Manufacturing Output Growth and Employment in Nigeria*

Adetunji Adeniyi

Tunji Adeniyi and Associates Limited, Lagos, Nigeria

Abstract

The Manufacturing sector of the Nigerian economy can perform better in job creation, particularly during the period of economic expansion, which did not happen in the last period of economic growth between 1981 and 2014. Consequently, it is important to understand the real relationship between growth and job creation in the sector during the period. Therefore, this study investigated the employment intensity of gross value added growth in the sector during the period of growth, using Vector Error Correction Model (VECM) with a view to providing useful statistics to facilitate policies for the development of sectoral employment strategy during the next cycle of economic growth. Previous studies have either used descriptive statistics or less robust econometric models applied to aggregate data of shorter series and did not explore the inter-sectoral relationship effect. The estimated employment elasticity of gross value added in the sector was not significant at 95 per cent confidence level, and can, therefore, not be relied upon for pin-point policy. However, the inter-sectoral and inter-temporal relationships provided significant estimates, indicating that such relationships should be taken into account in designing and developing sectoral employment strategy for the manufacturing sector. There is future scope for the extension of research to cover periods of recession, as well, for example, post COVID-19.

Keywords: Economic growth; Employment elasticity; Gross Value Added; Manufacturing sector

JEL Classifications: E24; L60

* This paper is derived from my PhD thesis entitled "Economic growth and employment nexus in Nigeria's agricultural and non-agricultural sectors (1981-2014)" at the University of Ibadan, Nigeria.

Introduction

In the growth period between 1981 and 2014, the contribution of the manufacturing sector to aggregate employment in Nigeria declined by 42.9 per cent from 2.1 per cent to 1.2 per cent. Similarly, the contribution to Gross Domestic Product (GDP) fell marginally by 1 per cent from 10.1 per cent to 10.0 per cent (NBS, 2015, and 2020; and, Adeniyi, 2019). With the growth in population at an annual rate of about 3.5 per cent to an estimated current population of about 200 million, and unemployment rate of about 33.3 per cent, the manufacturing sector should play more eminent roles in GDP and employment generation, particularly, in times of economic growth.

It is apparent that gross value added in the manufacturing sector during the last period of economic growth was “jobless” or not job-intensive. Incidentally, no studies have been conducted with specific focus on the job absorptive capacity of the manufacturing sector of the Nigerian economy. Furthermore, the relationship of the Manufacturing sector with the other sectors in generating employment was also never before explored econometrically. Therefore, this research will also fill methodological gap by using a multivariate analytical technique of VECM.

As Nigeria gets out of recession into another cycle of growth, we need to design sectoral employment policies to harness the full employment generating potentials of all the sectors, particularly in manufacturing, where we need to arrest the observed drift. The appropriate research questions then are: what is the employment intensity of value added growth in the manufacturing sector of the Nigerian economy: and, how may this be used to formulate employment policies for the sector? Consequently, the objectives of this study are to investigate the elasticity of employment in the manufacturing sector; and, employ the results in advancing recommendations to policy makers.

Literature Review

Theoretical framework

The output of any sector of an economy is produced by combining labour input (demand for labor) with other factors of production in that sector. The demand function for labor can be derived by assuming a constant elasticity of substitution (CES) production function and solving the marginal product of labor (MPL) equation for the labor input variable (Mkhize, 2015, and Adeniyi, 2019, and 2021) as follows:

$$GVA_t = A\{\alpha K_t^{-\rho} + (1-\alpha) E_t^{-\rho}\}^{-\frac{1}{1+\rho}} \quad (1)$$

where, GVA_t = Gross Value Added (sectoral output)

K_t = Capital (input) in year t; E_t = Employment/labor (input) in year t.

