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Human Capital Outcome, Industrialization and Unemployment in Nigeria

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ABSTRACT

The role of human capital outcome and industrialization in addressing the unemployment issue in developing countries has been debated in limited studies. Against this background, the study examines the impact of human capital outcomes and industrialization on unemployment rate in Nigeria ranging from 1991 to 2024. The study employed Autoregressive Distributed Lag (ARDL) techniques to achieve the objective of the study. The variables considered were unemployment as the dependent variable while human capital outcomes, industrialization, gross domestic product per capita and population growth are the independent variables. Data was sourced from World Bank Development Indicator 2024. To measure the human capital outcome, we used three proxy variables i.e., enrolment rate, life expectancy and literacy rate. The study ascertained the stationarity of the time series properties of the study, using Augmented Dickey Fuller (ADF). The result of unit root test revealed that human capital outcome, industrialization and population growth were stationary at first difference I(1), while for unemployment rate and gross domestic product per capita was found stationary at level form, I(0). The findings revealed that human capital outcome had a negative but significant impact on unemployment in Nigeria in the short term. The result further reveals that gross domestic product per capita had a negative and insignificant effect on unemployment in Nigeria. Further, industrialization had a positive and significant effect on unemployment rate in Nigeria. Also, population growth exerts a negative and statistically insignificant effect on unemployment in Nigeria. Lastly, the estimated Error Correction Term (ECT) of -2.681920 indicates the speed at which the model returns to equilibrium as 26.8%. The study, therefore recommended that government should review and modernize school curricula at primary, secondary, and tertiary levels to align with emerging labor-market demands.

1. Introduction

Unemployment has remained one of the most pressing socio-economic challenges in Nigeria, affecting the country's overall economic stability, social cohesion, and development trajectory. According to the National Bureau of Statistics (2024), Nigeria's unemployment rate rose to 4.38% in the third quarter of 2024, with youth unemployment remaining disproportionately high at over 40%. This trend highlights the urgent need to identify key determinants of unemployment and examine mechanisms that could mitigate its persistence. Preeti, Balbir, Anju and Pankaj (2024), define unemployment as a situation where individuals possessing a certain level of education and qualifications are unable to secure suitable employment opportunities corresponding to their skill set. According to the International Labor Organization (ILO, 2022), the unemployment rate is seen as "the percentage of the labor force that is without work, available for work, and actively seeking employment during a specified period". World Bank (2020), stated that unemployment rate shows the share of the labor force that is without work but available for and seeking employment. Similarly, Afolabi and Okonkwo (2022) define unemployment rate as the proportion of the economically active population that is capable of working but lacks gainful employment due to economic stagnation, skill mismatch, or weak institutional support. They stress that in Nigeria, high unemployment rates are linked to poor educational outcomes, weak industrialization, and limited access to entrepreneurial opportunities**.**

Unemployment has been a long-standing concern for researchers and policymakers worldwide (Gamberoni, Gausas, & Xia 2019). One of the major challenges developing nations face is that of unemployment and human capital loss. Human capital, broadly defined as the stock of skills, knowledge, education, and health available to a workforce, is a key determinant of productivity and employability. According to Mahinur, Ahasan & Golam, (2022), human capital refers as "education, health, skills, knowledge, and other human traits that may help a country's labor productivity".

Human capital plays a crucial role in a country's economic growth and development. It encompasses individuals' knowledge, skills, and experience that can increase productivity and economic growth. Human capital stimulates productivity which can be aided by healthy conditions, knowledge, skills, work experience and motivation (Lubna, Awan, & Tayyab 2018). Countries that invest in effective schooling, health service and skills development tend to produce more employable and productive workers, which in turn reduces unemployment and underemployment (World bank, 2023). Economists argue that higher levels of education, technical skills, and health outcomes improve labor market participation and reduce structural unemployment (Schultz, 1961; Mincer, 1974). In the Nigerian context, however, challenges such as inadequate education infrastructure, skill mismatches, and limited vocational training hinder the potential of human capital to reduce unemployment (Adebayo & Oladipo, 2021). Empirical studies suggest that while higher enrolment rates and literacy levels are positively associated with employment in theory, the translation into actual jobs in Nigeria has been inconsistent due to poor industrial absorption capacity (Onyeka, 2020; Olowookere, 2022).

