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MACRO-ECONOMIC DETERMINANTS OF INDUSTRIAL OUTPUT IN NIGERIA: EXCHANGE RATE AND EMPLOYMENT DIMENSION

[1]Adeniran Anjola, [2]Dr. Adetiloye Kehinde, [3]Fagboyo Oluwatobi, [4]Ibidapo David Timilehin and [5]Romanus Osabohien

[1]Department of Banking and Finance, Covenant University, Ota, Nigeria
[2]Associate Professor, Department of Banking and Finance, Covenant University, Ota, Nigeria
[3]Department of Banking and Finance, Covenant University, Ota, Nigeria
[4]Department of Banking and Finance, Covenant University, Ota, Nigeria
[5]Department of Economics and Development Studies, Covenant University, Ota, Nigeria

ARTICLE INFO	ABSTRACT
	This study looks at the macro-economic determinants of industrial output in relation to exchange rate and employment in Nigeria. It employs the Autoregressive Distribution Lag (ARDL) econometric approach to co-integration using time series data for the period of 30 years (1986 - 2016) to examine the long-run relationship between industrial performance and some macroeconomic variables in Nigeria to gain insights into the industrial paradox of high inflation and low employment rate alongsiderising interest rate, incessant power outage and political treat in the economy. Results obtained from the ARDL econometric approach shows that in the long-run increase in employment rate and political stability has the potential of enhancing industrial output by 83.07% and 15.2% respectively; while ineffective exchange rate, high inflationrate andincessant power outage in Nigeria reduces industrial performance by 8.15%, 19.0%. Based on the results obtained, thestudy therefore recommends that monetary and fiscal policies should be geared towards combating unavailability of jobs in the countryand increase investment directed toward improving the solid mineral sector. There is also need for the government to maintainsecured monetary and fiscal policies in order to fight inflation which has a negative effect on investment and exchange rate, thereby dwindle performance of the economy.

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INTRODUCTION

Exchange rate is an important macroeconomic indicator used in measuring the overall performance of an economy because the overall movement in exchange rate tends to have ripple effect on other economic variables such as interest rates, inflation rate and unemployment rate (Fagbemi, 2006). The exchange rate of any nation is a vital economic variable as its fluctuations has significant effects on other macroeconomic variables (Hashim & Zarma, 2005). Exchange rate is an important macroeconomic variable usually used in the context

*Corresponding author: **Adeniran Anjola**
Department of Banking and Finance, Covenant University, Ota, Nigeria.

of international economics for formulation of policies, and also a major variable used in measuring the external competiveness of a nation (Dornbusch, 2004). The exposure of organisations in the Nigerian industries to exchange rate fluctuations as a result of international trade activities, exchange rate policies by monetary authorities, is considered to have effect on industrial output and ultimately employment in Nigeria hence, the need for this study. The Nigerian foreign exchange market was led by various factors some of which includes structural shift in production, changing pattern of international trade and institutional changes in the economy. In the 1970s, the increase in oil prices contributed greatly in the foreign exchange market. Following the shift from agriculture to crude oil and gas in the late 1960s, Nigeria's growth has continued to be driven by consumption and high oil prices.

Previous economic policies left the country ill-prepared for the recent collapse of crude oil prices and production. The structure of the economy remains highly import dependent, consumption driven and undiversified. Oil accounts for more than 95 per cent of exports and foreign exchange earnings while the industrial sector accounts for less than one percent of total exports. The industrial sector plays a significant role and has numerous dynamic benefits that are relevant for the transformation of an economy. The industrial sector has been adversely affected as a result of the exchange rate fluctuations, this is because the sector is highly dependent on import of inputs and capital goods which are usually paid for in foreign exchange whose rate of exchange has been unstable (Jongbo, 2014).High level of importation leads to spikes in the exchange rate because the more the sector imports, the more foreign exchange becomes scarce, which then causes devaluation of the domestic currency in the foreign exchange market. Devaluation of the currency thus leads to monetary policy disorder as the naira becomes scarce thereby reducing the money in circulation, as a result of these industries will begin to cut down prices, reduce output as well as cut-back employment level in order to meet demand. This shows that there exists a cyclical relationship between exchange rate industrial output production and employment (CBN, 2016).

