

THE IMPACT OF SELECTED MACROECONOMIC VARIABLES ON INDUSTRIAL GROWTH IN SUB-SAHARAN AFRICAN COUNTRIES: ARDL-PMG APPROACH

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Abstract

This study examined the impact of selected macroeconomic variables on industrial growth in sub-Saharan Africa (SSA) using annual data spanning from 1986 to 2024. The study employed ARDL model to estimate the short and long relationship between the selected macroeconomic variables and industrial growth in SSA. The results of this study revealed that “there is significant positive relationship between growth rate of real gross domestic product (RGDPgr), broad money supply (MS₂) and real industrial growth rate (RINDR) in the long run. The findings of the study also showed that there is significant negative relationship between unemployment rate (UNMP) and RINDR both in the short run and long run in SSA. Moreover, there is insignificant negative relationship between real interest rate (RINT), real exchange rate (REXCH) and RINDR both in the short run and long run at 5% level of significance. It was concluded as a result of the findings of the study that exchange rate volatility is a serious threat to industrialization and is aggravating unemployment rate in some SSA countries. In line with the findings, the study recommended that governments of SSA should set on motion the machinery and strategies that can boost the growth of industries in the region so as to mitigate the high level of unemployment as well endeavour to stabilize exchange rate through appropriate policies in order to boost investment in SSA.

Keywords: Macroeconomic Variables, Real Industrial Growth Rate and Pooled Mean Group Approach.

1.0 INTRODUCTION

The industrial sector is classified as a secondary sector that possesses the capability to enhance the economic growth of developing nations. A robust industrial sector has been posited and observed as a catalyst for economic advancement due to its capacity to create opportunities for greater availability of goods, increased employment and income, enhanced efficiency, and improved balance of payments (Paulo et al., 2017). Furthermore, industrial development is regarded as a fundamental economic activity that exhibits significant sensitivity to macroeconomic variables (Otero, 2017). Industrialization constitutes a pivotal sector within any economy and is essential

for the growth and development trajectory of numerous developed countries and select emerging economies globally (Adesina, 2021). For instance, the rapid advancement of the Asian Tigers would not have been feasible without the contributions of the industrial sector. Conversely, countries in Sub-Saharan Africa (SSA) continue to fall significantly behind, largely due to their failure to cultivate this sector and their inadequacy in leveraging macroeconomic variables to establish a macroeconomic equilibrium that could catalyze industrialization. As of 2022, the data indicated that the manufacturing output share in SSA was \$235.78 billion, in stark contrast to \$7,737.39 billion and \$2,509 billion for East Asia and Europe, respectively (World Bank, 2024). The manufacturing export percentage for SSA stood at 23.6%, compared to 78.4% and 85.9% for Europe and East Asia, respectively (World Bank, 2024).

In recent years, macroeconomic variables have garnered increasing scrutiny within the realm of development economics, as economists and industrial scholars hold divergent perspectives on the interplay between industrial growth and various macroeconomic factors (Owolabi & Adegbite, 2014). The principal issues that have disrupted macroeconomic stability in SSA over the past two decades include inflation, interest rates, exchange rates, money supply, and unemployment. These elements have adversely impacted the economic performance of SSA to such an extent that they have hindered nations like Nigeria and Ghana from attaining price stability and equitable income distribution. Inflation has become chronic and escalated within Nigeria and other SSA economies over the last twenty years, subsequently fostering macroeconomic instability in these nations. For instance, in Nigeria, the largest economy in the region, inflation has surged to a 17-year peak of 21.34% (CBN, 2022). Similarly, in South Africa, the second-largest economy in the region, the inflation rate reached a 13-year high of 7.5% since 2009 (Statistics South Africa, 2022). Likewise, Ghana has experienced a rise in inflation for four consecutive months, reaching a record high of 30.0%, its highest level since April 2003, among other examples. Furthermore, elevated inflation rates undermine investor confidence, which consequently drives up interest rates and increases uncertainty within the economy, thereby diminishing capital investment and hindering economic development, ultimately exacerbating poverty levels” (World Bank, 2022). In alignment with this, the International Monetary Fund (IMF) in its 2022 report cautioned Nigeria and several SSA nations regarding social risks, political instability, and escalating food insecurity as a result of rising inflation.. The uncertainty following the “high and volatile inflation rates in this region has decreased the investments and potential output of industrial activities. This also has increased the risk premium in the financial asset. In view of the foregoing, interest rate exerts its own influence on the macro-economics of SSA, transmitting through the channel of saving, investment, output and employment. Interest rate as a cost of capital, it affects the demand for supply of credit (loanable fund) in SSA and its fundamental implications on these economies are not beneficial enough (Okonkwo & Egbulonu 2016). Exchange rate is another important macroeconomic variable used as a parameter for determining international competitiveness and it is regarded as an indicator of competitiveness of any currency of any country. More so, many economies of SSA most especially Nigeria are experiencing foreign exchange rate instability. Large and frequent changes in exchange rates can create a volatile economic structure particularly if financial institutions are underdeveloped.