Industrialization is another critical factor influencing employment dynamics. Industrial growth, characterized by the expansion of manufacturing and processing sectors, typically generates large-scale employment opportunities, fosters technological advancement, and enhances capital formation (Todaro & Smith, 2020). Industrialization refers to the transformation of a manual labor-based economy to a machine labor-driven industrial society (Morawetz, 2021). It involves a systematic change of the agrarian economic system to a complex mechanized mass manufacturing process. Historical experience from developed economies indicates that industrialization has been central to structural transformation and long-term economic growth (Rostow, 1960; Lewis, 1954). In Nigeria, however, industrialization has been relatively slow and uneven, constrained by factors such as energy deficits, inadequate infrastructure, policy inconsistency, and overreliance on the oil sector (Adegbite & Olaniyan, 2022). This uneven industrial growth limits the economy's ability to absorb the growing labor force, particularly among educated youths.

The combination of human capital challenges and inadequate industrialization creates a complex scenario where unemployment persists despite policy interventions. For instance, although government programs have aimed to improve education access and vocational training, they have not sufficiently aligned with industrial sector needs, leading to skills mismatch in the labor market (Ogunleye & Akintola, 2021). Also, the government has come up

with programmes that are consistent with global initiatives to promoting education for all, like the Millennium Development Goal (MDG) 4 on Universal Primary Education as well as the Sustainable Development Goal (SDG) 4 which aims at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (Asongu, & Odhiambo, 2020). However, the motivation for this study stems from the critical need to provide empirical evidence on how human capital outcomes and industrialization jointly influence unemployment in Nigeria. While several studies have examined human capital and employment separately, there is a paucity of research integrating both human capital outcomes and industrialization as determinants of unemployment in the Nigerian context, particularly using recent data. Addressing this gap is essential for policymakers seeking to design targeted interventions that promote skill development, industrial growth, and sustainable employment. This study therefore aims to fill this gap by investigating the impact of human capital outcome and industrialization on unemployment in Nigeria.

This study offers a novel contribution by addressing the existing research gaps related to human capital outcomes and industrialization in shaping unemployment dynamics, specifically in Nigeria. Unlike prior studies that predominantly examine broader global or regional contexts, this research provides a localized and empirical perspective on developing country, with a specific focus on the unique socio-economic characteristics of Nigeria. Also, unlike previous studies that focused on human capital with regard to government expenditure on education and health (Mahinur, Ahasan, & Golam, 2022; Onyele, & Ariwa 2020; Ogunjobi, Ekiran, & Adesanmi, 2021; Maharani and Yuliana, 2023), this study employed three indicators of human capital outcome namely enrolment rate, literacy rate and life expectancy. Integrating multiple dimensions, including rapid population growth, industrial value added, gross domestic product per capita and human capital outcomes such enrolment rate, literacy rate, life expectancy, into a single analytical framework distinguishes this study from previous works. The present study aggregated three different components of human capital outcomes into a single index to serve as a proxy for human capital outcome, using Principal Component Analysis (PCA). This study computed a composite for human capital outcome which consist of enrolment rate, literacy rate, life expectancy. This is what makes the present study unique. It seeks to uncover the nuanced relationships among these variables and their collective impact on unemployment rate, which needs to be more adequately explored in the existing literature. This study employs the ARDL technique. ARDL technique provides long-run as well as short-run coefficient estimates. This technique provides more reliable results that help design policy measures for the short-run and long-run that enhance employment rate in Nigeria, offering a more precise understanding of the underlying mechanisms than generalized findings. The primary objective of this study is to examine the impact of human capital outcomes and industrialization on unemployment in Nigeria.

The remaining study is organized; Section 2 literature reviews, section 3 describes the model, method, and data. The empirical estimates are offered in Section 4, but Section 5 gives the conclusions, policy implications and recommendations.

2. Review of Related Literature

In the extant literature based on this area of study, it has shown that the contemporary literature reviews highlight the global academic community's efforts in examining the impact of human capital development on unemployment. However, the relationship between human capital and unemployment is one that several past and contemporary studies have shown deep interest in; but, the role of human capital outcome and industrialization in curbing unemployment has been debated in a limited number of empirical studies.

Tran, Le Trung, Phan Thi, and Huynh (2023) explored the influence of human capital, institutional quality, and the Fourth Industrial Revolution on unemployment rates in 46 Asian countries during the period from 2007 to 2020. The study utilized generalized method of moments (GMM) techniques. This result confirmed that high-tech development increases unemployment in Asia. Moreover, some policy implications also have been suggested to reduce unemployment in Asian countries in the context of the Fourth Industrial Revolution.

Using the nexus between human capital and unemployment, Boge and Suryaning (2023) examined the interrelationships between corruption, human resources, and unemployment in Indonesia from 1996 to 2021. The study used Vector error Correction Model (VECM) analysis with the research variables used are Corruption, Human Capital, and Unemployment. The finding indicate

that corruption makes a considerable contribution to the growth and progress of the nation and its people.

