IMPACT OF HUMAN CAPITAL OUTCOMES AND INDUSTRIALIZATION ON UNEMPLOYMENT IN NIGERIA

BY

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GOU/U22/ECO/438

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TITLE PAGE

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A PROJECT PRESENTED TO THE DEPARTMENT OF ECONOMICS FACULTY OF MANAGEMENT AND SOCIAL SCIENCES, GODFREY OKOYE UNIVERSITY, THINKERS CORNER, ENUGU STATE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR IN ECONOMICS

SUPERVISOR: ASSOC. PROF. OLUCHUKWU ANOWOR

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APPROVAL

This project has been examined and approved by the Department of Economics, Godfrey Okoye University for the award of Bachelor of Science (B.Sc.) in Economics

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CERTIFICATION

I, EMEGHARA MALACHY CHIDIEBERE with Registration Number GOU/U22/ECO/438 hereby certify that I wrote this Research Project entitled " **IMPACT OF HUMAN CAPITAL OUTCOMES AND INDUSTRIALIZATION ON UNEMPLOYMENT IN NIGERIA".** And that it is an original work which has not been submitted and presented to any other university for the award of any other degree or certificate.

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EMEGHARA MALACHY CHIDIEBERE **DATE**

DEDICATION

I dedicate this project to Almighty God.

ACKNOWLEDGEMENT

I wish to express gratitude to Almighty God for his protection, and loving kindness upon my life.

My sincere gratitude goes to my supervisor Assoc. Prof. Oluchukwu Anowor for her supervision encouragement and assistance. My gratitude also goes to my HOD and lecturer Dr. Modesta Iduma and the lecturers of Economics Department.

My forever gratitude goes to my Parents and Siblings for their love and support.

Abstract

The main goal of this research is to analyze the impact of Industrialization and human resources on the unemployment rate in Nigeria for the periods 1991 to 2024. This has been done using the approach of Bounds Collaboration with Autoregressive Distributed Lag (ARDL) and Granger Causality for achievement of the stated objective. In order to make a contribution towards this goal, The Theory of Human Capital of Becker Gray (1964) has been adopted as the study's theoretical foundation. The data required for this study was sourced from the 2024 World Bank Development Indicator for the period of the research. The research proceeded to examine the stationary properties of the data by utilizing the Augmented Dickey Fuller (ADF). The unit root results indicated that literacy, life expectancy, enrollments rate, population growth rate and industrialization rates are I(1) non stationary at first differencing and; GDP per capita and unemployment rate were found to be I(0) constant at their level. The findings from the research indicated that the enrollments rate had short term, positive, and significant effect on Nigeria's unemployment rate, and that long term effect of enrollments rates had a negative and significant influence on the unemployment rates. The research concluded that there was a short run positive effect of literacy rate on the Nigerian unemployment rate. However, there was a negative and significant effect in the long term; moreover, a significant negative short-run impact of industrialization on the unemployment rate, whereas long run effect was found to be positive and significant. Finally, there are a unidirectional causal links, one runs from enrollment rate to unemployment rate in Nigeria, while the other goes from life expectancy to unemployment rate in the study period. Nigeria government should update its school curriculum in order to equip future generations with skills to create jobs for them at all levels of education.

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CHAPTER ONE
INTRODUCTION

1.1 Background to the study

Economists define progress with four keys: human resources, physical assets, natural, and energy assets, which collectively impact economic progress (Pelinescu, 2015). Human Capital is generally understood to cover the physical attributes that help generate income, such as training, education, skills and talents (Mahinur, Ahasan & Golam, 2023). When it comes to development, a higher the Human Capital means a more effective workforce, and thus better productivity output in an economy (Odonkor, 2017; Adeyemi & Ogunsola, 2019).

As Boge and Suryaning (2023) note, "The idea of Human Capital essentially suggests that we examine a population of people their education, health, and skills to its the actual talent needs for the purpose of the activity. ... The OECD (2001) characterizes human capital as the knowledge and human abilities that could contribute to the productive potential of the country or group of countries." This covers dimensions such as education, experience, competencies, talents and abilities more broadly (Boge & Suryaning, 2023). Investing in Human Capital also develops employable individuals (low or semi-skilled for basic employment opportunities), ready to meet the demands for goods and services in the economy (Ogunjobi, Ekiran & Adesanmi, 2021; Ahasan et al., 2023). Human capital helps productivity by ensuring improved working conditions, good knowledge, skills, work experience and drive, which are generally considered as essential factors to boost the economy (Eigbiremolen & Anaduaka, 2014; Lubna, Awan & Tayyab, 2018; Keji, 2021).

Similarly Boge and Suryaning (2023) define human capital as consisting of the knowledge, skills, attitude, experiences of individuals and their ability or skill as members of the community. All of these enable an individual to achieve productivity through a variety of channels. The impact of human capital in boosting economic growth through such skills like the capacity to analyze, the ability to communicate and the

capacity for group collaboration in addition to technical capabilities is often highlighted in the literature (Ahasan et al., 2023; Eigbiremolen and Anaduaka, 2014; Keji, 2021). It is often believed that a productive labour force plays an essential part in any economy because productivity itself has various impacts on growth, income and employment levels of a nation (Obayori, 2016; Ahsan et al., 2023). It contributes to an increase in GDP by enhancing individual and collective capacities, which allow better utilization of other factors of production (World Bank, 2023; Boge & Suryaning, 2023). Countries with a high concentration of productive workforce tend to generate more output than those with relatively low Human capital, since a more educated population tends to be more productive, which then feeds through into stronger overall GDP growth (Ahsan et al., 2023; Eigbiremolen and Anaduaka, 2014; Ahasan et al., 2023). The presence of qualified personnel in a nation contributes to technological development and advancement by fostering innovation, research and development (Tzenios, 2019).

A nation with a well-qualified human resources capacity is better placed to adapt quickly to new technologies, which in turn improves the efficiency of its production systems (Gamberoni et al., 2019). In light of this, investing in Education and Skills development is considered critical to achieving the sustainable development goals, since an economy with ample qualified Human Capital tends to grow faster on account of greater efficiency and innovation than one without it (Ahasan, 2023; World Bank, 2023; Boge & Suryaning, 2023). However, countries investing insufficient or quality in this sphere are deprived of its advantages and may be limited by structural shortcomings, especially when educational policies do not respond adequately to their specific needs and context. Globally, there is growing concern over the challenges of developing human capital, including insufficient financing for the sector, inadequate quality and poor coverage, and a mismatch between the skills taught in educational systems and what labour markets actually demand (Ngoc Su et al, 2021).

Human Capital can also be created through real world or work experience which obtained through informal sectors or even acquired by the means of the on-job-training or internship programs (Akkemik, Durak & Tuncer, 2020). From the definition, we can discover that there are a vast range of definitions to

cover and describe what comprises human capital which overlap on many points. For instance, formal education, informal education, training, knowledge gained from practice, competencies of human capital such as healthy status, ability to lead, ability to innovate and others (Boge and Suryaning, 2023; Ahasan et al. 2023; Olalekan, 2014; Adewusi et al., 2023). It represents the sum total of factors representing people which add value in an organization (Olatunji, Adeniyi & Oluwadare, 2023). For individuals, such as increased work capacity, improved employment chances and income. For companies such as increased efficiency and productively, or enhanced ability to innovate; for countries such as higher GDP per person and competitive advantages in the world market (OECD, 2001).

Human resources are important.on the evolution of individual productivity. Human Resources, including good health can enable workers carry out their task properly (Ahaasan, Odonkor & Gholam, 2023). On one hand human capital development is a requirement to enhance worker's ability; and on the other hand there is strong evidence from many studies which conclude that human development also has an effect on the work output level or productivity of the employees (Ahsan, Odonkor and Gholam, 2023; Ahasan et al., 2023).

Industrialisation is the transformation from agrarian society to a highly mechanical society which is primarily depended on machines. It denotes the process whereby the economy changes from Handicrafts and agriculture based to manufacturing and industry based. Industrial revolution leads to greater production and greater accumulation of wealth and the development of capital goods is encouraged (Morawetz, 2021). The Industrial Sector consists of crude oil and natural gas exploration and petroleum refining. It has some oil-free activities too. The main sub-sectors industries consist of such industries as; cement manufacture ; food & tobacco products, textiles, apparel & footwear ;wood & wood products; pulp, paper & printing & publishing ; non- metallic mineral products ; domestically industrial plastic & rubber products;electrical and electronic equipment;basic metal iron & steel; automobile; vehicle assembly plants(Okurebia, 2018).

Unemployment, on the other hand, means a situation where someone who possesses basic education and the ability to work cannot find job opportunities commensurate to their skill sets and educational qualifications (Preeti, Balbir, Anju & Pankaj, 2024). As De-Castella and Meclatchy (2011) state "Unemployment occurs at any age (above at least the legal minimum working age), who is able to work, yet cannot obtain employment (Paid work and it should be available for them to be able to obtain Paid work)". Similarly, Jhingan (2016) defined unemployment as the condition where a person who is ready to work at existing wage rates and willing to work but could not succeed to be provided job. Lastly, the World Bank (2021) "Unemployment rate is the share of the labour force that is without work but is available for and actively seeking employment".

This is typically taken to include all persons of working age who were not employed, were available for employment, and were actively searching for work during the specified survey reference period. In countries without unemployment benefits or income-support measures, individuals can be pushed into precarious employment simply to make a living. In 2019 and 2020, nearly half a billion of the world's workforce was at high risk of losing their jobs, about 2.5 times the number during the Great Recession. The Global unemployment rate declined to around 5% in 2020 but is still significantly higher than the 3.5% recorded prior to the global financial crisis (Gamberoni et al., 2019). Developing countries tend to face greater unemployment challenges, partly because the workforce in their major sectors is concentrated in lower occupational tiers, and partly because of generally weak economic performance (Gamberoni et al., 2019). Relationship of human capital with unemployment It is found that, Nigeria have for some years experienced a steady rise in the level of unemployment; leading to the increasing levels of poverty, disparity, criminality and low standard of living (Obayori, 2016). Nigeria, unemployment rate increased from 13.1 percent in first quarter 2000 to 14.8 percent in fourth quarter 2003. The country recorded the highest level of unemployment rate in the second quarter 2020 which is 27.1% from the period of second quarter 2012 when it recorded 23.9% (UNDP, 2020).

Unemployment in Nigeria constitutes a colossal waste of its human resource and an ensuing depressed living standard and economic output (Shobande and Etukomeni, 2017; Afolayan, et al., 2019). Consequently, there is a pressing need for the promotion of human capital for the generation of employment, hence, it is essential to ameliorate the negative ramifications of unemployment in the country. Therefore, the primary objective of this research study is to investigate the impact of human capital and industrialisation on unemployment rate in Nigeria.

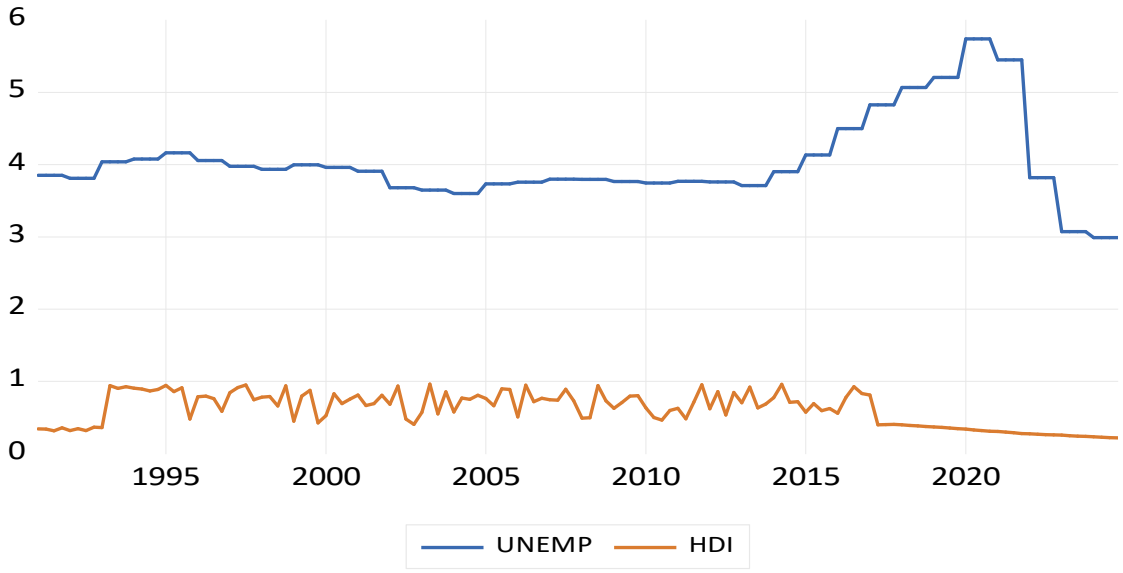
To address this challenge of human capital deficit the Nigerian government put in place various policy framework in the country expected to raise labour efficiency, output thus improve overall economy performance (Oladeji, 2015; Olalekan, 2014) The intervention to promote peoples welfare would lead to increase rates of employment (Asongu et al, 2020), which would not be of the people alone but of overall development of Nigerian economy and subsequently Nigerian welfare, the lasting economic progress would go very far in enabling us to have sustainable long run growth (Adewusi et al. 2023; Shobande and Etukomeni, 2017). It is our hope that this research would contribute to the already rich literature. It is in a bid to discover the investment to Human Capital has contributed to the reduction in the incidence of unemployment in Nigeria. This in turn has improved the Nigerian Economy. This study would attempt to address the question as: does human capital and industrialization impact on unemployment rate in Nigeria?

1.2 Statement of the Problem

In Nigeria, unemployment continues to be a severe issue, with myriad socio-economic factors contributing to the problem, including the quality of human capital. Despite extensive investments in education and training programmes, Nigeria is battling a high unemployment rate, primarily among the youth. According to the National Bureau of Statistics (2023), unemployment rate in the nation hit 33.3% in 2022. This figure underscores a critical discrepancy between the skill set of Nigeria's labour force and the demands of the labor market.Unemployment has consequences that span economic and social spheres.

Prolonged periods of unemployment can lead to debilitating health and social ailments, exclusion, and higher crime rates. This can exacerbate already prevailing social and economic challenges by intensifying poverty (Kacar and Yildirim, 2020). The purchasing power of people decreases not only now, but for the long term as their acquired skills/ education gradually become obsolete. The children's education is also hampered by the parents' situation (Jitendra, 2022).The National Bureau of Statistics (2017) report indicated an upward trend in Nigeria's unemployment rate since 1999. This happened even in the face of governmental structural adjustments of the industrial and agricultural sectors. It rose from 8.2% in 1999 to 13.6% in 2001, 14.8% in 2003, 17.8% in 2014 and 22.8% in 2018. The National Bureau of Statistic (NBS) disclosed an unemployment rate of 34.3% for Q2 2024, coupled with substantial rates of underemployment and labour underutilisation that indicate serious quality of job problems. However, these figures questions Nigeria's economic activity and its capacity to generate jobs for its populace.In addition, current literature has emphasized that outcomes of human capital-such as education, training acquisition and vocational preparation- play a crucial role in overcoming unemployment (Ogunyemi, 2023; Adeyemi & Adebayo, 2023). Nevertheless, there seems to be a deficiency of thorough, conclusive studies directly linking the effects of initiatives for human capital development to measurable results on unemployment rates in Nigeria. This research deficiency is significant when discussing the role of specific human capital measures in alleviating unemployment differences within demographics that differ by gender, education, and other factors. Information on the impact of a comprehensive set of human resources outcomes, and the part they play in Nigeria's unemployment, still lacks detailed treatment in existing research. Thus, this research intends to close this information gap, by studying human capital impact on unemployment.

Figure 1.1: Human Capital and Trend Relationships (enrolment rate) and Nigeria's unemployment rate, 1985-2020.



References: Unemployment (UMP); Human development index WDI, 2011. From the figure below, we noticed that human capital in the Nigeria economy via the school enrollments has been increasing consistently over the years. In 1985 the enrollment ratio was 100.1 per cent, while that of 1980 was 100 per cent. In 1995 the enrollments reduce to about 85 per cent and then rise to 95 in the year 2000.

Also in terms of unemployment rate in Nigeria, a cursory look reveals that between 1985 to 1995, there was a steady rise from 3 percent to 4 percent in Nigeria, likewise in 2000 the unemployment increase from 3% in the period 1985 to 4.5percent.

Also there were a corresponding rise in the unemployment rate to 7percent and 8percent in the year 2010 and 2020. From this finding we can see that human capital trend and the trend of unemployment follow each other and thus suggesting that on an average there is a positive correlation between human capital rates and unemployment in Nigeria. It was also grave that there was an increase in unemployment rate for skilled worker's, i.e accountant, engineers, etc in the country. The novel contribution of this study to the previous literature study is as follows: Firstly, To the best of our knowledge none of the previous researchers have identified or investigated the effect of Human resources outcomes on the rate of unemployment in Nigeria.

Second, we selected appropriate variables for determining human capital outcomes on unemployment rate that were overlooked in other studies. This will greatly help the policymakers formulate a national development agenda, youth employment reduction in crime, poverty, social crisis and promote economic activity in Nigeria. Third, various other researches have studied human resources development, human capital development, unemployment and economic growth of Nigeria without explicitly looking at the implications of human capital development on unemployment, whereas our present study is concerned with identifying the impact of human capital outcome on the unemployment rate by considering the human capital-related factors such as enrollment rate, literacy rate, human capital expenditure, growth of human capital development, industrialization and unemployment. Fourth, instead of error-fixing approach and cointegration analysis, this study employs ARDL approach. This The ARDL method offers both long-run and short-term coefficient estimation, thus yielding more significant results than others in formulating economic policy in Nigeria and helps to increase employment. Nonetheless, there appears to be a significant lack in the literature on how education, skills, and other human capital development outcomes affect people's vulnerability to unemployment in Nigeria.

The current research work fills these gaps by investigating how industrialization and human capital outcomes affect Nigerian unemployment and considering other recent issues and research gaps as part of an effort to promote the development of employment and provide effective support for policymakers and businesses to address this critical social and economic issue in Nigeria.