This exchange rate volatility can affect the prospect of industrial investment of any economy. The overvalued exchange rate in SSA has hurt the performance of export industries thereby reducing foreign exchange inflow, leading to sustainable balance of payments deficit (Okoye, Okorie and Nwakotry, 2017). In contrast, excessive devaluation of the home currency increases the cost of imported production input thereby fueling inflation pressures. Adebajo et al (2019) opined that

high dependence on external sector for import of essential industrial inputs caused low level development of the sector. The implication of this is that depreciation of domestic currency can impair the capacity to output, therefore impact industrial growth negatively. In many economies, the performance of industrial sector is the gauge for assessing the effectiveness of macroeconomic policies (Mordi et al., 2014).

Industrial development has played a vital role in the economies of developed countries and the emerging countries like china, Korea, Taiwan, Brazil, Mexico, and so on. For example, the GDP growth rate as at 2023 in Korea was 3.2%, in China, it was 5.25%, in Indonesia, it was 5.05, in Taiwan, it was 13.3%, in Mexico, it was 3.2% but in Nigeria and South Africa, it was 2.74% and 0.7 respectively as at 2023. One of the salient reasons in the variation of the GDP growth rate of these countries is the level of their industrialisation. Poverty has reduced in these countries that are highly industrialised as well as bridging income inequality. It is also evident that industrial development is a key driver of economic development of an economy. It serves as a catalyst for growth and modernization. For instance, industrialization has played a vital role in economic development of developed countries like japan, Germany, USA, UK, etc and the emerging countries like China, Korea, Taiwan, and so on. Industrial sector has been a channel to achieve macroeconomic objectives such as poverty reduction, equality of income, price stability and so on. However, industrialisation in the sub-Saharan African region has failed to grow but instead, it is characterized with plethora of challenges such as low per capital income, primary product dominated export, low foreign exchange earnings, increasing unemployment, inequality of income, vulnerability of external shocks, poverty aggravation, corruption and poor institutional framework (Rodrick, 2015). In view of these challenges, SSA countries have lagged behind the other regions in terms of industrialisation. Prior studies like Okeke et.al (2020) and Omengbeoji et al. (2021) have identified key macroeconomic variables such as inflation, exchange rate, interest rate, money supply and unemployment as the major setbacks for industrial growth in SSA rather than the foregoing enumerated challenges.

For several decades, economic performance has not been impressive in SSA. The continued economic crisis with the associated problem of high inflation and pressure, high exchange rate, high rate of unemployment and debt over long is difficult to explain (Aminu & Donga, 2014). Inflation is still very high in SSA. It is in double digits in 14 countries, which is still above the inflation target. More so, the region is still continued to face significant exchange rate volatility. Therefore, there is an arising need to manage economy effectively which has made the governments of the SSA to embark on various macroeconomic policies such as monetary policy, fiscal policy and exchange rate policy but despite all these measures, governments of SSA have not been able to achieve the desired goals of price stability, reduction in unemployment, sustainable economic growth and stable exchange rate.

In literature, most of the previous studies focused on different single variable of macroeconomic variables in relation to industrial growth. For instance, studies such as the relationship between exchange rate and manufacturing/industrial growth, some studies like Musa & Sanusi (2013) and Gokmenoglu, Azim & Taspinar (2015) are on relationship between inflation and industrial growth, other studies like Okonkwo & Egbulonu (2016) and Chioms & Ito (2020) are on interest rate and industrial growth both in country-specific and cross- countries. It is only few studies like Enu, Hagan & Attah-Obeng (2013), Osagie & Aigbovo (2016), Loto & Musa (2018), Adisu (2019), and many others that have delved into macroeconomic variables and industrial sector and they concentrated mainly on country –specific”. The just little studies such as Akinlo (2005), Oyerinde (2019) and Agbonrofo and Olusegun (2023) that were carried out on the nexus between industrial growth and macroeconomic performance on regional or sub regional basis did not consider the

causal relationship between these variables which is one of the study objectives that this study is looking into. This study is intended to close this noticeable gap.