However, in a study conducted in Bangladesh by Mahinur, Ahasan, and Golam (2022) looked at how human capital investment has affected unemployment from 1995 to 2019. The study employed autoregressive distributive Lag (ARDL) and pairwise granger causality techniques to achieve the objective of the study. The study's findings demonstrate that government health spending on human capital has a significant impact on Bangladesh's long-term unemployment rate. In the light of the findings, the study recommended that the government should increase health spending and strengthen the health sector. To connect education with employment, the government may give vocational and career-focused education equal weight with general education.

Mushtaq, Ahmed, Fahlevi, Aljuaid, and Saniuk (2022) studied the moderating role of human capital in the globalization-employment nexus in 26 Asian countries from 1996 to 2019. The study used generalized least square (GLS) method and generalized method of moments (GMM) for empirical analysis. The study found that industrial value added and economic growth leads to more employment creation, whereas population growth dampens it. The study therefore recommended that promoting human capital development would achieve globalization's benefits for more employment creation.

Ogunjobi, Ekiran and Adesanmi (2021) used the autoregressive distributed lag model "ARDL" to examined the impact of human capital and unemployment on economic growth in Nigeria between 1981 and 2020. The findings revealed that the level of human capital in Nigeria is not sufficient to stimulate economic growth in the country. The study further confirmed that growth in unemployment rate has adverse effect on economic growth. The study therefore recommended that government should place priority on financing human capital through health and education expenditures and embark on self-employed programmes to solve the problems of unemployment with the aim of attaining sustainable economic growth.

Onyele, and Ariwa (2020) investigated the role of human capital financing in unemployment reduction in Nigeria covering from 1991-2018. The study employed Johansen cointegration method and Vector Error Correction Model (VECM) techniques. The analysis revealed that the relationship between human capital financing and unemployment existed in the long and short-run during the study period. Specifically, in the long-run, the estimated coefficients indicated that health financing exerted a positive influence on unemployment rate while education financing had a negative effect.

The effects of human capital investment on unemployment in Nigeria was the focus of Victoria (2019) between 1981 and 2015. The study employed ordinary least square method (OLS) for the analysis. Findings showed that the government investment in human capital in terms of education expenditure should be increased significantly. Also, adequate training should be put in place to reduce the high unemployment rate in the country.

Adejumo (2017) examined the impact of Human capital development on employment generation in Nigeria between 1970 and 2014. The study made use of auto-regressive distributed lag (ARDL). The result of the analysis showed that trends in human capital are not sufficient to stimulate employment in Nigeria. The study therefore advised the policy makers to develop the infrastructural facilities, promote innovations, and reallocate resources to more productive sectors.

In same vein, Samiullah (2014) examined the relationship between unemployment and human capital in Pakistan. Secondary data was used while OLS and Johansen co-integration technique was applied to process the data. The results of the finding showed that an improved education and health care sectors would reduce unemployment in Pakistan. The findings also showed that all human development indicators in the study have significant and effective effect on unemployment rate. The study recommends an increased funding of education and health care delivery. In addition, government should endeavor to concentrate on the control of population, creation of investment is essential to take care of the increasing population and to reduce the high rate of unemployment

Olalekan (2014) examined the impact of human capital on unemployment in Nigeria using annual data on health and education, from 1980 to 2011. He adopted Generalized Method of Moment (GMM) techniques in the analysis and the estimated results provided evidence of positive relationship between human capital and unemployment in Nigeria.

It is found from reviewed literature that previous studies only focused human capital development and unemployment, while estimating the impact of human

capital on unemployment in the developing countries. However, this study seeks to examine the impact of human capital outcome and industrialization on unemployment in Nigeria. Therefore, the present study would fill this gap in the empirical literature.

3 Model, method and Data

3.1. Theoretical Framework and Empirical Model

The theoretical framework is anchored on human capital theory pioneered by Gray Becker in 1964. This theory is a fundamental concept in economics that views human knowledge, skills and abilities as essential assets contributing to economic growth and development. Theoretical research argues that investing in education and training of an individual covers other factors including the quality of life and healthcare of the individual which together with education, constitute investment in human capital. This theoretical framework is quite relevant, because without such investment, individuals that are not employed.