A = Efficiency parameter; $A > 0$

η = Returns to scale parameter; $\eta > 0$

α = Distribution parameter; $0 < \alpha < 1$

ρ = Extent of substitution (between K and E) parameter, $\rho > -1$, and related to elasticity of substitution;

$\sigma = 1 / 1 + \rho$

The derivative of labor (i.e. marginal product of labor (MP_L)) from Equation (1) can be written as:

$$dGVA/dE = \eta(1-\alpha)/A \cdot GVA^{\frac{\rho}{1+\rho}} \cdot E^{\frac{(1+\rho)\eta}{1+\rho} - \rho + 1} \quad (2)$$

The above MP_L expression is solved for the E_t input variable in order to derive the empirical labor (employment) demand function:

$$\begin{aligned} \eta(1-\alpha)/A^{\rho/\eta} \cdot GVA^{(1+\rho)/\eta} &= E_t^{\rho+1} \\ [\eta(1-\alpha)/A^{\rho/\eta} \cdot GVA^{(1+\rho)/\eta}]^{1/\rho+1} &= E_t \\ E_t &= [\eta(1-\alpha)/A^{\rho/\eta} \cdot GVA^{(1+\rho)/\eta}]^{1/\rho+1} \\ &= [\eta(1-\alpha)/A^{\rho/\eta}]^{1/\rho+1} \cdot GVA^{(1+\rho/\eta)(1/\rho+1)} \\ E_t &= \beta_0 GVA^{\beta_1} \end{aligned} \quad (3)$$

where,

$$\beta_0 = [\eta(1-\alpha)/A^{\rho/\eta}]^{1/\rho+1}$$

$$\beta_1 = (1+\rho/\eta)(1/\rho+1)$$

$$\beta_1 = 1+\rho/\eta \cdot \sigma$$

σ (elasticity of substitution) = $1/\rho+1$. However, if we log-transform Equation (3) above, we obtain the following employment function:

$$\ln E_t = \ln \beta_0 + \beta_1 \ln GVA_t = \beta_0 + \beta_1 \ln GVA_t + \dots \beta_n \ln X_{nt} + \epsilon_t \quad (4)$$

When a country experiences positive GDP growth, the employment elasticity figures can be explained as follows (Kapsos, 2005; Ajilore and Yinusa, 2011; and, Adeniyi, 2019):

Employment elasticity greater than 1 implies, positive employment growth; and, negative productivity growth. Employment elasticity between 0 and 1 implies, positive employment; and, positive productivity growth. Higher elasticity within this range implies more employment (lower productivity) intensive growth. Negative employment elasticity implies, negative employment growth; and, positive productivity growth.

Review of empirical literature

There have been not many studies on the Nigerian economy in this area. Furthermore, none has addressed the issues with the specific focus and intensity deployed in this research. Table 1 below summarises the relevant literature on the Nigerian economy:

Table 1: Related studies on Nigerian economy

S/N	Author(s)	Year	Study	Type of data	Methodology	Key results
1	Sodipe and Ogunrinola	2011	Employment and Economic Growth Nexus in Nigeria.	Aggregate output and aggregate employment time series	Ordinary Least Square (OLS) regression	Economic growth significantly co-integrated with employment in a progressively decreasing rate (diminishing returns).
2	Oloni	2013	The Impact of Economic Growth on Employment in Nigeria.	Aggregate growth and aggregate employment short series	"Johansen Vector Error Correction Model"	Aggregate growth co-integrated directly with aggregate employment, but not a significant relationship.
3	Ajakaiye, et al	2015	Understanding the Relationship Between Growth and Employment in Nigeria.	Time series aggregate data	Shapley decomposition	"Jobless growth". Transitioning in employment from primary production sectors to services sectors.

Consequently, apart from the specific focus on the manufacturing sector and its relationship with the other sectors, which were never before explored, this research also filled a methodological gap by using a multivariate analytical technic of VECM on long time series data.

Methodology

The study examined the employment intensity of the manufacturing sector of the Nigerian economy. The job creating capacity of the sectoral gross value added (GVA) growth between 1981 and 2014 was estimated. The secondary data used for the study were collected from the Central Bank of Nigeria (CBN), and the National Bureau of Statistics (NBS).

