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Does Public Debt Matter for Human Capital Development? Evidence from Nigeria

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Ebele S. Nwokoye
Department of Economics, Nnamdi Azikiwe University Awka, Nigeria
E-mail: es.nwokoye@unizik.edu.ng

Stephen K. Dimnwobi
(Corresponding Author)
Department of Economics, Nnamdi Azikiwe University Awka, Nigeria
E-mail: stephenkcdim@gmail.com

Favour C. Onuoha
Department of Economics, Evangel University Akaeze, Nigeria
E-mail: fc.onuoha@evangeluniversity.edu.ng

Chekwube V. Madichie
Department of Economics and Related Studies,
University of York, United Kingdom
E-mail: cvm509@york.ac.uk

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Abstract

An inquiry into the impact of external and domestic borrowings is considered timely for Nigeria, given the growing public debt profile amid deteriorating human capital development. Using data from 1990 to 2021, the study estimates the effects of domestic and external debts on Nigeria's human capital development. The study employed the fully modified ordinary least squares (FMOLS) and canonical cointegration regression (CCR) as the main estimation technique and the robustness check respectively. The study discovered that domestic and external debt, economic growth and debt servicing exert positive and significant influence on human capital development in Nigeria while environmental pollution has an inverse and significant impact on human capital development in Nigeria. Premised on the outcomes, policy suggestions aimed at enhancing human capital development in Nigeria have been put forward.

Keywords: Nigeria, Domestic debt, External debt, Human capital development

JEL Classifications: H63, H68, I24, O15

1. Introduction

Public debt is one of the major tenets of the financial stability and macroeconomic performance of any nation (Organisation for Economic Co-operation and Development - OECD, 2012). As noted by the OECD (2012), public debt can transmit directly or intensify shocks through economic agents' reactiveness to adjustments in macroeconomic situations. Hence, the means of accumulating public debt as well as its repayment procedures affect savings culture, human capital development, consumption models, investment climate, the type of international relations and the financial sector performance (Karazijienė, 2015; OECD, 2012; Saungweme & Odhiambo, 2020). Since the start of the global financial shock from 2007 to 2015, public debt composition and structure in both developed and developing nations have changed rapidly (Ostry, Ghosh & Espinoza, 2015). For instance, public debt increased from an average of 36% to 49% of gross domestic product (GDP) in developing nations while in developed countries, it rose from an average of 70% to 105% of the GDP (International Monetary Fund, 2018). Nigeria was not excluded from public debt accumulation during this time. Similar to various African nations, Nigeria has been borrowing actively from within and outside the country to fund its fiscal gap (Onafowora & Owoye, 2017).

The constant increase in public debt accretion which started in the 1980s remained unabated till 2005 when the Paris Club granted Nigeria a debt pardon totalling roughly $18 billion (Onafowora & Owoye, 2017). Given the debt pardon, Nigeria's external debt and total debt decreased by 90.8% and 59% respectively between 2004 and 2006. However, the debt pardon granted to Nigeria spared the nation from the burden of $2.3 billion in debt service annually. This debt forgiveness triggered a minute appreciation of the country's currency in comparison with the US dollar, from ₦132.2 and ₦128.6 in 2005 and 2006 respectively to ₦118.6 in 2008 (Central Bank of Nigeria - CBN, 2009). Unfortunately, the gains from this external debt cancellation were rapidly weakened by the global financial shocks of 2009 as the naira exchange rate to the US dollar increased from ₦118.6 in 2008 to roughly ₦150 in 2009 (CBN 2009). The financial shocks also resulted in a steep decrease in export earnings which decreased as a consequence of the enduring oil prices decline from $147 per barrel in 2007 to $45 per barrel in 2008 (CBN 2009).

Available data from Nigeria's Debt Management Office (DMO) show that, despite the 2005 debt pardon, the country's total debt stock has been increasing rapidly post-2010. For instance,

Nigeria's total public debt grew from $64.5 billion in 2013 to $67.7 billion and $70.9 billion in 2014 and 2017 respectively. At the end of 2018, Nigeria's total debt stock stood at $79.4 billion with domestic debt accounting for 68.18% of the total debt stock while external debt accounted for 31.82% (DMO, 2018). It increased to 103.312 billion dollars in June 2022 of which US$63.248 billion is domestic debt and US$40.064 billion is external debt (DMO, 2022). While Nigeria's debt stock continues to increase, the country continues to underperform in the various human development indexes and has become home to the largest number of out-of-school-learning youths in the world (Sohngen, 2017). Despite a modest increase from 0.48 in 2007 to 0.54 in 2021, Nigeria's Human Development Index (HDI) growth at an average annual rate of 0.82% still places it at a low ranking. As of 2021, Nigeria, Africa's largest economy, is placed 163rd out of 191 countries in the HDI ranking, indicating the country's continued struggle in addressing human development challenges (United Nations Development Programme - UNDP, 2021). Public debt provides the resources that are critical for social and human development