1.3 **Research Questions**

The study will address the following research questions:

1.What is the effect of health outcome on unemployment rate in Nigeria?

2. What is the effect of education outcome on unemployment rate in Nigeria.

3. Is there any link between industrialization and unemployment rate in Nigeria?

4. What is the causal-direction relationship between human capital outcome and unemployment rate in Nigeria?

1.4 Objectives of the Study

Generally, this study aims at exploring the impact of human capital outcome on the rate of unemployment in Nigeria. However, the following specific objectives were set;

1)To examine the influence of health outcome on the unemployment rate in Nigeria.

2) To investigate the influence of education outcome on unemployment rate in Nigeria.

3) To examine the relationship between industrialization and the unemployment rate in Nigeria.

4) To confirm the causal effect relationship between human capital outcome and unemployment rate in Nigeria.

1.5 Research Hypotheses

Consequently the following Research theories are postulated as

1. Ho1: Health outcome is not significant for unemployment rate in Nigeria.
2. Ho2: Education outcome is not significant for unemployment rate in Nigeria
3. H03: No meaningful connection is between industrialization and Nigeria's unemployment rate
4. H04:No significant causal relationship exist between human capital outcome and Nigeria's unemployment rate.

1.6 Significance of the Study

The importance of the study of human capital outcomes and their effects on the unemployment rate in Nigeria to any developing economies like Nigerian economy is no doubt in question across the length and breathe of the globe. In fact, the study is very significant in both theoric and practical aspects. It adds to the stock of knowledge on how human capital development affects unemployment rate. Theoretically, it gives a deeper understanding on how the quality of human capital development which covers education,

acquisition of skills, and good health would affect how jobs are created in a developing country like Nigeria, which has experienced high and persistent unemployment even with the proliferation of schools and higher investment in human development. The results would help determine whether our educational outputs matched what the job market required as many graduate unemployed in recent times. The results of this research have a number of useful ramifications to the policymakers and development planners in Nigeria. It would assist the government in making and developing and applying new human resource and labor policies. It helps government agents who design both human resource development strategies and policies that would minimize structural, cyclic and even technological unemployment, with the hope of re-training employees and new graduates for new emerging careers and industries, which were a factor of both human and financial capital of any country.

This study would provide useful and valuable material reference information for Researchers working in the same area.

It would help to supplement literature and encourage the extension and additional researches in field such as labor economics, and human capital development research methodology. In this perspective, a good deal of knowledge from the Nigeria situation would be of a guide and use to other developing countries in Africa's Sub-Saharan region and other parts of the world. This research is a significant attempt at finding a policy prescription to tackle unemployment through focus on human capital formation.

Since the Private sector needs highly skilled labor, findings of this would be quite important. With efficient manpower the economy might be able to move from a primitive level of production to an advance one and the demand for highly skill manpower would emerge. This study would thus be useful to those in private business in Nigeria.

Finally, due to its possible impacts and significance as a practical guideline, the international agencies engaged in human capital development and employment programs (for example, International Monetary

Fund (IMF), World Bank and UNDP) in Nigeria could benefit from this work in their endeavor to direct their attention, their programs, and the funds to where and how they are required the most.

For instance, since it would be of importance to note whether human capital is being effectively used in Nigeria economy it is thus would allow such agencies to develop an effective and operational guide on how to improve human capital outcomes to reduce unemployment. The study will therefore be helpful in setting international benchmark for such intervention programs and will ensure that such assistance are strategically channeled towards maximizing their impacts in Nigerian context. Hence, its finding could be important for drafting appropriate policy at both domestic as well as international level which can help achieving sustainable development Goals such as MDG- first Goal is ' Eradicate extreme poverty and hunger' by augmenting employment generation; the Fourth Goal- Achieve Universal Primary Education, gender equality and women empowerment by investing on human Capital. Hence it may make a contribution towards achieving the Sustainable Development Goals (SDGs) of United Nations, specifically Goal Number four ' Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all', Goal number eight 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all'.

1.7 Scope and Limitations of the Study

The study on effect of human capital outcomes and industrialization on unemployment rate in Nigeria this study is meant to bring into light the effect of the development of human capital on Nigerian economy and specifically on its effect to Nigeria unemployment problem. The Nigerian economy in general and particularly the labour market of Nigeria, has varied factors and conditions which shape and dictate the form that unemployment rate takes as a result of interaction among variables such as human capital variables. The study intends to analyze the effects of human capital particularly the effect of human capital on industrialization on Nigerian unemployment rate for the period of 1991 to 2024 (time series). This essentially seeks to examine the extent to which human capital development in Nigeria is connected

to industrialization in Nigeria and the relationship with the Nigerian rate of unemployment. The study will use data such as time series primary school enrolment as proxy for educational attainment; education spending by government as proxy for human health and standard of living; country's population etcetera; as well as human capital of interest. The time series would consist of thirty three (33) years beginning from 1991-2024 for countries such as Nigeria and collected annually to reflect any observed changes and variation; enough to ascertain dynamics of relationships and also prevent small sample size bias. The research would gather and compile secondary data from credible sources such as the National Bureau of Statistics (NBS); Central Bank of Nigeria (CBN); World Health Organization (WHO); World Development Bank; etc. The analytical technique would involve OLS (Ordinary Least Square); and Cointegration tests as well as Error Correction Model, where necessary for both short-run and long-run dynamic analysis; for instance to ascertain if observed long-run association is not a spurious one.

The researcher would use variables that would serve for an extensive inquiry into the relationship between human capital creation and unemployment rate in Nigeria by using: Variables required: human capital development which would serve as the independent variables such as: Primary school attendance in (%), Population of country (in millions), Health expenditure (as % of GDP), Population Growth Rate (as %) , and industrialization variable would as well be use to cover another dimension of employment and also economic growth factors and these includes: Inflaction Rate(as%), GDP (current Usd Million) , Oil production (as % of GDP), Unemployment Rate (in %) (as Dependent variables) . These variable ranges from year 1991- 2024 with the annual data frequency to ensure it would capture enough information required for the analysis of human capital and unemployment relation and its related factors.

However, this study is not without its drawbacks. One limitation of the study is the problem of data availability and reliability. Statistics on employment, quality of education and human capital outcomes in Nigeria, for instance are sometimes unstable and incomplete hence affecting the robustness of the results from the empirics.

The dynamic nature of unemployment in which a whole lot of human capital and macro-economic variable that is beyond the scope of human capital; inflation, exchange rate variability, changes in technology, policy decisions and government interventions affects the unemployed. Though these variables are held constant in this study they could be held fixed without accurately holding them perfectly constant so as to not confound them.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Literature

2.1.1 Human Capital

The word human capital, popularized by economists such as Gary Becker in Chicago University was defined by Miner, (as cited in Ghai, 2019) as "human capital is the bundle of competencies, skills, and other attributes that have an impact on an individual's ability to perform a job or task that provides economic value to the employee,". "They can also be learned and developed by an employee during his lifetime, including by means of education, experience and training," (Ghai, 2019). Human capital is seen as an indicator of a worker's level of skill, learning ability, inherent potential and attributes which affect their earning capacity and productivity (Pettinger, 2017). "Human capital embodies the knowledge, skills, competences and attributes of an individual or group of individuals which can be used to produce economic and non-economic goods and services," (OECD, 2020). In essence, human capital encompasses far more than just economic output, extending to innovations, agility, and active engagement within the community. Human capital encompasses a country's human resource base, including knowledge, health, and skills. Investing in its development is crucial as it directly relates to innovation, labour productivity, and economic growth (Baharin et al., 2020).

The concept of human capital centers around a person's collective knowledge, skills, abilities, health, and other qualities that enable them to create value in economic terms. It positions individuals as essential assets and productive assets that drive economic expansion and social advancement. In contrast to physical capital, which consists of physical assets such as machines and infrastructure, human capital emphasizes those unseen qualities that improve overall and national output.

To summarise, human capital assesses not simply how many workers there are, but how good they are- how capable of contributing effectively to productivity. It remains the bedrock of long-term development, influencing the distribution of earnings, job creation, and economic resilience.

2.1.2 Industrialization

Definition of Industrialization Industrialization refers to the transformation of the economy of a country or a region from one in which goods are manufactured to one in which goods are manufactured (Ugbomhe & Omoaka, 2025). This is to say it is a stage in evolution when there is a shift from agrarian to industrial economy in terms of mode of production (Okurebia, 2019). The transformation process is usually characterized by a change from manual and labor oriented mode of production to machine based industrial economy (Morawetz, 2021). It can be otherwise described as an evolution of an agricultural economy to a more complex and mechanized one based on mass production system. In other words, through mechanization it will promote new job opportunities, enhanced production levels, rapid economic growth and higher standard of living. Industrialization generally has many advantages that may serve to enhance rapid economic development and may transform industrial sector into catalytic one (Ugbomhe & Omoaka, 2025). The industrial sector comprises the food and beverage, textile, tobacco, automobile, cement production, and non-metallic products manufacturing; oil refining, electronics and computer; production of basic metals and iron and steel production, paper; printing and publishing; production of woods; and the manufacturing of plastics and rubber product (Okurebia, 2018).

2.1.3 Unemployment

This figure is one of the key macroeconomic variables that can show the proportion of employed and capable and available for employment of a labor force which is unemployment rate and shows an efficient usage of labor force of a country, therefore it is an indication of labor market and economic condition (ILO 2022). Increased rates for unemployment generally leads to a poor economic growth and disequilibrium at labor market. Based on The International Labour Organization (ILO, 2022) Unemployment rate is defined as the share of labor force not in employment, which are available for work, and are seeking work during the specific time period.

It means to be in the unemployment rate it must be not working, seeking for a job.

Individual must be free and ready to do the job that are open at that specific time. It is based on the calculation done according to the proportion of unemployed divided by labor force, multiply by 100 according to Mankiw (2021). Unemployment Rate includes following type;rictional, structural, and cyclic unemployment rate where frictional is related to job seeking, structural is related to mismatch skill set of employees versus the skill set requested by the employer, and cyclical unemployment corresponds to a business cycle's phase of contraction or recession. Also, unemployment in developing economies defined by Todaro and Smith (2020) is an underutilization of labor.

The segment of labor force with a skill set and qualifications that could have obtain jobs at better rates of salary end up either unemployed or underemployed in unproductive lower wage work.

Also, according to them, in the developing countries such as Nigeria the high rate of unemployment co-exist with a very high degree of underemployment, part-time work and a lot of jobs that does not tally with one's qualification. Additionally, according to Folawewo and Adeboje (2021), the definition of unemployment rate is the ratio of the labour force that is economically active but which lack the appropriate qualifications and wish for a paid employment. In the Nigeria study on unemployment rate, it is stated that a high unemployment rate means a high employment rate, low participation in production processes, a missing industrial strategy and inadequate skills matching of the employed to market demands. Likewise, Adewale and Olofin (2022) definition of unemployment rate is the ratio of number of unemployed people to the labour force of the country in a given period of time in percentage. According to their findings on unemployment, it is concluded that it is rampant in developing

countries including Nigeria as a result of the insufficient development of industries, inadequate utilization of human resource and slow pace of development in the country private sector.

To summarize, unemployment rate measures job shortage in any economy since it shows how well the economy uses human resources. Unemployment affects the efficiency of the economy in goods and services provision and it influences its human capital as well.

2.2 Theoretical Literature

2.2.1 Theories on Human capital

2.2.1.1 Human Capital Theory

The theory of human capital The theory is largely the brainchild of Theodore W. Schultz (1961), the concept however was supported with empirical data by Gary S. Becker (1964). According to Schultz (1961) increasing one's stock of knowledge and skills enhances the productivity of people. On the same note, Becker (1964) asserts that, characteristics of human capital including skills, education, knowledge and health, have an influence on their economic outcomes and that of the nation as a whole. Based on the human capital theory individuals are perceived as investment goods with bundles of knowledge, skills, expertise, attribute, experience which are highly valued and are hence investmentworthy. However, while many other theories consider the purchase of education, health and training as a process of consumption, it perceives them as investment since they lead to improved human ability that contribute to the increase in human output hence resulting in improved individual well being and economic performance of nations through high economic return in the form of wages and higher returns (Sweetland, 1996; Becker, 2002). Difference in incomes and productivity of individuals is due to their stock of human capital where the more productive and skillful an individual is, the more he/she earns (Hanushek & Woessmann, 2020).

2.2.1.2 Schultz's Human Capital Investment

Theory Human Capital Investment Theory is the theory the Theodore W. Schultz, Nobel prize winning economist first formulated and established as a part of his research "Investment in Human Capital" published in 1961. In this research, Schultz (1961) argued that treating investment in education and training as a form of consumption will turn an individual into a capital stock rather than merely a labor unit.

Schultz is famous for his focus on the importance of the people for firm's investment decision and for growth and development. Schultz's (1961) proposal that an individual can be conceived as a form of capital which possesses productiveness and for which investment is possible, made Schultz gain remarkable interest from the economists. Schultz (1961; 1981) explained that because of improved skills and knowledge due to investments in human capital, efficiency of individuals grows and this has direct effect on wages, employment and economy in general. Schultz points out that investing in human beings and them in themselves, in the form of education and training, health services and job search yields positive benefits in terms of productivity, income, employment chances and consequently in terms of country development including growth and stability (Schultz, 1961; 1981). Schultz (1961) also lists other categories of human capital investments such as health and medical care investments, migration investments with the purpose of improving opportunities of training, learning or employment and information and search investments. Schultz (1961, 1981) explains that all types of these capital investments have a positive influence on individual's productivity and economic growth. In addition to that Schultz (1961) believes that in some developing countries, human capital could be more responsible for the economic development than physical capital.

2.2.1.3 Endogenous Growth Theory

Endogenous Economic GrowthTheory grew from failures of the Neoclassical (Solow-Swan) Model since tech. Progress had been treated as exogenus in the NEOCLASSICAL MODEL. The contemporary versions of endogenous growth theory may be considered to have started with Paul M. Romer (1986), in the work entitled “Increasing Returns and Long-Run Growth”, later developed by him in Romer (1990) on an innovation driven framework. This theory, aims to tackle the issue of economic growth by specifying the internal determinants of the economy as opposed to external determinants such as Technological progress in the Solow Model. Therefore in its broadest definition it postulates growth originates within an economy from explicit incentives of investment in: Human Capital Knowledge & innovations R&D Technological accumulation Learning-by-doing It explains why there are differences in economic growth rates between nations since nations can steer their own growth path using human capital, institutions and innovation.

2.2.2 Theories on Industrialization

2.2.2.1 Classical Theory of Industrialization

It is developed from the essential ideas which was presented by Adam Smith (1776), David Ricardo (1817) and John Stuart Mill (1848). This is not structured in an ordered comprehensive way but formed from what these men understood on how economy growth process occurs, about dividing of labor and accumulating capital, expanding of the market. According to the Classical theory, industrialization emerges spontaneously in economies where there are free markets, fierce competition, and economic self-interest pursuit by economic players. Smith (1776) explains that specialization of work (division of labor) increases production efficiency, hence economic growth and development, which causes firms to invest in machinery and infrastructure. In addition, according to Ricardo (1817), industrialization entails a move from agricultural to manufacturing production due to savings, investments, and profits' re-investments; market expansion encourages adoption of advanced technology to meet rising demands.

2.2.2.2 Marxian Theory of Industrialization: This theory of industrialization has been developed by Karl Marx in 1848 in his very influential publication entitled The Communist Manifesto (Marx & Engels, 1848) and later in his book, Capital: Volume I (Marx, 1867). Even though Marx did not develop an explicit "theory of industrialization", his discussion of capitalism's fundamental principles of class struggle and innovations offers a detailed explanation of the process of industrialization development. According to the Marxian approach, industrialization is a revolutionary historical period determined by productivity development, class struggle, and capitalist exploitation. It states that industrialization takes place as a result of capitalists (bourgeoisie) innovations aimed at increasing production and profits and labor offered by workers (proletariat) for wages. Marx claims that societies evolve through different socio-economic stages such as feudalism and capitalism depending on changes in the mode of production. Industrialization is an important stage in capitalism development due to increased production capabilities of societies (Marx, 1867).

2.2.3 Theories on Unemployment

2.2.3.1 Classical Theory of Unemployment: The foundations for this theory can be seen in the writing of economists throughout the 18th and 19th centuries, from Adam Smith (1776) to David Ricardo (1817) to Jean-Baptiste Say (1803 – Say's Law) to John Stuart Mill (1848). The classical theory of unemployment itself came about through the developments in economics throughout the 19th century and the first part of the 20th century, with the theory continuing to dominate thinking about labor market dynamics until the 1930s (The Great Depression). A central premise of this model of unemployment is that Unemployment is voluntary and is a direct consequence of wage rigidity. This argument is carried further by economists within the neoclassical tradition, such as Alfred Marshall (1890) and Arthur Pigou (1933).

Theory of Unemployment assumes that there exists the tendency of competitive labor markets to move to full employment because of flexible wages and prices. Unemployment under this theory results from any

disruption or inflexibility in market adjustments and is called voluntary as people refuse to work because of wages being too low for their preferences.

2.2.3.2 Keynesian Theory of Unemployment: Basic ideas British economist, John Maynard Keynes, revolutionized economic thought on unemployment, inflation, and money policy with the release of his seminal work, The General Theory of Employment, Interest, and Money, in 1936. He posited that cyclical or Keynesian unemployment was the result of insufficient demand, and that such unemployment varied with the level of aggregate demand based on fluctuations within the business cycle, but that this may persist even during times of significant economic upheaval such as the Great Depression. In essence, it is based upon the conviction that inadequate aggregate demand results in the unemployment of individuals willing and able to work due to lack of sufficient aggregate demand at that moment in time (Obadan & Odusola, 2010). The decrease in demand for goods and services subsequently led to a decrease in production, and a corresponding increase in the unemployment rate of labor.