Therefore, in line with Ugbomhe, and Omoaka (2025) and Adeyem, Oseni and Awode (2018), the study adopts the following model specification:

$$Unemp_t = \eta_0 + \eta_1 human\_capital\_outcome_t + \eta_2 IND_t + \eta_3 GDPgr_t + \eta_4 POPgr_t + \mu_t \quad (1)$$

Where, Unemp is unemployment rate, human_capital_outcome is human capital outcome, IND is industry value added % of GDP as a proxy for industrialization. POPgr stand for population growth, GDPpc stand for Gross domestic product per capita, μ is stochastic error term and t represents a time series or time period. We used GDP per capita (GDP) and population growth as control variables. Improvement in human capital outcome in the country, η_1 will be to be negative. Regarding empirical and theoretical literature, industrialization could have positive and negative impacts on unemployment, η_2 will be to be positive or negative. Estimation of Equation (1) yields only long-run estimates. Thus, to include the short-term effect, an error-correction model is employed. An econometric approach that yields the long-run and the short-run effects in one step is that of (Pesaran et al., 2001) as follows:

$$\Delta Unemp_t = \eta_0 + \sum_{i=1}^{P1} \eta_1 \Delta ln Unemp_{t-i} + \sum_{i=2}^{q2} \beta\eta_2 \Delta human\_capital\_outcome_{t-i} + \sum_{i=3}^{q3} \eta_3 \Delta IND_{t-i} + \sum_{i=4}^{q4} \eta_4 \Delta GDPgr_{t-i} + \sum_{i=5}^{q5} \eta_5 \Delta POPgr_{t-i} + \alpha_1 Uenmp_{t-i} + \alpha_2 human\_capital\_outcome_{t-i} + \alpha_3 IND_{t-i} + \alpha_4 GDPgr_{t-i} + \alpha_5 Popgr_{t-1} + \delta.ECT_{t-i} + \mu_t \quad (2)$$

The error-correction Equation (2) is due to (Pesaran et al., 2001), where the short-run effects reflected by the η_{p1}, η_{q2}, η_{q3}, η_{q4}, and η_{q5}. Notations η_1, η_2, η_3, η_4, and η_5, are the short-run coefficients of the lagged dependent variable, human capital outcome, industrialization, GDP per capita, and population growth, respectively. The long-run coefficients are α_2, α_3, α_4, and α_5 for focused and other control variables. Lastly, δ displays the speed of adjustment. Using the error correction approach, (Pesaran et al., 2001) presented a bound testing system for cointegration known as the autoregressive distributive lag order (ARDL) model. An earlier study by (Ying, Shuobin, & Muhammad, 2023) recommends two tests to establish cointegration, such as diagnostic tests (e.g., F-test and ECM). The null hypothesis of the F-test among the variables is (H_O:$\eta_1=\eta_2=\eta_3=\eta_4=\eta_5=0$), but against the alternative hypothesis (H_1:$\eta_1\neq\eta_2\neq\eta_3\neq\eta_4\neq\eta_5=0$). However, the ARDL model considers the mixture of I(1) and I(0) variables.

Another privilege of the ARDL model is that it simultaneously provides long-run and short-run estimates. Additionally, a smaller number of observations is a common problem of time-series analysis. The advantage of the ARDL model is that it deals with the issue of a small number of observations and provides unbiased and efficient results. The study employed descriptive statistic and augmented dickey fuller (ADF) for characteristic of dataset and unit root testing purposes. The research also employs some diagnostic and stability tests to check the problems of serial correlation, functional misspecification, Heteroskedasticity. The renowned CUSUM and CUSUM-sq tests are also applied to confirm short-term coefficient estimates stability.

Table 1: Definition and sources of data

Variables	Definition	Sources of data
Unemployment (UEMP)	This indicates the number of unemployed persons expressed as a ratio of total labor force in Nigeria.	World Development Indicator, 2024
Human capital outcome	Data on human capital outcome found within 33 years, from 1991 to 2024, including measures of enrolment rate, life expectancy and literacy rate of the population within Nigeria	WDI, 2024
Industrialization (IND)	Industry, including construction, value added (% of GDP). It is comprised of mining, manufacturing, construction, electricity, water, and gas industries.	WDI, 2024
GDP per capita (annual % growth)	Gross domestic product per capita is the total income earned through the production of goods and services in an economic territory during an accounting period.	WDI, 2024
Population growth (POpgr)	Population growth	WDI, 2024

Source: Author's compilation 2025

3.2 Data Sources

The data utilized in this study is obtained from Nigeria, as released by the World Development Indicator (WDI), 2024. The study employed time series data covering the time from 1991 to 2024. This study's range of time periods is selected based on data availability. Due to data availability, we restrict our human capital outcome to only three variables: enrolment rate, literacy rate, and life expectancy. Annual time series data on the key variables of interest were unemployment rate, human capital outcome, industrialization, gross domestic product per capita and population growth. Unemployment is measured by total unemployment (% of the total labor force). So, we extract our dataset from the World Development Indicator (WDI) offered by the World Bank 2024.

4. Empirical results and discussion

In this section, results of the study are presented, interpreted and discussed.

