ISLAMIC UNIVERSITY JOURNAL OF SOCIAL SCIENCES VOL 4, NO 4, JULY 2025

ISSN: 2709-2429(Print), 2709-2437(Online)-Published 30th July 2025

Public Social Services Investments and Nigeria's Life Expectancy at Birth: A Review of Short-Run ARDL Dynamics

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Abstract

Nigeria's government spending, between 2015 and 2024, averaged approximately 13.1% of GDP, though well below the 21.2% Sub-Saharan average and ~30% global average, but as increased. However, human capital index has continued to show poor outcomes – leaving life expectancy at birth far below 60 years. Aroused by this, the impact of public social services investment on Nigeria's life expectancy at birth from 1986 to 2023 is examined. As independent variables, government expenditures on education (GOXE), health (GOXH), research and development (GORD) capture public social service investments, while life expectancy at birth (LIEB) serves as dependent variable. Using secondary data sourced from the bulletin of Central Bank of Nigeria, the study adopts short-run autoregressive distributive lag dynamic econometric method for data analysis. Resultantly, the analysis reveals that government expenditures on education, health, research and development in the current, lags 1, 2 and 3 periods do not significantly impact on Nigeria's life expectancy. Consequently, the study concluded that public social service investments have not made reasonable contributions towards improvement of life expectancy at birth in Nigeria. Prioritizing budget toward social services and improving the efficiency and accountability of social spending on education, health, research and development are recommended as the way forward.

Keywords: Government Expenditure, Education, Health, Research and Development, Investment, Life Expectancy, ARDL.
JEL Code: C32, I10, I15, I20, Q16, J11

1. Introduction

Investment in public social services could be defined as government expenditures on social services (education, health, research and development, and other welfare services) which are important for increasing long-run earning abilities and productive capacities of the population especially for the poor and vulnerable (Bokhari, Gai, & Gottret 2017). Investment in social services is critical for fostering inclusive economic growth, reducing inequality, and ensuring social cohesion. Across the continent, governments invest significantly in sectors like healthcare, education, social protection, and care services, recognizing their essential role in supporting both individuals and the broader economy (World Bank, 2018; 2023).

Welfare systems in Europe, especially in Nordic and Western countries, are designed to redistribute income through progressive taxation and generous social benefits. Responsibly, Investments in social protection (pensions, unemployment benefits, family support) help reduce income inequality and prevent social exclusion. Social transfers reduce the at-risk-of-poverty rate by over 30% in many European Union countries. This indicates that

spending on education and healthcare increases productivity and prepares citizens for an evolving labour market. Countries like Finland and Sweden that invest heavily in education consistently perform well in OECD's PISA rankings (World Bank, 2023).

Investments in social services create jobs (especially for women) and enable more people to participate in the labour force. Social services stimulate demand by putting money in the hands of consumers (e.g., via pensions and family allowances) thereby increase their quality of life and life expectancy. The European Commission reports of 2023 underscored that public social spending has multiplier effects - particularly during downturns - helping to stabilize economies. As a supplement, it could be discerned that strong social safety nets reduce social tensions and improve trust in institutions. Inclusive welfare policies, through adequate investment in social services, contribute to lower crime rates and stronger democratic engagement. A case in point is the Scandinavian countries who, as a result of deliberate investment in social services, have among the highest levels of trust in government and the lowest levels of corruption and inequality in Europe.

According to the Organization for Economic Co-operation and Development report in 2023, there are EU-27 average public social expenditure is between the neigbourhood of 25% – 30% of their gross domestic product. In fact, the top spenders in social services are France, Denmark, Sweden, Germany, and Finland whose social protection accounts for about 40% of total government expenditure in the EU. In Europe, investing in social services is not just a moral or political decision – it is a strategic one that supports economic resilience, human development, and social peace. As challenges like automation, inequality, and aging increase, such investments are more important than ever.

Public social services investment in Africa is a critical component of the continent's development strategy, focusing on enhancing access to education, healthcare, social safety nets, and infrastructure. These investments aim to reduce poverty, promote economic growth, and improve the quality of life, life expectancy at birth in particular, for millions across the continent. The African Development Bank (AfDB) has been instrumental in financing social service projects across Africa. The bank's capital expanded significantly, with substantial investments in infrastructure and social sectors. Notably, the AfDB pledged €74 million in 2024 to support young and female entrepreneurs in Senegal, emphasizing the role of small and medium enterprises in economic development (World Bank, 2023).

In the Democratic Republic of Congo, the AfDB is accelerating the transformation of infrastructure and access to basic social services, benefiting over 19 million people by improving market access, food security, and economic activities. The World Bank has expanded its support for adaptive social protection approaches to build household resilience and enhance the shock responsiveness of social safety net systems. In the Central African Republic for example, the World Bank approved a $30 million grant in 2024 to support the Adaptive and Productive Social Safety Nets Project, aiming to scale up social protection for poor and vulnerable families. Additionally, in Sudan, the World Bank approved two projects totaling $182 million in 2025 to restore and enhance access to health services and provide emergency safety nets for vulnerable communities affected by conflict and natural disasters. The Global Fund has committed $1.3 billion to Africa between 2024 and 2025 to support human resources for health, with over 60% allocated to the remuneration of the health workforce. This investment aims to strengthen health systems, improve service delivery and life expectancy at birth across the continent.

Public social services investment in Nigeria encompasses a range of initiatives aimed at reducing poverty, improving healthcare, enhancing education, and fostering economic development. These efforts involve both government-led programs and collaborations with international partners. Given the importance of social service and its roles in economic development processes, the Nigerian government has several initiatives aimed at improving quality of life (life expectancy) of the citizenry. In 2016, the Federal Government of Nigeria established National Social Investment Programme (NSIP) to provide vocational training and stipends to unemployed youth. Additionally, the government of the day, introduced Conditional Cash Transfer (CCT) to serve as financial assistance to the poorest households. Government Enterprise and Empowerment Programme (GEEP) was equally launched to extend microloans to small businesses and artisans. Home Grown School Feeding Programme (HGSF) supplies meals to schoolchildren to boost enrollment and nutrition.