The major objective of our paper is to assess the effect of public debt on human capital development in Nigeria. Given this, the basis for this paper is multifaceted. First, prior studies have predominantly concentrated on external debt, neglecting the significance of domestic debt, which forms a crucial component of overall indebtedness in developing economies (Barik & Sahu, 2020). For example, in Nigeria, domestic debt constituted 68.18% of the nation's total debt stock in 2018. By June 2022, it accounted for 61.22% of the total national debt (DMO, 2018, DMO, 2022). Second, diverging from common practice using ordinary least squares (OLS), we chose to employ the fully modified ordinary least squares (FMOLS) method due to its effective resolution of serial correlation and endogeneity concerns. To ensure robustness, we also implemented the canonical cointegration regression (CCR) for its nonparametric estimation capabilities, permitting superior parameter estimates and the capacity to mitigate endogeneity issues by excluding nuisance parameters. Third, examining the correlation between public debt and human development is in harmony with the United Nations' Sustainable Development Goals (SDGs), especially Goal 3 (Good Health and Well-being) and Goal 4 (Quality Education). Gaining insights into the impact of public debt on human development enables informed policy formulation and resource allotment targeted at fostering sustainable and inclusive development. Ultimately, this research can offer guidance on how to navigate the essentiality of public borrowing while prioritizing the advancement of human development, thereby bolstering Nigeria's efforts to meet the SDGs.

The rest of the paper is arranged as follows. Section 2 contains the literature while Section 3 outlines the method of study. Section 4 discusses the results while Section 5 concludes the paper.

2. Literature Review

Considerable attention has been devoted to the investigation of public debt and economic outcomes. The theory provides arguments for a negative, neutral and positive influence of public debt on the economy. For instance, from the Keynesian perspective, expansionary fiscal policy results in higher levels of debt and simultaneously accelerates economic growth, particularly via expenditure multiplier (Okere, Dimnwobi, Ekesiobi & Onuoha, 2023). Howbeit, this positive impact is mostly predicted in the short term. Similarly, the neo-classical theory avers the crowding-out effects of public debt. Public debt could result in higher interest rates and hence decrease investment and consequently national income by a multiplier, amongst other negative economic outcomes (Onuoha, Dimnwobi, Okere & Ekesiobi, 2023a). Conversely, the Ricardian equivalence argues that public debt does not influence growth and other economic outcomes. The theory argues that debt repayment could be funded via future taxation as individuals are spurred into improving their savings (Onuoha, Dimnwobi, Okere & Ekesiobi, 2023b). Thus, the impact of public debt stays neutral as future accumulated taxes would be funded via individual savings (Barik & Sahu, 2020; Butkus & Seputiene, 2018).

Regarding the empirical literature, numerous studies have assessed the link between public debt and economic growth (see Barik & Sahu, 2020; Edo, Osadolor & Dading, 2019; Onafowora & O woye, 2017; Saungweme & Odhiambo, 2020 for detailed review) while others have documented the determinants of human capital development (see Nwokoye, Onugha & Kalu, 2020; Shuaibu & Oladayo, 2016; Tsaurai, 2018). However, for precision and concision, the review is focused on studies on the public debt-human capital development relationships. For multi-countries studies, Lora and Olivera (2007) established that debt has a deleterious impact on social expenditures in a sample of fifty-seven countries cutting across various continents. Similarly, in a panel of thirty-five sub-Saharan African (SSA) nations, Fosu (2007) and Fosu (2008) concluded that external debt burdens hurt education and health spending respectively. Shabbir and Yasin (2015) employed the generalized method of moments (GMM) and found that external debt reduces social sector spending specifically on health and education. In a sample of 95 developing economies, Zaghdoudi (2018) applied a panel smooth threshold regression model to evaluate the

connection between external debt and human development. The author concluded that the connection between both variables is non-linear and the study established an optimal external debt threshold of 41.7775%. Below the threshold, external debt drives human development while above the debt threshold, human development is hampered. Whajah, Bokpin and Kuttu (2019) utilized the fixed effect model to unearth the nexus between public debt, government size and inclusive growth in Africa and the authors discovered that inclusive growth is negatively influenced by public debt. Also, Wang, Bui, Zhang, Nawarathna and Mombeui (2020) examined the role of public debt in the nexus between renewable energy and human development in Brazil, Russia, India, China and South Africa (BRICS) nations between 1990 and 2016. The study reported, among other things, that public debt lessens human development. Likewise, Said and Morai (2020) applied the GMM technique to report a negative connection between debt accumulation and health spending in SSA nations. A recent study by Sadiq, Wen, Bashir and Amin (2022) for 16 OECD nations between 1990 and 2019 reported that human development is hampered by public debt. In a related study of BRICS nations from 1990 to 2019, Sadiq, Shinwari, Usman, Ozturk and Maghyereh (2022) discovered that external debt impedes human advancement. Likewise, in a sample of 49 African nations between 1990 and 2019, Osakede and Adeleke (2022) reported that external debt has a negative influence on human development.