Keynesian unemployment theory admits the existence of unemployment even when full employment is reached in an economy because of some mismatches in it such as job vacancy not matching the pool of potential employees. Keynes argued that the problem of insufficient aggregate demand could be solved by government policies aimed at deficit spending that would increase employment and demand in the economy.

2.3 Empirical Literature Review

Much Research has been conducted to investigate the human resources influence on the rate of unemployment. Much past and present research highlighted the correlation between the amount of human capital and unemployment rate, however the impact on human capital and unemployment has been tested only on a limited basis on empirical evidence.

For example: In The impact of institutional quality, human capital, and the Fourth Industrial Revolution on the unemployment rate of 46 Asian countries (2007–2020), Tran, Le Trung, Phan

Thi, Huynh (2023) utilized GMM methods and obtained evidence that advanced technologies development contributed to the increase in unemployment rate in Asia. The correlation between the human capital, institutional condition and unemployment rate in each Asian country varies, and appropriate policy recommendations to mitigate the unemployment rates of the Asian countries within the scope of the Fourth Industrial Revolution.

In the impact of capital expenditure on the unemployment rate in Nigeria 1981-2020: AJohansen cointegration and error correction approach Isiaq & Aduralere (2023) performed research and analyzed the relationship between capital expenditures and unemployment in Nigeria by analyzing the time series data from 1981 to 2020. Thedata set for the study were obtained from the Statistical bulletin of Central bank of Nigeria and world Bank indicators of Development. After unit root test and co-integration test through Johansen test was conducted, error correction method was used to estimate the impact of capital expenditure on the unemployment rate in Nigeria.

Dependent variables included the unemployment rate and its explaining factors are capital expenditures, tax revenue, labour force, compensation of employees, gross capital formation, gross domestic product, and imports of goods and services. The results all suggest thatfour out of sevenfactors used were statistically significant, and that gross capital formation and capital expenditure had negative impact on the unemployment rate, while the positive relationship existed for gross domestic product (GDP) and labor force. Therefore, based on the above results, the government of Nigeria should increase the capital expenditure to promote employment and, therefore, the productivity of the labour force and decrease the unemployment rate.

Research that discusses the impact of unemployment and education on the development of human capital (a) The empirical research was analyzed using secondary data from 2017 to 2021

using path analysis techniques. (b) In addition to conclusion of negative major impacts of unemployment on the development of human capital, there are several other conclusions. (c) It also has a Unemployment Policy Implication that is able to connect our topic of research of Unemployment and Human Capital.

Interrelationship Between Corruption, Human Resources and Unemployment In Indonesia Using Vector Error Correction Model (VECM) (1996–2021) (a) This study examined several variables, namely Corruption, Human Resources, and Unemployment. Corruption has a major impact on national development and the welfare of the citizens of Indonesia. (b) Our study clearly proved the importance to treat corruption, to ensure beneficial for economic growth and national development, since undoubtedly it may inhibit innovation, disregard law enforcement and Investment. (c) In light of this, the need to addressCorruption in order to prosper in a country. Overall, our study confirms an abundant evidence on the negative impact of Corruption on Unemployment and human resources of Indonesia.

A study was undertaken by Olufemi, Abiola, Olabisi, Abel, and Iseolorunkanmi (2022) where they analyse the effects of shocks and long-run implications of financing education and health on the output and employment of Nigeria through a vector error correction model (VECM). The findings suggest that government expenditures shocks on health and education have more impact on the output than employment during the 10-period timeframe. Regarding long-run equation of output it was found that government expenditure on education and human capital index has a significant role whereas the government expenditure on health was not found to be significant, implying a positive influence of expenditure on education and human capital index to output.

In contrast, in the long-run equation of employment, both government expenditure on health and education has significant roles whereas human capital index was found to be insignificant, where expenditure on education shows negative relationship to employment and expenditure on health has positive relationship to employment.

Hence it was concluded that human capital indicators in both qualitative and quantitative terms has a negative and insignificant role in employment in Nigeria. Thus, entrepreneurship training and self-reliance has to be encouraged to foster employment. A different study by Mahinur, Ahasan and Golam (2022) investigates the role of human capital investment in unemployment rate in Bangladesh from 1995 to 2019. Their methodology applied in order to investigate their objectives was an autoregressive distributed lag (ARDL) models and pairwise Granger causality tests models. The result of their study concludes that human capital investment in the government expenditure in the health sector has a significant impact on the long-run unemployment rate in Bangladesh. The result of Pairwise Granger causality tests demonstrate a unidirectional Granger causality between government expenditure on education sector and unemployment rate, in short run there is no significant relationship between human capital investment and unemployment rate in Bangladesh. From their study, the recommendations made by the authors are government should concentrate on health expenditure and ensure to boost the health sector to decrease the unemployment in Bangladesh and also give importance to vocational education and career education just like general education.

Mushtaq et al. (2022) examines the moderating effect of human capital in globalization on employment for twenty-six countries of Asia during 1996-2019. They use the generalized least squares (GLS) and generalized method of moments (GMM) in estimation of their empirical study and prove that globalization has direct and indirect effect on employment, the indirect

effect works through human capital. Further, the study revealed that the growth of economic activities and industrial value added affect job generation in a positive way, while the growth in population affects the job creation in a negative way. The evidence shows that human capital enhances the effects of globalization on job creation. This study also confirmed the fact that the development of human capital could be an approach of utilizing globalization for increased employment generation and is also in support of the previous literature in a way that human capital development can serve as tool to use Globalization in job generation.

This paper corroborates the prior literature recommendations to ensure development of human capital for realization of the globalization gains in the form of increased job creation.

In a different study Keji (2021) assesses the effect of human capital and economic growth for Nigeria from 1981 to 2017 by employing the Johansen and vector autoregressive models. The findings show that estimated coefficient of human capital influences the economic growth of Nigeria significantly in the long run. Additionally, diagnostic tests were carried out to check the validity of the study model, VEC residual serial correlation LM test, VEC residual heteroskedasticity test and normality test results provided evidence for the rationale and validity of the estimated result of the study. The study further suggests that policy measures, in order to enhance and maintainNigeria's economy should include increasing budgetary allocation to the health and education sector to support human capital development which is needed for a knowledge economy.

However, contrary to the other findings Ogunjobi, Ekiran and Adesanmi (2021) examined the effect of human capital and unemployment on the Nigerian economy for 1981-2020 by utilizingJohansen Co-integration and Autoregressive Distributed Lag (ARDL)models. Their finding indicated that the current state of Nigerian human capital is not sufficient for the

country's economic growth. Also the study confirmed the negative impact of rise in the rate of unemployment on Nigerian economy for the considered period. Based on the finding, policy recommendations suggested funding of human capital via expenditure on health and education and provision of self-employment schemes that are viable to address the problem of unemployment and ultimately foster sustainable Nigerian economic growth.

Onyele, and Ariwa (2020) investigated the effects of financing human capital on unemployment using annual time-series data from 1991 to 2018, applying Johansen cointegration and Vector Error Correction Model (VECM) analysis, which show long-run and short-run causality from financing human capital to unemployment. It was revealed that government expenditure on health has a positive impact on unemployment in the long-run while financing of education negatively affects it.

In Nigeria's human capital development: "current trends would not help to achieve employment" in accordance with the analysis of Adejumo (2017). Specifically, research focused on the importance of learning beyond education structure into education for development. The author highlights several components other than human capital such as Inflation, ICF, Technological Change. He suggested the formulation of developmental policies involving the improvement of infrastructure, innovations and the allocation of funds towards appropriate areas.

In a similar approach, Samiullah (2014) researched the association between human capital and unemployment with the support of data from Pakistan covering the span 1980-2012. With the usage of both Johansen co-integration and OLS methods, results indicated positive correlations between education, and healthcare and employment rates reduction. Health, education, and other measures of human development are positively related to unemployment, based on the findings. In addition, the research recommends raising budgetary allocations to healthcare and education

sectors; government control on the population rate and investment to overcome the problem of increased population and unemployment.

In Nigeria's economy, Obi (2014) tested for the relationship between the two variables and found the connection between recurrent spending and unemployment, through the medium of the GDP, for the duration 1981-2012, aiming to discover the effect of investment in education for socio-economic progress in Nigeria.

While a positive relation was noticed, the test was unsuccessful in providing an indication of a long-term relation over this particular timeframe. Moreover, Ehimare, Ogaga-Oghene, Obarisiagbon, and Okorie (2014) analyzed the effects of government expenditure on unemployment, and the human capital growth through the use of unit root tests, such as Phillips-Perron, and Data Envelopment Analysis, and inferred a downswing in government spending effectiveness from 1990 to 2011 which contributed to the low quality of output in the education sector.

However, it is the conclusion of the work done by Ibok and Ibanga (2014) concerning human capital development effect on employment in Nigeria which show the changes over years by the government for their investment on public sector human resources as this includes training, re-training of the people and as well the implementation of empowerment program that makes so many people to gain their self employed, while many gained employers employment. Olalekan (2014), the effect of human capital on unemployment using Generalised Method of Moment techniques with data health and education in Nigeria from 1980 to 2011 shows the positive relationship between the expansion of economy and human capital.

2.4 Gap in Literature

Following the above analysis, it's obvious that the contribution of human capital to unemployment rate has been empirically verified with the help of diverse angles and techniques. As an empirical research on human capital and institutional quality on unemployment rate by

Tran et al. (2023), study of Isiaq and Aduralere (2023) assesses capital expenditures on unemployment rate of Nigeria, so study of Onyele and Ariwa (2020) examine contribution of investment in human capital for reducing the unemployment rate of Nigeria; whereas a research by Ahasan and Golam (2022) inspects contribution of investment in human capital to unemployment rate in Bangladesh. Additionally, Olalekan (2014) researched effect of human capital on unemployment rate of Nigeria, and research of Boge and Suryaning (2023) examined impact of corruption on human resources and unemployment. In overall, many previous studies focus on connection between human capital and unemployment through examination the effect of investments of human capital on unemployment rate but never cover all dimensions of human capital as such as enrollments, literacy rate, and health care cost that is used in this study and at the same time to investigate the effects of human capital outcome on unemployment rate in Nigeria; Moreover the previous studies were predominantly conducted on developing economies and some advance countries. Although the research done worldwide in relation with effect of human capital on unemployment has been numerous but the issue relating to effect of human capital financing on unemployment rate has yet to be examined, specifically by taking into account the period of 1991–2021 in Nigeria. This paper intends to provide its own empirical investigation to bridge this research gap by examining the effect of human capital output on unemployment rate in Nigeria for the period 1991–2024. Most of the contemporary and historic studies overlooked another key variable which causes the increase in the unemployment rate such as skill mismatches and literacy rate except the relation between the human capital development and unemployment rate. Therefore, the present paper covers these elements to contribute to address the aforementioned research gap by integrating the effect of enrollment,

industrialisation, population size, human capital development outcomes and educational achievements on the unemployment rate.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

Research design can be defined as methods and procedures used in collecting and analyzing measures of the variables specified in a particular research problem(s). Research designs are useful in research because they help the researcher to develop a logical view of the structure for the source of data and the analysis expected to be performed in the study (Nworuh, 2004). This study adopted the *Ex-Post facto* research design because the research study incorporates data gathering from published work, exploratory survey research (*ex-post factor* research design) was employed. From the foregoing, this present study examines and anchors its analysis on already published data.

3.2 Theoretical Framework

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. The theory assumes the importance of investing in education and training to enhance the individuals' capabilities. 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. The weakness inherent in this theory is that sometimes investment in human capital may end up being a wasted effort as a result of the unseriousness of the individual involved. This theoretical framework is quite relevant, because without such investment, individuals that are not employed will not be able to raise money to invest in their education and training, especially students that are not working. Therefore, the need for the government and organized private sector to partner and invest in human capital should become the government priority. Also, such individuals may not be able to invest in themselves without external support especially in this prevailing economic hardship occasioned by hyper-inflation in Nigeria.

3.3 Pre-estimation Tests

The preliminary analysis is performed to show the characteristics of the variables under consideration. They includes-descriptive statistic, correlation matrix, unit root test and cointegration test.

3.3.1. Descriptive Statistics

Descriptive analysis helps to capture the inherent statistical behavior of the series. The parameters include; mean, median, mode, minimum, maximum, standard deviation, skewness, kurtosis, and Jacque-Bera. Also, this is a test that is carried out in order to obtain the characteristic of the dataset. However, before engaging any regression analysis, it is essential to have a feel of how the dataset is conveyed. It is relevant for parametric or non-parametric and also essential in quantitative and qualitative research. It enables us to know whether our sample is normally distributed or not. Are there outliner in the dataset or not. It provides information on mean, median, mode, range, variance and standard deviation etc. It also provides the measure of normality-Kurtosis (measure the degree of sharpness and flatness) and skewness (measure the degree of symmetry).

3.3.2 Correlation Matrix

Correlation analysis measures the degree of association among variables employed in the study. The degree of correlation can either be positive or negative. The correlation test was conducted in ensuring that our model is void of multicollinearity problem – situation where a perfect linear relationship exists among two or more of our explanatory variables. The test of correlation is conducted, namely, the Pairwise Correlation Coefficients and it signifies absence of multicollinearity.

3.3.3 Unit Root Test

The first step for an appropriate econometric analysis is to determine if the data in the series are stationary or not. The unit root test is a preliminary econometric criterion that measures the level of stationarity of the variables under consideration. Time series data can either be stationary or non-stationary. In stationary time series, shocks will be temporary and over time their effects will be eliminated as the series revert to their long-run mean value. On the other hand, non-stationary

time series will necessarily contain permanent components. However, time series analysis must be stationary to make predictable and stable economic policies and recommendations and also forecast for the future.

In order to avoid the problem of spurious regression, the first thing to do in a time series study is to explore the time series properties. A time series variable is said to be a unit root process if its first and second moments depend on time. In such situation, the variable is nonstationary and may produce a misleading result. The subsequent sections presented the approaches related with handling the unit-rot test, cointegration and the basic error correction mechanisms that have to be addressed in resolving the basic problem. The unit root test helps us to conclude whether the variable under study could be relied to use it as it is or it needs further integration to render it stationary. The most famous test to do so is the Augmented Dickey Fuller (ADF) and the Phillips-Petron (PP) unit-root tests. The ADF test is the test of a particular series say, Y_t, such that;

$$\Delta y_t = \delta y_{t-1} + \Delta y_{t-i} + \mu t \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 3.1$$

The method to be applied in this study is the Augmented Dickey fuller Unit root test. The ADF equation is stated below:

$$\Delta y_t = \delta y_{t-1} + \Delta y_{t-i} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 3.2$$

The testing procedure follows an examination of the student-t ratio for δ. The critical values of the test are all negative and larger in absolute terms than standard critical t-values, so they are called DF and ADF statistics. If the null hypothesis cannot be rejected then the series Y_t cannot be stationary.

Decision Rule:

Reject Ho, if the absolute DF or ADF t-statistic > 5% critical values. If otherwise, accept Ho.

3.3.4 Cointegration Test

The cointegration test is an econometric technique used in the testing correlation between non-stationary time variables. Two series are co-integrated if they both move together along a trend at the same rate. Cointegration talks about the convergence of an econometric system to the existence of a long-run equilibrium relationship over time. The essence of cointegration is to determine the long run relationship among the times series variables involved in the study.

In order to empirically analyze the long-run relationships among the variables of interest, the study adopts ARDL bound co-integration test. This is possible because all the variables are integrated at level form and first difference.

To perform the bound test cointegration, the conditional ARDL (p,q1,q2) long run model for Unemp is specified as:

$$\Delta_t=\beta_0+++\delta_{1t-i}+\delta_2 Enrol\_rate_{t-i}+\delta_{3t-i}+\delta_4 Health\_exp_{t-i}+\delta_5 Popgr_{t-1}+\delta_6 IND_{t-1}+\delta_7 INF_{t-i}+\varepsilon_t \quad 3.3$$

The F-statistics is found by conducting Wald test on the coefficient of unrestricted ECT variables. The F-statistics is important for testing the existence of long run relationship in the model and compared with Pesaran critical value at 5% level of significance.

H_0: $\beta_1 =\beta_2=\beta_3=\beta_4=\beta_5= 0$ (No co-integration among the variables)

H_1: $\beta_1\neq\beta_2\neq\beta_3\neq\beta_4\neq\beta_5\neq0$ (Co-integration exists among the variables).

Decision rule:

If the F-statistics is above the upper bound value and lower bound value, we reject the null hypotheses of no co-integration among variables, if it falls below the lower bound value, we do not reject the null hypotheses of no co-integration and if it lies between the bounds, the result is inconclusive (Pesaran and Shin, 1999).

3.4 The Model

Autoregressive Distributive Lag (ARDL) was adopted for this study for three reasons. First it uses mixed integrated data, secondly, it is more efficient and offers better results for small set of data and thirdly, the long run results are unbiased (Harris & Sollis, 2003). An autoregressive distributed lag (ARDL) model includes the lagged value(s) of the dependent variable and also the lagged values of explanatory variables. The study employs ARDL model to estimate the short-run dynamics and the long-run relationships among the variables.

3.4.1 Model Specification

Model specification is the expression of a relationship into a precise theoretical, mathematical, and econometrical form. This study however, adopted model by adding other variables from the model of Ugbomhe, and Omoaka (2025) and Adeyem, Oseni and Awode (2018). This is because some of the variables added in the model are supported by economic theory. Thus, the model in the study is given as:

Unemp=f(Enrol_rate, Lit_rate, Life_exp, IND, GDPpc, Popgr)..... 3.4

The econometric form of the model is given as:

$Unemp_t = \beta_0 + \beta_1 Enrol\_rate_t + \beta_2 Lit\_rate_t + \beta_3 Health\ Exp_t + \beta_4 Popgr_t + \beta_5 IND_t + \beta_6 GDPgr + \varepsilon_t$ 3.5

where,

f = Functional Relationship,

Unemp = Unemployment rate;

Enrol_rate = Enrolment rate used as a proxy for school enrolment rate

Lit_rate = Literacy rate;

Life_exp= Life Expectancy rate;

Popgr = Population rate;

GDPpc= Gross domestic product per capita

IND = Industry value added as a % of GDP as a proxy for Industrialization;

Ɛ = Stochastic Error Term,

t = Time period,

$\beta_{5,}$ = Parameters to be estimated.