In 2022 there was National Health Insurance Authority (NHIA) Act which mandates health insurance coverage for all Nigerians, replacing the voluntary National Health Insurance Scheme. It seeks to provide universal healthcare access, especially for vulnerable groups, by collaborating with employers, government agencies, and private insurers. In 2024, President Tinubu approved ₦32.7 billion to expand these programs, aiming to reach 15 million households with cash transfers totaling ₦75,000 per household. In the same year,

the Federal Government approved ₦30 billion for the National Social Investment Programme (NSIP) to support approximately 70 million Nigerians. The program also initiated second-round payments to about one million verified recipients under the Direct Benefit Transfer (DBT) scheme.

Aryee, (2016) noted that Nigeria's social service initiatives have been bolstered by substantial international funding. Worthy of mention is that the World Bank, in 2024, approved $1.57 billion in financing for Nigeria. Of the total amount, $500 million was earmarked for the HOPE-GOV project to address governance issues in education and health delivery, $570 million for the Primary Healthcare Provision Strengthening Program (HOPE-PHC), and $500 million for the Sustainable Power and Irrigation for Nigeria Project (SPIN) (World Bank Mid Term Report, 2025). Additionally, the World Bank Support in 2025 was geared towards using $500 million for the Community Action for Resilience and Economic Stimulus (NG-CARES) Programme, $80 million for Accelerating Nutrition Results in Nigeria (ANRIN 2.0), and $500 million for the Hope for Quality Basic Education for All (HOPE-EDU). All were made for the purpose of economic development.

Nigeria's economic reforms have laid the groundwork for potential growth and stability, addressing persistent challenges such as inflation, energy supply, security and low life expectance at birth is crucial for sustainable development, but seem to have defiled the potency of economic growth. Economic theories (human capital theory, public goods and externalities and marginal returns and efficiency) suggest that strategic public investment in social services leads to improved life expectancy by enhancing human capital, reducing externalities, and addressing social determinants of health. However, the case of Nigeria’s life expectancy at birth seems not to be in receipt of this positive relationship. In fact, it has over decades remained within fifties (50s) – meaning that on the average a child born today is expected to live within 50 years, based on current health, social and economic conditions. More concerning is that this is the point such a child is expected to make significant contributions to the growth of the Nigerian economy – since the labour force of the country ranges between18 to 65 years.

A cursory look at the life expectancy rate experience of Nigeria has been reveals unpleasant scenario as it had remained within 50s. The Nigeria’s life expectancy at birth was 51.32 in 2010, it increased to 0.17 to 51.49 in 2011. In 2012, it slightly increased to 51.69, 51.83 in 2013, 51.94 in 2014 and 2015. It somewhat increased to 52.19 in 2016,

52.40 in 2017, 52.67 in 2018, 53.01 in 2019, 53.07 in 2020, 53.46 in 2021, 54.08 in 2022, 54.46 in 2023 and 64.05 in 2024 (World Bank, 2023). From the foregoing, it is evident that between 2010 and 2024, Nigeria's life expectancy at birth has shown a gradual upward trend, reflecting improvements in healthcare access, disease control, and public health initiatives, despite the huge investments done by public and private sectors. Despite these gains, Nigeria's life expectancy remains below the global average, highlighting the need for continued investment in healthcare infrastructure, education, and poverty alleviation to sustain and accelerate progress. Consequently, this study seeks to examine the impact of public social service investment on Nigeria's life expectancy at birth from 1986 to 2023. The rest of the paper is documented in four sections – section 2 covers literature review, methodology is treated in section 3, results and discussion are presented in section 4 and section 5 covers conclusion and recommendations.

2. Literature Review

Conceptual Clarification

Public Social Services Investment

Investment in public social services is an investment in social infrastructure to strengthen the economic well-being of the populace. Public social services also called welfare services or social work, involves any of the numerous publicly or privately provided services intended to aid the disadvantaged, distressed, or vulnerable persons or groups in a nation. In a similar manner, Asghar and Zahra (2022) argue that government expenditure on education had a positive and statistically significant impact on employment generation, while expenditures on health and other community services were also significant but had unexpected signs. Investments in health, education, and social protection significantly reduced the loss of Human Development Index (HDI) caused by inequality, indicating a strong redistributive effect (Adebiyi, 2016). He further argues that that using the Human Development Index as a proxy, expenditures in defense, health, and education positively and significantly influenced economic wellbeing in both the short and long term in Turkey.

Investment in public social services also known as government expenditure in education, health care and research and development refer to the allocated resources handled by the government for its own interest and the nation at large. It connotes the achievement of government roles. The roles of government include the provision of social services, protective and welfare functions, the achievement of these roles require huge number of

resources to be expended. Government expenditure on education is of two types, recurrent expenditure and capital expenditure. A report by the Levy Economics Institute in Turkey compared the effects of public investment in early childhood care and preschool education (ECCPE) to equivalent investments in the construction sector and posits that approximately 719,000 new jobs - 2.5 times more than the construction sector were created as a result of deliberate investment in social services by the government. Additionally, 85% of ECCPE jobs included social security benefits, compared to just over 30% in construction. In South Asia, Scafarto, Ricci and Scafarto, 2016) report that public health spending increased human development in the short term in Bangladesh and India, while education spending had a significant impact on the Human Development Index.

This supports the argument that public social service investment refers to government spending on essential services that aim to improve the well-being and quality of life of the population, particularly the most vulnerable groups. These services are usually non-profit, publicly funded, and aimed at promoting social equity and economic development. Effective investments in public social services have far-reaching implications for the Nigerian economy. A skilled and healthy workforce is essential for driving economic growth, attracting foreign investments, and fostering innovation and entrepreneurship.

Also, a well-educated and healthy population is more likely to escape the cycle of poverty, contributing to social stability and national development. In Nigeria, investments in public social services are crucial for achieving economic prosperity and social well-being. The country is blessed with a large population of young people that could serve as a demographic dividend if properly harnessed and developed. However, the reality is that the quality of human capital in the country is low due to various factors such as poor educational quality, inadequate health care, and limited opportunities for skills acquisition and employment. These challenges have hampered the country's development prospects, resulting in high poverty rates, unemployment, inequality, and social dislocation.