Aside from these cross-country studies, few studies on the subject also exist in single-country cases. For instance, Egungwu (2018) employed the OLS to appraise the effect of external debt on human capital development in Nigeria. The study reported, among other things, that external debt has a negative significant effect on Nigeria's human capital development. In another study for Nigeria, Atueyi (2019) applied the OLS technique and confirmed that external debt hampers human capital development in Nigeria. Igudia (2021) assessed the implications of external debt and external debt servicing on Nigeria's human capital development between 1960 and 2019 using the OLS. The study concludes that external debt boosts human capital development while external debt servicing undermines human capital development. In another study, Opara, Nzotta and Kanu (2021) appraised the implications of domestic debt on human development in Nigeria. Employing OLS and data between 1981 and 2018, the authors discovered that internal debt stimulates human development.

To summarize, it is worth noting that the majority of studies conducted thus far concentrate on external debt thereby ignoring domestic debt which is also a very essential fraction of total indebtedness particularly in developing economies like Nigeria. Also, the bulk of these studies are based on multi-country data. Hence drawing deductions from this cross-country evidence, though insightful, is going to be rather limited from a policy viewpoint given Nigeria's distinctive macroeconomic configurations. Aside from being one of the largest economies in Africa, Nigeria is one of the most indebted African nations (Ezenekwe, Okere, Dimnwobi & Ekesiobi, 2023; Onafowora & Owoye, 2017).

3. Method and Data Description

3.1. Empirical Model

To explore the association between public debt and human capital development, the study followed the works of Osakede and Adeleke (2022); Sadiq, Shinwari, Usman, Ozturk and Maghyereh (2022) and Wang, Zhang and Wang (2017). Their model specified a relationship between human capital development proxied with the human development index (HDI) and a set of independent variables (including eternal debt, trade openness, CO2 emission and economic growth). We modified the model by disaggregating public debt into external and domestic debt as well as adding some new variables such as debt servicing, and financial development which gives us the following functional model

$$HDI_t = f(EXD_t, DMD_t, DS_t, GDPC_t, FD_t, CO2_t, TO_t) \quad (1)$$

Where HDI is the Human development index, EXD is external debt, DMD is domestic debt, DS is debt servicing, FD is financial development, CO2 is carbon emissions while TO is trade openness and subscript t is time t. Hence, the economic model is given by the following equation;

$$HDI_t = \beta_0 + \beta_1 EXD_t + \beta_2 DMD_t + \beta_3 DS_t + \beta_4 GDPC_t + \beta_5 FD_t + \beta_6 CO2_t + \beta_7 TO_t \quad (2).$$

However, the econometric model of equation 2 becomes;

$$HDI_t = \beta_0 + \beta_1 EXD_t + \beta_2 DMD_t + \beta_3 DS_t + \beta_4 GDPC_t + \beta_5 FD_t + \beta_6 CO2_t + \beta_7 TO_t + \mu t \quad (3)$$

Where β_0 is the intercept while $\beta_{2-}\beta_6$ are the coefficients, μt represents the white noise assumption.

To avoid dynamic properties relating to data series, we transformed the data into the natural logarithmic form. Hence, equation (3) can be written in its logarithmic form as follows:

$$LHDI_t = \beta_0 + \beta_1 LEXD_t + \beta_2 LDMD_t + \beta_3 LDS_t + \beta_4 LGDPC_t + \beta_5 LFD_t + \beta_6 LCO\_2_t + \beta_7 LTO_t + \mu t \quad (4)$$

Where L denotes natural logarithm.

3.2. Estimation Techniques

3.2.1 Stationarity Tests

We tested for the stationary properties of the data by adopting a unit root test which helps to avoid spurious results. Hence we adopted both the Augmented Dickey-Fuller (ADF) test propounded by Dickey and Fuller (1979) and the Phillips-Perron (PP) test developed by Phillips and Perron (1988). The use of the unit root tests enables us to ascertain that none of the variables exceeded the desired order of integration and to validate the adoption of the fully modified OLS (FMOLS) method.