2.0 LITERATURE REVIEW

Enu, Hagan and Attah-Obeng. (2013) used ordinary least squares estimation technique to investigate the impact of macroeconomic indicators on industrial production in Ghana. The study identified “real petroleum prices, real exchange rate, import of goods and services and government spending as the key macroeconomic factors that influence industrial production in Ghana. Pagan and Modak (2014) also employed multiple regressions to analyse the impact of macroeconomic variables on GDP growth in India. The study revealed that macroeconomic variables such as savings, investment, economic output, unemployment and employment, and inflation play a crucial role in the economic performance of India. Both studies agreed that macroeconomic variables are crucial to industrial growth.

Agbonrofo and Olusegun (2023) also employed panel data to investigate the effect of monetary policy on the manufacturing sector value added in 24 sub-Saharan African (SSA) countries using annual data from 1995 to 2020. Findings from the study showed that the monetary variables are time sensitive and heterogeneous in their effects depending on the long or short-run. The study also revealed that interest rate and the exchange rate had statistically significant negative impacts on manufacturing value added in the long-run, only credit to the private sector had no real impact on manufacturing value added in the short and long-run. Adisu (2019) equally employed ARDL bond test approach to examine the effect of macroeconomic industrial sector output growth in Ethiopia using data covering 1991 to 2018. The results showed that there is existence of long run relationship between macroeconomic variables on industrial output growth in Ethiopia. The study also revealed that prime lending rate, trade balance affect industrial output negatively while inflation, money supply and gross capital formation affects industrial output positively in Ethiopia. The findings of the study that the interest rate is negatively related to the industrial output is similar to the results of Agbonrofo and Olusegun (2023)

Musa and Sanusi (2013) employed Vector Error Correction model to investigate the response of aggregate industrial output to relative changes in prices and exchange rate in Nigeria using annual data from 1970 to 2011. The response of industrial output to the shock of exchange rate was significantly positive more specifically in the initial year while shock to price changes, the industrial output responds negatively with the small magnitude at the beginning.

Osagie and Aigbovo (2016) examined the impact of macroeconomic variables on Manufacturing Sector output in Nigeria from 1980 to 2014 using data from secondary sources. The study employs multiple Ordinary Least Square (OLS) analysis for the estimation process, unit root test for stationarity variables, cointegration analysis for long-run equilibrium relationship and error correction model to examine the short run effect of the variables. The result revealed that money supply positively and significantly impact on the manufacturing sector while exchange rate has negative but significant effect on manufacturing sector but unemployment rate and capacity utilization rate were not significant determinants of manufacturing sector output. David-Wayas et al (2018) also employed Ordinary Least Square method to evaluate the impact of some selected variables on manufacturing productivity in between 1981 and 2015. The Study showed similar results with that of Osagie and Aigbovo (2016) that there is existence of a long run relationship between the macroeconomic variables and industrial output in Nigeria. The findings from the study also revealed that there is negative relationship between exchange rate, government expenditure and manufacturing sector while there is positive relationship prime lending rate, domestic private investment, foreign direct investment and manufacturing Sector of Nigerian economy. Ezu, Anyench and Adaorao (2020) also used simple regression model to analyse the effect of

macroeconomic variables on performance of manufacturing sector in Nigeria a thirty-eight-year (38) period spanning from 1981-2019 with variant findings. Specifically, this study investigated how macroeconomic variables such as real interest rate, exchange rate and inflation rate relate with performance of manufacturing sector measured by output contribution ratio to real gross domestic product and average capacity utilization. The findings of this study revealed that macroeconomic variables significantly relate with performance at 5% significant level.