Life Expectancy at Birth

Life expectancy at birth is a statistical measure of the average number of years a newborn is expected to live, assuming that current mortality rates remain constant throughout their life. For example, if Nigeria's life expectancy at birth is 56 years. This means that a baby born in Nigeria today is expected to live, on average, 56 years, based on the current health and mortality conditions. In the global perspective, life expectancy at birth is widely

regarded as a universal benchmark of a country's overall health, development, and well-being. It serves not just as a demographic statistic, but also as a proxy for how effectively a society is meeting the basic needs of its people - such as access to clean water, nutrition, healthcare, and safety (World Bank, 2023). This implies that life expectancy at birth is more than just a number – it is a reflection of how healthy, safe, and equitable a society is. It is perceived as both a mirror of current living conditions and a tool for shaping policy and development goals.

Life expectancy at birth is a widely used demographic indicator that estimates the average number of years a newborn is expected to live if current mortality rates continue to apply throughout their life. World Health Organization (WHO, 2023) conceptualizes life expectancy at birth as the average number of years that a newborn could expect to live if he or she were to pass through life exposed to the age-specific mortality rates of a given period. United Nations (UN, 2024) opines that it is the number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality at the time of birth were to stay the same throughout the child's life. World Bank (2023) says that it indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. It is seen as the expected number of years of life for a newborn based on recent mortality patterns. From the foregoing, it could be discerned that life expectancy at birth is not a prediction of individual lifespan, rather it is a statistical average based on current death rates across all age groups in a population that helps assess overall health conditions, public health effectiveness, and development levels in a society.

2. Theoretical Review

Human Capital Theory

This theory was primarily propounded by Theodore W. Schultz and further developed by Gary S. Becker. Schultz (1979 cited in Aniekwu & Ozochi, 2020) introduced the idea that expenditures on education, training, and health should be viewed as investments in human capital, much like investments in physical capital. Becker (1992 documented in Roomi, 2023) expanded the theory to include on-the-job training, healthcare, and other forms of personal development, emphasizing the economic returns of investing in people. The central argument of the theory centres on human skills, knowledge, abilities, and health as forms of capital that contribute to productivity and economic growth - just like physical

assets. It argues that investments in human capital (e.g., education and health) lead to higher earnings and societal benefits.

The theory explains how individuals and societies derive economic value from investments in people - especially through education, training, health, and skills development. It further posits that individuals acquire knowledge, skills, abilities, and health through investment - just like physical capital (e.g., machinery) - which then enhances their productivity and economic outcomes (like income, employment prospects, and economic growth). Githaiga (2021) argues within the context of the theory that human capital represents the essential asset to service organizations, such as banks and professional firms, since the main output is created and delivered by human resources. The quality of services varies from one employee to another (Namasivayam *&* Denizci, 20*1*6). Bontis*,* (20*2*0) suggests that human capital represents an organization's knowledge stock held by its employees, while Maditinos*,* (20*2*1) views human capital as the "brainpower of the employee inside the company. In a broader sense, all these definitions suggest that human capital represents learning related concepts such as education, training, work experience, competences, and skills and psychological and social ideas, for instance, ability, attitudes and motivation.

Extant literature shows that human capital plays a critical role in firm innovativeness and customer satisfaction (Bornay-Barrachina, 2017; Aryee, 2016). While some studies have also linked an organization's investment in human capital to improve firm value and profitability (Hejazi, 2016*;* Li, 2014*)*. Therefore, a firm's expenditures on employees should be viewed as an investment rather than costs. Expenses on employees' education and training improve human capital rather than physical or financial capital (Bontis, 2020*)* leading to greater employee efficiency and improved organizational performance. Furthermore, firms with quality human capital are likely to have a competitive edge in the marketplace since a knowledgeable workforce is likely to develop new and innovative products (Delery & Roumpi, 2017).

Considering the importance of human capital, organizations invest massive resources on employee programs such as recruitment, training and development to equip its human resources with firm-specific skills and capabilities for competitive advantage and superior performance. Macro-level studies further show that human capital accounts for over three-quarters of the developed nation's wealth, thus depicting it as a necessary ingredient for economic development and sustainable development (Pelinescu 2015). In the same line of

argument, several studies have also shown that human capital fosters innovations and diffusion of technologies, hence stimulating total factor productivity and economic growth (Akhvlediani & Cieślik, 2019; Männasoo, Hein & Ruubel, 2018).

Social Capital Theory

Social Capital Theory focuses on the social networks, relationships, and social norms that facilitate cooperation and mutual benefit among individuals and groups. In the context of your research, social capital theory can be applied to analyze how social networks and community relationships influence human capital development outcomes in Nigeria. Investments in education and healthcare can enhance social capital by fostering community engagement and trust, leading to improved access to resources and opportunities. Using social capital theory, Bontis (2020) argue that corporate social capital - especially organizational network ties - positively influences sales revenue; government connections mainly benefit state-owned firms. Trust-based social capital, bonding ties, and participation boost entrepreneurial intentions via social innovation.

Structural-Functionalism Theory

Structural-Functionalism is a sociological theory that views society as a complex system with interconnected parts, each serving a specific function. In the context of this research, this theory can be used to examine how different components of human capital expenditure, such as education, healthcare, and vocational training, function within the larger societal structure of Nigeria. Analyzing these functions can provide insights into the overall impact of these expenditures on human capital development outcomes, including factors such as employment rates, literacy levels, and healthcare access. The adoption of theoretical framework in the management and social sciences greatly helps in the analysis and even understanding of concepts from some theoretical point of view and/or orientation.

The relationship between public social service investment and life expectancy at birth can be understood through several interrelated development and economic theories that explain how government expenditure influences human capital, health outcomes, and long-term wellbeing. By adopting human capital-social theories which argue that government expenditure on social services leads to improved education raises health awareness, while better health increases individual productivity and life expectancy. Government investments in education and healthcare are expected to improve the health status of the

population, thereby increasing life expectancy at birth and social service investments are forms of welfare-enhancing interventions that can reduce inequalities in access to health and social infrastructure, thus leading to improvements in life expectancy. Public expenditure on health and related services contributes to the health production function by providing individuals with resources to improve and maintain their health status, which in turn affects life expectancy. Investment in education, healthcare, and R&D fosters long-term human development, which is essential for achieving improvements in life expectancy and other sustainable development goals (SDGs).