3.2.2 Co-integration Tests

We applied two co-integration tests to validate the long-run equilibrium linkage between the variables and they include; the Johansen co-integration test and the ARDL bounds test developed by Pesaran et al. (2001). The Johansen cointegration test is used based on the result of the Phillips-Perron unit root test and ADF which indicates that the variables tend to converge in the long run. On the other hand, the ARDL bound test was also adopted because of the merits it possesses over other methods of co-integration particularly its suitability when a series is integrated into various orders as well as providing accurate estimation.

3.2.3. Fully Modified Ordinary Least Squares (FMOLS) and Canonical Cointegration Regression (CCR)

To obtain reliable results, this study employed two methods. First, the FMOLS advanced by Phillips and Hansen (1990) were applied. The FMOLS is a semi-parametric approach for

correcting endogeneity and serial correlation concerns. To put it another way, the FMOLS is more robust than the least square method, and as a result, it produces concise and superior parameter estimates free from endogeneity and autocorrelation.

The study used the Canonical Cointegration Regression (CCR) created by Park (1992) for a robustness check. The CCR is primarily concerned with data transformation which implies that with its utilization, more efficient and superior parameter estimations will be created asymptotically. Additionally, as a nonparametric estimator, the CCR can eliminate the issue of nuisance parameters while also resolving the issue of endogeneity if it exists in the model.

3.3. Data and variable description

The study employed time-series data spanning from 1990 to 2021. The variables chosen are based on previous research. Similarly, the choice of the period is based on data availability. The data for the study were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, United Nations Development Programme (UNDP) and World Bank World Development Indicators (WDI) database. In alignment with past studies (Opara, Nzotta & Kanu, 2021; Wang, Bui, Zhang, Nawarathna & Mombeui, 2020), we employed the human development index to capture human capital development. Following Solarin (2016) and Yusuf and Mohd (2021), we disaggregated public debt into external debt and internal debt. Given that Nigerian policymakers have relied heavily on these sources to fund human development; these decompositions are vital for policy formulation. Following previous studies on human development (Atueyi, 2019; Egungwu, 2018; Igudia, 2021; Opara, Nzotta & Kanu, 2021; Zaghdoudi, 2018; Sadiq, Wen, Bashir & Amin, 2022; Sadiq, Shinwari, Usman, Ozturk & Maghyereh, 2022), we introduced several control variables namely financial development, trade openness, GDP per capita, debt servicing and carbon emissions. These variables were added because they have been established in the literature to influence human development. These variables are documented in Table 1

Please insert Table 1 here

4. Empirical Findings

4.1. Summary of Statistics

The result in Table 2 depicts the summary statistics across variables, including the statistical values of diverse normality tests (skewness, kurtosis, Jarque-Bera, and probability). The Skewness values

of all our variables are close to zero which implies that the variables are normally distributed. Also, the average value of domestic debt is 4597.704 which is the highest followed by external debt (2944), then GDPC (1892) and DS (717). More so, the Jarque-Bera probability has values higher than 0.05, meaning that the variables are normally distributed.

Please insert Table 2 here

4.2. Correlation Test

The correlation result shown in Table 3 is used to test for linearity between the variables and as indicated by the outcome, all of the variables are correlated. Thus, LEXD, LDMD, LDS, LGDPC and LFD are highly and positively correlated with HDI. On the other hand, LCO2 and LTO have a negative correlation with HDI.

Please insert Table 3 here

4.3. Results of unit root tests

The ADF and PP unit root results presented in Table 4 show that all the variables in our model were non-stationary at the level but became stationary after differencing once. This implies that the series is stationary at first-order integration, I(1), which supports the adoption of the Johansen or ARDL bounds co-integration techniques.

Please insert Table 4 here

4.4. Results of the cointegration tests

Having established a stationarity status of our variables, we estimated the long-run equilibrium relationship using both Johansen and the ARDL bounds test for cointegration techniques. Both results are presented in Tables 5 and 6 respectively. However, both the trace test and max-eigenvalue outcomes of the Johansen test reveal 4 cointegrating equations at the 5% significant level which implies the rejection of the null hypothesis of no cointegration.

Please insert Table 5 here

The ARDL bounds test reveals that the F-test is greater than the values of both lower I(0) and upper bounds I(1), which means there is a long-run equilibrium linkage between the variables.