Authors have argued on the effect of industrial output on employment, some are of the opinion that increased output increases aggregate employment in that excess demand would trigger increased production hence, the need for more man power. However, (Sahin, Tansel, & Berument, 2013), reveals that increase in aggregate demand may not necessarily lead to higher employment as it may only lead to increased hours of work for each worker. This is likely because of the cost of training and orientation consideration therefore; the firm may rely more on increased work time for existing labour force. This study seeks to therefore ascertain the effect of industrial output on employment in Nigeria. Evidence from literature has shown that theoretically, the effect of exchange rate can either increase or decrease industrial output. The Optimum Currency Area (OCA) theory developed by Mundell (1961) and McKinnon (1963) stated that a fixed exchange rate regime can increase output growth by reducing exchange rate uncertainty. The theory also states that it can reduce output growth by slowing the necessary relative price adjustment.This research work seeks to examine the long run relationship between exchange rate, industrial output and employment in Nigeria. This study is divided into four sections; section one is the introduction, section two refers to the literature review, section fours shows the methodology and section five summarizes and concluded the paper.

Theoretical Framework

Optimal Currency Area Theory (OCA): The optimal currency area theory is the earliest and leading theoretical foundation for the choice of exchange rate regime which was developed by Mundel (1961) and McKinnon (1963). This theory is based on the stabilization of the business cycle and trade. It focuses on the concepts of the symmetry of shocks, degree of openness and labour market mobility. According to this theory, a fixed exchange rate can either increase or decrease trade and output growth by reducing exchange rate uncertainty and thus the cost of hedging, and also interest rates. However, it can also reduce trade and output growth by

discontinuing, delaying or slowing the necessary relative price adjustment process.

The Monetary Model of Exchange Rate: This theory postulates that higher growth rates in a country leads to an appreciation of the country's currency. The monetary approach yields two important implications. The first is the intuitive result that higher relative income induces a stronger currency. The second is that a higher relative interest rate induces a weaker currency. Based on the monetary model, in the long run there is a stable nominal demand for money which is linked positively to the level of national income but connected inversely to interest rate. The monetary base times the multiplier is equal to the nation's money supply. The monetary base of the country is equivalent to the domestic credit generated by its monetary authorities plus its international reserve. When there is an excess supply of money in the economy it usually leads to an outflow of reserves under the fixed exchange rate regime and a depreciation of currency under the flexible exchange rate regime. The reverse is usually the case when there is an excess demand for money in the economy.

Empirical Literature: Okweshineand Mohammed (2015) investigated the impact of exchange rate on industrial output from 1980-2013 using the Error Correction Model (ECM). The ECM was adopted to examine if a relationship existed between exchange rate and industrial output. According to the findings of the study, it was observed that there was a positive and significant long run relationship between exchange rate and industrial output. Investigating the impact of changes in exchange rate on industrial production in Nigeria, (Akinlo and Lawal, 2015) adopted the Vector Error Correction Model to ascertain the existence of a long run relationship between production index which is a proxy for industrial production; exchange rate, money supply and inflation rate, which are selected macroeconomic indicators. For the period under study (1986-2010), the study revealed that impact exchange rate depreciation in Nigeria had fairly significant in the short run. Moreover, exchange rate depreciation in the long run has a positive impact on industrial production. However, the study didn't capture fluctuations in exchange rate and the effect of shock on industrial output. VECM isn't adequate model to capture the impact of exchange rate on production. Onakoya (2018), studied the dynamics of macroeconomic variables and the output in the industrial sector in Nigeria. The study adopted data from 1981 to 2015 while using descriptive statistics and stationary evaluation for its analysis. While understanding the impact of changes in macroeconomic factors on industrial sector's output, study reveals that there exists no short run relationship between output and exchange rate and unemployment amongst other variables considered. The study also recommended the unification of both monetary and fiscal policies on which economy stability is possible. However, the study didn't reveal whether there exists a long run impact of these variables on industrial output. Additionally, the study was looking at the behaviour of industrial output not macroeconomic stability, hence, the recommendation suggested isn't sufficient. Lee (2018), while studying industrial output fluctuations in developing countries, argues that income levels and trade openness are important factors in determining shocks in industrial output especially in agricultural productivity. Lee maintained that a negative shock to agricultural productivity likely increases food prices and labour which enables capital movement from industrial into

