance at the 0.05 level

Table 4: Unit Root Test Results (PP)

At Level

		p	gr	d	r	cpa	/cp	cp	r	/dp	/dp	dp	lsfwdp	/dp	vdp	wdp	vdp	>	/_gdp	_gdp	i_gdp		:	g_gdp	en
	istic																								
With Constant		12	21	54	37	51	80	61	37	38	45	37	-0.573	95	08	29	21	45	60	51	76	74	09	54	58
												n0	n0												
With Constant & Trend		38	28	78	23	96	72	73	23	72	41	83	-1.584	79	37	96	55	82	68	31	47	81	06	64	60
	istic																								
												n0	n0												
Without Constant & Trend	istic	95	67	81	00	53	04	55	00	87	67	70	0.389	88	52	05	02	51	77	78	76	26	20	18	93
												n0	n0												

First Difference

		etp)	agr)	ind)	ser)	gvcpa)	gvcp)	gvcp)	ser)	fwdp)	fwdp)	fwdp)	d(lsfwdp)	bwdp)	bwdp)	bwdp)	bwdp)	dp)	gv_gdp)	va_gdp)	va_gdp)	pi)	ce)	ag_gdp)	open)
With Constant	istic	95	27	94	81	03	28	84	81	94	97	00	-4.281	39	66	36	46	80	16	47	98	84	95	10	47
												***	***												
With Constant & Trend	istic	70	56	80	57	48	95	67	57	80	64	85	-4.489	66	81	61	81	36	62	36	41	97	47	98	82
												***	***												
Without Constant & Trend	istic	35	19	65	25	34	50	08	25	49	05	23	-4.271	86	76	09	40	93	40	64	35	89	60	68	58
												***	***												

Notes:

a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

c: Probability-based on MacKinnon

(1996) one-sided p-values.

5.2. Main Results

In this subsection, the main results of this study are presented for total employment, agricultural sector employment, industrial sector employment, and services sector employment.

5.2.1. Total Employment

We first estimate the effects of total GVC, forward GCV and backward GVC on total employment. The results are presented in Table 5. As shown in the Table, total employment is weakened by total and forward GVC participation. This means that total employment tends to reduce by 0.601% and 0.395% irrespectively if the total and forward GVC participation increase by 1%. However, total employment in the country tends to rise by participating in backward GVC. Specifically, an increase in backward GVC participation by 1% leads to an increase in total employment increases by 0.126%, all things being equalled. If we compared employment gain through backward GVC participation with the one lost through total and forward GVC participation, the net effect still shows that the country still suffers employment loss. Our results may not be surprising because it has been argued that developing countries like Nigeria may not benefit from participating in global value chain activities like developed countries unless some economic policy reforms are carried out (World Bank, 2020). Farole (2016) had previously argued that the impacts of the global value chain on jobs depend on many factors which include lead firms, specialisation, skills and quality of institutions possessed by a country. Hollweg (2019) also noted that GVC participation tends to biased employment gains towards skill labours or workers than unskilled ones in developing countries (see also Jiang and Milberg, 2013) Thus, GVC participation may worsen jobs in a country where there is a high rate of institutional weakness, poor policy formation and implementation or absence of cogent policy reforms, macroeconomic instability, low-skilled workers and fragmented labour market.

We examined the effects of other factors that may affect employment. These factors as aforementioned include real gross domestic product (GDP), consumer price index, government consumption expenditure, wage and trade openness. The effects of these variables on total employment follow a prior expectation except for real GDP and wage. Contrary to expectation, we found the negative effect of real GDP on employment. This is, however, not surprising as growths experienced in many developing countries including Nigeria are not pro-employment. In the face of tremendous economic growth, unemployment also rises in more proportion. This situation is described by Ajakaiye, et al. (2016) as "jobless growth". In the case of wage, wage rate, in most developing countries like Nigeria, is not determined by the forces of demand for labour and supply of labour but by negotiation between government and workers. Thus, the empirical finding may not follow the theoretical expectation of the inverse nexus between wage and employment. CPI, government consumption expenditure and trade openness lead to an increase in employment.