The ARDL approach to long co-integration relationship involves estimating the unrestricted Error correction model (ECM) model and has been identified following Pesaran et al (2001) below as:

$\Delta_t = \beta_0 + + + \alpha_{1t-i} + \alpha_2 Enrol\_rate_{t-i} + \alpha_{3t-i} + \alpha_4 Life\_exp_{t-i} + \alpha_5 Popgr_{t-1} + \alpha_6 GDPgr_{t-1} + \alpha_7 IND_{t-i} + \varepsilon_t$ 3.6

The optimal Lag length test has been conducted by means of the lag length criteria which is (AIC) to obtain the optimal number of lags for each variable. This was followed by the estimation of a

single equation unrestricted error correction model with the number of selected lags as shown in Equation (3.4).

To obtain the short run coefficients, the short run model is specified as follows: -

$\Delta_t=\beta_0+++\alpha_{1t-i}+\alpha_2 Enrol\_rate_{t-i}+\alpha_{3t-i}+\alpha_4 Health\_exp_{t-i}+\alpha_5 Popgr_{t-1} +\alpha_6 IND_{t-1}+\alpha_7 INF_{t-i} + \lambda ECT_{t-i} +\varepsilon_t$ 3.7

Where;

ECT_{t-1}, is error correction term lagged by one period,

Δ is the first difference operator; p is the optimal lag length and all other variables remain the same in the model; ECT is the error correction term; λ in equation (3.11) represents the speed of adjustment while the other coefficients (α1, α2, α3 … α7) of the short-run equation are coefficients relating to the short-run dynamics of the model's convergence to equilibrium; β1 – β8 are long-run coefficients; and ε_t is the white noise error term.

3.4.2 A Priori Expectation

Symbolically, the expectations were represented, thus: *β1< 0, β2< 0, β3< 0, β4> 0, β5>0, β5>0*

3.5 Granger Causality Test:

Granger causality was one of the earliest methods developed to quantify the causal effect from time series observations. Causality testing in the Granger sense is conventionally conducted by estimating VAR models: a VAR model in the level data, a VAR model in the first differenced data, and a vector error correction model (Clarke & Mirza, 2006). However, it has been observed that VAR estimation often involves nuisance parameters and then no satisfactory basis for supporting a causality test applies as the F-test statistic does not have a standard distribution when variables are integrated. In other words, the existence of a relationship between variables does not prove causality or the direction of influence (Gujarati, 2005). The essence of causality analysis, using the granger causality test, is to actually ascertain whether a causal relationship exists between two variables of interest. Below is the Granger specification model:

The Decision Rule: The p-value determines the causal link. There is causation if the P-value of the two variables is < 5%. It can be deduced from the aforementioned finding that there is a two-way causal link.

3.6 Method of Evaluation

3.6.1 Economic Criterion Test (A Priori Test)

This refers to the expected signs and magnitude of parameters of economic relationship to know if they agree with economic theory. The a priori test of the analysis will be based on the regression coefficient based on the coefficient of the algebraic signs of the parameters. It is a test that will be based on evaluating the conformity of the relationship between the variables on economic theory. Therefore, based on economic theory, the independent variables are expected to have the following signs:

$\beta 1 > 0, \beta 2 > 0, \beta 3 > 0, \beta 4 > 0, \beta 5 < 0$

3.6.2 Econometric test for significance

3.6.2.1 Test for Goodness of Fit

This test involves the test of the goodness of fit. To evaluate the working hypothesis of this study. R^2 the co-efficient of determination is used to test the explanatory power of the variable. R^2 lies between zero and one ($0 \leq R^2 \leq 1$). The closer R^2 is to 1 the greater the proportion of the variation in the dependent variables attributed to the independent variables.

3.6.2.2 T-Test of Significance

To test for the statistical significance of individual regression co-efficient, t-statistic was used. A two-tailed test was conducted at 5% level of significance and n-k degree of freedom. The null hypothesis Ho was tested against the alternative hypothesis H_1.

Decision Rule (T-Test)

If $t_{0.025} < t^*$ Ho will be rejected and the H_1 accepted. Otherwise, the alternative hypothesis H_1 will be rejected and the null hypothesis Ho be accepted.

3.6.2.3 F-Test of Significance

To Test the statistical significance of the entire regression, the f-ratio is used. A one-tail test was conducted at 5% level of significance and v_1/v_2 degree of freedom.

Decision Rule (F-Test)

If $f^* > (f_{0.05})$, we say the regression is statistically significance but if otherwise, it implies that it is statistically insignificant

Decision Rule: If the probability value is less than 0.05, the alternative hypothesis is accepted otherwise the null hypothesis is accepted.

3.7 Post-estimation Test (Robustness check)

For the post-estimation (diagnostic) test, this study considered five major tests, these include the Ramsey Reset or Linearity test which is used to check for the validity of the model specification as well as the linearity assumption, the Jacque-Berra test which is used to check whether the residuals have the normal distribution property, the Breusch-Godfrey test to check for the presence of serial correlation, the Auto-Regressive Conditional Heteroskedasticity Lagrangian Multiplier (ARCH-LM) test to ascertain whether the error term (u) in the regression model has a common or constant variance, and lastly, the CUSUM and CUSUM of squares test to ascertain the structural stability of the model.

3.7.1. Normality Test

For testing whether the series is normally distributed or not, Jarque-Bera normality test statistic was employed. In the test statistic the difference of both skewness and kurtosis of the series from the normal distribution was measured. If the probability value of Jarque-Bera statistics is less than 5%, then the residual is not normally distributed but if the probability value of the test is greater than 5%, then the residual is normally distributed.

3.7.2. Autocorrelation Test

It a problem in a time-series data when the errors associated with a given time period carry over time periods. The Breush-Godfrey Serial Correlation LM test was employed for testing the problem in the present study. If the probability value is less than 5%, then we can reject the null

hypothesis that indicates that the model has serial correlation and otherwise, no serial correlation. The problem can be removed from the model by creating one period lag of the dependent variable or changing all the variables in to first difference indeed (Gujarati, 2004).

3.7.3. Heteroskedasticity Test

Heteroskedasticity is a problem when variances of the errors are not constant and changes overtime. This study used the Breush-Pagan-Godfrey test to test the presence of heteroskedasticity. If the probability value is less than 5%, then the model has heteroskedasticity and vice versa.

3.7.4. Stability Test

The stability tests of the long-run and short-run coefficients used in this study were Cusum and Cusum-of-Squares test. Both of the test statistics are plotted against the critical bound of 5% significance. If the plot of these statistics remains within the critical bound of the 5% level of significance, the null hypothesis that the coefficient vector is the same in every period would not be rejected. That is, all coefficients in the error correction model are stable.

3.7.5 Ramsey Reset Test

This test is a specification test that helps to check if the model estimated was correctly specified. It makes use of F-statistic and the null hypothesis is that the model was correctly specified. This is to be rejected if the probability value of F-statistic is less than 0.05. Otherwise, the null hypothesis is not to be rejected**.**

3.4. Sources of Data

This work employed secondary annual time series data. The time series data such as enrolment rate, adult literacy rate, population growth rate, industry value added % to GDP, gross domestic product per capita, unemployment rate and inflation were sourced from World Bank Development indicators 2024. The period considered of the time series data covered in this study ranges from 1991-2024.

3.5. Econometric Software for the work

The researcher employed E-view 13 as Econometric software for the data estimation.

CHAPTER FOUR
PRESENTATION AND ANALYSIS OF DATA

This section has addressed estimation and results interpretation. The fourth and final section addresses the analysis of the results as well as the econometric interpretation of the implications of the results and their consequences in the discussion section. 4.1.1. Descriptive Statistics In statistical research, the notion of descriptive analysis is used to determine the statistical characteristics of the series that are being examined.

The median, mean, and highest, lowest, Jarque-Bera, skewness, kurtosis, and standard deviation statistics, probability, total number of observations, sum, square of deviation, and summation of variable are all included.

Table 4.1 Result of Descriptive statistics

	UNEMP	ENROLMENT_ RATE	LITERACY_R ATE	LIFE_EXP	GDPPC	INDU	POPGR
Mean	4.037000	78.26729	62.56735	49.83142	1.358205	28.46193	2.569721
Median	3.876500	84.52607	69.02000	50.56450	1.437691	28.24839	2.641230
Maximum	5.742000	96.66244	86.17000	54.46200	12.21039	37.70961	2.802785
Minimum	2.989000	25.56576	0.770000	45.48300	-4.597233	18.17313	2.082978
Std. Dev.	0.592328	19.41712	22.26768	2.964677	3.474620	4.995174	0.239671
Skewness	1.273133	-1.322866	-1.832776	-0.188449	0.521815	0.159118	-1.088877
Kurtosis	4.583547	3.446207	5.728035	1.590951	4.211794	2.466738	2.750035
Jarque-Bera	12.73738	10.19858	29.57779	3.013916	3.623277	0.546327	6.807215
Probability	0.001714	0.006101	0.000000	0.221583	0.163386	0.760968	0.033253
Sum	137.2580	2661.088	2127.290	1694.268	46.17897	967.7057	87.37050
Sum Sq. Dev.	11.57814	12441.81	16363.04	290.0473	398.4085	823.4082	1.895594
Observations	34	34	34	34	34	34	34

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

4.1 Descriptive Analysis

The average unemployment rate (Unemp), average enrollment rate (enrollmentrate), average adult literacy rate (literacyrate), average life expectancy (lifeexp), average GDP per capita (GDPpc), average industrialization (IND), and average population growth (popgr) between 1991 and 2024 are, respectively, 4.037, 78.26, 62.56, 49.83, 1.35, 28.46, and 2.56, according to Table 4.1 above. LIFEEXP and Enrollment Rate, at 22.26768 and 19.41712, respectively, were variable, according to the average values standard deviation, but Unemp, life_exp, GDPpc, Ind, and POPgr were found to be of low fluctuation. In summary, every data set used in this investigation differed considerably from the mean, suggesting that each one was highly skewed by its extreme value. Unemp, GDPpc, INDU, and POPGR are skewed in a positive way according to the skewness metric, while ENROLMENTRATE, LITERACYRATE, and life_exp are skewed in a negative direction. Kurtosis, which measures the "tailedness" of a real-valued random probability variable and is equal to 3 in the normal case, can be either a peak or a floor on the normal curve, according to the study. When the result was larger or less than 3, it was considered leptokurtic or platykurtic, respectively. The analysis revealed that the distributions of enrollmentrate and IND were mesokurtic, whereas those of unemployment, GDPgr, and literacyrate were leptokurtic, life_exp, ind, and popgr were platykurtic. Jarque-bera is utilized to determine normality of variable's and, it is noticed that any insignificant of less than or equal to 5 percent demonstrates that residuals are normally distributed. To put it another way, unemployment, enrollment rate, literacy rate, POPGR, and INFL had a probability of Jarque-bera's statistic below 5 percent, however HEALTH_EXPENDITURE and IND were at 5 percent significance levels above.

4.1.2 Correlation Analysis: Correlation analysis quantifies the number of variables that occur or the extent of connection between the variables. The relationship coefficient of the link between factors used in the study is shown in Table 4.2 16 Table 4.3 demonstrates the strong positive relationship between the variables (GDPpc and ind), with a correlation coefficient of 0.88837. There was a reasonably high positive association between the other pair variables, such as enrollment rate and literacy rate.

(GDPpc and enrollmentrate),(GDPpc and literacyrate), (ind andenrollmentrate), and(ind and literarcyrate), had weak and moderately weak correlation. Unemp had only a positive strong correlation with GDPpc (0.5634), whereasPOPgr withGDPpc. Andpopgr.with IND did not reveal any linear relations. However, the relation between POPgr and GDPpc was found to be negative. The variables of life_exp were positive with GDPpc. The other variables have weak relationship.

Table 4.2: Result of Correlation Matrix

Variable	UNEMP	ENROLR	LITR	HEALTHEXP	POPGR	IND	INFL
UNEMP	1.000000						
ENROLR	-0.141332	1.000000					
LITR	0.071831	-0.170673	1.000000				
LIFE_EXP	0.206954	-0.297069	0.364553	1.000000			
GDPgr	-0.433824	0.222213	0.125844	0.102390	1.000000		
IND	-0.095462	0.133637	-0.107445	-0.546929	-0.284776	1.000000	
POPgr	-0.426539	0.465388	-0.208245	-0.558630	0.395369	-0.128764	1.000000

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

Table 4.2 shows the relationship between Nigeria's unemployment rate and human capital outcomes. **There was a negatively relationship**

between Nigeria's enrollment and unemployment rates. It suggested that there was a linearly negative correlation between Nigeria's primary school enrollment rate and unemployment.

In other words, because the coefficient was -0.141332, there was a linear association with a negative direction between unemployment and enrollment rate. This coefficient showed a "weak negative correlation" between the unemployment rate and enrollment rate because it was less than 0.5. On the other hand, a positive association was found between the rate of literacy and unemployment. That is, there was a linearly positive correlation between unemployment and literacy rate, the coefficient of the linear relationship between these variables was 0.071831, and because this coefficient was greater than 0.5, it denoted a "strong positive correlation" between joblessness and literacy rate. Additionally, there was a linear positive correlation (coefficient of 0.206954) between life expectancy and unemployment. The

coefficient was more than 0.5, indicating a "strong positive correlation" between life expectancy and unemployment.

In other words, a higher unemployment rate in Nigeria is associated with a lower life expectancy. Finally, the correlation study found a negative association (coefficient of -0.433824) between GDP per capita and unemployment in Nigeria. According to this, a unit increase in unemployment in Nigeria causes the GDP per capita to rise by 0.433824 (and vice versa for all data).

In other words, a higher unemployment rate in Nigeria is associated with a lower life expectancy. Finally, the correlation study found a negative association (coefficient of -0.433824) between GDP per capita and unemployment in Nigeria. According to this, a unit increase in unemployment in Nigeria causes the GDP per capita to rise by 0.433824 (and vice versa for all data).

4.1.3 Unit root test

Given that it was greater than 0.5, this coefficient showed a "strong negative correlation." Furthermore, industrialization and unemployment in Nigeria showed a "strong negative correlation" with a correlation of -0.095462 (less than 0.5). Conversely, there was a linear negative correlation (r = -0.426539) between unemployment and population growth. This resulted in a "strong negative correlation". Since the correlation between the independent variables is less than 0.8, no multicollinearity issues were found overall (Gujarati, 2003). In other words, determining whether and when a times series process of any kind has a "unit root" is one of the primary goals of a unit roots test. As a result, every series in the nation was examined. A clear outcome for each of these test processes is provided in Table 4.3 below.

Table 4.3: 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)**
Enrolment_rate	-2.314661	-2.957110	-10.79047	-2.957110	**I(1)**
Literacy_rate	-0.665421	-2.976263	-8.821812	-2.976263	**I(1)**
Life_exp	-1.216868	-2.960411	-3.466244	-2.967767	**I(1)**
GDPpc	-3.131355	-2.954021	---	---	**I(0)**
IND	-1.671319	-2.963972	-6.165165	-2.960411	**I(1)**
Popgr	-2.433583	-2.971853	-4.669939	-2.963972	**I(1)**

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

The stationarity test results utilizing the ADF method on the unit root are displayed in Table 4.3 above. The unit root test results in Table 4.3 show that whereas all other series on enrollment rate, life expectancy, literacy rate, industrial aztins, and population growth are stable at first difference i (1), unempRate (Unemp) and PerCapGrossDomeSticPro are stationary at level i (0). Since not all of the data series had stable values, cointegration analysis is necessary to investigate the long-term relationship between the variables. It was found that stationarity checks of variables employ mixed i(0) and i(1) series. When there is a mix of i(0) and i(1) variables in its sample, the ARDL technique makes sense because this model can manage any combination of I (0) and I (1) variables.

4.1.5 ARDL Cointegration Test

The ARDL Bounds Cointegration Test is commonly used to ascertain whether a selected set of variables has a long-term relationship, as was previously described. If the F-statistic is determined to be higher than the lower and upper critical values (1%, 5%, and 10%), then the null and alternative hypotheses are rejected, respectively, and a long-term link between the variable can be established. To ascertain whether particular variables have a long-term relationship, Pesaran Shin and Smith (2010) developed the ARDL Bounds cointegration technique. This method can be applied when a linear combination of variables is an i(0) or i(1) series, or when variables are stationary at their levels or at their first difference.

Table 4.5: ARDL Bounds Cointegration Test

Test Statistic	**Value**	**k**
F-statistics	19.31057	**6**
Critical Value Bounds,		
Significance	**I0 Bound**	**I1 Bound**
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

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

The results of the ARDL Bound test for cointegration are shown in Table 4.5 The F-statistic result of 19.31057 exceeds the crucial values at the upper bound of 10%, 5%, 2.5%, and 1%. Consequently, cointegration—a long-term relationship between the variables under study—is confirmed. Estimates for both short- and long-run models were thus produced.

4.2 Short-Run Analysis of the relationship between Unemployment rate and Human Capital outcome in Nigeria.

Table 4.6 displays the short-term analysis's findings. This is obvious from the estimations generated using the ECM model, as can be seen from the short term elasticity values.