Ogbonna (2021) examined the impact of fluctuations of macroeconomic variables such as exchange rate, lending rates and inflation rates on the manufacturing output in Nigeria. The study used descriptive analysis to investigate the relationship between manufacturing output and macroeconomic stability in Nigeria. The findings showed that macroeconomic instability impacted negatively on the manufacturing output. Another study, Mwenda, Ngollo and Mwasqota (2023) used multiple linear regression analysis to examine the effects of macroeconomic variables on the performance of listed firms using data Spanning from 2006 to 2021. The findings revealed that GDP, inflation and exchange rate had significant positive coefficient, while interest rate and exchange rate had significant negative coefficient which indicate that Macroeconomic conditions have a substantial effect on form performance. This result is also at variance with that of Osagie and Aigbovo (2016) and David-Wayas et al (2018) in the aspect of the exchange rate and Industrial growth. Achioch, Okereafor and Bashir (2023) used ordinary least squares and cointegration analysis to examine the effect of macroeconomic variables (exchange rate, interest rate and inflation rate) on productivity of Nigeria's manufacturing sector. Three research hypotheses were formulated to guide the study. The study used secondary data collected from annual time series from 1980-2020 obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin. The study found that exchange rate and interest rate has significant effect on the productivity of Nigeria's manufacturing sector; and that inflation rate has no significant effect on the productivity of Nigeria's manufacturing sector.

Loto and Musa (2018) employed nonlinear ARDL bound test approach to co-integration to examine macroeconomic policy and industrial sector performance in Nigeria. The study found that a long-run bound relationship exists between selected policy variables and each industrial sub-sector. The study also revealed that financial deepening, exchange rate depreciation and economic openness are significant in the long run while monetary policy rate is effective in the short run. More so, Adelowokan, Oduola, and Popoola (2020) also used Non-linear ARDL model to investigate the responsiveness of manufacturing Sector performance to major macroeconomic determinants in Nigeria using data Spanning from 1981 to 2018 with almost similar results with that of Loto and Musa (2018). The results revealed that the variables like exchange rate, inflation rate interest rate except CGDP per capital played important roles in influencing manufacturing sector performance in Nigeria. The findings from the study confirm the presence of asymmetric shock on manufacturing performance in Nigeria.

Adedoyin *et.al* (2022) employed Autoregressive Distributed Lag (ARDL) to analyze the impact of macroeconomic variables and some salient socio-economic and political variables on the manufacturing sub-sector of the Nigerian economy using data sourced from 1986 to 2019 within the context of two macroeconomic theories: The Solow growth and the endogenous growth theories. The study noted that both the Solow growth theory and endogenous growth model are valid in the short run for the studied economy, but the result is not the same in the long run, as only the endogenous growth model was valid in the long run.

Okonkwo and Egbulonu (2016) used Autoregressive Distributed Lag (ARDL) technique to investigate the effect of interest rate fluctuation on industrial growth in Nigeria. The findings of the study revealed that inverse relationship exist between interest rate and industrial growth in

Nigeria, meaning that increase in interest rate will decrease industrial growth and vice versa in Nigeria. Chioms and Itoro (2020) also employed ARDL Bound test to investigate the effect of interest rate on industrial sector in Nigeria using data from 1980 to 2018 with different results. The ARDL Cointegration revealed that there is long-run relationship between interest rate and industrial outputs. The study also revealed that there is positive relationship between interest rate and industrial output.

Ukwunna, Ihugba and Okoro (2022) examined the relationship between exchange rate fluctuations and Industrial productivity growth in Nigeria. The study used Johansen Cointegration Model and Vector Error Correction Model to capture the objective of the long-run co-movement between exchange rate fluctuations and industrial growth, The Study also utilized Granger Causality test to assess the causal relationship between the variables. The result of the study showed that there is long-run relationship between the two variables and that the Granger Causality test confirmed bi-directional relationship industrial productivity in Nigeria. However, Nwosa, Adeleke and Kuku (2019) also employed ARDL model to examine the impact of exchange rate regimes on Industrial output growth in Nigeria using annual data series, from 1960 to 2016. The result of ARDL technique showed that exchange rate regime has not enhanced industrial output in Nigeria. The period of the flexible exchange rate regime had negative impact on Industrial production in Nigeria which is at variance with Ukwunna, Ihugba and Okoro (2022).

Efuntade and Efuntade (2021) used trend analysis and descriptive statistical technique to assess the trend between exchange rate variability and growth of Industrial sector in Nigeria. The study found that a relationship exists between the industrial productivity growth rate, ratio of industrial production to gross domestic product, exchange rate, interest rate. In order to determine the short term dynamics around the equilibrium relationship, exchange rates emerged as significant determinant of industrial productivity growth rate in Nigeria. Akinlo and Lawal (2015) also examined the impact of exchange rate on industrial production in Nigeria over the period 1986 2010 using Vector Error Correction Model (VECM). The results of the study revealed the existence of long run relationship between industrial production index, exchange rate, money supply and inflation rate. Moreover, exchange rate depreciation had no perceptible impact on industrial production in the short run but had positive impact in the long run. Finally, the results exhibited that money supply has a very large proportion of variation in industrial production in Nigeria.