Empirical Review

Many research works which have been undertaken to study the investments in public social services and human capital development outcomes in Nigeria have had conflicting findings in their results. For instance, in the study carried out by Adebayo and Adeniyi (2019) investigated the relationship between human capital development and economic growth in Nigeria using a vector autoregressive approach. It found that human capital development positively influences economic growth, emphasizing the need for increased investments in education, health, and skills development, while Adebayo and Adeniyi (2019) examined the impacts of human capital development on economic growth in Nigeria. It concluded that investments in education, health, and skills development significantly contribute to economic growth and development in the country. Similarly, they also investigated the relationship between human capital development and economic growth in Nigeria using a vector autoregressive approach. It found that human capital development does not positively influence economic growth, emphasizing the need for increased investments in education, health, and skills development.

A study conducted by Aregbeyen (2021) on public sector efficiency in delivering social services in India, Pakistan, and Bangladesh found that health spending had a positive short-term impact on human development in Bangladesh and India. Education spending showed significant long-term effects on the Human Development Index (HDI). The effectiveness of spending varied across countries, highlighting the need for country-specific strategies. Pelinescu (2015) did a study on the impact of socio-economic infrastructure investments on income inequality South Asian countries using data from 2007 to 2016. The analysis of the study reveals that investments in education, healthcare, communication technology, energy, and water infrastructures significantly reduced income inequality. The magnitude of these

effects varied, emphasizing the importance of optimal allocation of resources.

Männasoo, Hein and Ruubel (2018) analyzed the effects of government spending on education, health, and community services on employment generation. The found that education spending had a positive and statistically significant impact on employment. Health and community services spending were statistically significant but negatively signed, indicating potential inefficiencies or misallocations in these sectors. Utilizing an autoregressive distributed lag (ARDL) model, Muhammad and Kashif-ur (2025) estimated the effect between public investment in social services and income inequality in Nigeria (2023). The result revealed that total public expenditure as a percentage of GDP had a negative but insignificant effect on income inequality, suggesting that the composition of spending matters more than the aggregate amount.

Novignon, Olakojon& Nonvignon (2022) assess the relationship between government sectoral spending and human development in Nigeria. The study submits that spending on health and education positively influenced human development and investments in agriculture, water resources, and housing also contributed to improvements in HDI. Odumodu and Ewa (2017) examined that impact of public investment in the social sector and employment generation in Nigeria, 1980 – 2016. According to the study, education spending had a positive and statistically significant impact on employment. Health and community services spending were statistically significant but negatively signed, indicating potential inefficiencies or misallocations in these sectors.

Githaiga (2021) used an autoregressive distributed lag (ARDL) model to examine the effect of public investment in social services and income inequality in Nigeria. The study argues that total public expenditure as a percentage of GDP had a negative but insignificant effect on income inequality, suggesting that the composition of spending matters more than the aggregate amount. The study also assessed the relationship between government spending in various sectors and the Human Development Index (HDI). The study submits that spending on health and education positively influenced human development and investments in agriculture, water resources, and housing also contributed to improvements in HDI.

These studies collectively highlight the multifaceted benefits of investing in public social services, including employment generation, income inequality reduction, and

improvements in human development indicators. Studies reviewed show that the impact of public social service investment on economic development has extensively been explored. However, it is pertinent to point out that studies that delved into the impact of public social services investment on life expectancy were done in European and Asian countries, with a most recent one ending in 2020. To this end, it becomes imperative to argue that no study to the best of our knowledge has assessed the impact of public social service investment on Nigeria's life expectancy at birth from 1986 to 2024. This is the study gap that necessitated this study.

3. Methodology

Ex-post factor research design is adopted to examine the impact of public social service investment on Nigeria's life expectancy at birth, 1986 to 2023. The study variables include life expectancy at birth (LIEB) – which serves as a dependent variable, while government expenditure on education (GOXE), government expenditure on health (GOXH) and government expenditure on research and development (GERD) are the independent variables. The dependent variable is measured in percentage while the independent variables are measured in millions and billions and Nigerian currency (naira and kobo).

By relying on the theoretical framework which argues that investment in education, healthcare, and R&D fosters long-term human development, which is essential for achieving improvements in life expectancy and other sustainable development goals (SDGs). Consequently, the study adopts Bornay-Barrachina (2017); Delery and Roumpi (2017) with considerable modification by way of introducing certain unique variables, this study proposes a functional model that life expectancy at birth is a functionally dependent on public social service investment. Hence the functional impact is stipulated thus:

$$LIEB = f(GOXE, GOXH, GORD) \quad 3.1$$

Where:

LIEB = Life Expectancy at Birth, GOXE = Government Expenditure on Education, GOXH = Government Expenditure on Health, and GXRD = Government Expenditure on Research and Development.

From the functional relationship, the short run Autoregressive Distributive Lag (ARDL) natural log form econometric model is cast thus:

$$InLIEB_t = \alpha_0 + \alpha_1 InGOXE_{t1} + \alpha_2 InGOXH_{t2} + \alpha_3 InGORD_{t3} + \mu_t \quad 3.2$$

Where:

In = Natural log, LIEB, GOXE, GOXH and GORD retain their initial definitions, α_0 is the constant or the intercepts of the LIEB equation respectively, α_1, α_2 and α_3 are the slopes of regression lines of GOXE, GOXH and GORD in LIEB equation, t = time series dimension, and μ = stochastic term.

Autoregressive distributed lag (ARDL) method is often used to analyze dynamic relationships with time series data in a single-equation framework. It is an econometric configuration which allows having one dependent variable which is regressed on lags of itself and the independent variable. It uses standard least squares regressions to include lags of both the dependent variable and explanatory variables as regressors by examining cointegrating relationships between investments in public social services and human capital development outcomes in Nigeria. This is adopted because the Autoregressive Distributed Lag Model.