Table 4.6: Result of ARDL short-run Estimates

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-2.251200	0.111413	-20.20596	0.0003
D(UNEMP(-1))	-2.312146	0.159805	-14.46853	0.0007
D(UNEMP(-2))	-2.900739	0.210958	-13.75030	0.0008
D(ENROLMENT_RATE)	0.003991	0.000778	5.126503	0.0144
D(ENROLMENT_RATE(-1))	-0.002973	0.001045	-2.843796	0.0654
D(ENROLMENT_RATE(-2))	0.003166	0.000931	3.401751	0.0424
D(LITERACY_RATE)	-0.002822	0.000182	-15.47720	0.0006
D(LITERACY_RATE(-1))	-0.007820	0.000745	-10.49265	0.0018
D(LITERACY_RATE(-2))	-0.002581	0.000603	-4.281740	0.0234
D(LIFE_EXP)	-0.319826	0.100476	-3.183125	0.0003
D(LIFE_EXP(-1))	-0.555483	0.155051	-3.582572	0.0372
D(LIFE_EXP(-2))	0.841924	0.145150	5.800380	0.0102
D(INDU)	-0.057357	0.006844	-8.380212	0.0036
D(INDU(-1))	0.068999	0.006272	11.00039	0.0016
D(INDU(-2))	0.031835	0.006302	5.051808	0.0150
D(GDPPC)	-0.050820	0.004730	-10.74530	0.0017
D(GDPPC(-1))	0.055372	0.004627	11.96787	0.0013
D(GDPPC(-2))	-0.001201	0.003644	-0.329728	0.7633

D(POPGR)	1.313307	0.429275	3.059361	0.0550
D(POPGR(-1))	-9.684538	0.629365	-15.38779	0.0006
D(POPGR(-2))	-5.488584	0.616317	-8.905450	0.0030
CointEq(-1)*	-2.083183	0.103448	-20.13758	0.0003
R-squared				0.995500
Adjusted R-squared				0.984999
F-statistic				94.80240
Prob(F-statistic)				0.000000

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

The table 4.6 provides the findings of ARDL short run model definition of the research. The coefficient of Unemployment Rate(Unemp) in current periods is -2.312146 that negative affect current Unemployment Rate in Nigeria. In Nigeria, the lagged2 unemployment rate has a statistically significant negative impact on the present unemployment rate (-0.301846, P value = 0.0000). However, the country's unemployment rate is negatively impacted by lagged 1 UnemploymentRate (-0.369206, P value = 0.0000). The effect of unemployment on itself during the lag times demonstrates how persistent it is. Negative shocks to the unemployment rate, for instance, have long-term detrimental effects. The impact of this shock on current unemployment in the lag 1 period (-0.369206, P value=0.0000) indicates that, on average, a one percent shock on unemployment in the preceding year would raise current unemployment in Nigeria by roughly 0.36 percent. Lag 2's unemployment rate likewise significantly and negatively impacted Nigeria's current unemployment rate (-0.301846, P value=0.0000). The association between School enrolmentRate (School Rate) and UnemploymentRate has a positive and substantial relation in both present periods and lag 2 periods. In contrast to earlier expectations, the current period's school enrollment coefficient was 0.003991, meaning that a one percent increase in the school enrollment rate results in a 0.003% rise in the unemployment rate. However, in lag 1, it is negatively significant, meaning that a one percent increase in school enrollment will result in a decrease in Nigeria's jobless rate; in lag 2, however, it has a negative and statistically significant impact on the unemployment rate (P Value=0.0122). This demonstrates that while school enrollment rises, unemployed people are unable to find work because there is a deficient and ineffective educational system that would generate competent, effective, and employable graduates.

The present unemployment rate falls as the literacy rate increases, as indicated by the literacy rate coefficient (literacy_rate) of -0.002014. This is in the predicted direction and is statistically significant (P value = 0.0000). Consequently, for every percentage increase in literacy, Nigeria's unemployment rate decreases by 0.002014 percent. The positive sign of the unemployment rate at lags 1 and 2 suggests that Nigeria's current jobless rate will significantly increase with a greater literacy rate at lags 1 and 2.

For example a good shock in literacy in past may leads to the increasing number of seekers of employment in the country in the current period. Al-Hasawi's study supported the aforementioned findings; nevertheless, Nigeria's literacy is improving in lags 1 and 2, but the country's literacy trend is currently declining. The current unemployment rate decreases by 0.312539 percent for every 1% increase in life_exp; during lag1 and lag2 periods, the unemployment rate decreases by (-0.229653) and (-0.032981), respectively, both of which are substantial. There appears to be a negative correlation between life expectancy and unemployment. This is not an exceptional conclusion because it is commonly believed that higher living standards will lower the unemployment rate. In our earlier estimates, life expectancy and the unemployment rate were found to be significantly correlated negatively. One could argue that as life expectancy increases, many people—including elderly workers who may have left the workforce—may choose to stay employed, which would have a negative impact on future unemployment rates. The idea that an increase in life expectancy may lead to an increase in unemployment at lags may seem surprising. In fact, while higher life expectancy is frequently associated with wealth, and wealth is associated with lower unemployment rates, it is possible that other factors associated with longer life expectancies—like high fertility and educational attainment—can result in higher unemployment rates through labor force growth or decreased participation among older workers. The coefficient of Industrialization(Ind.) has a value of -0.057357, at current levels which suggests an inverse relationship between the two variables; a1 percent increase in industrial growth causes a 0.057357% decline in the rate of unemployment. This outcome is expected and is consistent with the economic theory which states that a high level of industrial growth provides opportunities for a higher number of jobs and a reduction in the

unemployment rate. On the other hand, at lag 1, industrialisation has a significant positive impact on the Unemployment rate of the country, but lagged 2 shows it has a significant negative relationship (-0.045537, P Value=0.0353). However, since a greater focus on industrial efficiency may result in job displacement, a positive correlation between current period industrialization and unemployment would, at least in theory, suggest that it contributes to growth in output, even though it may also be accompanied by rising levels of involuntary unemployment. Nigeria's current unemployment rate decreases by 0.050820% with every 1% growth in GDP per capita. Atlag 1, however, GDP per capita significantly and negatively affected Nigeria's unemployment rate (0.071983, P Value = 0.0230). A positive correlation between GDP per capita and current unemployment may indicate both strong growth rates and rising unemployment, which may indicate a low economy's potential for absorption. This could happen if a capital-intensive industrial sector, which employs few people despite the sector's large expansion, is the only factor contributing to the growth rate (World Bank, 1996). High rates of population growth are positively correlated with the nation's 1.315223 unemployment rate. At lagged 1 and 2 the effect is negative and highly significant (-1.271032 and -1.524564) respectively. It shows that a 1% rise in population growth currently results in a 1.3% increase in unemployment, but its impacts in lags 1 and 2 have the opposite trend, which could have an impact on the long-term unemployment rate. With a t-statistic (-3.648408) at the 5% significant level, the error correction model's speed of adjustment is approximately 20.83%, suggesting that equilibrium was attained for almost 21% each time an error occurred. The model's overall fit, R2=0.999356, shows that the explanatory variables together account for around 99.94% of the fluctuations in Nigeria's unemployment rate. The F-statistic was 94.80240 with a probability value of 0.00000, and the adjusted R squared was 0.998301 adjusted by degrees of freedom. As a result, the model is reliable and appropriate for explaining the unemployment rate.

4.2.1 Long-Run Analysis of the relationship between Unemployment and Human Capital outcome in Nigeria.

Table 4.7 Result of Long-run estimates between human capital outcome and unemployment rate in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ENROLMENT_RATE	-0.008154	0.002546	-3.202591	0.0492
LITERACY_RATE	-0.019430	0.002658	-7.310931	0.0053
LIFE_EXP	-0.003907	0.001060	-3.685851	0.0346
INDU	0.098496	0.030887	3.188931	0.0498
GDPPC	0.070756	0.021546	3.283904	0.0463
POPGR	-2.444755	0.272900	-8.958421	0.0029

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

Enrolment Rate (ENR): According to the preceding table, the unemployment rate is significantly impacted negatively by the enrollment rate. Based on a coefficient value of-0.008 % and p-value of 0.0492 the finding implies that if enrolment rate increased by one percent it resulted in-0.008 percent drop in unemployment Rate and vice versa.

Literacy Rate (LIT) is predicted to have a major detrimental long-term effect on Nigeria's unemployment rate. According to a coefficient value of -0.019 and a p value of 0.0053, Nigeria's unemployment rate would eventually drop by -0.019 percent if the literacy rate increased by one percent.

Life Expectancy (LE): According to the coefficient value of -0.003, there is a substantial negative correlation between life expectancy and unemployment in Nigeria. For every 1% rise in life expectancy, the unemployment rate decreases by -0.003%, and vice versa.

The per capita gross domestic product (PCGDP) and industrialization (INDU) are thought to significantly reduce unemployment. Thus if the values increase by one percent, it led to the rise in unemployment by 0.09% and 0.07% respectively in Nigeria.

Life Expectancy (LE): According to the coefficient value of -0.003, there is a substantial negative correlation between life expectancy and unemployment in Nigeria. For every 1% rise in life expectancy, the country's unemployment rate decreases by -0.003%, and vice versa.

According to estimates, industrialization (INDU) and per capita gross domestic product (PCGDP) significantly reduce unemployment. Thus if the values increase by one percent, it led to the rise in unemployment by 0.09% and 0.07% respectively in Nigeria.

4.3 Analysis of Granger Causality To determine the direction of causation between variables, the Granger causality test is used (Granger, 1969). Since the variables are stationary for the Granger Causality test, this is accomplished by using first-difference.

Table 4.8 Result of Granger causality Test

Number of observations:32, Lags:2 Null Hypothesis	**F-Statistic**	**Probability Value**	**Remark**
ENROLMENT_RATE does not Granger Cause UNEMP	5.95910	0.0072	Unidirectional Causality
UNEMP does not Granger Cause ENROLMENT_RATE	0.26318	0.7706	
LITERACY_RATE does not Granger Cause UNEMP	1.00631	0.3789	No Causality
UNEMP does not Granger Cause LITERACY_RATE	0.48340	0.6219	
LIFE_EXP does not Granger Cause UNEMP	0.76131	0.4768	Unidirectional Causality
UNEMP does not Granger Cause LIFE_EXP	5.12761	0.0130	
POPGR does not Granger Cause UNEMP	7.84167	0.0021	Unidirectional Causality
UNEMP does not Granger Cause POPGR	0.42551	0.6577	
INDU does not Granger Cause UNEMP	0.50202	0.6108	No Causality
UNEMP does not Granger Cause INDU	1.26601	0.2982	
GDPPC does not Granger Cause UNEMP	0.38756	0.6824	No Causality
UNEMP does not Granger Cause GDPPC	0.00083	0.9992	

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

Granger Causality Tests in Pairs Table 4.8 provides a summary of the Pairwise Granger Causality Test results. There is a unidirectional causal relationship between school enrollment and the unemployment rate because we are testing at the five percent level. Stated differently, the current unemployment rate can be significantly explained by historical school enrollment numbers.

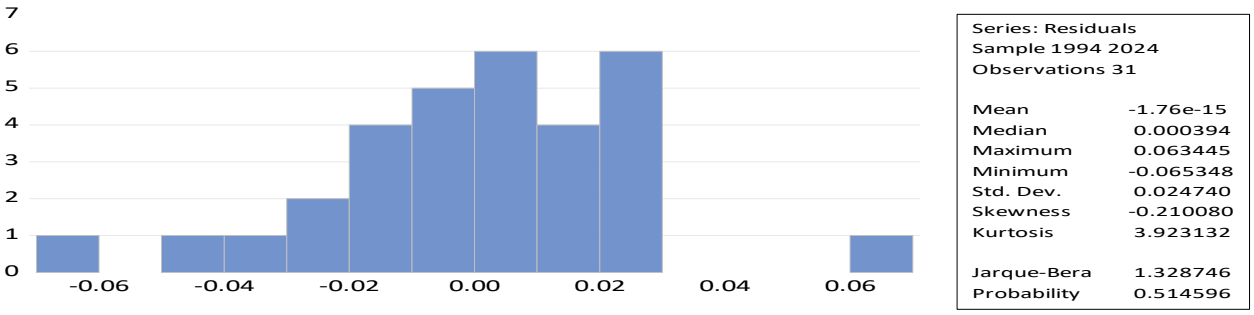
Conversely, we find no evidence that the school enrollment rate may be significantly predicted by past unemployment.

In other words, a one-way causal relationship between the unemployment rate and school enrollment is anticipated. None of causality could be obtained between unemployment rate and literacy rate. Unidirectional causality exist between population growth and unemployment rate as well as life expectancy and unemployment rate, so life expectancy and population growth predict the current jobless rate in the country. However, neither the gross domestic product per capita nor the unemployment rate are causally related to industrialization.

4.5 POST ESTIMATION/DIAGNOSTIC TESTS The purpose of the post-estimation test is to ensure that the model has no form of clear specification.

4.5.1 Normality Test

Figure 1.2: Test for Normality of the Residual



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

Figure 1.3 shows that the null hypothesis that the residuals are normally distributed cannot be rejected, with a Jarque-Bera statistic of around 1.328746 and a probability value of 0.514596. As a result, there are no anomaly issues with this model.

4.5.2 Breusch-Godfrey Test for Autocorrelation

The model's serial correlation was examined using the Breusch-Godfrey test results. Since the Prob. (F-statistic) is higher than 5%, the null hypothesis that there is no serial correlation is not rejected.

Table 4.9: Result of Autocorrelation Test

F-statistic	486.1179	Prob. F(2,7)	0.5321
Obs*R-squared	30.96815	Prob. Chi-Square(2)	0.6134

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

According to Table 4.9, the null hypothesis that there is no serial correlation cannot be rejected at the 5% significance level with an F-stat probability of 0.5321 and a Chi-square probability of 0.6134. As a result, the model is considered to be free of the serial correlation issue.

4.5.3 Breusch-Pagan-Godfrey Heteroskedasticity Test

The presence of serial correlation in the regression model was ascertained using the results of the Breusch-Godfrey test. Since the Prob. (F-statistic) is greater than 5%, the null hypothesis that there is no serial correlation is not rejected.

Table 4.10: Result of Heteroskedasticity Test

F-statistic	4.068571	Prob. F(22,9)	0.1364
Obs*R-squared	30.17591	Prob. Chi-Square(22)	0.3063
Scaled explained SS	0.413045	Prob. Chi-Square(22)	1.0000

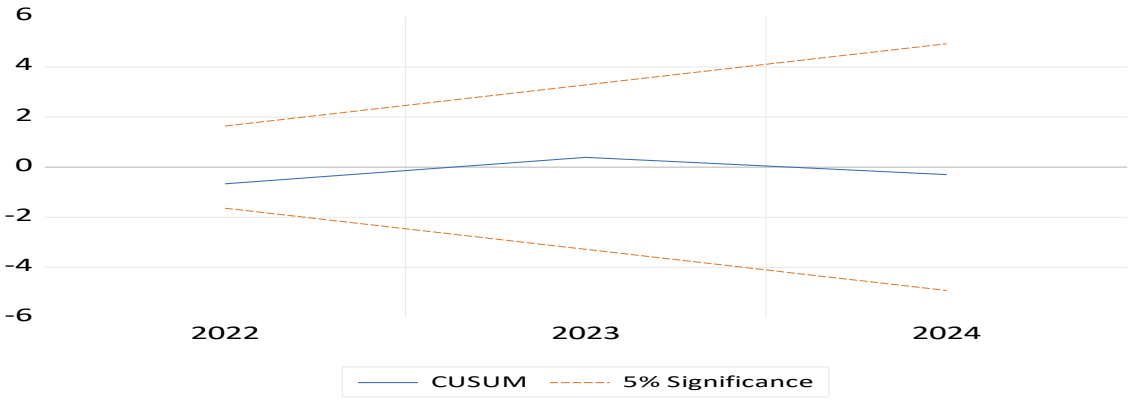
Source: *Author's computation using E-view 13*

Table 4.10 indicates that the null hypothesis of homoscedasticity cannot be accepted due to the F-stat probability of 0.1364 and the Chi-square probability of 0.3063. We therefore came to the conclusion that the model does not have a heteroskedasticity issue. 4.5.4 Test for Stability Plots of the cumulative sum (CUSUM) of recursive residuals and the cumulative sum squares (CUSUMSQ) test were used as stability tests to determine whether the model is structurally stable.

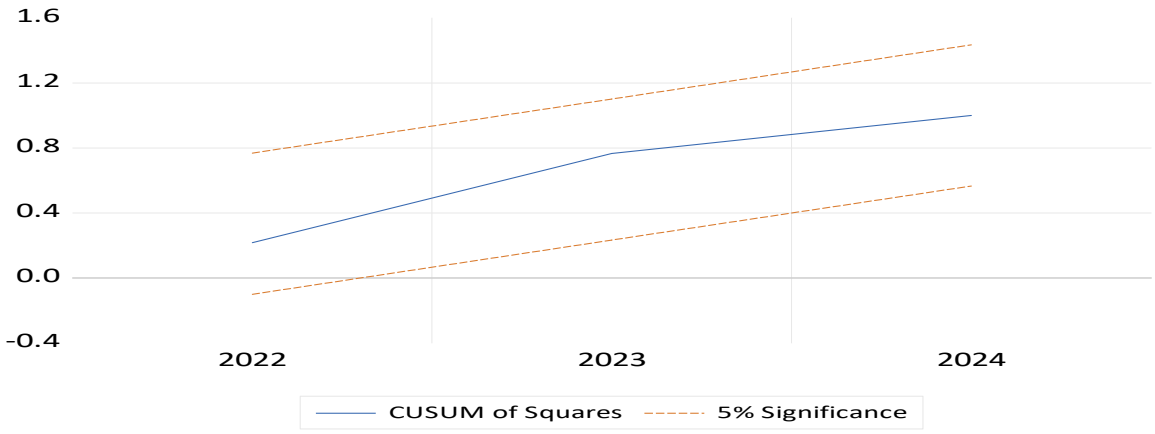
Figure 1.3 and 1.4

shows that the series is contained within the critical upper and lower bounds (shown by the red lines in the break).

These satisfy the model's structural stability requirements, which show that the model is appropriate for policy implications.



0Figure 1.4 Plot of Cumulative Sum of Squares of Recursive Residuals



Additionally, examining the cum sum (CUSUM) and cum sum of squares (CUSUMSQ) graph of the model's parameter derived via recursive estimate reveals that the parameter is stable and that there is no systematic trend for the coefficient at the sample's 5% significance level.

4.5.5 Ramsey RESET Based on the F-statistic with the null hypothesis that the model is adequately specified, the Ramsey test is used to assess the suitability of model specification. It is rejected if the estimated probability of the F-statistic is less than 0.05.