Please insert Table 6 here

4.5. FMOLS Result

FMOLS method is adopted to examine the long-run effects of public debts (external and domestic), economic growth, debt servicing, carbon emission, financial development and trade openness on the human development index in Nigeria. Table 7 showcases the outcome of the FMOLS. The findings indicate that the predicted long-run coefficients of LEXD, LDMD, LGDPC and LDS are positive and significant at 5% levels, meaning that a 1% rise in LEXD, LDMD, LGDPC and LDS will result in a 0.003%, 0.046%, 0.069% and 0.008% increases in HDI. This shows that these variables drive human development. The improving effect of public debt (domestic and external) on human welfare obtained by our study is unsurprising as it signifies that carefully managed debt, when invested in critical sectors like infrastructure, healthcare, and education, can significantly improve human development indicators and stimulate economic growth, leading to enhanced opportunities and well-being for the population. This finding is consistent with Igudia (2021) and Opara, Nzotta and Kanu (2021) for Nigeria while contrasting Wang, Bui, Zhang, Nawarathna and Mombeui (2020); Sadiq, Shinwari, Usman, Ozturk and Maghyereh (2022) for BRICS economies. Our study showed that economic expansion displayed a positive influence on human development aligning with Wang, Bui, Zhang, Nawarathna and Mombeui (2020); Hashemizadeh, Bui and Zaidi (2021); Sadiq, Shinwari, Usman, Ozturk and Maghyereh (2022) while contradicting Mustafa, Rizov and Kernohan (2017); Khan, Ju and Hassan (2018) and Wang, Danish, Zhang and Wang (2018). The revelation that economic growth positively influences human development in Nigeria highlights the need for sustained economic progress to foster improvements in healthcare, education, and overall well-being, emphasizing the importance of economic policies aimed at promoting growth to contribute to human development indicators and underscoring the necessity of ensuring economic advancements lead to tangible improvements in the quality of life for Nigerians. Surprisingly the study highlighted that debt servicing boosts human development in Nigeria thereby disagreeing with the debt overhang hypothesis. This finding is inconsistent with the research of Igudia (2021) and Yusuf and Mohd (2021). Debt payment is the current generation's burden from earlier obligations. It represents foregone domestic expenditure if it is

paid on external loans. However, the bulk of Nigeria's debt servicing is on domestic loans as domestic debt accounts for the bulk of the nation's total debt stock. The loan repayment to domestic sources could be reinvested in the economy which could act as an injection into the economy thereby stimulating human welfare. On the other hand, paying off debts promptly and effectively can boost a country's creditworthiness and financial stability, improving access to global financial markets and enabling potential investment in crucial human development projects. In addition, the calculated long-run coefficient of LCO2 is negative and significant at a 10% level of significance, implying that a 1% rise in LCO2 leads to a 0.02% decrease in HDI. This reveals that pollution reduces human development. Human development is predicted to be negatively correlated with carbon dioxide emissions. This is due to the prevalence of energy poverty in Nigeria (Dimnwobi, Madicihie, Ekesiobi & Asongu, 2022; Dimnwobi, Onuoha, Uzoechina, Ekesiobi & Nwokoye, 2022; Nwokoye, Dimnwobi, Ekesiobi & Obegolu, 2017; Omoju, Beyene, Ikhide, Dimnwobi & Ehimare, 2020). Poor access to clean energy leads to the widespread utilization of polluting fuels which worsens health outcomes and aligns with Zaman, Ahmad, Hamzah and Yusoff (2015); Orji, Ogbuabor, Mba and Anthony-Orji (2021) and Oyedele (2022). This result highlights the significance of tackling environmental obstacles to protect human resources, promote lasting economic progress, and alleviate the economic impact linked to health issues resulting from pollution (Dimnwobi, Okere, Azolibe & Onyenwife, 2023; Dimnwobi, Okere, Onuoha, Uzoechina, Ekesiobi & Nwokoye, 2023).

LFD and LTO on the other hand exhibit positive and negative insignificant impacts on HDI respectively. The positive but insignificant relationship between financial development and human development in Nigeria may be due to the limited impact of financial advancements on critical human development indicators like healthcare and education. More targeted policies and efforts are needed to enhance the influence of financial development on overall well-being and quality of life, resulting in more substantial human development outcomes. This outcome differs from Acheampong, Erdiaw-Kwasie and Abunyewah (2021) and Sadiq, Wen, Bashir and Amin (2022). On the other hand, the adverse yet negligible effect of trade openness on human development may be linked to insufficient inclusive growth arising from trade, which may result in unequal distribution of benefits among the populace. Moreover, it appears that trade openness is not yielding measurable enhancements in critical human development domains like healthcare and

education, highlighting the necessity for more holistic policies to ensure equitable distribution of trade benefits and more direct contributions to enhancing the overall welfare of the population. Our results match the outcome of Wang, Danish, Zhang and Wang (2018) for Pakistan. Trade openness is also expected to generate negative socioeconomic impacts such as environmental pollution and resource depletion in developing countries like Nigeria with lax environmental restrictions and institutional quality (Azolibe, Dimnwobi & Uzochukwu-Obi, 2022; Ekesiobi & Dimnwobi, 2020) thereby stifling domestic production and undermining human development.