The variables collected, collated, analysed and presented were the figures of manufacturing sectoral gross value added, manufacturing sectoral employment, minimum wage rates, weighted average prime lending rates and inflation rates from 1981 to 2014. Similar data were collected for the other sectors. Estimation methodology of elasticity of employment, in deference to Ajilore and Yinusa (2011); Mkhize (2015); and, Adeniyi (2019) was used to analyse the data. Specifically, we used the Vector Error Correction Model (VECM).

In order to estimate the sectoral employment elasticity of the manufacturing sector of the economy and the elasticity of employment with respect to wage rate, inflation and user cost of capital in the economy during the period under review, a double-log linear regression equation was constructed for the parameters as follows

$$\ln L_t = \beta_0 - \beta_1 \ln W_t + \beta_2 \ln r_t + \beta_3 \ln GVA_t + \beta_4 \ln \pi_t + T_t + \varepsilon_t \quad (5)$$

where, $t = 1, \dots, n$ years. The dependent variable, L_t , represents aggregate employment (formal and informal, public and private) in thousands of persons in the specific economic sectors, in year t .

The exogenous variables are:

W_t = minimum wage rate in time t , measured in thousand Naira.

r_t = is the user cost of capital in time t , represented by the weighted average prime lending rate in the economy.

π_t = inflation rate in time t .

GVA_t = manufacturing sector gross value added (GVA) in constant 2010 basic prices.

GVA_MAN_t = Gross Value Added in the Manufacturing sector in year t .

$TIME(T)_t$ = yearly time trend variable, where $t = 1$ is year ended December, 1981 and

$t = 34$ is year ended December, 2014.

ε_t = error term.

From the model, the equation to analyse is:

$$EMP_MANU_t = f(GVA_MANU_t, W_t, r_t, \pi_t) \quad (6)$$

Where:

W_t = Minimum Wage Rate in year t

r_t = WAPLR in year t

π_t = inflation rate in year t

The above model postulates that employment of persons in the mining and quarrying sector, will vary with gross value added in mining and quarrying, and macroeconomic variables of wage rate, interest rate, and inflation rate, and that employment decisions by economic units in the mining and quarrying sector are a function of previous year's information.

Results and Discussions

From the VECM estimates of equation 6 presented in table 2 below, the employment intensity of manufacturing gross value added is 0.04. However, this was not significant at 95 per cent level of confidence, meaning that the statistic may not be relied upon for policy. The result is, ordinarily, interpreted to mean that a one per cent change in gross value added in the manufacturing sector will lead to a 0.04 per cent change in employment in the same direction.

Furthermore, the manufacturing sectoral employment intensity with respect to wage rate, interest rate, inflation rate, respectively, are: -0.01, -0.02, and -0.01. The coefficients are also not significant at 95 per cent level of confidence, and cannot be relied upon for policy. However, the interpretation is that a one per cent change each in wage rate, interest rate, and inflation will lead to a change in manufacturing employment in the opposite direction by 0.01 per cent, 0.02 per cent; and 0.01 per cent, respectively.

Table 2: VECM estimation of employment intensity of the manufacturing sector in Nigeria

EMP_MANU=f (GVA_MANU_t, W_t, r_t, π_t)

Vector error-correction model

Sample: 1983 - 2014

Number of obs = 32

AIC= -1,716852

Log likelihood = 78,46964

HQIC= -,9425288

Det(Sigma_ml) = 5,10e-09

SBIC= ,6191644

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_lnemp_manufac	9	,039786	0,3902	14,07551	0,1197
D_lngva_manufac	9	,127828	0,3163	10,17859	0,3362
D_lninflation	9	,600862	0,5447	26,31688	0,0018
D_lnwap_rate	9	,164978	0,6171	35,45211	0,0000
D_lnminim_wage	9	,46972	0,2871	8,858094	0,4505

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	

D_lnemp_manufac						
_ce1						
L1.	-0,29	0,10	-2,85	0,004	-0,49	-0,09
_ce2						
L1.	-0,06	0,02	-3,19	0,001	-0,10	-0,02
_ce3						
L1.	0,02	0,02	1,10	0,271	-0,01	0,05
lnemp_manufac						
LD.	0,01	0,18	0,05	0,962	-0,35	0,37
lngva_manufac						
LD.	0,04	0,08	0,51	0,611	-0,11	0,19
inflation						
LD.	-0,01	0,01	-0,69	0,490	-0,03	0,02
lnwap_rate						
LD.	-0,02	0,04	-0,55	0,584	-0,10	0,05
lnminim_wage						
LD.	-0,01	0,02	-0,53	0,596	-0,04	0,03
_cons	0,06	0,02	3,40	0,001	0,02	0,09