Table 4.11: Result of Ramsey RESET test

	Value	df	Probability
t-statistic	8.606559	2	0.4132
F-statistic	74.07285	(1, 2)	0.4132
Likelihood ratio	112.7949	1	0.2156

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

4.5 Model Specification Tests. Both the t-statistics and F-statistics probability have a probability of 0.4132 (t=0.8231, F=0.8231), as shown in Table 4.11 above; hence, they cannot be ignored. As a result, the null hypothesis for no specifications problem cannot be rejected, indicating that there are no issues with the model's fit and accurate specification of estimates.

4.6 Examining the Research Hypotheses According to the aforementioned estimates, we test the following hypothesis: H01: The unemployment rate in Nigeria is not significantly impacted by human capital outcomes.

In conclusion, we reject the null hypothesis H01 for the short-run and long-run, respectively, since the probability of human capital is less than the critical value of 0.05 P (t) = 0.0144, 0.0006, 0.0003 & 0.0492, 0.0053, 0.0346 <0.05, as shown in Tables 4.6 and 4.7, respectively. This demonstrates that the unemployment rate in Nigeria is significantly impacted by human capital outcomes. H02: The unemployment rate in Nigeria is not significantly impacted by the literacy rate Conclusion: The likelihood of literacy rate is less than the crucial value of 0.05 P (t) = 0.0006 in the short run and 0.0053<0.05 in the long run, according to Tables 4.6 and 4.7, respectively. As a result, we reject the null hypothesis H02 for both the short and long terms, respectively. This indicates that unemployment in Nigeria is significantly impacted by the literacy rate. H03: The unemployment rate in Nigeria and industrialization do not significantly correlate.

In summary, Tables 4.6 and 4.7 show that the probability value of industrialization is less than the critical value of 0.05 P (t) = 0.0036 and 0.0498<0.05 in the short-run and long-run, respectively.

We reject the null hypothesis H03, which contends that industrialization has a major impact on Nigeria's unemployment rate over the short and long terms. In conclusion, the probability value of industrialization is less than the critical value of 0.05 P (t) = 0.0036 and 0.0498<0.05 in the short-run and long-run, respectively, according to Tables 4.6 and 4.7. In both the short and long term, we reject the null hypothesis H03, which suggests that industrialization significantly affects Nigeria's unemployment rate. However, we observed a negative significant relationship between industrialization and unemployment in the short-run, while a positive significant relationship between industrialization and unemployment in the long-run was identified H04: There is no causal relationship between human capital outcome and unemployment rate in Nigeria. Conclusion: Based on the analysis shown in Table 4.8, we discovered that the probability values of F-statistic of pairs for (enrollmentrateunemp, Lifeexpunemp) are less than 0.05 percent (0.0072 & 0.7706; 0.4768 & 0.0130), while the probability values of F-statistic of pairs for (literacy_rateunemp) are above 0.05 percent (0.3789 & 0.6219), indicating a one-way causality between enrollment rate and unemployment rate.

In contrast, there is no direct relationship between the unemployment rate and the literacy rate. As a result, we only reject the null hypothesis of H04 for life expectancy and enrollment rates that have a unidirectional relationship with Nigeria's unemployment rate.4.8. Results Discussion The current analysis uses annual time series data from 1991 to 2024 to examine the relationship between the human capital outcome variables and Nigeria's unemployment rate.

To examine the general properties of variables in terms of their averages, variance, standard deviations, and correlations, descriptive statistics were used.

The study used the Augumented Dicker-Fuller (ADF) test to evaluate the sequence of integration in order to conduct unit root testing and guarantee reliable results for analysis. All of the variables are integrated of order 1, I(1), and I(0), respectively, according to the unit root analysis result. Using PesaranARDL Bounds test methods, the long-term and short-term relationships between variables have been examined. The enrollment rate had a favorable and large short-term influence on unemployment in Nigeria, but a long-term negative short-term impact, according to the results of the empirical investigation.

This result contradicts the findings of Syafri et al. (2021), Priambodo (2021), Syafri et al. (2021), and Mahararu and Yuliana (2023), who discovered that unemployment had a beneficial effect on the growth of economic and human capital. Empirical findings show that literacy has a substantial detrimental effect on unemployment both in the short and long term. This result is consistent with the Syafri et al. (2021) findings.

Life expectancy and unemployment in Nigeria are found to have substantial short-term detrimental effects and long-term favorable effects, respectively. According to [81,94], life expectancy and unemployment have a strong short-term detrimental impact but a significant long-term favorable influence. Nigerian unemployment was negatively and significantly impacted in the short and long terms by industrialization and GDP per capita, respectively.

This study shows that population increase has a considerable beneficial impact on unemployment, whereas inflation has a significant negative long-term impact on unemployment.

Finally, there is a unidirectional causal relationship between the enrollment rate and unemployment, meaning that past enrollment levels predict future unemployment levels. Additionally, there is a one-way causal relationship between population growth and unemployment as well as between life expectancy and unemployment. The unemployment rate and literacy rate did not appear to be causally related. Additionally, there is a relationship between industrialization, GDP per capita, and unemployment.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Finding

Highlights The findings:

1. The growth rate of enrollment had a short-term positive and significant impact on Nigeria's unemployment rates, but over time, it had a long-term negative impact. According to the consequences, Nigeria's jobless rates could eventually drop by 0.008% for every percentage rise in enrollment.

2.Further empirical findings showed that literacy rates have a diminishing but significant impact on Nigeria's unemployment rates over both short and long time periods, respectively. This implies that unemployment rates would drop by 0.002% or 0.019% for every percentage increase in literacy rates. 3. The study identified an upward impacting relationship between industrialization and the unemployment rate in Nigeria over the long term, but it also indicated a short-term negative influencing association.

4.

While there is no association between the unemployment rate and the literacy rate, the results have shown unidirectional relationships between the enrollment rate and the unemployment rate, as well as between life expectancy and the unemployment rate in Nigeria throughout the time under analysis. The current study used the auto-regressive distributed lag model and the cointegration test (ARDL) to determine the effect of human capital outcomes on Nigeria's unemployment rates. A descriptive statistical analysis of the sampled data was carried out.

However, testing of stationarity using the Augmented Dickey-Fuller (ADF) on GDP per capita and unemployment rate revealed a unit root that is rejected when estimated at level I (0). On the other hand, it was discovered that the rates of population growth, life expectancy, enrollment, literacy, and

industrialization were not I(0). Further, the first difference of the selected variables, demonstrated that the chosen variables were stationary at first difference (I(1)).

The study's empirical findings also suggested that an increase in school enrollment may lead to a short-term rise in unemployment rates but a long-term decline (a 1% increase would result in a -0.008% fall in Nigeria's jobless rate).

As well, literacy rates contributed to reducing the unemployment rate in Nigeria at short and long term periods (-0.002% and -0.019% decrease respectively in 1% point increment), with industrialization positively contributing to unemployment in long term, contrary to its negative impact at short duration. The causality between the selected variables indicated unidirectional relation from enrolment to unemployment rate, and life expectancy to unemployment rate, but no relationship between literacy rates and unemployment rate. Conclusion There are numerous ways to interpret the obtained result: In order for Nigeria to achieve sustained economic growth, job creation, and poverty reduction from improved human capital outputs, the government must create policies, mechanisms, and frameworks aimed at bridging the gaps that currently exist between schooling system output (human capital outcome) and job market demand. This is because enrollments have both positive short-term and long-term effects on unemployment in Nigeria.

5.3 POLICY RECOMMENDATIONS

Based on the findings and conclusions, policy efforts aimed at enhancing human capital development outcomes are suggested to assist lower Nigeria's unemployment rate. These activities should prioritize the following: i. The Nigerian government should concentrate on policies, tools, and procedures aimed at enhancing the quality and scope of the school curriculum for primary, secondary, and higher institutions, given that enrollment rates had a positive and significant influence on unemployment rates in short periods but a negative and significant influence in long periods.

Nigerian schools will start to incorporate curriculum topics that correspond with changing job markets in important industries including digital technology, renewable energy, digital payments, the creative arts, supply chains for agricultural value products, and technical skills.

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Appendix I

Annual Time series Data for Regression analysis

Year	Unemp	Enrolment rate	Literacy rate	Life exp	Popgr	Indu	GDPpc
1991	3.851	82.32250214	43.73	45.483	2.6411032	36.965566	-2.25751903
1992	3.81	86.74437714	67.65	45.587	2.6252876	37.7096082	1.92006635
1993	4.038	91.29586029	55.45	45.783	2.6501478	33.1743425	-4.59723301
1994	4.078	91.53790283	0.77	45.748	2.6413572	31.3183896	-4.37439194
1995	4.163	87.44753265	62.49	45.87	2.6366293	36.5404898	-2.67294759
1996	4.056	76.79721069	81.36	45.833	2.6142968	37.4454787	1.50723165
1997	3.977	44.45579147	71.19	45.96	2.6030871	35.2488501	0.29213187
1998	3.935	52.79673004	43.32	46.148	2.6133764	28.7024397	-0.06485321
1999	3.997	91.58309174	66.77	46.609	2.6359292	29.3636933	-2.03256097
2000	3.963	95.51016235	54.77	47.143	2.6743978	33.8230033	2.24461411
2001	3.91	92.52490234	0.77	47.549	2.7163955	‘28.2762663	3.07926732
2002	3.681	93.69761658	60.51	48.02	2.7414706	23.0408372	12.2103863
2003	3.648	94.8095932	78.13	48.618	2.7567351	26.0024149	4.42833468
2004	3.601	95.78090668	68.99	49.148	2.7705397	28.3900401	6.26527337
2005	3.734	96.30635071	64.25	49.538	2.7688339	28.2015834	3.53183711
2006	3.756	96.66243744	76.13	49.876	2.761247	25.7516356	3.1709281
2007	3.799	88.06884766	70.20	50.381	2.771801	24.3447178	3.67720698
2008	3.795	79.26875305	0.90	50.748	2.7845338	24.7142489	3.83258899
2009	3.766	80.30917358	74.50	51.08	2.7873082	21.2367615	5.06718321
2010	3.746	79.83003998	83.12	51.315	2.7951494	25.3174522	5.02853779
2011	3.77	84.68055725	78.69	51.49	2.8027852	28.2777999	2.39734842
2012	3.76	85.91259003	70.18	51.688	2.7742293	27.0730175	1.37822147
2013	3.711	87.83497023	51.60	51.827	2.7146899	25.7423212	3.81449208
2014	3.902	84.12165801	78.50	51.94	2.642214	24.6436086	3.53757268
2015	4.135	25.56575631	66.78	51.939	2.5361735	20.1607829	0.08197958
2016	4.499	78.87805176	70.75	52.189	2.4718324	18.1731317	-4.01892534
2017	4.828	46.89315033	86.17	52.397	2.4317094	22.3151172	-1.61585537
2018	5.067	81.62785137	79.16	52.669	2.3121726	25.7333066	-0.40683685

2019	5.206	44.12208939	79.84	53.009	2.1944019	27.382537	-0.01000476
2020	5.742	84.37158398	53.25	53.072	2.1302971	28.2205055	-3.864201
2021	5.45	83.8092556	73.73	53.455	2.0961869	31.407534	1.49716085
2022	3.821	45.44493866	63.16	54.079	2.0928169	30.7755687	1.11326739
2023	3.074	89.58711243	81.43	54.462	2.0983892	32.5844117	0.7242957
2024	2.989	40.48852921	69.05	53.615	2.0829778	29.6482359	1.29437207

Source:*World Bank Development Indicator 2024*

Appendix II

Descriptive statistic

	UNEMP	ENROLMENT_RATE	LITERACY_RATE	LIFE_EXP	GDPPC	INDU	POPGR
Mean	4.037000	78.26729	62.56735	49.83142	1.358205	28.46193	2.569721
Median	3.876500	84.52607	69.02000	50.56450	1.437691	28.24839	2.641230
Maximum	5.742000	96.66244	86.17000	54.46200	12.21039	37.70961	2.802785
Minimum	2.989000	25.56576	0.770000	45.48300	-4.597233	18.17313	2.082978
Std. Dev.	0.592328	19.41712	22.26768	2.964677	3.474620	4.995174	0.239671
Skewness	1.273133	-1.322866	-1.832776	-0.188449	0.521815	0.159118	-1.088877
Kurtosis	4.583547	3.446207	5.728035	1.590951	4.211794	2.466738	2.750035
Jarque-Bera	12.73738	10.19858	29.57779	3.013916	3.623277	0.546327	6.807215
Probability	0.001714	0.006101	0.000000	0.221583	0.163386	0.760968	0.033253
Sum	137.2580	2661.088	2127.290	1694.268	46.17897	967.7057	87.37050
Sum Sq. Dev.	11.57814	12441.81	16363.04	290.0473	398.4085	823.4082	1.895594
Observations	34	34	34	34	34	34	34

Covariance Analysis: Ordinary
Date: 11/07/25 Time: 20:44
Sample: 1991 2024
Included observations: 34

Correlation
Probability

	UNEMP	ENROLMENT_RATE	LITERACY_RATE	LIFE_EXP	GDPPC	INDU	POPGR
UNEMP	1.000000						

ENROLMENT_RATE	-0.141332	1.000000					
	0.4253	-----					
LITERACY_RATE	0.071831	-0.170673	1.000000				
	0.6864	0.3345	-----				
LIFE_EXP	0.206954	-0.297069	0.364553	1.000000			
	0.2402	0.0880	0.0340	-----			
GDPPC	-0.433824	0.222213	0.125844	0.102390	1.000000		
	0.0104	0.2065	0.4782	0.5645	-----		
INDU	-0.095462	0.133637	-0.107445	-0.546929	-0.284776	1.000000	
	0.5912	0.4512	0.5453	0.0008	0.1026	-----	
POPGR	-0.426539	0.465388	-0.208245	-0.558630	0.395369	-0.128764	1.000000
	0.0119	0.0055	0.2373	0.0006	0.0206	0.4680	-----

Unit root test (Augmented Dickey Fuller test)

Null Hypothesis: UNEMP has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.769797	0.0078
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEMP)
Method: Least Squares
Date: 11/07/25 Time: 20:04
Sample (adjusted): 1995 2024
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEMP(-1)	-0.492455	0.130632	-3.769797	0.0009
D(UNEMP(-1))	1.053250	0.184760	5.700632	0.0000
D(UNEMP(-2))	-0.368242	0.198384	-1.856205	0.0752
D(UNEMP(-3))	1.244814	0.437239	2.846986	0.0087
C	1.943337	0.524157	3.707545	0.0010

R-squared	0.597403	Mean dependent var	-0.036300
Adjusted R-squared	0.532988	S.D. dependent var	0.374830
S.E. of regression	0.256153	Akaike info criterion	0.264926
Sum squared resid	1.640355	Schwarz criterion	0.498458
Log likelihood	1.026116	Hannan-Quinn criter.	0.339635
F-statistic	9.274219	Durbin-Watson stat	2.247035
Prob(F-statistic)	0.000097		

Null Hypothesis: ENROLMENT_RATE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.314661	0.1737
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ENROLMENT_RATE)
Method: Least Squares
Date: 11/07/25 Time: 20:07
Sample (adjusted): 1993 2024
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ENROLMENT_RATE(-1)	-0.553894	0.239298	-2.314661	0.0279
D(ENROLMENT_RATE(-1))	-0.374112	0.186957	-2.001056	0.0548
C	42.57496	19.25496	2.211117	0.0351

R-squared	0.474168	Mean dependent var	-1.445495
Adjusted R-squared	0.437904	S.D. dependent var	25.58098
S.E. of regression	19.17885	Akaike info criterion	8.834554
Sum squared resid	10667.02	Schwarz criterion	8.971966
Log likelihood	-138.3529	Hannan-Quinn criter.	8.880102
F-statistic	13.07534	Durbin-Watson stat	1.882142
Prob(F-statistic)	0.000090		

Null Hypothesis: D(ENROLMENT_RATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.79047	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ENROLMENT_RATE,2)
Method: Least Squares
Date: 11/07/25 Time: 20:07
Sample (adjusted): 1993 2024
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ENROLMENT_RATE(-1))	-1.652570	0.153151	-10.79047	0.0000
C	-1.297349	3.628430	-0.357551	0.7232

R-squared	0.795130	Mean dependent var	-1.672514
Adjusted R-squared	0.788301	S.D. dependent var	44.60815
S.E. of regression	20.52456	Akaike info criterion	8.941583
Sum squared resid	12637.72	Schwarz criterion	9.033191
Log likelihood	-141.0653	Hannan-Quinn criter.	8.971948
F-statistic	116.4342	Durbin-Watson stat	2.102922
Prob(F-statistic)	0.000000		

Null Hypothesis: LITERACY_RATE has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.665421	0.8391
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITERACY_RATE)
Method: Least Squares
Date: 11/07/25 Time: 20:08
Sample (adjusted): 1998 2024
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LITERACY_RATE(-1)	-0.261022	0.392265	-0.665421	0.5138
D(LITERACY_RATE(-1))	-0.703434	0.357960	-1.965121	0.0642
D(LITERACY_RATE(-2))	-0.789087	0.310928	-2.537848	0.0201
D(LITERACY_RATE(-3))	-0.751815	0.265410	-2.832648	0.0106
D(LITERACY_RATE(-4))	-0.767820	0.226865	-3.384475	0.0031
D(LITERACY_RATE(-5))	-0.667905	0.174039	-3.837674	0.0011
D(LITERACY_RATE(-6))	-0.692758	0.130378	-5.313453	0.0000
C	20.00879	24.91214	0.803174	0.4318

R-squared	0.800687	Mean dependent var	-0.079259
Adjusted R-squared	0.727257	S.D. dependent var	29.19989
S.E. of regression	15.24960	Akaike info criterion	8.528178
Sum squared resid	4418.454	Schwarz criterion	8.912130
Log likelihood	-107.1304	Hannan-Quinn criter.	8.642347
F-statistic	10.90395	Durbin-Watson stat	2.005728
Prob(F-statistic)	0.000017		