The coefficient of multiple determination (R^2) and adjusted R^2 values are 0.9857 and 0.9815 respectively, denoting that the estimated regression model is a good fit. Also, this means that the explanatory variables are responsible for 98% of the variation in the dependent variable's change.

Please insert Table 7 here

4.6. Robustness check

As a robustness check of FMOLS estimation, we adopted CCR regression as indicated in Table 8. The findings of the CCR estimator validate the FMOLS estimation's robustness. The CCR outcome confirmed the coefficients of LEXD, LDMD, LGDPC and LDS to be positively and significantly associated with HDI in Nigeria.

Please insert Table 8 here

4.7. Diagnostic Tests

To validate the efficiency of the estimation, we computed normality, heteroscedasticity, and serial correlation tests (See Table 9). The result indicates that there is an absence of auto-correlation and heteroscedasticity among the variables.

Please insert Table 9 here

The stability tests of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) tests in Figures 1 and 2 reveals that the residuals' values are within the lines of confidence at a 5% significance level, which confirms that our model is stable.

Please insert Figure 1 here

Please insert Figure 2 here

5. Conclusion and Policy Recommendations

This study investigated the impact of public debt on human capital development in Nigeria using quarterly data that spanned from 1990 to 2021. The main thrust of the study investigate the impact of both domestic and external debts on human capital development in Nigeria, as well as identify other determinants of human capital development in Nigeria during the review period. The study employed the FMOLS and CCR as the main estimation technique and the robustness check respectively. Our findings revealed that domestic and external debt, economic growth and debt servicing exert positive and significant influence on human capital development in Nigeria. The study further reported that environmental pollution has an inverse and significant impact on human capital development in Nigeria while financial development and trade openness do not drive human capital development.

Based on the study's results, policy suggestions involve linking the utilization of public debt with investments in crucial human development sectors like education, healthcare, and social infrastructure to optimize its positive influence. Furthermore, there could be a focus on maintaining transparent and efficient management of public debt to consistently uphold human development projects. Moreover, efforts could be directed towards enhancing the efficacy and availability of financial services tailored to address the requirements of underprivileged and marginalized groups to ensure that financial development more effectively contributes to holistic human development in Nigeria.

Lastly, to create a buffer against the cyclical impact of oil price volatility (which is the primary source of government revenue, and its fluctuations are often cited as the reason for borrowing), the government should put economic diversification into action. Without a doubt, the government continues to pay lip service to the diversification campaign (Agboola, Bekun, Osundina & Kirikkaleli, 2020; Dimnwobi, Nwokoye, Ekesiobi & Igbanugo, 2017; Goshit & Terese, 2020; Nathaniel & Bekun, 2020; Nwokoye, Igbanugo & Dimnwobi, 2020). Diversifying away from natural resource dependency is an alternative investment and competitiveness strategy (Dimnwobi, Ekesiobi, Madichie & Asongu, 2021; Nwokoye, Igbanugo, Ekesiobi & Dimnwobi, 2022). Indonesia, for instance, was able to diversify into the real sector supported by suitable trade and business infrastructure policies. The World Bank recommends that Africa (Nigeria inclusive)

implement a general “annuity policy” that includes spending oil revenues on infrastructure as well as encouraging inward investment and domestic savings. That is a calculated, frugal, and well-informed spending, saving, and investment (in other assets) strategy that prioritizes the creation of human capital, as well as the conversion of mineral wealth into higher-yielding financial assets. Diversification into the digital economy (which is at the heart of the fourth industrial revolution) could also be a surefire way to boost government revenue, thereby reducing the country’s continuous reliance on borrowing.

While this study provides new insights into the impact of public debt on human capital development in Nigeria, future investigations should aim to further dissect domestic debt into bank-sourced and non-bank-sourced debt, exploring alternative econometric methodologies. Given public debt’s importance as a fiscal instrument, ongoing discourse and empirical assessments are projected to raise crucial questions extending beyond the scope of this study. The interest in understanding the effects of public debt on various economic sectors is anticipated to persist, requiring further exploration. Similarly, subsequent studies might explore the effects of public debt on infrastructure development. Lastly, researchers are encouraged to incorporate interactive regressions due to their increasing prominence in contemporary literature (Adedoyin, Afolabi, Yalçiner, Bekun, 2020; Asongu, Agyemang-Mintah & Nting, 2021; Duodu & Baidoo, 2020).