agriculture sector to meet the subsistence need for food. Result reveals differences in agricultural yield explainabout 44% of industrial output fluctuations in developing countries. Therefore, a reduction in yield reduces employment and ultimately industrial output. Some studies have also explained the impact of employment on industrial output. This sometimes leads to deindustrialization which is typically referred to as deterioration in industrial output as a share of total employment. The long run implications of deindustrialization cannot be overemphasized, however, (Tregenna, 2009), posit that explaining deindustrialization in terms of employment is restrictive. His study sought to analyze changes in industrial employment and output internationally. Using a decomposition technique in analysing 48 countries during periods of deindustrialization, result reveals that more often than not, industrial decline is allied mainly with a declining labour intensity. This is in contrast to the believe that overall decline in the size of industrial sector results in employment reduction. To this end, (Tregenna, 2009) recommends that deindustrialization should denoted in terms of persistent decline in industrial size in total employment as well as size or share of industrial in GDP. Castillo, Garone, Maffioli, & Salazar (2017), argues a causal effect of industrial policies on employment and industrial output in any sector, industry and ultimately the economy at large. Their study adopted a synthetic control measure approach to determine the long-term impact of tourism development policies on industrial growth and output as well as on employment in the Argentinean province of Salta. Result found a significant positive effect with over 1376 formal jobs accounting for 11 percent average annual impact over 10 years on employment in the hospitality sector of the economy. The study also revealed a non-detrimental effect on other sectors or regions in the economy. Therefore, growth in the hospitality industry as a result of job creation resulted into job creations in other industries of the economy. Industrial output may lead to job creation; however, a more efficient development in an industry may lead to more employment generation as compared to current operations in an industry. Garrett-peltier (2017), compared the employment impacts of energy efficiency, renewable energy and fossil fuels using an input-output model. Result shows that an expense of $1million in fossil fuels will create on an average 2.65 full time equivalent jobs whereas spending the same amount on energy efficiency, will amount for a job creation of 7.49-7.72 full time equivalent jobs. Hence, shifting spending from brown to green energy will create a net increase of 5 jobs. However, study didn't show period covered and how purchasing power of money can affect industrial operations and ultimately aggregate employment levels. A $ million dollars this year could have more purchasing power than that of next year therefore, putting exchange rate in consideration would have made this study complete.

MATERIALS AND METHODS

This study adopts the Auto-regressive Distribution Lag (ARD) cointegration approach in examining the long-run relationship between industrial output, exchange and employment in Nigeria. The ARDL closely follows the study of Osabohien et al., (2018) and Omotola (2016).Omotola (2016) employed the ARDL cointegration to examine the long run relationship between exchange rate and industrial output in Nigeria, this study included other variables such as power outage and political stability and absence of violence or terrorism. The rational for the use of ARDL approach to cointegration is built

on the premise that time series variables trend in difference order of stationarity, hence the traditional approach to cointegration becomes inefficient. The implicit form of the model 1 is specified as:

manoput = f (employ, infl, exr, eptdl, psav).................................(1)

The explicit form of model 1 as specified in log form is thus:

manoput= α + βemploy + γinfl + ηexr +δeptdl + σpsav + ε
--------------------------------------*(2)*

$$\Delta indoutput_t = \alpha$$
$$+ \sum_{t=1}^{n} \beta\Delta employ_{t-1} + \sum_{t=0}^{n} \gamma\Delta infl_{t-1}$$
$$+ \sum_{t=0}^{n} \eta\Delta exr_{t-1} + \sum_{t=0}^{n} \delta\Delta eptdl_{t-1}$$
$$+ \sum_{t=0}^{n} \sigma\Delta psavt - 1 + \lambda ECM_{t-1}$$
$$+ \quad e_t \qquad\qquad ......(3)$$

Where: Δ represents the change in operator and ECM_{t-1} represents the error correction term, λ presebts the rate of adjustment. The rate of adjustments means how fast the system adjust back to equilibirium in the event of distortion. From the above asseertion, the model for the ARDL is specified in equation (4)

$$\Delta indoutput_t = \alpha$$
$$+ \sum_{t=1}^{n} \beta\Delta employ_{t-1} + \sum_{t=0}^{n} \gamma\Delta infl_{t-1}$$
$$+ \sum_{t=0}^{n} \eta\Delta exr_{t-1} + \sum_{t=0}^{n} \delta\Delta eptdl_{t-1}$$
$$+ \sum_{t=0}^{n} \sigma\Delta psav_{t-1} + e_{t-1} ....(4)$$