An ARDL (p,q) model assumes that a time series Y_t can be represented by a linear function of 'p' of its lagged values and 'q' lags of another time series X_t: such that,

$$InY_t = \beta_0 + \beta_1 InY_{t-1} + \beta_2 InY_{t-2} + \cdots + \beta_p InY_{t-p} + \delta_1 InX_{t-1} + \delta_2 InX_{t-2} + \cdots + \delta_q InX_{t-q} + u_t \quad 3.3$$

Consequently, at the event unit root test fail to converge or become stationary at level or have the same order of integration, the study will adopt the estimation of ARDL model as specified below:

From equations 3.2, and 3.3, we will proceed to estimate the Short-run Autoregressive Distributed Lag (ARDL) Model Form is Simplified thus:

$$\Delta Y_t = \alpha + \sum \beta_i \Delta Y_{t-I} + \sum \gamma_j \Delta X_{t-j} + \phi ECT_{t-1} + \epsilon_t \quad 3.4$$

Where:

Δ = First difference (captures short-run change), α is the intercept or constant of the regression line, Y represents the dependent variable (LIEB), X represents the three independent variables (GOXE, GOXH and GORD), ECT_{t-1} = Error Correction Term (long-run adjustment), ϵ_t = estimated error term, γ_j = Short-run coefficients (your focus)

Apriori Expectations: LIEB = $\alpha_1 > 0$, $\alpha_2 > 0$, and $\alpha_3 > 0$

4.1: Presentation Results and Discussion

Table 1: *Results of Descriptive Statistical Test*

	LIEB	GOXE	GOXH	GORD
Mean	49.10580	47.02837	117.3638	89.00257
Median	49.29700	3.552162	55.70000	68.80000
Maximum	53.63300	550.7792	437.5200	377.2600
Minimum	45.48700	-4.162060	0.004000	0.620000
Std. Dev.	2.802578	101.2381	138.6135	95.20962
Skewness	0.023165	3.762406	1.036759	1.223272

Kurtosis	1.439834	18.75744	2.814860	4.059395
Jarque-Bera	3.552883	444.6747	6.320055	10.36567
Probability	0.169239	0.000000	0.042425	0.005612
Sum	1718.703	1645.993	4107.734	3115.090
Sum Sq. Dev.	267.0511	348470.9	653266.3	308205.7
Observations	35	35	35	35

Source: *Authors' Computation, 2025*

To ascertain the behavioral dynamics of the time series data employed for this study, the results of descriptive statistics for the variables; Life Expectancy at Birth (LIEB), Government Expenditure on Education (GOXE), Government Expenditure on Health (GOXH), and Government Expenditure on Research and Development (GORD) were obtained. The results of this (presented in Table 1) shows that within the 38-year period (1986 - 2023), LIEB has a mean value 49.1 which provides a summary measure of the central tendency of the dataset – meaning that the average life expectance at birth is 49.1 when considering all observations.

This further suggests that the average number of years a newborn is expected to live in Nigeria, if current mortality rates at the time of birth remain constant throughout their lifetime is 49.1. The median value of 49.3 implies that given data set of LIEB, half of the values are below 49.3 and half are above it. The maximum value of 53.6 signifies the largest value of LIEB; while the minimum value of 45.9 shows the shortest expected life that an individual is expected to have in Nigeria. The standard deviation has the value of 2.3 – which means, on average, the value point of which the distribution deviates from the mean of LIEB. It further implies that the life expectance at birth fluctuates significantly by 2.3 around the average value of LIEB.

The positively skewed to the value of 0.023165 indicates the level of asymmetry of a distribution around its mean, and shows a perfectly symmetrical distribution because it rightly-skewed (longer tail on the right). This is because the values of mean and median of the dataset are almost equal; hence it could be argued that there is no major distortion in the data due to outliers and the variable is normally distributed and well-suited for further statistical analysis. Since the kurtosis value (1.439834) which is less than 2, it suggests that the distribution is not too peaked – it is platykurtic (flatter than a normal distribution with lighter tails and fewer outliers. The value of Jarque-Bera (3.552883) is greater than the 0.05

meaning that the data on series (LIEB) is normally distributed – indicating normality in the data analysis process.

GOXE has a mean value 47.0 which provides a summary measure of the central tendency of the dataset – meaning that the average government expenditure on education is ₦47million when considering all observations. It further suggests that the average among of money government spent on education within the period of the study is ₦47m. The median value of ₦3.55m implies that given data set of GOXE, half of the values are below ₦3.55m and half are above it. The maximum value of ₦550.78m signifies the largest value of GOXE; while the minimum value of ₦4.16m shows the minimum value of government expenditure on education in Nigeria from 1986 to 2023. The standard deviation has the value of 101.23 – which means, on average, the value point of which the distribution deviates from the mean of GOXE.

It further implies that the government expenditure fluctuates significantly by 101.23 around the average value of GOXE – indicating a high level of variability or spread in the dataset. The positively skewed to the value of 3.76 indicates the dataset is highly positively skewed – suggesting majority of the values are concentrated on the lower side. The value of kurtosis, 18.75744, is very high, which indicates that the dataset has extremely heavy tails and a sharp peak compared to a normal distribution. The value of Jarque-Bera (444.6747) is greater than the 0.05 meaning that the data on series (GOXE) is normally distributed – indicating normality in the data analysis process.

GOXH has a mean value 117.3638 which provides a summary measure of the central tendency of the dataset – meaning that the average government expenditure on health is ₦117.36million when considering all observations. It further suggests that the average among of money government spent on health within the period of the study is ₦47m. The median value of ₦55.70million, implies that given data set of GOXH, half of the values are below ₦55.70million half are above it. The maximum value of ₦437.52million signifies the largest value of GOXH; while the minimum value of ₦9.00million shows the minimum value of government expenditure on health in Nigeria from 1986 to 2023.

The standard deviation has the value of 138.6135 – which means, on average, the value point of which the distribution deviates from the mean of GOXH. It further implies that the

government health fluctuates significantly by 138.61 around the average value of GOXH – indicating a high level of variability or spread in the dataset. The positively skewed to the value of 1.04 indicates the dataset is moderately positively skewed and the distribution has a longer tail on the right side. The value of kurtosis, 2.8148604 is slightly less than 3, which indicates that the data distribution is very close to normal but with a slightly flatter peak and lighter tails. The value of Jarque-Bera (6.320055) is greater than the 0.05 meaning that the data on series (GOXH) is normally distributed – indicating normality in the data analysis process.