Table 5: Effects of Total, Forward and Backward GVC Participation on Total Employment

ependent Variable	Total Employment)	Total Employment)	Total Employment)

Main Independent Variable	Total GVC	Forward GVC	Backward GVC
Log of GVC	0.601***	0.395***	126**
	(0.159)	(0.042)	(0.053)
Log of GDP	0.185***	0.165***	0.150***
	(0.046)	(0.016)	(0.035)
Log of CPI	027**	028***	015**
	(0.010)	(0.003)	(0.007)
Log of GCE	036***	047***	050***
	(0.008)	(0.003)	(0.007)
Log of Wage	031*	012**	0.016
	(0.018)	(0.005)	(0.012)
Log of Trade Openness	112***	083***	059***
	(0.022)	(0.006)	(0.021)
Constant	031***	445***	858***
	(.203)	(0.431)	(0.838)
Observation	5	5	5
R-squared	953	955	910
Adjusted R-squared	0.923	0.927	0.855

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1
Note: GVC, GDP, CPI, CGE and Wage denote Global Value Chain, Real Gross Domestic Product, Consumer Price Index, Government Consumption Expenditure and Compensation of Employee respectively.

5.2.2. Agricultural Sector Employment

Apart from ascertaining the effects of the total, forward and backward GVC participation on total employment, we also examined the nexus between sectoral GVC participation and sectoral employment. The results of effects of total agricultural, forward and backward GVP participation on agricultural employment are presented in Table 5. The Table revealed that total agricultural GVC and forward agricultural GVC participation exert positive and significant effects on agricultural sector employment. As total and forward agricultural GVC participation increases by 1%, agricultural sector employment tends to increase by 0.331% and 0.287% respectively. most descriptive statistics, we observed that Nigeria, as a country, participates in forward GVC productive activities than the backward GVC productivity, especially in the agricultural sector, by supplying raw materials to other countries (WTO, 2016). However, backward agricultural GVC has no impact on the agricultural sector employment. Our results are tandem with Olukunle (2015) who concluded that the cassava value chain generates employment and improve income in Nigeria. Oyetola et al (2019), in the case of the cattle value chain, employment and income can only improve if there is minimum support from the government.

With regard to the effects of other control variables on agricultural sector employment, we found that agricultural value-added promotes employment as it has a positive effect on agricultural sector employment. CPI is negatively and significantly related to agricultural employment. This is understandable as the increase in general price level does have a negative influence on agricultural commodity price which in turn would affect agricultural production and employment. Government expenditure and trade openness also boost

agricultural sector employment. However, the wage rate is negatively influenced agricultural sector employment.

Table 6: Effects of Total, Forward and Backward GVC Participation on Agricultural Sector Employment

Dependent Variable Employment)	(Total Agric Employment)	(Total Agric Employment)	(Total Agric
Main Independent Variable	Total AGVC	Total AFGVC	Total ABGVC
og of AGVC	331***	287***	).062
	).049)	(0.045)	).131)
og of AVA_GDP	053*	0.057*	049
	).028)	(0.031)	).120)
og of CPI	).040***	-0.040***	-0.055***
	).005)	(0.005)	).018)
og of GCE	022***	0.016**	016
	).007)	(0.007)	).024)
og of Wage	).106***	).099***	).081*
	).012)	(0.013)	).042)
og of Trade Openness	050***	063***	041
	).012)	(0.013)	).084)
onstant	364***	464***	395***
	).140)	(0.149)	).629)
bservation	5	95	95
-squared	986	0.986	979
djusted R-squared	977	0.978	966

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1
Note: AGVC, AFGVC, ABGVC, AVA_GDP, CPI, CGE and Wage denote Agricultural Global Value Chain, Agricultural Forward Global Value Chain, Agricultural Backward Global Value Chain, Agricultural Value-Added as a Percentage of GDP, Consumer Price Index, Government Consumption Expenditure and Compensation of Employee respectively.