The hypothesis is stated thus

H_0: $\alpha = \beta = \gamma = \eta = \delta = \sigma$ (No long run relationship exists)

H_1: $\alpha \neq \beta \neq \gamma \neq \eta \neq \delta \neq \sigma$ (long run relationshipexists)

The main variables of interest in this study are employment and exchange rates, it is expected that their coefficients should be statistically significant and greater than zero and positive for employment and lesser that zero and negative for exchange rate; hence $\beta >0$; $\eta<0$. This means that an increase in the rate of employment of employment contributes positively to the growth of industrial output, while increase in exchange rate (ineffective exchange rate) negatively affect or reduceindustrial output.

Variables source, definition and measurement are presented in table 1

Table 1. Variables, Data Sources and Measurement

Variable Name	Identifier	Source of Data	Definition and Measurement
Industrial output	indoutput	WDI, 2016	This measures the total output of businesses integrated in the industrial sector of the Nigerian economy such as manufacturing, mining and utilities.
Employment	employ	WDI, 2016	Measures the percentage of labour force that is employed
Inflation	infl	WDI, 2016	This measures the rate at which general prices of goods and services are rising leading to a fall of the purchasing power of money in the economy.
Exchange Rate	exr	WDI, 2016	This measures the value of one's currency against other currencies. It is the rate by which one currency is exchanged or traded for another currency in the FX market.
Power outage	Eptdl	WDI, 2016	Power outage proxied by electricity power transmission and distribution loss. This is measured by as percentage of total output which includes losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage.
Political stability and absence of Violence	psav	WGI, 2016	This is an institutional variable as the part of the World Governance Indicators that measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.

Source: Authors' Compilation

Table 2. Summary Statistics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Industrial output	5.6477	2.3286	2.41013	9.75413
employment	4.0707	942621	2.6907	5.88e+07
inflation	20.2816	18.8251	5.382224	72.8355
Exchange rate	88.8269	70.2901	2.020575	253.4923
Power outage	29.1905	11.6536	5.865399	43.83741
Political stability	-1.9229	0.2020	-2.19	-1.52

Source: Authors

Table 3. Unit Root Test of Stationary

Variables	DF t-statistic	Critical Value 5%	Integration Order	Remarks
Manoput	-5.787	-2.989	I(1)	Stationary
Employ	11.070	-3.716	I(0)	Stationary
Infl	-4.781	-3.723	I(1)	Stationary
Exr	-3.480	-2.989	I(1)	Stationary
Eptdp	-7.103	-2.989	I(1)	Stationary
Psav	-5.834	-3.000	I(1)	Stationary

Source: Authors' Computation using STATA 12, 2018.

RESULTS AND DISCUSSIONS

This section four of the study presents the results obtained from the econometric analysis. The starting point of presenting the econometric results is by presenting the summary statistics of the variables as shown in Table 2. The results show the summary statistics of the selected variables such as: industrial output as the dependent variable, and the independent variables: inflation, exchange rate, employment, political stability/absence of violence and power outage proxied by electricity power supply and distribution loss that were engaged in this study. The mean, standard deviation, minimum and maximum are as presented, to bring to bear the real information required for the study as presented in table 2 (Osabohien et al., 2018). Following the summary statistics of variables shown in table 2 is the unit root test for variables stationarity which was conducted using the Augmented Dickey-Fuller (ADF) which is presented in table 3. The Augmented Dickey Fuller (ADF) test unit root for stationarity shows that the variables are integrated indifferent order that is; order 0 [I(0)] and order 1 [I(1)] this means that, some variables such as employment are stationary at levels [I(0)] while other variables: industrial output, inflation, exchange rate, power outage and political stability are stationary after first difference [I(1)], hence ARDL becomes more suitable for the analysis (Dickey and Fuller, 1981).