GORD has a mean value 89.00257 which provides a summary measure of the central tendency of the dataset – meaning that the average government expenditure on research and development is ₦89.00million when considering all observations. It further suggests that the average among of money government spent on research and development within the period of the study is ₦89m. The median value of ₦68.80million, implies that given data set of GORD, half of the values are below ₦68.80million half are above it. The maximum value of ₦377.26million signifies the largest value of GORD; while the minimum value of ₦0.62million shows the minimum value of government expenditure on research and development in Nigeria from 1986 to 2023. The standard deviation has the value of 95.20962 – which means, on average, the value point of which the distribution deviates from the mean of GORD.

It further implies that the government health fluctuates significantly by 95.21 around the average value of GORD – indicating a high level of variability or spread in the dataset. The positively skewed to the value of 1.22 indicates the dataset is moderately positively skewed and the distribution has a longer tail on the right side. The value of kurtosis, 4.06 is slightly above 3, which indicates that the data distribution is not very close to normal and not with a slightly flatter peak and lighter tails. The value of Jarque-Bera (10.36567) is greater than the 0.05 meaning that the data on series (GOXH) is normally distributed – indicating normality in the data analysis process.

Table 2: Presentation of ADF Unit Root Results

Variables	At Level				At 1st Differencing			Order of Integration
	ADF Statistics	5%Critical Value	Remarks		ADF Statistics	5% Critical Value	Remarks	

LIEB	1.327122	-2.945842	Not Stationary		-3.061953	-2.948404	Stationary	I(1)
GOXE	-3.535376	-2.945842	Stationary				Stationary	I(0)
GOXH	-3.382262	-2.954021	Not Stationary		-6.484210	-2.948404	Stationary	I(1)
GORD	0.646888	-2.945842	Not Stationary		-6.369424	-2.948404	Stationary	I(1)

Source: Authors' Computation, 2025

In order to ascertain the trend movements of the variables according to econometric standards, the Augmented Dickey-Fuller unit root test was performed. The diagnostic test result was presented in Table 2 above with the test for stationarity. The a priori expectation when using the ADF is that a variable is stationary when the value of the ADF test statistic is greater than the 5% critical value - only government expenditure on education (GOXE) became stationary at level. The other variables had to be differenced at first difference to become stationary. Thus, Augmented Dickey-Fuller unit root tests showed that the log of the variables life expectancy at birth (LIEB), Government Expenditure on Health (GOXH), and Government Expenditure on Research and Development (GORD) are all stationary after first differenced; government expenditure on education is stationary at level (ADF Statistics > 0.05 critical value) i.e there is a mixed order of integration.

Table 3: Result of Short-Run ARDL Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.356930	3.258993	2.564267	0.0201
LIEB(-1)*	-0.181360	0.071133	-2.549586	0.0207
GOXE**	8.61E-05	0.000564	0.152542	0.8806
GOXE(-1)	0.001733	0.001667	1.039245	0.3132
GOXE(-2)	0.007230	0.002874	2.515331	0.0222
D(LIEB(-1))	0.636365	0.249021	2.555463	0.0205
D(LIEB(-2))	0.104330	0.283995	0.367367	0.7179
D(LIEB(-3))	0.499152	0.272637	1.830829	0.0847
D(GOXH)	-0.001228	0.002254	-0.544894	0.5929
D(GOXH(-1))	-0.004699	0.002459	-1.911109	0.0730
D(GOXH(-2))	-0.004277	0.002107	-2.029656	0.0583
D(GOXH(-3))	-0.006697	0.002581	-2.594169	0.0189
D(GORD)	0.000662	0.001622	0.408380	0.6881
D(GORD(-1))	-0.002907	0.001975	-1.471875	0.1593
D(GORD(-2))	-0.005467	0.001990	-2.746796	0.0138
D(GORD(-3))	-0.004614	0.002623	-1.759268	0.0965
R^2 = 0.796924; Adj R^2 = 0.794210				
F-Statistic = 367.3016				
Prob(F-Statistic) = 0.0000				
CoinEq(-1)*	-0.181360	0.052398	-3.461235	0,0030

Source: Researchers' Computation, 2025

From the values of government expenditure on education are 8.61 indicating a positive relationship with life expectancy at birth. This result is in line with the apriori expectation which postulates that increase in government expenditure on education is expected to increase life expectancy at birth. The result further implies that one unit increase in government expenditures on education in the short run increased life expectancy at birth by 8.61 at the current year. By lagging the analysis by one (-1), the result revealed that one unit increase in government expenditure on education still increased life expectancy at birth 0.00 in the immediate past year, while that of past two years is 0.01 respectively; with none being significant in the short run. In line with the result of our study, Oluwatobi and Ogunrinola (2021) reported a positive relationship between government education spending and economic growth in Nigeria. It emphasizes the importance of allocating more funds to education to stimulate long-term development.

An increase in government spending on education in the previous period (e.g., last year) leads to an increase in life expectancy at birth in the current period – which happens within a short time frame, rather than over many years. Instructively, the result reveals that the health benefits of education spending are not instantaneous, but they begin to show after one time period - even in the short run. Lawal and Wahab, (2021) support that education spending increases GDP over time. Adegbite and Ayadi, (2020) argue for improved allocation and accountability in education funding. Thus, the increases in government spending on education in the previous years contributes to the present level of life expectancy. And Nurudeen and Usman (2020) find positive but insignificant effects of education expenditure on growth, suggesting inefficiencies in how funds are used.

By aligning with theoretical expectation is predicated on the fact that increased number of educated individuals are expected to be equipped with the right kind of knowledge that could enable them translate their earnings to improve their standard of living – all things remaining constant. Additionally, better-educated people make healthier lifestyle choices, because they have ability to increase their incomes, which allows access to better nutrition, healthcare, and living conditions. Baldacci, Clements, Gupta and Cui (2018) find that increased public spending on education and health significantly improves human capital and growth. Asghar and Zahra (2022) report short-run impacts are weaker but still significant in Pakistan. Although the probability of the t-statistics values shows that government expenditure on education has not significantly affected life expectancy at birth.

This indicates that government expenditure on education is not enough to gender increase in life expectancy at birth. This could be attributed misappropriation of budgeted government expenditure on education to other items and do have direct bearing on human capital development; hence it becomes near impossible for the available expenditure on education to absorb the geometrically increasing in population in Nigeria. Okonkwo (2024) shows that education spending stimulates long-term growth and welfare in Nigeria but warns that short-term effects may be minimal. Romp and Haan (2007) report mixed findings but suggest that quality and efficiency of spending matter as much as volume. However, Aregbeyen (2021) finds that recurrent education spending has a significant positive effect on Nigeria's economic growth, while capital expenditure shows mixed results.