Null Hypothesis: D(LITERACY_RATE) has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.821812	0.0000
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITERACY_RATE,2)
Method: Least Squares
Date: 11/07/25 Time: 20:08
Sample (adjusted): 1998 2024
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LITERACY_RATE(-1))	-6.100514	0.691526	-8.821812	0.0000
D(LITERACY_RATE(-1),2)	4.175766	0.616662	6.771565	0.0000
D(LITERACY_RATE(-2),2)	3.208280	0.512150	6.264342	0.0000
D(LITERACY_RATE(-3),2)	2.322588	0.377600	6.150929	0.0000
D(LITERACY_RATE(-4),2)	1.456605	0.234716	6.205827	0.0000
D(LITERACY_RATE(-5),2)	0.725274	0.119179	6.085567	0.0000
C	3.551824	2.951285	1.203484	0.2428

R-squared	0.926058	Mean dependent var	-0.081852
Adjusted R-squared	0.903875	S.D. dependent var	48.49591
S.E. of regression	15.03566	Akaike info criterion	8.477141
Sum squared resid	4521.424	Schwarz criterion	8.813099
Log likelihood	-107.4414	Hannan-Quinn criter.	8.577039
F-statistic	41.74701	Durbin-Watson stat	2.036725
Prob(F-statistic)	0.000000		

Null Hypothesis: LIFE_EXP has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.216868	0.6543
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIFE_EXP)
Method: Least Squares
Date: 11/07/25 Time: 20:08
Sample (adjusted): 1994 2024
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIFE_EXP(-1)	-0.020481	0.016831	-1.216868	0.2342
D(LIFE_EXP(-1))	0.813041	0.331089	2.455655	0.0208
D(LIFE_EXP(-2))	-0.393287	0.330868	-1.188651	0.2449
C	1.152701	0.831797	1.385796	0.1771

R-squared	0.216612	Mean dependent var	0.252658
Adjusted R-squared	0.129569	S.D. dependent var	0.272954
S.E. of regression	0.254658	Akaike info criterion	0.222122
Sum squared resid	1.750966	Schwarz criterion	0.407153
Log likelihood	0.557109	Hannan-Quinn criter.	0.282437
F-statistic	2.488559	Durbin-Watson stat	1.362257
Prob(F-statistic)	0.081769		

Null Hypothesis: D(LIFE_EXP) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.466244	0.0165
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIFE_EXP,2)
Method: Least Squares
Date: 11/07/25 Time: 20:11
Sample (adjusted): 1996 2024
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIFE_EXP(-1)	-2.528889	0.729576	-3.466244	0.0019
D(LIFE_EXP(-1),2)	1.472836	0.547621	2.689517	0.0126
D(LIFE_EXP(-2),3)	0.726488	0.341498	2.127355	0.0434
C	-0.014588	0.048200	-0.302646	0.7647

R-squared	0.343932	Mean dependent var	-0.047814
Adjusted R-squared	0.265204	S.D. dependent var	0.296816
S.E. of regression	0.254432	Akaike info criterion	0.227872
Sum squared resid	1.618385	Schwarz criterion	0.416465
Log likelihood	0.695852	Hannan-Quinn criter.	0.286937
F-statistic	4.368603	Durbin-Watson stat	1.310424
Prob(F-statistic)	0.013235		

Null Hypothesis: POPGR has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.433583	0.1421
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(POPGR)
Method: Least Squares
Date: 11/07/25 Time: 20:17
Sample (adjusted): 1997 2024
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPGR(-1)	-0.130304	0.053544	-2.433583	0.0240
D(POPGR(-1))	1.172066	0.183622	6.383030	0.0000
D(POPGR(-2))	-0.665747	0.274852	-2.422200	0.0246
D(POPGR(-3))	0.842122	0.280223	3.005186	0.0067
D(POPGR(-4))	-0.349966	0.253338	-1.381418	0.1817
D(POPGR(-5))	0.580820	0.233282	2.489777	0.0212
C	0.345752	0.143222	2.414107	0.0250

R-squared	0.810905	Mean dependent var	-0.018976
Adjusted R-squared	0.756877	S.D. dependent var	0.045434
S.E. of regression	0.022402	Akaike info criterion	-4.546985
Sum squared resid	0.010539	Schwarz criterion	-4.213933
Log likelihood	70.65778	Hannan-Quinn criter.	-4.445167
F-statistic	15.00918	Durbin-Watson stat	1.684943
Prob(F-statistic)	0.000001		

Null Hypothesis: D(POPGR) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.669939	0.0008
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(POPGR,2)
Method: Least Squares
Date: 11/07/25 Time: 20:18
Sample (adjusted): 1995 2024
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(POPGR(-1))	-1.125021	0.240907	-4.669939	0.0001
D(POPGR(-1),2)	0.274495	0.173341	1.583555	0.1249
C	-1.07E-05	0.004701	-0.002280	0.9982

R-squared	0.490957	Mean dependent var	0.000422
Adjusted R-squared	0.453250	S.D. dependent var	0.034806
S.E. of regression	0.025736	Akaike info criterion	-4.387203
Sum squared resid	0.017883	Schwarz criterion	-4.247084
Log likelihood	68.80805	Hannan-Quinn criter.	-4.342378
F-statistic	13.02033	Durbin-Watson stat	1.828209
Prob(F-statistic)	0.000110		

Null Hypothesis: GDPPC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.131355	0.0339
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPPC)
Method: Least Squares
Date: 11/07/25 Time: 20:45
Sample (adjusted): 1992 2024
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPPC(-1)	-0.463053	0.147876	-3.131355	0.0038
C	0.737450	0.551776	1.336503	0.1911

R-squared	0.240296	Mean dependent var	0.107633
Adjusted R-squared	0.215790	S.D. dependent var	3.333070
S.E. of regression	2.951622	Akaike info criterion	5.061278
Sum squared resid	270.0742	Schwarz criterion	5.151976
Log likelihood	-81.51109	Hannan-Quinn criter.	5.091795
F-statistic	9.805382	Durbin-Watson stat	2.140611
Prob(F-statistic)	0.003780		

Null Hypothesis: INDU has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.671319	0.4350
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INDU)
Method: Least Squares
Date: 11/07/25 Time: 20:22
Sample (adjusted): 1995 2024
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INDU(-1)	-0.215977	0.129226	-1.671319	0.1071
D(INDU(-1))	0.274347	0.207781	1.320368	0.1987
D(INDU(-2))	-0.404641	0.173364	-2.334060	0.0279
D(INDU(-3))	0.088964	0.191559	0.464418	0.6464
C	5.849545	3.632577	1.610302	0.1199

R-squared	0.318581	Mean dependent var	-0.055672
Adjusted R-squared	0.209554	S.D. dependent var	3.202895
S.E. of regression	2.847598	Akaike info criterion	5.081840
Sum squared resid	202.7203	Schwarz criterion	5.315373
Log likelihood	-71.22760	Hannan-Quinn criter.	5.156549
F-statistic	2.922042	Durbin-Watson stat	1.899188
Prob(F-statistic)	0.041219		

Null Hypothesis: D(INDU) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.165165	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INDU,2)
Method: Least Squares
Date: 11/07/25 Time: 20:23
Sample (adjusted): 1994 2024
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INDU(-1))	-1.340128	0.217371	-6.165165	0.0000
D(INDU(-1),2)	0.484015	0.162486	2.978814	0.0059
C	-0.186604	0.511969	-0.364482	0.7182

R-squared	0.591243	Mean dependent var	0.051584
Adjusted R-squared	0.562046	S.D. dependent var	4.294250
S.E. of regression	2.841852	Akaike info criterion	5.018554
Sum squared resid	226.1314	Schwarz criterion	5.157327
Log likelihood	-74.78759	Hannan-Quinn criter.	5.063791
F-statistic	20.25019	Durbin-Watson stat	1.934555
Prob(F-statistic)	0.000004		

Dependent Variable: UNEMP
Method: ARDL
Date: 11/07/25 Time: 20:48
Sample (adjusted): 1994 2024
Included observations: 31 after adjustments
Dependent lags: 3 (Fixed)
Dynamic regressors (3 lags, fixed): ENROLMENT_RATE
LITERACY_RATE LIFE_EXP INDU GDPPC POPGR
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
UNEMP(-1)	0.771037	0.430465	1.791173	0.1712
UNEMP(-2)	-0.588594	1.062686	-0.553873	0.6183
UNEMP(-3)	2.900739	1.383889	2.096078	0.1270
ENROLMENT_RATE	0.003991	0.002107	1.894242	0.1545
ENROLMENT_RATE(-1)	0.010023	0.003552	2.821594	0.0667
ENROLMENT_RATE(-2)	0.006139	0.006045	1.015489	0.3846
ENROLMENT_RATE(-3)	-0.003166	0.002085	-1.518267	0.2262
LITERACY_RATE	0.001653	0.003131	0.527964	0.6341
LITERACY_RATE(-1)	0.004790	0.002502	1.914341	0.1515
LITERACY_RATE(-2)	0.005239	0.001795	2.919104	0.0615
LITERACY_RATE(-3)	0.002581	0.002785	0.926599	0.4225
LIFE_EXP	-0.319826	0.493591	-0.647957	0.5632
LIFE_EXP(-1)	-0.555689	0.515712	-1.077520	0.3602
LIFE_EXP(-2)	1.397407	1.005312	1.390024	0.2587
LIFE_EXP(-3)	-0.841924	0.511294	-1.646655	0.1982
INDU	-0.057357	0.025778	-2.225014	0.1125
INDU(-1)	-0.078830	0.025082	-3.142856	0.0515
INDU(-2)	-0.037163	0.028102	-1.322440	0.2778
INDU(-3)	-0.031835	0.022284	-1.428613	0.2484
GDPPC	-0.050820	0.031156	-1.631138	0.2014
GDPPC(-1)	-0.041205	0.027363	-1.505868	0.2292
GDPPC(-2)	-0.056573	0.038238	-1.479486	0.2356
GDPPC(-3)	0.001201	0.016436	0.073094	0.9463
POPGR	1.313307	1.271231	1.033099	0.3775
POPGR(-1)	-5.904973	1.856227	-3.181169	0.0500
POPGR(-2)	4.195954	2.517615	1.666638	0.1942
POPGR(-3)	5.488584	1.279698	4.288968	0.0233
C	-2.251200	8.920424	-0.252365	0.8171

R-squared	0.998401	Mean dependent var	4.050290
Adjusted R-squared	0.984015	S.D. dependent var	0.618777
S.E. of regression	0.078234	Akaike info criterion	-2.787147
Sum squared resid	0.018362	Schwarz criterion	-1.491933
Log likelihood	71.20079	Hannan-Quinn criter.	-2.364940
F-statistic	69.39676	Durbin-Watson stat	3.470418
Prob(F-statistic)	0.002421		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(UNEMP)
Selected Model: ARDL(3, 3, 3, 3, 3, 3, 3)
Case 3: Unrestricted Constant and No Trend
Date: 11/07/25 Time: 20:49
Sample: 1991 2024
Included observations: 31

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.251200	8.920424	-0.252365	0.8171
UNEMP(-1)*	2.083183	0.885512	2.352517	0.1001
ENROLMENT_RATE(-1)	0.006531	0.001197	5.456756	0.0121
LITERACY_RATE(-1)	0.014263	0.004507	3.164714	0.0507
LIFE_EXP(-1)	-0.320033	0.058334	-5.486199	0.0119
INDU(-1)	-0.205186	0.045017	-4.557965	0.0198
GDPPC(-1)	-0.147397	0.081747	-1.803082	0.1692
POPGR(-1)	5.092872	2.069144	2.461342	0.0908
D(UNEMP(-1))	-2.312146	0.679868	-3.400872	0.0424
D(UNEMP(-2))	-2.900739	1.383889	-2.096078	0.1270
D(ENROLMENT_RATE)	0.003991	0.002107	1.894242	0.1545
D(ENROLMENT_RATE(-1))	-0.002973	0.005024	-0.591772	0.5956
D(ENROLMENT_RATE(-2))	0.003166	0.002085	1.518267	0.2262
D(LITERACY_RATE)	0.001653	0.003131	0.527964	0.6341
D(LITERACY_RATE(-1))	-0.007820	0.003184	-2.456304	0.0912
D(LITERACY_RATE(-2))	-0.002581	0.002785	-0.926599	0.4225
D(LIFE_EXP)	-0.319826	0.493591	-0.647957	0.5632
D(LIFE_EXP(-1))	-0.555483	0.625949	-0.887425	0.4402
D(LIFE_EXP(-2))	0.841924	0.511294	1.646655	0.1982
D(INDU)	-0.057357	0.025778	-2.225014	0.1125
D(INDU(-1))	0.068999	0.023329	2.957576	0.0597
D(INDU(-2))	0.031835	0.022284	1.428613	0.2484
D(GDPPC)	-0.050820	0.031156	-1.631138	0.2014
D(GDPPC(-1))	0.055372	0.031451	1.760564	0.1765
D(GDPPC(-2))	-0.001201	0.016436	-0.073094	0.9463
D(POPGR)	1.313307	1.271231	1.033099	0.3775
D(POPGR(-1))	-9.684538	2.210595	-4.380965	0.0220
D(POPGR(-2))	-5.488584	1.279698	-4.288968	0.0233

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ENROLMENT_RATE	-0.008154	0.002546	-3.202591	0.0492
LITERACY_RATE	-0.019430	0.002658	-7.310931	0.0053
LIFE_EXP	-0.003907	0.001060	-3.685851	0.0346
INDU	0.098496	0.030887	3.188931	0.0498
GDPPC	0.070756	0.021546	3.283904	0.0463
POPGR	-2.444755	0.272900	-8.958421	0.0029

EC = UNEMP - (-0.0082*ENROLMENT_RATE -0.0068*LITERACY_RATE + 0.1536*LIFE_EXP + 0.0985*INDU + 0.0708*GDPPC -2.4448*POPGR)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	19.31057	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43
			Finite	
Actual Sample Size	31		Sample: n=35	
		10%	2.387	3.671
		5%	2.864	4.324
		1%	4.016	5.797
			Finite	
			Sample: n=30	
		10%	2.457	3.797
		5%	2.97	4.499
		1%	4.27	6.211

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	2.352517	10%	-2.57	-4.04
		5%	-2.86	-4.38
		2.5%	-3.13	-4.66
		1%	-3.43	-4.99

ARDL Error Correction Regression
Dependent Variable: D(UNEMP)
Selected Model: ARDL(3, 3, 3, 3, 3, 3, 3)
Case 3: Unrestricted Constant and No Trend
Date: 11/07/25 Time: 20:51
Sample: 1991 2024
Included observations: 31

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.251200	0.111413	-20.20596	0.0003
D(UNEMP(-1))	-2.312146	0.159805	-14.46853	0.0007
D(UNEMP(-2))	-2.900739	0.210958	-13.75030	0.0008
D(ENROLMENT_RATE)	0.003991	0.000778	5.126503	0.0144
D(ENROLMENT_RATE(-1))	-0.002973	0.001045	-2.843796	0.0654
D(ENROLMENT_RATE(-2))	0.003166	0.000931	3.401751	0.0424
D(LITERACY_RATE)	-0.002822	0.000182	-15.47720	0.0006
D(LITERACY_RATE(-1))	-0.007820	0.000745	-10.49265	0.0018
D(LITERACY_RATE(-2))	-0.002581	0.000603	-4.281740	0.0234
D(LIFE_EXP)	-0.319826	0.100476	-3.183125	0.0003
D(LIFE_EXP(-1))	-0.555483	0.155051	-3.582572	0.0372
D(LIFE_EXP(-2))	0.841924	0.145150	5.800380	0.0102
D(INDU)	-0.057357	0.006844	-8.380212	0.0036
D(INDU(-1))	0.068999	0.006272	11.00039	0.0016
D(INDU(-2))	0.031835	0.006302	5.051808	0.0150
D(GDPPC)	-0.050820	0.004730	-10.74530	0.0017
D(GDPPC(-1))	0.055372	0.004627	11.96787	0.0013
D(GDPPC(-2))	-0.001201	0.003644	-0.329728	0.7633
D(POPGR)	1.313307	0.429275	3.059361	0.0550
D(POPGR(-1))	-9.684538	0.629365	-15.38779	0.0006
D(POPGR(-2))	-5.488584	0.616317	-8.905450	0.0030
CointEq(-1)*	-2.083183	0.103448	-20.13758	0.0003

R-squared	0.995500	Mean dependent var	-0.033839
Adjusted R-squared	0.984999	S.D. dependent var	0.368785
S.E. of regression	0.045168	Akaike info criterion	-3.174244
Sum squared resid	0.018362	Schwarz criterion	-2.156576
Log likelihood	71.20079	Hannan-Quinn criter.	-2.842510
F-statistic	94.80240	Durbin-Watson stat	3.470418
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

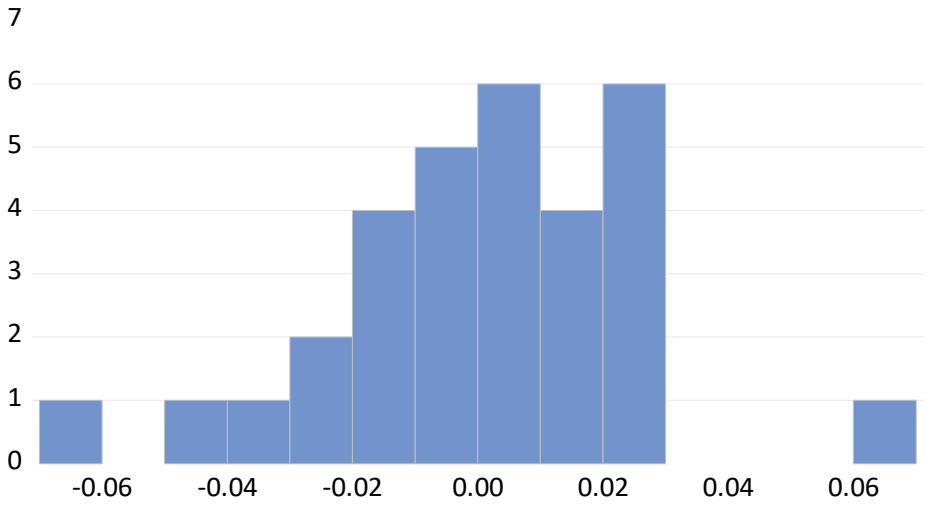
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	19.31057	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	20.13758	10%	-2.57	-4.04
		5%	-2.86	-4.38
		2.5%	-3.13	-4.66
		1%	-3.43	-4.99