The ARDL cointegration approach for this study focuses on the long run relationship (see table 4). The ARDL results show that employment, inflation, exchange rate, power outage and political situation of a country has a long-run effect on industrial output in Nigeria. Results obtained from ARDL shows that 1% increase in employment rate, political stability and absence of violence or terrorism increases industrial output by 18.66% and 15.25% respectively. On the contrary, 1% increases in inflation rate, exchange rate, power outage has the potential of reducing output approximately by 19.0%, 8.15% and 8.25% respectively. Results from to some extent support some empirical evidence from other studies. For example, in line with Omotola (2016), the effective exchange rate is necessary and needed for industries to strive in the long run, on the contrary, ineffective of exchange rate leads to distortions in the system of consumption and production. Mordi, (2006) pointed that unnecessary fluctuations in inflation and in exchange rate brings uncertainty and risks for industrial agents and employment with destabilising effects on industrial performance and this fluctuation affects investment portfolios and can lead to capital losses. In line with the above, the study of Douglas and Jike (2005) pointed inflation and exchange rate fluctuations are seen to have wrinkle consequence on other economic variables among others employment rate. Errors which may occur before the long-run relationship were corrected using the error correction mechanism as shown in Table 5.

Table 4. Result from Autoregressive Distribution Lag (ARDL) Model

D.industrialoutput	Coefficient	Standard Error	pro-value
ADJ			
Industrial output			
L1.	0.1866	0.10804	0.098
Long run relationship			
employment	0.8307	3.8807	0.033**
inflation	-0.0190	0.0678	0.782
Exchange rate	-0.0815	0.0530	0.001*
Power outage	-0.0825	0.53048	0.0139**
Political stability	0.0152	03048	0.003*
cons	4.427137	2.0703	0.044**

Note: *, ** means that variables are statically significant at 1% and 5% respectively, Lag (1, 0, 0, 0); F = 1.758; t = -1.727 (F > t; showing that there exist a long-run relationship) Source: Authors' using STATA 12

Table 5. Estimates from Vector Error-Correction Model

Regress and Regressors	D_indoutput	D_employ	D_infl	D_exr	D_eptdl	D_psav
ECterm	-0.0256*	-0.8582	-0.0523**	-0.966**	-0.4399**	-0.0852
	(0.000)	(0.112)	(0.0059)	(0.0315)	(0.0313)	(0.142)
manoput(LD)	0.2231	-0.4875	-16.3709*	-22.6151	-0.84670**	2.5307**
	(0.000)	(0.179)	(0.000)	(0.375)	(0.0365)	(-0.021)
employ(LD)	4.5407**	1.29786**	-4.2106**	0.0072*	-1.1806	-0.0212***
	(0.011)	(0.044)	(0.0435)	(0.002)	(0.430)	(0.060)
infl (LD)	-0.0073*	9738.279	0.41551**	1.5456	0.0054	0.0093
	(0.000)	(0.203)	(0.014)	(0.224)	(0.907)	(0.113)
exr (LD)	0.0374*	5285.57	0.0960*	1.110149	-0.0073	0.632
	(0.000)	(0.338)	(0.000)	(0.024)	(0.668)	(0.113)
eptdl (LD)	-0.0666*	2621.797*	-1.9769**	-2.1504	-0.0848***	-0.0541 (0.113)
	(0.000)	(0.000)	(0.0244)	(0.867)	(0.008)	
psav (LD)	-1.9236* (0.000)	5.77627*	32.82501*	45.7597	0.8244	-0.8083
		(0.000)	(0.000)	(0.256)	(0.576)	(0.024)
Adj. R-sq	0.6429	0.9927	0.8269	0.7480	0.5348	0.8053
AIC: 12.35498			HQIC: 12.32833		SBIC: 14.85676	

Note: *, **, *** means that variables are statically significant at 1%, 5% and 10% respectively.AIC means Akaike information criterion; HQIC means Hannan-Quinn Information Criterion and SBIC means Schwarz-Bayesian information criterion
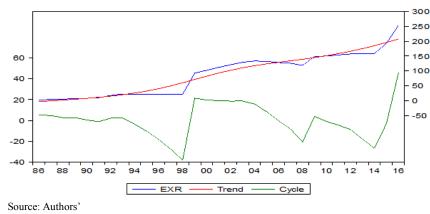