Table 2: Result of Descriptive Statistics

	UNEMP	HUMAN_CAPITAL_OUTCOME	GDPPC	INDU	POPGR
Mean	4.037000	3.53E-08	1.358205	28.46193	2.569721
Median	3.876500	-0.023053	1.437691	28.24839	2.641230
Maximum	5.742000	2.031285	12.21039	37.70961	2.802785
Minimum	2.989000	-2.818861	-4.597233	18.17313	2.082978
Std. Dev.	0.592328	1.249867	3.474620	4.995174	0.239671
Skewness	1.273133	-0.161271	0.521815	0.159118	-1.088877
Kurtosis	4.583547	2.521271	4.211794	2.466738	2.750035
Jarque-Bera	12.73738	0.472053	3.623277	0.546327	6.807215
Probability	0.001714	0.789760	0.163386	0.760968	0.033253
Sum	137.2580	1.20E-06	46.17897	967.7057	87.37050
Sum Sq. Dev.	11.57814	51.55150	398.4085	823.4082	1.895594
Observations	34	34	34	34	34

Source: *Author's estimation using E-view 13*

From **Table 2** above, the descriptive statistics revealed that from 1991 to 2024, unemployment rate (Unemp), human capital outcome, industrialization (IND), gross domestic product per capita (GDPpc), and population growth (Popgr) shows an approximate mean value of 4.037, 3.53, 28.46, 1.35, and 2.56 respectively. The standard deviation disclosed that GDP per capita and industrialization at 3.474620 and 4.995174 demonstrate high variability, while values for UNEMP, human capital and POPgr disclose low variability. Summarily, all the variables under this study are widely dispersed around their means, indicating that they are grossly affected by their lower value. The Skewness statistic from the table showed that UNEMP, GDPpc, and INDU are positively skewed, while human capital outcome and population growth are negatively skewed. Kurtosis can either flat or peak of the normal curve. It estimates the "tailedness" of the probability distribution of a real-valued random variable. It is normal distribution and mesokurtic if kurtosis equals 3, platykurtic if kurtosis is less than 3 and leptokurtic if kurtosis is greater than 3. In the study, some series such as human capital outcome

and population growth are mesokurtic in their distribution, while UNEMP and GDP per capita are leptokurtic, and industrialization is platykurtic in nature. Jarque–Bera is used to test for normality of the series, whether they are normally distributed or not. Finally, the probability of the Jarque-Bera statistic revealed only UNEMP, and POPGR are below the p-value of 0.05, while human capital outcome, GDP per capital and IND were above the 5% significance level.

4.1 Unit Root Test

To inspect the level of stationarity of selected variables, we have employed the traditional unit root tests, i.e., augmented dickey fuller test (ADF) test. It is necessary to investigate the integration order of variables. The results of the ADF are reported in **Table 3** below.

Table 3: Result of ADF Unit Root Test

Variables	Augmented Dickey-Fuller (ADF)				Order of Integration
	At Level	5% Critical Value	At First Difference	5% Critical Value	
Unemp	-3.769797	-2.963972	---	---	**I(0)**
Human capital outcome	-1.399759	-2.957110	-8.419343	-2.957110	**I(1)**
IND	-2.311287	-2.954021	-4.988535	-2.957110	**I(1)**
GDPpc	-3.131355	-2.954021	---	---	**I(0)**
Popgr	-2.433583	-2.971853	-4.669939	-2.963972	**I(1)**

Source: *Author's estimation using E-view 13*

Table 3 above displays the outcome of the stationarity test using ADF approach for unit root. Based on the outcome of the unit root test in **Table 3**, unemployment rate (Unemp) and gross domestic product per capita achieved stationary at level form I(0), while human capital outcome, industrialization and population growth were integrated at first difference I(1). The result show that our model variables have mixed order integration, but none of the variables is I(2). The stationarity test performed revealed that a mixed result of the variables at I(0) and I(1). This explains why the ARDL approach is being used; given the combination of I(0) and I(1) variables.

Table 4. ARDL bounds Cointegration tests

Test Statistic	**Value**	**k**
F-statistics	3.677052	**4**
Critical Value Bounds,		
Significance	**I0 Bound**	**I1 Bound**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: *Author's estimation using E-view 13*

The results of the ARDL bound test for cointegration are shown in **Table 4**. Here, the estimated F statistic of 3.677052 is lower than the upper bound's critical value at a 5% level of significance. In other words, the f-statistic value of 3.67 falls in-between lower bound and upper bound critical values at a 5% level of significance (2.86<3.67>4.01). This implies that long-run equilibrium does not exist among the variables, and the null hypothesis of no cointegration may thus be accepted. we, therefore, conclude that there is no long run equilibrium. Hence, we would restrict our analysis to only ARDL short-run estimation.