Dimas et al. (2022) employed an input-output model to quantify intangible trade and innovations, to access the impact of change in the manufacturing sector's contributions to economic growth of economies. The study noted that imported intangibles and patents are key to growth rate of the manufacturing sector. The study highlighted the role of economic growth as a key factor in driving industrialization. Lawal et al. (2022) examined the impact of macroeconomic, socio-economic and political variables on the manufacturing sub-sector of the Nigerian economy by using the autoregressive distributed lag to analyze data source from 1986 to 2019. The study noted that to achieve sustainable economic growth powered by strong manufacturing sector, there must be an alignment between macroeconomic variables and socio political factors.

Anochie, Okereafor and Bashir (2023) applied Ordinary Least Square regression analysis to examine the effect of Macroeconomic variables on productivity of Nigeria's manufacturing sector using data covering the period of 1980 to 2020. The study showed that exchange rate and interest rate have no significant effect on productivity of Nigeria's manufacturing sector. However, a study like Justine (2025) also used ARDL model to investigate the effect of selected macroeconomic variables on manufacturing sector output in Nigeria. The result of the study revealed that exchange rate has significant positive impact on industrial growth in the long run while inflation, money

supply and unemployment were found to have no significant effects on manufacturing output in the long run.

3.0 METHODOLOGY

3.1 Theoretical Framework

Romer Endogenous Growth Model

This theory is a modification of arrows seminar work on the economies of learning by doing showing that investment in knowledge (experience) has strong connection with increase in productivity. Romer (1988) based theory on the indices of experience by cumulative investment follow the following production function

$$Y_{it} = f(K_{it}A(t)L_{it}) \text{-----3.1}$$

Where Y_{it} is the output of firm(i), $A(t)$ is the stock of knowledge of firm (i) at period t, K_{it} and L_{it} are the capital and labour of the firm at period t. Romer pointed out that labour is more productive due to accumulation of knowledge which depend on experience.

However, experience in a function of past investment. As a result, the growth rate of output of the firm can be written as a function of indexes of experience by cumulative investment as follow:

$$G_{it} = \int_{-w}^r I(V)dv = K_t \text{-----3.2}$$

Where G_t is the growth rate of the output of the firm, $I(v)dv$ is the indexes of the cumulative investment which is equal to the capital stock (K_t)

More so, in the definition of money demand function using the IS/LM model, Romer (1996) put forward a relationship between some macroeconomic variables like inflation, money supply and interest rate as stated below;

$$\frac{M}{P} = L(r, y) \text{-----3.3}$$

This can be written in linear form, thus;

$$y = 1/\alpha \frac{M}{P} + \alpha/\beta r \text{-----3.4}$$

Where $1/\alpha$ and α/β are elasticities of macroeconomic variables respectively substituting equation 3.3 & 3.4. Therefore,

$$G_t = 1/\alpha \frac{M}{P} + \alpha/\beta r \text{-----3.5}$$

Thus, the growth rate of a firm can be presented as a function of these macroeconomic variables such as inflation, interest rate, unemployment, exchange rate, real GDP and others

3.2 Model Specification

Guided by the theoretical framework above and to achieve the objectives of this study, the model is specified as follows:

$$RINDgr = f(RGDPgr, MS_2, EXCR, INF, RINT, UMP_r) \text{-----3.8}$$

Explicitly, in equation 3.6, money supply was log linearised being an absolute value compared to others that are in rates and therefore, the equation was re-stated as below:

$$RINDgr_{it} = \pi_0 + \pi_1 RGDPgr_{it} + \pi_2 \ln MS_{2it} + \pi_3 EXCR_{it} + \pi_4 INF_{it} + \pi_5 INT_{it} + \pi_6 UMP_{rit} + \varepsilon_t \text{-----3.9}$$

Where $RINDgr$ = Real Industrial growth rate

$RGDPgr$ = Real GDP growth rate

MS_2 = Broad Money Supply

$EXCR$ = Exchange Rate

INF = Inflation

INT = Interest Rate

UMP_r = Unemployment Rate

ε_t = Error Term

3.3: Description and Measurements of Variables**Table 3.1: Description and Measurements of Variables.**