With respect to government expenditure on health, the result revealed that in the current, lag 1, 2 and 3 (-1, -2 & -3) periods are -0.00, -0.00, -0.00 and -0.01, suggesting that one unit increase in government expenditure on health made life expectancy to fall in that numeric order within the period of study. This result appears worrisome at it defiled the theoretical expectation of having positive relationship with life expectancy at birth. This negative short run impact is not significance – which implies that government expenditure on health has no tendency to improve life expectancy at birth. It further reveals that in the short term, an increase in government expenditure on health is associated with a decrease in life expectancy at birth, or at least a slowing in its improvement. This may well be attributed to inadequately funding and improper utilization of budget allocation to the health sector.

If funds are misused, delayed, or allocated poorly (e.g., to administration instead of primary care), the impact might be negative or ineffective (Bokhari, Gai & Gottret (2017). Sometimes, governments increase health spending in response to a crisis (e.g., disease outbreaks) (Oluwatobi & Ogunrinola, 2021). These crises may temporarily reduce life expectancy, even though spending rises. If the health system is weak, as we have in the Nigerian state, even large expenditures may not translate into better health services or outcomes (Akinlo & Sulola, 2019), and in countries with poor governance, increased health budgets may not fully reach the intended health facilities or services, thus failing to improve - or even worsening - health outcomes. The result further shows that there is a

high degree non alignment between the actual findings and what theory predicts - suggesting that in the short run as government spends more on health, people do not tend to live longer. This aligns to the fact the existence of public investment, health policies, programmes and infrastructural improvements funded by the government do not improve health outcomes in the short run.

Additionally, in the short run, the positive relationship between government expenditure on health and life expectancy at birth is not significant as revealed by the t-statistic of 0.3132. This indicates that the data does not provide enough evidence that increases in spending are associated with changes in life expectancy at birth. A non-significant result implies that government health spending may not be directly or efficiently influencing life expectancy, pointing to issues in allocation, the role of other socio-economic factors, or measurement limitations (Omokugbo & Imogiemhe, 2020). It highlights the need for policy reassessment and broader, multi-sectoral approaches. In practical sense, this result reveals that the mere increase in spending by government on health may not be translating into better health outcomes – which could be attributed to inefficiencies, misallocation, or corruption in the health sector that leads to diversion of spending to areas that do not directly impact life expectancy at birth. This implies that Government expenditure activities on health is not enough to provide the adequate healthcare delivery.

By corroborating the findings of our study, Bokhari, Gai and Gottret (2007) report that government health spending significantly increases life expectancy, especially in low-income countries. Anyanwu and Erhijakpor (2019) argue that the impact is more pronounced when funds are targeted toward basic services. The study by Ogundipe, Lawal and Omojolaibi, (2024) find government health spending improves life expectancy, especially over time. Filmer and Pritchett (2019) find little correlation between government health spending and improved life expectancy - arguing that governance and efficiency matter more than spending volume. However, Novignon, Olakojo and Nonvignon (2022) argue that public health spending significantly improves life expectancy, but the effect is weaker when compared to other health indicators like infant mortality. Farag, Nandakumar, Wallack, Hodgkin, Gaumer, and Erbil (2023) opine that government health spending raises life expectancy, especially when combined with strong governance and low corruption. Akinlo and Sulola, (2019) maintain that increased public health spending has a positive but delayed impact on life expectancy, suggesting a long-run benefit more than a short-run gain.

Government expenditure on research and development from the short run ARDL result in the current, lag 1, 2 and 3 (-1, -2 & -3) are 0.000662, -0.002907, -0.005467 and -0.004614 respectively. This shows that government expenditure on research and development activities can result into the increase of the life expectancy at birth at current period. At this point, it is instructive to point out that one unit increase in government expenditure on research and development results to 0.000662 increase in life expectancy at birth. This shows how much life expectancy changes per unit change in R&D expenditure; that is, if the expenditure variable is measured in Nigerian local currency (Naira), then a ₦1 increase in R&D spending is associated with a 0.000662-year increase in life expectancy. This implies that in the short run, a unit increase in government R&D expenditure is associated with an increase of 0.000662 years (or approximately 0.24 days) in life expectancy at birth, holding other factors constant. The effect is positive but very small, meaning R&D spending helps, but its immediate, direct impact on life expectancy is modest. At the same current year, the coefficient value of 0.6881 is not statistically significant – suggesting that R&D does not have a measurable short-run impact on life expectancy in the short. Thought within outside the scope of this study, the real benefits of R&D are likely long-term, affecting life expectancy indirectly through innovations in healthcare, technology, and social development.

However, at the lags 1, 2 & 3, one unit increase in government expenditure on research and development results to 0.002907, 0.005467 and 0.004614 decrease in life expectancy at birth. These lagged coefficients represent the delayed effects of past government R&D spending on current life expectancy. So, lag 1 (-0.002907) means that a one-unit increase in government R&D spending one period ago (e.g., 1 year ago) is associated with a decrease of 0.002907 years (~1.06 days) in current life expectancy at birth. Lag 2 (-0.005467) indicates that a one-unit increase in R&D spending two periods ago decreases current life expectancy by 0.005467 years (~2 days); lag 3 (0.004614) suggests that a one-unit increase in R&D spending three periods ago increases current life expectancy by 0.004614 years (~1.68 days).

In the practical sense, this intuitively means that a ₦1 million increase in R&D spending 1, 2, or 3 years ago decreases life expectancy by 1.06, 2 and 1.68 days respectively. So, one unit of R&D spending leads to nearly 5 extra days of life expectancy over a 3-year lagged

period. This lag structure shows delayed benefits of R&D on life expectancy at birth. In other words, not proper funding of R&D does not impact life expectancy immediately. Instead, the benefits are delayed accumulate over time, peaking at lag 2 (possibly when innovations or policies mature). Consequently, governments should not expect immediate returns on R&D health-related investments. The positive impact grows over 1–3 years, reinforcing the need for sustained investment.