4.2 Short-Run Analysis of the Relationship Between Human Capital Outcome, Industrialization and Unemployment Rate in Nigeria.

Given the outcome of unit root test and ARDL bound test for cointegration, the study used the ARDL approach to find out the short-run elasticities of coefficients in **Table 5**.

Table 5: Result of ARDL short-run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.73169	3.611983	5.739698	0.0022
D(UNEMP(-1))	2.355529	0.325824	7.229451	0.0008
D(UNEMP(-2))	1.408114	0.392911	3.583795	0.0158
D(UNEMP(-3))	1.284337	0.415054	3.094382	0.0270
D(HUMAN_CAPITAL_OUTCOME)	-0.132251	0.029443	-4.491710	0.0064
D(HUMAN_CAPITAL_OUTCOME(-1))	-0.152376	0.039979	-3.811415	0.0125
D(HUMAN_CAPITAL_OUTCOME(-2))	-0.134740	0.049234	-2.736737	0.0410
D(HUMAN_CAPITAL_OUTCOME(-3))	-0.037680	0.037795	-0.996967	0.3646
D(GDPPC)	-0.030777	0.013639	-2.256474	0.0737
D(GDPPC(-1))	0.048733	0.016918	2.880582	0.0346
D(GDPPC(-2))	0.089335	0.024189	3.693263	0.0141
D(GDPPC(-3))	0.060368	0.014783	4.083762	0.0095
D(INDU)	0.056136	0.014991	3.744520	0.0134
D(INDU(-1))	0.048060	0.018268	2.630915	0.0465
D(INDU(-2))	0.060238	0.016031	3.757683	0.0132
D(INDU(-3))	0.023366	0.014103	1.656781	0.1585
D(POPGR)	-1.205084	1.179308	-1.021856	0.3537
D(POPGR(-1))	3.142603	1.868848	1.681572	0.1535
D(POPGR(-2))	-4.402007	1.890612	-2.328351	0.0673
D(POPGR(-3))	0.306281	1.480812	0.206833	0.8443
CointEq(-1)*	-2.681920	0.466203	-5.752692	0.0022
R-squared				0.971847
Adjusted R-squared				0.909284
F-statistic				15.53400
Prob(F-statistic)				0.000104

Source: *Author's estimation using E-view 13*

Table 5 presents the short run ARDL estimates for the model. The short-run coefficient of unemployment rate (Unemp) was 2.355529, indicating a significant positive impact on current unemployment in Nigeria at lagged 1, 2 and 3 periods.

On the other hand, human capital outcome had a negative but significant impact on unemployment rate with a coefficient of -0.132251. However, in lagged 1 and 2 periods, human capital outcome also had a negative but significant impact on unemployment in Nigeria, while in lagged 3 periods, it had a negative and insignificant impact on unemployment rate. The sign of coefficient is line with a priori expectation. This indicates that 1% increase in human capital outcome would leads to -0.132% decrease in unemployment rate and vice versa. This implies that an increase in human capital outcome would translate to a decline in unemployment rate in the country. Interestingly, findings from this research contradict with the views of Syafri, Firdayeti and Handoyani (2021), Primabodo (2021) and Mahararu and Yuliana (2023) which reported that unemployment, inflation and poverty have a significant negative effect on human capital development.

The result of our study shows a negative relationship between gross domestic product per capita and unemployment rate in Nigeria. This is in line with economic theory that economic growth tends to create jobs and reduce unemployment. However, in the lagged 1, 2 and 3 periods, gross domestic product per capita had a positive and significant effect on unemployment rate. This implies that a 1% increase in gross domestic product per capita would decrease unemployment rate by -0.031%. The result shows a negative but insignificant effect of gross domestic product per capita on unemployment indicates that improving GDP per capita can effectively reduce unemployment rate in Nigeria. The increase in GDP per capita generally reflects economic growth that encourages an increase in production, consumption, and investment activities (CM, Hoang, & Yarram, 2025). As the economy grows, companies experience increased demand for the products and services they produce. To meet this demand, companies tend to increase production capacity by increasing the number of workers, both in the industrial, trade, and service sectors. This directly lowers the unemployment rate in the short term. With the increase in economic activity, more jobs are created in a relatively short time, thereby reducing unemployment (Moh'd AL & Jaradat, 2019).