5.2.3. Industrial sector employment

Table 7 reports the effect of total industrial, forward and backward GVC participation on industrial sector employment. As shown in the Table, both forward and backward and forward GVC participation including total GVC participation has a positive effect on industrial sector employment. An increase in industrial, forward and backward GVC participation by 1% leads to 0.094%, 0.087% and 0.116% increase in industrial sector employment respectively. This suggests that industrial sectors benefit from all global value chain activities. This may be attributed to the fact the sector is the only sector that has some sort of relatively skilled workers compared to agricultural and services sectors characterised by informality. Some studies have found that highly skilled workers do benefit more from GVC participation than nonskilled workers (Ma, Liang and Zhang, et al. 2019). Ma, et al (2019) specifically stated that both in developed and developing countries, highly capital-intensive industries benefit more from GVC than non-highly capitalised industries. Thus, we can situate our findings here within the spectrum of studies that found that the industrial sector benefits from GVC participation in terms of output and employment.

Industrial value-added is found to have a positive effect on industrial employment as expected. Likewise, the consumer price index also has a positive influence on industrial employment. Wage, though, is positively linked with industrial employment. This effect of wage on industrial employment does not, however, follows a prior expectation. Government expenditure has a negative effect on industrial employment, a symbol of crowing out effects. Crowding out effect occurs when the increase in government spending through borrowing drives up interest rates, the cost of borrowing funds, which in turn dampens the private investment spending. The openness of the economy is also detrimental to industrial employment. This could be attributed to the level of competitiveness of domestic firms. In a country characterised by uncompetitive firms, the openness of the economy may be detrimental to the growth of domestic firms and their employability (Dowrick and Golley, 2004).

Table 7: Effects of Total, Forward and Backward GVC Participation on Industrial Sector Employment

Dependent Variable	(Total Ind Employment)	(Total Ind Employment)	(Total Ind Employment)
Main Independent Variable	Total IGVC	Total IFGVC	Total IBGVC
og of IGVC	094***	087***	0.116*
	).014)	).012)	(0.062)
og of IVA_GDP	431***	432***	0.255***
	).025)	).023)	(0.032)
og of CPI	039***	039***	0.017***
	).006)	).006)	(0.006)
og of GCE	).130***	).130***	-0.082***
	).008)	).007)	(0.009)
og of Wage	103***	103***	0.048***
	).008)	).008)	(0.014)
og of Trade Openness	).291***	).291***	-0.282***
	).012)	).011)	(0.024)
onstant	338***	365***	4.278***
	).104)	).096)	(0.187)
bservation	5	5	95
l-squared	986	986	983
djusted R-squared	977	977	972

Standard errors are in parenthesis
*** *p<0.01, ** p<0.05, * p<0.1*
Note: IGVC, IFGVC, IBGVC, IVA_GDP, CPI, CGE and Wage denote Industrial Global Value Chain, Industrial Forward Global Value Chain, Industrial Backward Global Value Chain, Industrial Value-Added as a Percentage of
GDP, Consumer Price Index, Government Consumption Expenditure and Compensation of Employee respectively

5.2.4. Services Sector Employment

In Table 8, we report the results of total services, forward and backward GVC participation on services sector employment. Our findings revealed that even though total services, forward and backward GVC participation exhibited positive effects on services employment, albeit, the positive effects are not statistically significant. In other words, we do not find evidence that services sector GVC participation would lead to employment in the sector. It has been suggested that not every industry or sector would benefit from

participating in GVC activities (Banh, Wingerder and Gueye, 2020). Even though a lot of people are employed in the services sector as shown during background and descriptive analyses, most of these are self-employed, operating in the formal section of the labour market in Nigeria. Most of these economic activities require low-skill to start. Thus, these sets of people or workers with low skill may not benefit directly from GVC participation compared to highly skilled people or workers (Ma, et al, 2019).