Variables	Abbreviation	Measurements	Sources of Data
Real Industrial growth rate	RINDgr	This is measured by the contribution of the industrial sector to the GDP. It is calculated by dividing GDP by mid-year population. It is calculated without making deduction for depreciation of natural resources. It is also adjusted percentage increase in industrial output over time removing inflation's effect.	IMF(World Economic Outlook) & World Bank Development Indicator
Real Gross Domestic Product Growth rate	RGDPgr	Real Gross Domestic Product Growth rate is the percentage change in a country's total output (goods and services) after adjusting for inflation showing true economic expansion or contraction. It is calculated as $\frac{\text{Real GDP year 2} - \text{Real GDP year 1}}{\text{Real GDP year 1}}$ multiplied by 100%.	World Bank Development Indicator
Broad Money supply	MS ₂	. Money Supply (MS ₂) is the total quantity of money in the economy at any given time. The quantity of money in the economy set by the monetary authority of a country which is usually by the central banks. Its measure consists of money in the circulation and bank deposit.	World Bank Development Indicator
Real Exchange Rate	REXCR	It is defined as the nominal exchange rate multiplied by the ratio of the consumer price index of the domestic economy to the US dollar. REXCR can be measured as the purchasing power of a currency relative to another country exchange rates and prices.	World Bank Development Indicator
Inflation	INF	Consumer price index is defined as the variation in prices for retail goods and other items. It is measured by annual percentage change in consumer prices	World Bank Development Indicator

Real Interest Rate	RINTR	This is the rate at which commercial banks grant credits to the borrowers in the economy after adjustment has been made for inflation. It can be measured by deflating the nominal interest rate i.e nominal rate less inflation.	“”
Unemployment Rate	UMPr	This is measured by the number of unemployed people by labour force	World Bank Development Indicator

Source: Authors’ computation(2025)

4.0 RESULTS AND DISCUSSION

4.1: Panel Unit Root Analysis

Table 4.2: “Panel Unit Root Tests

Variables	Levin, Lin & Chilt Unit Root				Im, Pesaran and Shin Unit Root Test				Order of Integrati on
	At Level		At First Difference		At Level		At First Difference		
	t-statisti cs	P-value	t-statisti cs	P-value	t-statisti cs	P-value	t-statisti cs	P-value	
GDPgr	-2.843	0.0622	-8.7693	0000	-4.5975	0.057	-12.1411	0.000	I(1)
MS ₂	-2.9531	0.0816	-8.6754	0000	-3.6554	0.0601	-10.1697	0.000	I(1)
RINT	-5.4369	0.0277	-----	-----	6.1065	0.0360	-----	-----	I(0)
RINDR	-11.7918	0.000	-----	-----	8.2590	0.000	-----	-----	I(0)
REXCH	2.0175	0.0218	-----	-----	2.2442	0.0124	-----	----	I(0)
INF	9.7692	0.000	-----	-----	11.1411	0.000	-----	-----	I(0)
UNMP	-71.608	0.00	-----	-----	52.535	0.000	-----	-----	I(0)

Source: Author's Computation (2025)

Table 4.2 presents results of Levin- Lin- Chu (LLC) and Im-Pesaran-Shin (IPS) panel unit root tests conducted in this study. As reported in table 4.3, variables such as RINT, RINDR, REXCH, INF and UNMP are stationary at levels, that is, they are integrated of order zero suggesting that these variables do not retain innovative shock pass on them while variables like MS and GDPGR are made to be stationary at first difference, that is, they are integrated order one, i.e, $I(1)$ which connote that these variables retain innovative shock pass on them for only for a short period of time. The panel unit root test results therefore showed that the variables used in this study are integrated of different orders of zero(0) and one (1).

Objective of the study: Analyse the effect of selected macroeconomic variables on the industrial growth in SSA.

This section presents the results of the analyses conducted in the study to examine the effect of selected macroeconomic variables on industrial growth in SSA.

4.3. Hausman Test

Table 4.3: Hausman Test

Null Hypothesis	Test Statistics	Probability
Difference in coefficients not systematic	1.49	0.9603

Source; Author's Computation (2025)

The post estimation test result presented in the table 4.3 revealed that the pooled mean group (PMG) estimation is the most preferred estimation compared with the mean group estimation result under the null hypothesis that the difference in coefficient is not systematic. As presented in the table 4.3 that the chi-square statistic stood at 1.49 alongside probability value of 0.9603 which connotes that there is no enough evidence to reject the null hypothesis that difference in coefficient of the mean group and pooled mean group estimation is not systematic. Hence, the pooled mean group is valid for the study. Therefore, the panel ARDL estimation is based on the PMG option as presented in the table below.