The coefficient for industrialization is positive (0.056136), but the t-statistic (3.744520) indicates that it is statistically significant (p-value = 0.0134). However, lagged 1 and 2 periods, industrialization had a positive and significant impact on unemployment rate, while in lagged 3 period, it had a positive but insignificant impact on unemployment rate. This implies that a 1% increase in industrialization would increase unemployment rate by 0.05%. This suggests that industrialization has a significant positive impact on unemployment rate in Nigeria. Based on the regression data, the positive and significant coefficient of industrialization show that when the added value of industrial increases, paradoxically the unemployment rate also increases in the short run. This phenomenon can be explained through several structural and dynamic mechanisms within the manufacturing industry sector itself. This finding is also in line with Ugbomhe, and Omoaka (2025) and Onah (2021) whose result show that industrialization has a significant effect on unemployment rate, but contradicts with Mohammed, Hamisu, Mohammed and Salihu (2025) study who revealed that improvements in the industrial sector can reduce unemployment in the short run.

Further, the result of our study shows a negative relationship between population growth and unemployment rate in Nigeria. However, in lagged 1, 2 and 3 periods, population growth had a negative and insignificant effect on unemployment rate. This implies that a 1% increase in population growth would decline unemployment rate by -1.21%. The finding resonates with Janifar, Quazi, and Tanvirul (2020) whose study noted that population growth reduces unemployment rate in Bangladesh economy.

The error correction term (CointEq(-1)) has a coefficient of -2.681920, indicating the speed at which the model returns to equilibrium as 26.8%, and statistically significance at 5% level. This suggests that despite short-term fluctuations in unemployment rate, the system will return to a significant long-term equilibrium state. The overall model is robust, explaining approximately 97% of the variation in the dependent variable (R^2 = 0.971847). The R-squared measures the determination of coefficient, measuring the fit of the model. The value of the R-squared is 0.971847, this shows that about 97% variation in the dependent variable is been explained by the variations in the independent variables. Hence, there is a good fit in the model. Likewise, the adjusted R squared measure the goodness of fit while the degree of freedom is put into consideration. The F-statistics value is 15.53400 with the probability of 0.000104; this indicates that the independent variables jointly explained the dependent variable at a 5% significance level.

4.3 Post-Diagnostic Test Results

The diagnostic/fitness and stability tests employed for this model are summarized in the **table 6** below;

Table 6 Result of Post Diagnostic Tests

Jarque-Bera Normality Test		**Breusch Godfrey Serial Correlation LM Test**		**Heteroskedasticity Test: Breusch-Pagan-Godfrey**	
Jarque-Bera	0.384636	F-statistic	0.604255	F-statistic	0.592819
Probability	0.825044	Prob. ChiSquare(2)	0.6019	Prob. ChiSquare(2)	0.8239

Source: *Author's estimation using E-view 13*

The results of the diagnostic tests are reported in **Table 6**. It reveals that the probability value of all the tests was higher than the 5% significant level, meaning that the null hypothesis of nonexistence of heteroskedasticity, serial correlation, and non-normality test were not rejected, implying that there are no homoscedastic variances, serial correlation and the model is normally distributed. In addition, to ensure model stability, the study used the cumulative sum of recursive residues (CUSUM) and cumulative sum of recursive residue squares (CUSUMSQ), as shown in Figs. 1 and 2, respectively.