Post-Estimation Tests

Normality Test



Series: Residuals	
Sample 1994 2024	
Observations 31	
Mean	-1.76e-15
Median	0.000394
Maximum	0.063445
Minimum	-0.065348
Std. Dev.	0.024740
Skewness	-0.210080
Kurtosis	3.923132
Jarque-Bera	1.328746
Probability	0.514596

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	486.1179	Prob. F(2,1)	0.5321
Obs*R-squared	30.96815	Prob. Chi-Square(2)	0.6134

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 11/07/25 Time: 20:54
Sample: 1994 2024
Included observations: 31
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEMP(-1)	0.097302	0.039929	2.436849	0.2479
UNEMP(-2)	-0.023401	0.080046	-0.292341	0.8189
UNEMP(-3)	0.703004	0.137769	5.102784	0.1232
ENROLMENT_RATE	0.001106	0.000126	8.754105	0.0724
ENROLMENT_RATE(-1)	0.002687	0.000303	8.864664	0.0715
ENROLMENT_RATE(-2)	0.001986	0.000541	3.672707	0.1692
ENROLMENT_RATE(-3)	-0.000768	0.000185	-4.158427	0.1502
LITERACY_RATE	0.001488	0.000388	3.831428	0.1625
LITERACY_RATE(-1)	0.000453	0.000151	3.005835	0.2045
LITERACY_RATE(-2)	0.000798	0.000158	5.062987	0.1241
LITERACY_RATE(-3)	-0.001236	0.000319	-3.878101	0.1607
LIFE_EXP	-0.162337	0.028901	-5.616963	0.1122
LIFE_EXP(-1)	0.146295	0.048665	3.006151	0.2044
LIFE_EXP(-2)	-0.244932	0.100046	-2.448192	0.2469
LIFE_EXP(-3)	0.215336	0.045207	4.763283	0.1317
INDU	-0.025604	0.002459	-10.41164	0.0610
INDU(-1)	-0.011907	0.002485	-4.792189	0.1310
INDU(-2)	-0.000738	0.002456	-0.300552	0.8141
INDU(-3)	-0.001635	0.001309	-1.249547	0.4297
GDPPC	-0.002250	0.001954	-1.151410	0.4553
GDPPC(-1)	-0.020742	0.003392	-6.115789	0.1032
GDPPC(-2)	-0.010890	0.003565	-3.054768	0.2014
GDPPC(-3)	0.017154	0.002336	7.342656	0.0862
POPGR	0.282187	0.071242	3.960949	0.1574
POPGR(-1)	-0.199186	0.110799	-1.797734	0.3232
POPGR(-2)	1.623453	0.209861	7.735853	0.0818
POPGR(-3)	-0.483809	0.073020	-6.625680	0.0954
C	-3.332466	0.918209	-3.629312	0.1712
RESID(-1)	-2.520667	0.142614	-17.67472	0.0360
RESID(-2)	-2.423167	0.252531	-9.595508	0.0661

R-squared	0.998972	Mean dependent var	-1.76E-15
Adjusted R-squared	0.969175	S.D. dependent var	0.024740
S.E. of regression	0.004344	Akaike info criterion	-9.538742
Sum squared resid	1.89E-05	Schwarz criterion	-8.151012
Log likelihood	177.8505	Hannan-Quinn criter.	-9.086376
F-statistic	33.52538	Durbin-Watson stat	2.952688
Prob(F-statistic)	0.135920		

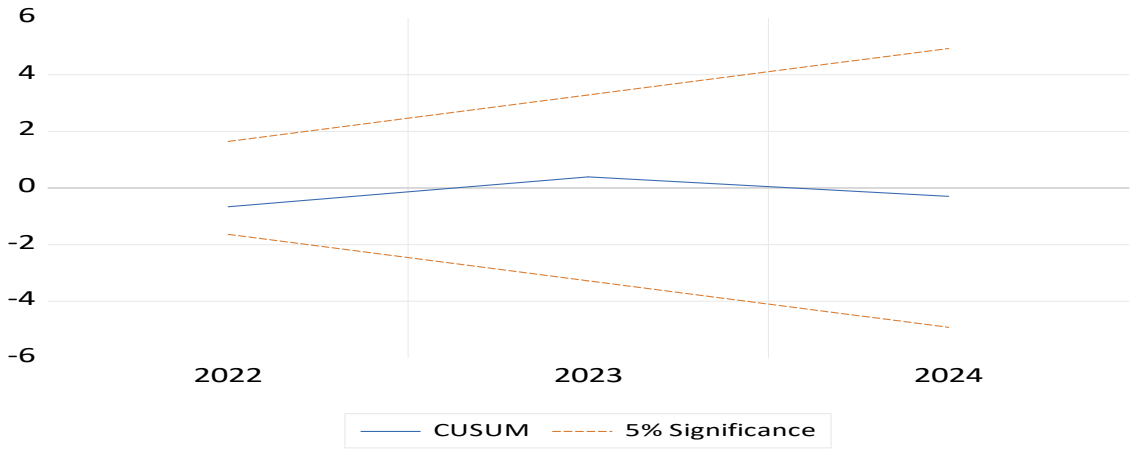
Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	4.068571	Prob. F(27,3)	0.1364
Obs*R-squared	30.17591	Prob. Chi-Square(27)	0.3063
Scaled explained SS	0.413045	Prob. Chi-Square(27)	1.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/07/25 Time: 20:55
Sample: 1994 2024
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.073790	0.060519	-1.219277	0.3099
UNEMP(-1)	0.004716	0.002920	1.614672	0.2048
UNEMP(-2)	-0.012623	0.007210	-1.750848	0.1783
UNEMP(-3)	0.005211	0.009389	0.555023	0.6176
ENROLMENT_RATE	-2.69E-05	1.43E-05	-1.880602	0.1566
ENROLMENT_RATE(-1)	-3.98E-05	2.41E-05	-1.651835	0.1971
ENROLMENT_RATE(-2)	-5.39E-06	4.10E-05	-0.131355	0.9038
ENROLMENT_RATE(-3)	-3.61E-05	1.41E-05	-2.550916	0.0839
LITERACY_RATE	2.32E-05	2.12E-05	1.090816	0.3551
LITERACY_RATE(-1)	-4.36E-05	1.70E-05	-2.566160	0.0828
LITERACY_RATE(-2)	-1.20E-05	1.22E-05	-0.986866	0.3965
LITERACY_RATE(-3)	-2.78E-05	1.89E-05	-1.473292	0.2371
LIFE_EXP	0.008185	0.003349	2.444245	0.0922
LIFE_EXP(-1)	0.002879	0.003499	0.822850	0.4709
LIFE_EXP(-2)	-0.012445	0.006820	-1.824753	0.1655
LIFE_EXP(-3)	0.002447	0.003469	0.705446	0.5314
INDU	0.000319	0.000175	1.824648	0.1656
INDU(-1)	3.66E-05	0.000170	0.214949	0.8436
INDU(-2)	0.000407	0.000191	2.133523	0.1226
INDU(-3)	-5.83E-06	0.000151	-0.038595	0.9716
GDPPC	-0.000237	0.000211	-1.119423	0.3445
GDPPC(-1)	-2.36E-05	0.000186	-0.126959	0.9070
GDPPC(-2)	-0.000161	0.000259	-0.619964	0.5792
GDPPC(-3)	9.18E-06	0.000112	0.082371	0.9395
POPGR	-0.005168	0.008624	-0.599237	0.5912
POPGR(-1)	0.002532	0.012593	0.201093	0.8535
POPGR(-2)	0.004912	0.017080	0.287566	0.7924
POPGR(-3)	0.005289	0.008682	0.609235	0.5854

R-squared	0.973416	Mean dependent var	0.000592
Adjusted R-squared	0.734164	S.D. dependent var	0.001029
S.E. of regression	0.000531	Akaike info criterion	-12.77343
Sum squared resid	8.45E-07	Schwarz criterion	-11.47821
Log likelihood	225.9881	Hannan-Quinn criter.	-12.35122
F-statistic	4.068571	Durbin-Watson stat	3.018556
Prob(F-statistic)	0.136410		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4
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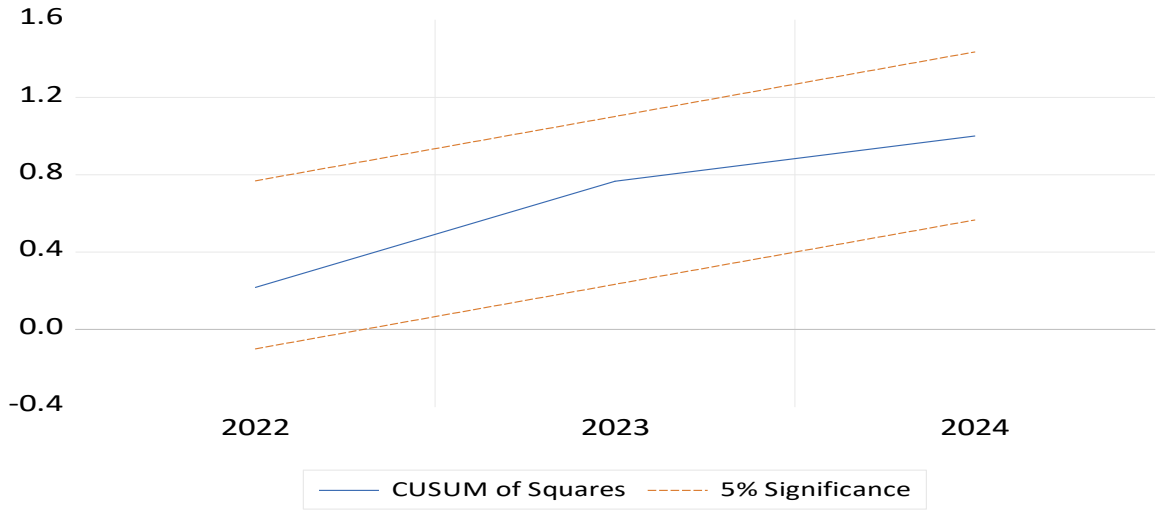
2023
2024
CUSUM
5% Significance


1.6
1.2
0.8
0.4
0.0
-0.4
2022
2023
2024
CUSUM of Squares
5% Significance

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: UNEMP UNEMP(-1) UNEMP(-2) UNEMP(-3)
ENROLMENT_RATE ENROLMENT_RATE(-1)
ENROLMENT_RATE(-2) ENROLMENT_RATE(-3)
LITERACY_RATE LITERACY_RATE(-1) LITERACY_RATE(-2)
LITERACY_RATE(-3) LIFE_EXP LIFE_EXP(-1) LIFE_EXP(-2)
LIFE_EXP(-3) INDU INDU(-1) INDU(-2) INDU(-3) GDPPC GDPPC(
-1) GDPPC(-2) GDPPC(-3) POPGR POPGR(-1) POPGR(-2)
POPGR(-3) C

	Value	df	Probability
t-statistic	8.606559	2	0.4132
F-statistic	74.07285	(1, 2)	0.4132
Likelihood ratio	112.7949	1	0.2156

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.010767	1	0.010767
Restricted SSR	0.018362	3	0.006121
Unrestricted SSR	0.007595	2	0.003797

LR test summary:

	Value
Restricted LogL	71.20079
Unrestricted LogL	84.88446

Unrestricted Test Equation:
Dependent Variable: UNEMP
Method: Least Squares
Date: 11/07/25 Time: 20:56
Sample: 1994 2024
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEMP(-1)	-1.851953	1.594194	-1.161686	0.3653
UNEMP(-2)	2.077583	1.791004	1.160010	0.3658
UNEMP(-3)	-8.076954	6.609841	-1.221959	0.3462
ENROLMENT_RATE	-0.008466	0.007581	-1.116661	0.3803
ENROLMENT_RATE(-1)	-0.025211	0.021111	-1.194221	0.3548
ENROLMENT_RATE(-2)	-0.020739	0.016657	-1.245074	0.3392
ENROLMENT_RATE(-3)	0.008340	0.007027	1.186766	0.3572
LITERACY_RATE	-0.007407	0.005919	-1.251460	0.3373
LITERACY_RATE(-1)	-0.010848	0.009494	-1.142602	0.3715
LITERACY_RATE(-2)	-0.013493	0.011214	-1.203233	0.3520
LITERACY_RATE(-3)	-0.004336	0.004657	-0.931114	0.4501
LIFE_EXP	0.584715	0.663113	0.881773	0.4709
LIFE_EXP(-1)	0.783890	0.893246	0.877575	0.4727
LIFE_EXP(-2)	-2.242913	2.302340	-0.974188	0.4327
LIFE_EXP(-3)	1.576624	1.491700	1.056931	0.4014
INDU	0.139861	0.118869	1.176599	0.3604

INDU(-1)	0.201365	0.167569	1.201686	0.3525
INDU(-2)	0.058278	0.060849	0.957754	0.4393
INDU(-3)	0.081421	0.069512	1.171317	0.3621
GDPPC	0.134925	0.113006	1.193965	0.3549
GDPPC(-1)	0.113644	0.094453	1.203186	0.3520
GDPPC(-2)	0.155579	0.129541	1.201003	0.3527
GDPPC(-3)	-0.014473	0.015945	-0.907666	0.4599
POPGR	-4.416868	3.547245	-1.245155	0.3392
POPGR(-1)	14.22431	12.04329	1.181099	0.3590
POPGR(-2)	-11.64282	9.612960	-1.211159	0.3495
POPGR(-3)	-11.61897	10.20957	-1.138047	0.3731
C	22.76503	16.43420	1.385223	0.3003
FITTED^2	0.333990	0.198347	1.683866	0.2342

R-squared	0.999339	Mean dependent var	4.050290
Adjusted R-squared	0.990082	S.D. dependent var	0.618777
S.E. of regression	0.061623	Akaike info criterion	-3.605449
Sum squared resid	0.007595	Schwarz criterion	-2.263977
Log likelihood	84.88446	Hannan-Quinn criter.	-3.168163
F-statistic	107.9603	Durbin-Watson stat	3.005733
Prob(F-statistic)	0.009217		

Pairwise Granger Causality Tests
Date: 11/07/25 Time: 20:56
Sample: 1991 2024
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ENROLMENT_RATE does not Granger Cause UNEMP	32	5.95910	0.0072
UNEMP does not Granger Cause ENROLMENT_RATE		0.26318	0.7706
LITERACY_RATE does not Granger Cause UNEMP	32	1.00631	0.3789
UNEMP does not Granger Cause LITERACY_RATE		0.48340	0.6219
LIFE_EXP does not Granger Cause UNEMP	32	0.76131	0.4768
UNEMP does not Granger Cause LIFE_EXP		5.12761	0.0130
INDU does not Granger Cause UNEMP	32	0.50202	0.6108
UNEMP does not Granger Cause INDU		1.26601	0.2982
GDPPC does not Granger Cause UNEMP	32	0.38756	0.6824
UNEMP does not Granger Cause GDPPC		0.00083	0.9992
POPGR does not Granger Cause UNEMP	32	7.84167	0.0021
UNEMP does not Granger Cause POPGR		0.42551	0.6577
LITERACY_RATE does not Granger Cause ENROLMENT_RATE	32	1.23028	0.3081
ENROLMENT_RATE does not Granger Cause LITERACY_RATE		1.94464	0.1626
LIFE_EXP does not Granger Cause ENROLMENT_RATE	32	3.04428	0.0642
ENROLMENT_RATE does not Granger Cause LIFE_EXP		0.41188	0.6665
INDU does not Granger Cause ENROLMENT_RATE	32	0.49616	0.6143
ENROLMENT_RATE does not Granger Cause INDU		1.40215	0.2634
GDPPC does not Granger Cause ENROLMENT_RATE	32	0.73734	0.4878
ENROLMENT_RATE does not Granger Cause GDPPC		3.16061	0.0584
POPGR does not Granger Cause ENROLMENT_RATE	32	3.31353	0.0517
ENROLMENT_RATE does not Granger Cause POPGR		0.13732	0.8723
LIFE_EXP does not Granger Cause LITERACY_RATE	32	5.85805	0.0077
LITERACY_RATE does not Granger Cause LIFE_EXP		0.30304	0.7410
INDU does not Granger Cause LITERACY_RATE	32	2.61165	0.0919
LITERACY_RATE does not Granger Cause INDU		1.57319	0.2258
GDPPC does not Granger Cause LITERACY_RATE	32	0.09251	0.9119
LITERACY_RATE does not Granger Cause GDPPC		3.03699	0.0646
POPGR does not Granger Cause LITERACY_RATE	32	2.54445	0.0972
LITERACY_RATE does not Granger Cause POPGR		0.25076	0.7800
INDU does not Granger Cause LIFE_EXP	32	2.81760	0.0774
LIFE_EXP does not Granger Cause INDU		0.44183	0.6474
GDPPC does not Granger Cause LIFE_EXP	32	0.32809	0.7231

LIFE_EXP does not Granger Cause GDPPC		1.88895	0.1707
POPGR does not Granger Cause LIFE_EXP	32	1.65354	0.2102
LIFE_EXP does not Granger Cause POPGR		3.14361	0.0592
GDPPC does not Granger Cause INDU	32	1.94718	0.1622
INDU does not Granger Cause GDPPC		0.08586	0.9180
POPGR does not Granger Cause INDU	32	1.09653	0.3484
INDU does not Granger Cause POPGR		1.70900	0.2001
POPGR does not Granger Cause GDPPC	32	2.61920	0.0913
GDPPC does not Granger Cause POPGR		0.04366	0.9574