In support, the study by Omri, Kahouli, Afr and Kahia (2022) shows that health and R&D expenditures decrease infant mortality and increase life expectancy and health and R&D expenditures reduce CO2 emissions in all the estimated models. It further reveals that health and R&D expenditures can improve health outcomes through reducing CO2 emissions; and health and R&D expenditures have both direct and indirect effect on health outcomes. Policy implications and limitations are also discussed. R&D-driven medical progress, health care costs, and the future of human longevity, doubling pharmaceutical R&D expenditure adds about one extra year of life expectancy at age 40, especially for males - implicating the power of R&D in lifespan extension (Omokugbo & Imogiemhe, 2020; Omri, Kahouli, Afr & Kahia, 2022).

However, studying environmental quality, healthcare and R&D in Saudi Arabia (Pelinescu, 2015) argues that a 0.149-year increase in life expectancy per 1% rise in R&D spending, even controlling for public health expenditure. Romp and Haan (2007) confirms that higher R&D leads to statistically significant improvements in life expectancy, even after accounting for income and private/public health expenditures. Though focused on general health spending, it also accounts for health R&D; Scafarto, Ricci and Scafarto, (2016) find that public health and R&D spending co- cause life expectancy increases, with bidirectional Granger causality. Investing in health R&D yields long-term expectancy gains – potentially more cost-effective than short-term health spending.

The value of coefficient of determination, the R^2 is 0.796924 – indicating that, approximately, 79.7% of the variation in life expectancy at birth can be explained by changes in public social service investment (and possibly other explanatory variables included in the model). The model does a very good job of explaining life expectancy based on the predictors. But only 20.3% of the variation in life expectancy is due to other factors not captured in the model (e.g., genetics, lifestyle, environmental factors, etc.). A R^2

of 0.797 suggests that government social spending is strongly associated with longer life expectancy. Nearly 80% of the changes in life expectancy are explained by public social service spending – suggesting that government spending on health, education and research and development plays a major role in improving population health. Thus, investing in social services is not just socially beneficial - it is economically efficient for improving human capital and implies high returns on investment in human development, justifying sustained or increased public expenditure in these areas. The F-statistic of 367.3016 means that the model as a whole (i.e., all the included variables like public health, education, research and development) significantly explains the variation in life expectancy at birth. It indicates that the model has a very strong explanatory power – with a very low p-value (usually $p < 0.0000$), meaning the results are statistically significant. In essence, it confirms that the model is not due to random chance.

The value –0.181360 in the context of a short-run ARDL (Autoregressive Distributed Lag) model most likely refers to the coefficient of the Error Correction Term (ECT), which indicates the speed at which the dependent variable (e.g., life expectancy at birth) returns to equilibrium after a short-run shock caused by changes in variables like public social service investment. A coefficient of –0.181360 means that approximately 18.14% of the deviation from long-run equilibrium is corrected (or "adjusted") each period (e.g., each year) following a shock. The negative sign is crucial - it means that the system is converging back to long-run equilibrium (which is a good sign). A -0.181360 coefficient suggests that it will take several periods (roughly 5 - 6 periods) for full adjustment to occur after a shock. If a sudden increase in public social service investment temporarily boosts life expectancy above its long-run trend, the ECT coefficient of –0.181360 indicates that life expectancy will return toward the trend gradually - by 18.14% per year.

Despite theoretical expectations and policy frameworks emphasizing the critical role of social sector spending in improving human well-being, the empirical evidence suggests a weak or non-robust linkage between these public expenditures and life expectancy outcomes within the Nigerian context. This lack of significance may be attributed to several possible factors, including inefficiencies in public spending, corruption, poor implementation and monitoring mechanisms, misallocation of resources, or time-lagged effects that may not be immediately observable within the analyzed timeframe. Additionally, other socio-economic determinants - such as poverty, inequality,

environmental quality, access to basic infrastructure, and political stability - might exert a more pronounced influence on health and longevity outcomes than government expenditure levels alone. Overall, while investment in public social services remains crucial, the study underscores the need for not just increased spending, but also enhanced effectiveness, targeting, transparency, and policy alignment to translate such investments into measurable improvements in population health and longevity.

Table 4: Serial Correlation LM test of the selected ARDL Model

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.410515	Prob. F(2,15)	0.0601
Obs*R-squared	10.31546	Prob. Chi-Square(2)	0.6958

Source: Authors' Computation, 2025

Serial correlation test was conducted using the Breusch-Pagan Serial correlation LM test. From Table 4.6 above, it can be seen that the probability, Prob.F (0.6958) is greater than 0.05 at 5% significant level. The study therefore argues that the residual in the short-run ADRL model is not serially correlated. From the results the findings indicates that government investment in social services and human capital development has not been significantly accounted for significant change in life expectancy at birth. The results indicate that government expenditure of education is though positive but not significant enough to enhance the life expectancy of the populace, government expenditure on health and research and development are not significant enough to contribute to factors that can enhance the life expectancy of her citizens.

5. Conclusion and Recommendations for Policy Actions

This study reviews the short-run ARDL dynamic effects of public social services investment on Nigeria's life expectancy at birth. This is done by considering, specifically, the effects of government expenditure on education, health, research and development, as the indices for public social service investments, on life expectancy at birth from 1986 to 2023. With data sourced from the statistical bulletin of the Central Bank of Nigeria, the findings reveal that public investment in social services - specifically government expenditures on education, health, and research and development - did not have a statistically significant effect on life expectancy at birth in Nigeria during the period from 1986 to 2023. Despite theoretical expectations and policy frameworks emphasizing the critical role of social sector spending in improving human well-being, the empirical

evidence suggests a weak or non-robust linkage between these public expenditures and life expectancy outcomes within the Nigerian context.

The study therefore concluded that public social service investments in terms of government expenditures on education, health, research and development have not made reasonable contributions towards improvement of life expectancy at birth. The study thus argues that the importance of human capital development cannot be over emphasized, in this light, the followings are recommendations that can be adopted to ensure these investments are effective enough – prioritize budget toward social services and improve the efficiency and accountability of social spending on education, health, research and development, addressing structural and institutional bottlenecks, enhance intersectoral collaboration, enhance quality of education, strengthen healthcare systemsand supporting vocational training and skill development.

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