Evidence from the control variables reveals that services sector value-added, inflation rate and government consumption expenditure have positive impacts on services sector employment. Even though the effects of wage and trade openness are also positive, the impacts are, however, not statically insignificant.

Table 8: Effects of Total Services, Forward and Backward GVC Participation on Services Sector Employment

Dependent Variable	(Total Ser Employment)	(Total Ser Employment)	(Total Ser Employment)
Main Independent Variable	Total SGVC	Total SFGVC	Total SBGVC
og of SGVC	024	026	0.038
	).049)	).049)	(0.030)
og of SVA_GDP	046	051	0.235*
	).268)	).272)	(0.125)
og of CPI	073**	075**	0.051***
	).031)	).031)	(0.011)
og of GCE	).025	).027	0.039*
	).049)	).050)	(0.022)
og of Wage	064	062	0.001
	).076)	).076)	(0.038)
og of Trade Openness	043	045	0.068
	).076)	).077)	(0.058)
onstant	433***	436***	1.492
	.125)	.135)	(0.920)
bservation	5	5	5
-squared	990	990	0.989
djusted R-squared			

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1
Note: SGVC, SFGVC, SBGVC, SVA_GDP, CPI, CGE and Wage denote Services Global Value Chain, Services Forward Global Value Chain, Services Backward Global Value Chain, Value-Added as a Percentage of GDP, Consumer Price Index, Government Consumption Expenditure and Compensation of Employee respectively

6.0.   Conclusion and Policy Recommendations

This study has investigated the effects of GVC participation on employment in Nigeria using quarterly data that spans the period between 1991Q1 and 2015Q4. The GVC data are obtained from Eora MRIO while the employment data and other control variables are sourced from World Development Indicators, 2020 version. Our investigation is not limited to the effect of total GVC participation (backward and forward GVC participation) on total employment, we also consider the impact of sectoral GVC participation (backward and forward GVC participation) on sectoral employment. The sectors considered include the

agricultural sector, industrial sector and services sector. Dynamic OLS, which is superior to OLS, is used as a method of estimation.

Our results showed that only backward GVC participation positively influences total employment as total and forward GCV participations tend to negatively affect total employment. We, however, found that some sectors benefit from GVC participation than others. For instance, total agricultural sector GVC participation have a positive effect on agricultural sector employment. We break down agricultural sector GCV participation into the backward and forward GVC participation and examine their impacts on agricultural sector employment. We found that only forward GVC participation in the agricultural sector positively affects agricultural sector employment. In the case of the industrial sector, total service sector GVC participation including its forward and backward positively impacts industrial sector employment. However, services sector employment does not benefit from aggregate and disaggregate services sector GVC participation as we did not find empirical evidence to support the positive effect of GVC participation in the services sector on services sector employment.

The effects of other control variables on total employment also vary on sectoral employment. Aside from real GDP, other control variables such as inflation rate, government consumption expenditure, wage and trade openness on total employment. Apart from inflation rate and wage, agricultural value-added, government consumption expenditure and trade openness promote the agricultural sector. Industrial value-added, inflation rate and wage have positive effects on industrial sector employment. However, government consumption expenditure and trade openness worsen the industrial sector employment. In the case of the services sector, evidence showed that services sector value-added, inflation rate and government consumption expenditure have positive impacts on services sector employment. The effects of wage and trade openness though positive are, however, not statically insignificant.

The policy implications of our finding are very clear. The government needs to encourage wider participation in GVC activities across different sectors and industries, taking advantages of both backward and forward GVC participation. The requisite skills needed by workers in different sectors of the economy must also be developed and harnessed to optimally benefit from GVC participation.