Figure 1. Cyclical Fluctuations of Exchange Rate

Table 5 presents the estimates from the error correction mechanism or model (ECM). The error-correction mechanism for this study is used to correct for time-period's divergence from the short-run to long-run equilibrium relationship between industrial output, inflation, exchange rate and other variables considered in this study (Granger and Newbold, 1974). Thus, ECM directly estimates the speed at industrial output returns to equilibrium after a change in employment rate and other exogenous variables. From the ECM it was observed industrial output is been corrected and for any for any fluctuation that may result from employment rate, inflation rate, exchange rate, power shortage in the short-run, industrial output will adjust back to equilibrium by 85.82%, 5.23%. 96.6%, 43.99% and 8.52% respective. The exchange rate and inflation cyclical fluctuations using the Hodrick-Prescot (HP) Filter are presented in Figure 1 and figure 2 respectively In Nigeria, exchange rate and inflation fluctuation figure (shown in Figure 1 and Figure 2) can be attributed to policies which are often insensitive and controversial because of the need for structural transformation required; such as expanding non-oil exports, invariablyleading toa depreciation of the nominal exchange rate (Obadan, 2006).This exchange rate policy is supposed to improve access to foreign exchange for production thereby increasing industrial output and employment while reducing inflation rate (Ajakaiye et al., 2015).

Paradoxically, the distortionsinbuilt in an overestimated exchange rate period are barely a topic of debate in developing countries, especially Nigeria that rely on importation for production and consumption (Obadan, 2006).In Nigeria, the exchange rate policy has undergone substantial transformation from the immediate. However, in spite of these different methods of determining exchange rate, a realistic exchange rate has not been found for naira because the existing exchange rate systems had continued to widen thegap between the official and the parallel markets and had failed to prevent disequilibrium in the foreign exchange market (Amassoma, 2016). Intuitively, it is suggested that employment growth, exchange and inflation rate reduction are closely related. This is based on the fact increase in employment are enhances industrial performance (output), while reduction in exchange and inflation has the capacity of increasing employment and thus, industrial output increase. Olotu et al. (2015) view this scenario as a result of an inability to fully utilize available factors of production and argue that unemployment growth rate in Nigeria is rising as a result of the extreme high number of graduates produced every year, and industries lack the ability to absorb them. The country's growth and business environment which has not been able to significantly expand the formal sector has left the economy largely trapped in its pre-2001 trajectory when it started to witness a sustained expansion in its non-oil economy.
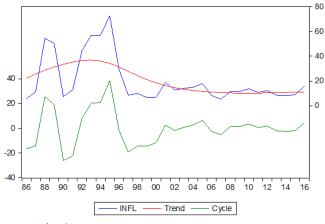

Source: Authors'

Figure 1. Cyclical Fluctuations of Inflation Rate

On a general note, Inflation rate, exchangerate and unemployment remain as the main problems of concern in Nigeria and as a result, policy makers to large extenttend to have low of inflation and unemployment. All things been equal, is often argued that a single-digit rate of inflation and unemployment rate of the range4% to 6% will ensure the stability of the economy.

Summary and Conclusion

This study tried to acertain the relationship that exist between industrial output, exchange rate and inflation and also to reveal the effects of these economic indicators on industrial output. Result has revealed that in Nigeria, exchange rate flunctuations has had a negative effect on industrial output. With the devaluation in Naira value, importation of goods become more expensive therefore increasing the cost of purchasing these inputs. The result of the analysis obtained from this study

agrees with Apriori expectattions. The study as also revealed a long run relatinship existing between variables adopted in this study therefore we reject the null hypothesis. The study also revealed the importance of employment in boosting industrial output in Nigeria by approximately 83%. Inflation rate and exchage rate has shown a negative effect on industrial output, however, flunctuations in exchange rate has affected mostly the contribution of the industrial sector to the Nigerian GDP.

Recommendation

On the basis of this analysis, the study therefore recommends the following:

- The study revealed employment rate as a crucial indicator in determining the behaviour of industrial output. With persistent increase in Nigerian unemployment rate, there exist a threat on the output realisable in the industrial sector. Therefore, this study recommends monetary and fiscal policies geared to combating unavailability of jobs in the country.

- It has been observed that the manufacturing sector contributes immersely to the industrial sector followed by crude petroleum and Natural gas sector. However, the solid mineral sector has low contribution to the industrial sector. Thuus this study recommends that more investment should be directed toward improving the solid mineral sector since dependency of the oil and gas sector has posed risky following the sudden drop in the oil price leading to the economy entering a recession.

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