Source: Author's Analysis of Data collected from the National Bureau of Statistics

Furthermore, the economy consists of other sectors with which manufacturing sector co-exists and establishes various dynamic linkages, which if estimated, may help explain and stimulate its job absorptive capacity (Adeniyi, 2019). In order to incorporate this inter-sectoral linkages and relationships, a system of six plausible scenarios were developed from a system of six simultaneous equations of aggregate employment from the series as follows:

Scenario 1: $\text{Intot_empl} = f(\text{lnemp_agric}, \text{lnemp_non-agric}, \text{lngva_agric}, \text{lngva_nonagric}).$

Scenario 2: $\text{Intot_empl} = f(\text{lnemp_agric}, \text{lnemp_minin}, \text{lnemp_manufac}, \text{lnemp_const}, \text{lnemp_admin}, \text{lngva_agric}, \text{lngva_minin}, \text{lngva_manufac}, \text{lngva_const}, \text{lngva_admin})$

Scenario 3: $\text{Intot_empl} = f(\text{lnemp_agric}, \text{lnemp_mini}, \text{lnemp_manufac}, \text{lnemp_const}, \text{lnemp_admin}, \text{lninflation}, \text{lnwap_rate}, \text{lnminWage})$

Scenario 4: $\text{Intot_empl} = f(\text{lngva_agric}, \text{lngva_minin}, \text{lngva_manufac}, \text{lngva_const}, \text{lngva_admin}, \text{lninflation}, \text{lnwap_rate}, \text{lnminimWage})$

Scenario 5: $\text{Intot_empl} = f(\text{lngdp}, \text{lninflation}, \text{lnwap_rate}, \text{lnminim_wage})$

Scenario 6: $\text{lnemp_agric} = f(\text{lnemp_minin}, \text{lnemp_manufac}, \text{lnemp_const}, \text{lnemp_admin}, \text{lngva_agric}, \text{lngva_minin}, \text{lngva_manufac}, \text{lngva_const}, \text{lngva_admin})$ (9)

The above equations (9) were then estimated using VECM, and the results presented in Table 3 below:

Table 3: Employment in Manufacturing Sector

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario5	Scenario 6
	Coef.(z)	Coef.(z)	Coef.(z)	Coef.(z)	Coef.(z)	Coef.(z)
Ce1		0.306(0.83)	-2.626(-0.12)**	0.834(1.75)		-0.101(-0.27)
Ce2		0.329(0.8)	20.739(2.45)**	0.067(0.2)		-0.03(-0.46)
Ce3		-0.185(-0.49)	-2.233(-2.40)**	-1.127(-.49)		0.44(0.55)
Ce4		0.609(0.75)				
Ce5		-0.199(-0.59)				
Employment		0.74(0.27)	-11.133(-1.82)*			2.361(1.71)
Agriculture(-1)						
Employment		3.17(0.85)	0.300(0.10)			1.594(1.66)
Agriculture(-2)						
Employment Mining(-1)		-3.370(-1.06)	5.134(1.83)*			0.453(0.28)
Employment Mining(-2)		-2.999(-0.83)	2.441(0.92)			-4.498(-3.37)***
Employment		-2.331(-1.61)	-3.337(-1.22)			-2.521(-2.83)***
Manufacturing (-1)						
Employment		-1.436(-0.92)	-3.044(-1.79)*			-0.4(-0.36)
Manufacturing (-2)						
Employment		-1.181(-0.29)	-15.197(-2.20)**			-2.914(-1.56)
Construction(-1)						
Employment		-1.003(-0.28)	-7.667(-1.54)			1.983(1.36)
Construction(-2)						
Employment Admin(-1)		0.136(0.04)	5.259(1.76)*			3.304(2.08)**
Employment Admin(-2)		1.243(0.36)	5.378(1.71)*			-2.390(-1.58)
Employment Trade						
Employment Non-agric(-1)						
Employment Non-agric(-2)						
GVA Agriculture(-1)		-0.151(-0.53)		0.249(0.62)		-0.501(-1.94)*
GVA Agriculture(-2)		-0.275(-0.86)		-0.252(-0.81)		0.011(0.06)
GVA Mining(-1)		0.549(1.09)		1.352(2.94)***		0.228(1.16)
GVA Mining(-2)		0.317(1.03)		0.712(2.18)**		0.446(2.17)**
GVA Manufacturing (-1)		-0.109(-0.35)		-1.197(-2.11)**		-0.110(-1.1)
GVA Manufacturing (-2)		-0.090(-0.29)		-1.036(-4.28)***		-0.014(-0.17)
GVA Construction(-1)		0.010(0.04)		0.334(1.31)		-0.3 (-1.38)
GVA Construction (-2)		-0.379(-0.86)		-0.241(-0.88)		-0.061(-0.5)
GVA Admin (-1)		1.107(0.76)		-0.723(-1.06)		1.01 (1.28)
GVA Admin (-2)		1.039(1.09)		0.605(0.76)		1.473(2.11)
GVA Trade						
GVA Non-agric(-1)						
GVA Non-agric (-2)						
GDP (-1)						
GDP (-2)						
Inflation Rate(-1)			-0.060(-1.90)*	0.053(2.14)**		0.00634(0.36)
Inflation Rate(-2)			-0.002(-0.12)	0.029(1.11)		0.032(1.81)
WAPLR(Weighted Average Prime Lending Rate)(-1)			-0.270(-2.32)**	0.099(0.5)		
WAPLR(Weighted Average Prime Lending Rate)(-2)			-0.184(-2.13)**	-0.063(-0.52)		
Minimum wage (-1)			-0.007(-0.36)	-0.149(-2.6)***		
Minimum wage (-2)			0.0002(0.01)	-0.08(-1.84)		
Constant		-0.050(-0.41)	-0.043(-0.78)	0.096(1.62)		0.004(0.14)

Source: Author's Analysis of Data collected from the National Bureau of Statistics

Table 3 reveals the sectoral dependencies or inter-sectoral linkages. The highlighted significant relationships can be interpreted as follows:

Employment in the manufacturing sector is inversely affected by the immediate past year's employment level in agriculture. The elasticity is -11.133 and lagged by one year. This means that a one per cent change in the immediate past year's employment in agriculture results in 11.133 per cent change in employment in the manufacturing sector in the opposite direction.

Furthermore, employment in the manufacturing sector is significantly stimulated by prior year's employment in the mining and quarrying sector. Employment elasticity in the manufacturing sector with respect to employment in the mining and quarrying sector is 5.134 lagged by one year; that is, a one per cent change in employment in the immediate past year in the mining sector will lead to a 5.134 per cent change in employment in the manufacturing sector, in the same direction.

The results also show that employment in the manufacturing sector is inversely affected by the last two years' employment in that sector. The inter-temporal job creation intensity of growth in the manufacturing sector is -3.044, with a lag of two years. The meaning is that a one per cent change in the level of employment of the past two years in the manufacturing sector results in an inverse change in the current year's employment level by 3.044 per cent in the same (manufacturing) sector.

The results, also, show that current employment level in the manufacturing sector is affected inversely by previous year's employment in the construction sector. The employment elasticity of growth in the manufacturing sector with respect to employment in the construction sector is -15.197, lagged by one year. This means a one per cent change in the previous year's employment in the construction sector, during the period under review, is accompanied by a 15.197 per cent inverse change in employment in the manufacturing sector.

The results further show that current employment level in the manufacturing sector is directly co-integrated with the immediate past year's employment in the administration and social services sector. The employment elasticity of growth in the manufacturing sector with respect to employment in the administration and social services sector of the economy is 5.259, lagged by one year. This means a one per cent change in the immediate past year's employment in the administration and social services sector results in a 5.259 per cent direct change in employment in the manufacturing sector of the Nigerian economy during the period.