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Table 1: Data Summary

Variables	Definition	Sources
Human capital development	Human development index	UNDP
Domestic Debt	Billions of naira	Central Bank of Nigeria (2021)
External Debt	Billions of naira	Central Bank of Nigeria (2021)
Debt Servicing	Billions of naira	Central Bank of Nigeria (2021)
Financial development	Domestic credit to the private sector as a % of GDP	World Bank (2021)
Trade openness	% of GDP	World Bank (2021)
Carbon emissions	Metric tons per capita	World Bank (2021)
Gross Domestic Product Per Capita	Constant 2010 US$	World Bank (2021)

Source: Authors Computation

Table 2: Descriptive Statistics

	HDI	EXD	DMD	DS	GDPC	FD	CO2	TO
Mean	0.469771	2944.404	4597.704	717.1385	1892.903	10.26021	0.687486	37.59956
Median	0.469000	1207.118	1639.583	307.6502	1878.931	9.395146	0.680926	38.75300
Maximum	0.547200	15855.23	19242.56	4221.653	2550.470	19.62560	0.916618	53.27796
Minimum	0.391306	298.6144	84.09310	19.40026	1341.616	4.957522	0.498623	20.72252
Std. Dev.	0.048835	3728.684	5445.467	1024.398	447.0124	3.527216	0.119606	8.392710
Skewness	0.050600	0.046817	0.209803	0.996839	0.069144	0.832837	0.320836	-0.139133
Kurtosis	1.725951	6.780452	3.284547	6.373177	1.364943	3.403684	1.822695	2.561167
Jarque-Bera	2.177924	3.39954	2.913950	3.43705	3.590047	3.916572	2.397051	0.360007
Probability	0.336566	0.15246	0.319121	0.125432	0.166124	0.141100	0.301639	0.835267
Sum	15.03267	94220.94	147126.5	22948.43	60572.90	328.3267	21.99954	1203.186
Obs	32	32	32	32	32	32	32	32

Source: Authors' estimation

Table 3: Correlation result

Variables	LHDI	LEXD	LDMD	LDS	LGDPC	LFD	LCO2	LTO
LHDI	1	0.630405	0.989693	0.96276	0.914193	0.790551	-0.84968	-0.18945
LEXD	0.630405	1	0.651099	0.713377	0.377335	0.300381	-0.30589	-0.08865
LDMD	0.989693	0.651099	1	0.959584	0.888815	0.786758	-0.83728	-0.15303
LDS	0.96276	0.713377	0.959584	1	0.873636	0.704439	-0.77732	-0.15536
LGDPC	0.914193	0.377335	0.888815	0.873636	1	0.770389	-0.87033	-0.27735
LFD	0.790551	0.300381	0.786758	0.704439	0.770389	1	-0.82475	-0.14
LCO2	-0.84968	-0.30589	-0.83728	-0.77732	-0.87033	-0.82475	1	0.183671
LTO	-0.18945	-0.08865	-0.15303	-0.15536	-0.27735	-0.14	0.183671	1

Source: Authors' estimation

Table 4: Unit Root Result

Variables	ADF	PP	ADF	PP	Decision
LHDI	-0.952529	-1.523333	-4.782791	-8.284373	
	(0.7574)	(0.1199)	0.0007	(0.0000)	I(1)
LEXD	-1.359651	-1.019451	-3.835554	-3.820993	
	(0.5883)	(0.7338)	(0.0067)	-0.0069	I(1)
LDMD	-2.481556	-2.132052	-3.50364	-3.400721	
	-0.1295	(0.2342)	(0.0149)	-0.0189	I(1)
LGDPC	-1.123951	-0.719929	-3.651036	-4.651036	
	(0.6930)	(0.8271)	0.0044	(0.0023)	I(1)
LDS	-0.082407	-0.337194	-5.481498	-8.465353	
	(0.9412)	(0.9080)	(0.0001)	(0.0000)	I(1)
LFD	-2.199214	-2.109789	-4.92802	-7.097156	
	(0.2105)	(0.2423)	(0.0005)	(0.0000)	I(1)
LCO2	-1.238068	-1.099905	-5.762136	-6.736618	
	(0.6450)	(0.7031)	(0.0000)	(0.0000)	I(1)
LTO	-2.16356	-2.16356	-6.221306	-6.632593	
	(0.1497)	(0.1497)	(0.0000)	(0.0000)	I(1)