Appendix

Method of Computing GVC Indexes

A considerable number of methods have been suggested for the construction of Global Value-Chain Index from input-output table. In this study, we follow Aslam, Novta and Rodrigues-Bastos (2017) method. Thus, in line with Aslam, et al. (2017), the procedure for constructing GVC index are as follows. Assume that X, A and Y represent the gross output matrix, the matrix of input-output coefficients, and the matrix of goods used for final demand (the FD matrix in Eora) respectively. Gross output must be used as either

intermediate goods or final goods. A indicates the units of intermediate goods required to produce a unit of gross output, and it, therefore, indicates the matrix of intermediates used (the T matrix in Eora). The expression of the basic relationship between X, A and Y is given as follows:

$$X = AX + Y \qquad (1)$$

Equation (1) can be rearranged in matrix form as follows:

$$X = (1 - A)^{-1}Y \qquad (2)$$

If B denotes $(1 - A)^{-1}$, then equation 2 becomes:

$$X = BY \qquad (3)$$

Equation (3) is the Leontief inverse matrix and it represents inter-linkages that arise within and between countries. The elements of the Leontief inverse matrix are referred to as the technical coefficients which indicate the total output required both directly and indirectly to produce a unit of goods for final demand (i.e. input share of output). B is the matrix of input-output coefficients, and there is a need to recover it to be able to estimate the Leontief inverse matrix.

Now to the computation of total GVC index and sectoral GVC index, we employ the MATLAB suite provided by Aslam, Novta and Rodrigues-Bastos (2017) and applies it to the full Eora dataset to obtain the country-sector level of Domestic Value-Added (DVA), Indirect Value-Added (IVA), and Foreign Value-Added (FVA). From these values-added, we compute the forward (upstream) GVC participation (FWDP), backward (downstream) GVC participation (BWDP), and total GVC participation (GVCP) based on the GVC measures provided by Hummels, Ishii and Yi (2001) which is also stated in Aslam, Novta, and Rodrigues-Bastos (2017) as given as follows:

$$BWDP = \frac{FVA}{GE} \qquad (4)$$
$$FWDP = \frac{IDV}{GE} \qquad (5)$$
$$GVCP = \frac{FVA + IDV}{GE} \qquad (6)$$

Where FVA is the foreign value-added, and it implies the actual number of imported intermediate inputs used to produce output for export. Therefore, FVA refers to the use of foreign inputs in the process of export production. IDV refers to indirect value-added. In GVC literature, IDV is also denoted as VS1 (Vertical Specialisation from export perspective). IDV is the portion of exports that are used by another country in the production of its exports. GE is the gross exports. The larger the GVCP ratio, the greater the intensity of involvement of a particular country in the GVCs.

Since the dataset in the global Eora Multi-Region Input-Output (MRIO) which covers 189 countries and 26 sectors for the period 1991-2015. The eventual GVC indexes we obtained

after employing the Matlab suite provided by Aslam, Novta and Rodrigues-Bastos (2017) are for 26 sectors. Since the data of Nigeria from the World Development Indicators (WDI) on employment are on three major sectors which are agriculture, industry, and service, we therefore grouped the sectors in Eora MRIO into the three sectors and then sum up the GVC indexes of sectors in each group to obtain the forward (upstream) participation in GVC, backward (downstream) GVC participations in GVC, and total participation in GVC for each sector. Table 1A presents list of each sectors under each of the three main sectors.

Table 1A: Grouping of 26 Sectors in Eora MRIO into Agricultural, Industrial, and Service Sectors

SN	Sector
Agricultural Sector	
1	Agriculture
2	Fishing
Industrial Sector	
1	Mining and Quarrying
2	Food & Beverages
3	Textiles and Wearing Apparel
4	Wood and Paper
5	Petroleum, Chemical and Non-Metallic Mineral Products
6	Metal Products
7	Electrical and Machinery
8	Transport Equipment
9	Other Manufacturing
10	Recycling
11	Electricity, Gas and Water
12	Construction
Service Sector	
1	Maintenance and Repair
2	Wholesale Trade
3	Retail Trade
4	Hotels and Restaurants
5	Transport
6	Post and Telecommunications
7	Financial Intermediation and Business Activities
8	Public Administration
9	Education, Health and Other Services
10	Private Households
11	Others
12	Re-export & Re-import

Source: Authors' grouping based on Eora MRIO.

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