Figure 1 *Cumulative Sum of Recursive Residuals*

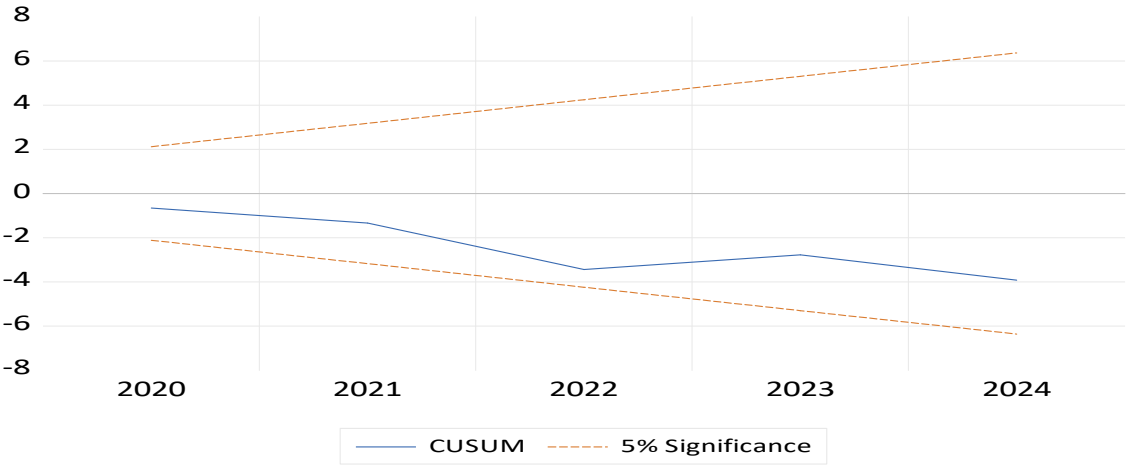
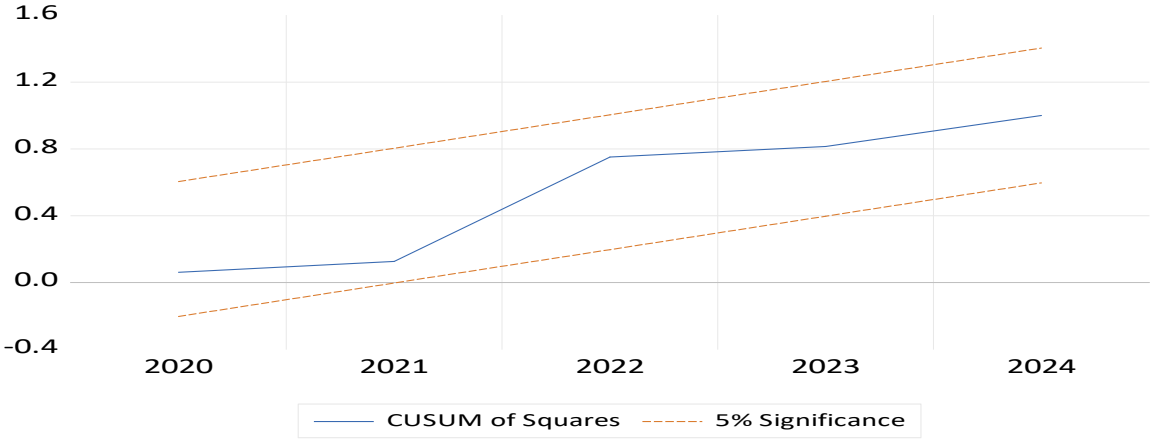


Figure 2 *Cumulative Sum of Recursive Residuals Square Test*



Stability of the ARDL model was tested using CUSUM and CUSUMSQ tests. The idea behind this test is to reject the hypothesis of model stability if the blue line lies outside the dotted red lines otherwise, the model is said to be stable. The result of the CUSUM and CUSUMSQ tests shows that the blue lines lie inside the dotted red line which indicates that the model is dynamically stable at 5 per cent significance level.

5 Conclusions, Policy Implications and Recommendations.

Having empirically sought for the impact of human capital outcome and industrialization on unemployment in Nigeria between 1991 and 2024, several conclusions can be drawn. Firstly, human capital outcome has a negative but significant impact on unemployment in Nigeria, indicating that that an increase in human capital outcome will lead decline on unemployment in Nigeria. Secondly, GDP per capita has a negative but insignificant effect on unemployment, meaning that higher GDP per capita can effectively reduce unemployment in Nigeria. Thirdly, industrialization variable has a positive and significant impact on unemployment variable, showing that an increase in industrialization will lead to a rise in unemployment in the country. Lastly, population growth has a negative and insignificant effect on unemployment, indicating that an increase in population growth will result to decline unemployment in Nigeria.

Based on the obtained results, several policy suggestions can be formulated. Firstly, efforts should be made to enhance human capital and reduce unemployment by facilitating access to resources, especially in the domains of education and skill development. For this purpose, Nigeria government should improve education by review and modernize school curricula at primary, secondary, and tertiary levels to align with emerging labor-market demands in ICT, renewable energy, digital finance,

creative industries, agricultural value chains, and technical trades. Education system in primary and secondary schools should be strengthening. A policy of "no child out of school" should be ensured. Infrastructure of schools should be improved. Introduce periodic industry–academic engagement to ensure that educational institutions are align with evolving employability requirements. Promote skill-targeted educational reforms, ensuring schools and universities produce graduates aligned with current and future labor market requirements. Implementing skill training programs and creating new job opportunities would be essential to mitigate unemployment rates.

Given that GDP per capita and population growth have a negative and insignificant effect on unemployment in Nigeria, government should promote inclusive and employment-intensive economic growth through shifting from capital-intensive sectors to labor-intensive sectors such as agriculture, agro-processing, textiles, construction, transportation, hospitality, and the creative economy. Also, strengthen family planning services and public awareness campaigns to encourage balanced population growth that aligns with economic capacity.

Since industrialization has positive and significant impact on unemployment in Nigeria, government should intensify in its effort by encourage industries to adopt production processes that require moderate-to-high labor input, especially in early phases of operation. This can be done through provide tax rebates, wage subsidies, and reduced import tariffs for firms employing local labor rather than relying heavily on automation or imported labor. Also, develop industry-driven training curricula, created with input from manufacturers, engineers, service and trade sector associations.

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Appendix I. Figure 3 Result of Histogram analysis for normal distribution