Recommendations

The managers of the economy of Nigeria, should work with the organised private sector and all the relevant stakeholders in the manufacturing sector to enhance the employment generation capacity of the sector by designing and implementing policies that promote the growth of sectoral output since employment in the sector is co-integrated with sectoral output.

The results show that employment and wage rate move in opposite directions. Consequently, the Federal and sub-national governments, working in collaboration with all sectoral stakeholders, should design and implement policies that encourage low wage rate in the sector. This will enable employers to be able to employ more people within their budget constraints.

Interest rate and job creation are negatively co-integrated. The Central Bank of Nigeria should design and implement policies that facilitate low interest rate. This will encourage both new and expansionary investments in the manufacturing sector.

The economic management team, particularly, the Central Bank of Nigeria, should facilitate stable general price level and low inflation rate in the in the economy in order to encourage planning and investment that will, in turn, create more jobs. Inflation rate and job creation are negatively co-integrated.

The managers of the economy of Nigeria should design and execute policies aimed at taking advantage of the inter-temporal linkages by making more use of long-term or perspective planning.

The inter-sectoral linkages of the manufacturing sector with the agricultural sector, mining and quarrying sector, construction sector and the administration and social services sector of the economy should be explored and exploited to enhance job creation.

Conclusions

The manufacturing sector of the Nigerian economy needs to occupy a more preeminent position in job creation, particularly during the period of economic expansion, which did not happen in the last period of economic growth between 1981 and 2014. The above results which explained, to some extent, the relationships between manufacturing gross value added, wage rate, interest rate, and inflation rate, together with the inter-sectoral and inter-temporal dependencies, should be factored into any sectoral employment policy.

References

- Adeniyi, A. (2021). Designing a framework for employment-growth targeting in Nigeria. *Journal of Asia Development*. ISSN 2377 – 9594. DOI: <https://doi.org/10.5296/jad.v7i1.18401>.
- Adeniyi, A. (2019). Economic growth and employment nexus in Nigeria's agricultural and non-agricultural sectors (1981-2014). PhD Thesis in the Department of Agricultural Economics, University of Ibadan, Nigeria. (in Press).
- Ajakaiye, Olu; Jerome, Afeikhena T.; Nabena, David; Alaba, Olufunke A. (2015) : Understanding the relationship between growth and employment in Nigeria, WIDER Working Paper, No. 2015/124, ISBN 978-92-9256-013-3, The United Nations University World Institute for Development Economics Research (UNU-WIDER), Helsinki, <http://dx.doi.org/10.35188/UNU-WIDER/2015/013-3>.
- Ajilore, T. and Yinusa, O. (2011). An Analysis of Employment Intensity of Sectoral Output Growth in Botswana. *Southern Africa Business Renew*, 15(2):26-42.
- Kapsos, S. 2005. Employment intensity of growth: trends and macroeconomic determinants. *Employment Strategy Paper 2005/12*. Geneva, ILO.
- Mkhize, N. (2015). The Sectoral Employment Intensity of Growth in South Africa: 2000:01 2012:04. School of Economic Sciences, University of South Africa. P.O. Box 392, Pretoria, 0003. South Africa. DOI: <https://doi.org/10.25159/1998-8125/4343>
- NBS. (2020). Unemployment and Underemployment Report. https://www.nigerianstat.gov.ng/pdfuploads/Q2_2020_Unemployment_Report.pdf
- NBS. (2015). Nigerian Gross Domestic Product Report, Quarter Two. Issue 6.
- Oloni, E. F. 2013. The Impact of Economic Growth on Employment in Nigeria. *Journal of International Business and Management*, 6(1):113-119. DOI: <http://dx.doi.org/10.3968/j.ibm.1923842820130601.1145>
- Sodipe, O. A. and Ogunrinola, O. I. (2011). Employment and Economic Growth Nexus in Nigeria. *International Journal of Business and Social Science*, Vol. 2 No. 11. <http://eprints.covenantuniversity.edu.ng/id/eprint/523>