4.4; Panel ARDL estimation Result

Table 4.4: Panel ARDL estimation Result

Dependent Variable: GDP

SHORT RUN ESIMATES				
Variables	Coefficient	Standard Error	Z- Test	Probability
GDPGR	0.1211	0.12033	1.01	0.014
MS ₂	0.0703	0.26167	0.27	0.038
UNMP	-0.1543	0.1194	1.29	0.016
RINT	-0.2365	0.1571	-1.51	0.132
INF	0.422	0.37411	1.13	0.021
REXCH	-0.4588	1.6186	-0.28	0.057
ECT	-0.0648	0.0383	-1.67	0.90
LONG RUN ESTIMATES				
Variables	Coefficient	Standard Error	Z- Test	Probability
GDPGR	0.3685	0.0274	13.44	0.005
MS ₂	0.3067	0.3358	9.13	0.022
UNMP	-0.4603	0.0482	-9.56	0.022

RINT	-0.06103	0.0523	-1.18	0.243
INF	0.4903	0.0313	15.66	0.001
REXCH	-0.0103	0.0101	-91.0	0.310

Source; Author's Computation (2025)

The results show that there is significant positive relationship between RGDPgr, MS₂, INF and RINDR. This implies that RGDPgr, MS₂ and INF can improve industrial output in SSA while there is significant negative relationship between UNMP and RINDR in SSA. This implies that unemployment is increasing in SSA because of poor industrial performance. The result also revealed that there is negative relationship between REXCH, RINT and RINDR in SSA. This indicates that increase in interest rate has not assisted the growth of industry in SSA. More so, exchange rate volatility has also hampered industrial growth in SSA.

4.6 Discussion of the Findings

To avoid spurious regression, unit root test was conducted. The results of panel unit root test revealed that the variables like RINT, RINDR, REXCH, and UNMP are stationary at levels while MS₂ and RGDPgr are made to be stationary at first difference. The panel unit root test results showed that the variables involved in the study are integrated of order zero and one.

The result of panel ARDL estimates showed that there is significant positive relationship between RGDPgr, MS and RINDR in long run. This result is line with the theoretical connotation and also in tandem with results of Okonko and Egbulonu (2016), Mwenda, Ngollo and Mwasgota (2023) and Agbonrofo and Olusegun (2023).

The findings of the study also showed that there is significant negative relationship between UNMP and RINDR both in the short run and long run in SSA. This result is in consonance with a priori expectation. Moreover, there is insignificant negative relationship between RINT, REXCH and RINDR both in the short run and long run at 5% level of significance. This result has direct relationship with the findings of Nwosa, Adeleke and Kuku (2019), David-Wayas et al (2019) and that of Adisu (2019) and Chioma and Ito (2020) respectively.

5.0 CONCLUSION AND RECOMMENDATIONS

The study examined the impact of selected macroeconomic variables on industrial output in SSA. The results of panel unit root test revealed that the variables like RINT, RINDR, REXCH, and UNMP are stationary at levels while MS₂ and RGDPgr are made to be stationary at first difference. The panel unit root test results showed that the variables involved in the study are integrated of order zero and one which prompted the use of Panel ARDL model.

The result of panel ARDL estimates showed that there is significant positive relationship between RGDPgr, MS₂ and RINDR in long run. The findings of the study also showed that there is significant negative relationship between UNMP and RINDR both in the short run and long run in SSA. Moreover, there is insignificant negative relationship between RINT, REXCH and RINDR both in the short run and long run at 5% level of significance. Based on the findings of this study, that UNMP, RINT has negative impact on industrial output in SSA, therefore this study concluded that poor growth of industrial sector in SSA has aggravated the rate of unemployment in SSA. It was concluded as a result of the findings that the exchange rate volatility has seriously constituted a threat to the growth of industrialization in SSA". In line with the findings and the conclusions of this study, it was recommended that governments of SSA should set on motion the machinery and

strategies that can boost the growth of industries in SSA so as to mitigate the high level of unemployment in the region as well endeavour to stabilize exchange rate through appropriate policies in order to boost investment in SSA.

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