Source: Authors' estimation

Table 5: The results of the Johansen cointegration test

Trace test outcomes				
No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.961953	315.6430	159.5297	0.0000
At most 1 *	0.947598	217.5747	125.6154	0.0000
At most 2 *	0.853849	129.1102	95.75366	0.0000
At most 3 *	0.683546	71.41684	69.81889	0.0371
At most 4	0.517795	36.89954	47.85613	0.3523
At most 5	0.311392	15.01795	29.79707	0.7789
At most 6	0.114350	3.825437	15.49471	0.9171
At most 7	0.006062	0.182424	3.841466	0.6693
M-Eigenvalue outcomes				
No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.961953	98.06830	52.36261	0.0000
At most 1 *	0.947598	88.46450	46.23142	0.0000
At most 2 *	0.853849	57.69336	40.07757	0.0002
At most 3 *	0.683546	34.51730	33.87687	0.0419
At most 4	0.517795	21.88159	27.58434	0.2265
At most 5	0.311392	11.19251	21.13162	0.6280
At most 6	0.114350	3.643013	14.26460	0.8950
At most 7	0.006062	0.182424	3.841466	0.6693

∗ Rejection of the hypothesis at 0.05 level; ∗∗ P-values of MacKinnon-Haug-Michelis (1999)

Source: Authors' estimation

Table 6: ARDL bound test for Cointegration

F-Bound Test		Null hypothesis: No levels of relationship		
test statistic	Value	Significance	I(0)	I(1)
F-statistic	8.622606	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9

Source: Authors' estimation

Table 7: The outcome of FMOLS: Dependent variable LHDI

Variables	Coefficient	Std. Error	t-Statistic	P-values
LEXD	0.00324	0.001546	2.096043	0.0473
LDMD	0.045656	0.002601	17.55496	0.0000
LGDPC	0.06949	0.01166	5.959942	0.0000
LDS	0.007791	0.002308	3.375374	0.0026
LFD	0.006848	0.00456	1.501741	0.1468
LCO2	-0.0219	0.011775	-1.859897	0.0757
LTO	-0.005703	0.003465	-1.645764	0.1134
C	-1.697787	0.086898	-19.53769	0.0000
R2	0.985791			
Adjusted R2	0.981466			
S.E. of regression	0.013738			

Source: Authors' estimation

Table 8: CCR Results: Dependent variable LHDI

Variables	Coefficient	Std. Error	t-Statistic	P-values
LEXD	0.00334	0.002376	3.98943	0.0027
LDMD	0.046824	0.003298	14.19834	0.0000
LDS	0.006348	0.006228	2.519294	0.0096
LGDPC	0.065366	0.022589	2.893754	0.0082
LFD	0.005761	0.007307	0.788321	0.4386
LCO2	-0.025181	0.017987	-1.399983	0.1749
LTO	-0.007501	0.00591	-1.269091	0.2171
C	-1.660921	0.179992	-9.227759	0.0000
R 2	0.985791			
Adjusted R 2	0.981467			
S.E. of regression	0.013737			

Source: Authors' estimation

Table 9: Diagnostics results

Diagnostic tests	Coefficient	p-value	Decision
Jarque-Bera test	4.008	0.1347	Residuals are normally distributed
Lagrange Multiplier test	2.512054	0.1746	There is no serial correlation
Breusch-Pagan-Godfrey test	1.96587	0.1269	There is no heteroscedasticity

Source: Authors' estimation

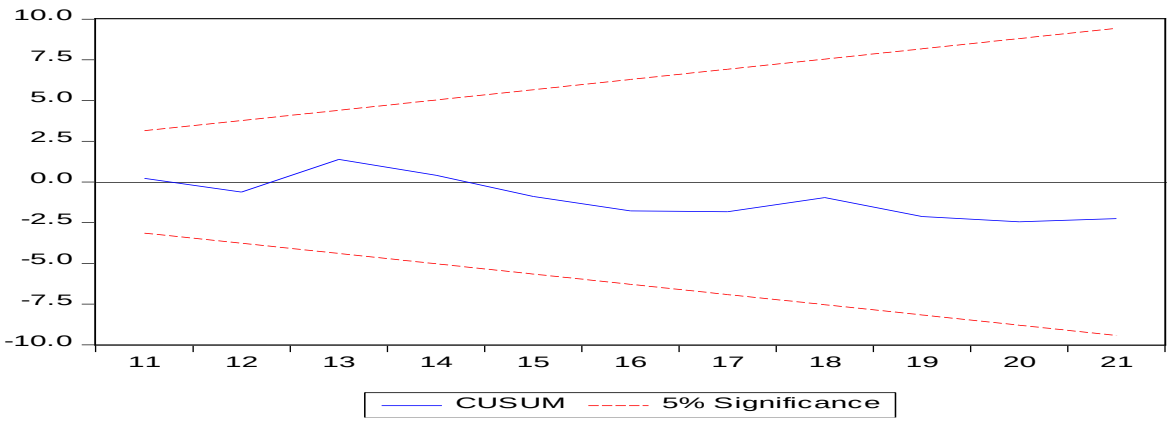

Figure 1: CUSUM (critical bounds at 5% significance level)

Source: Authors' estimation

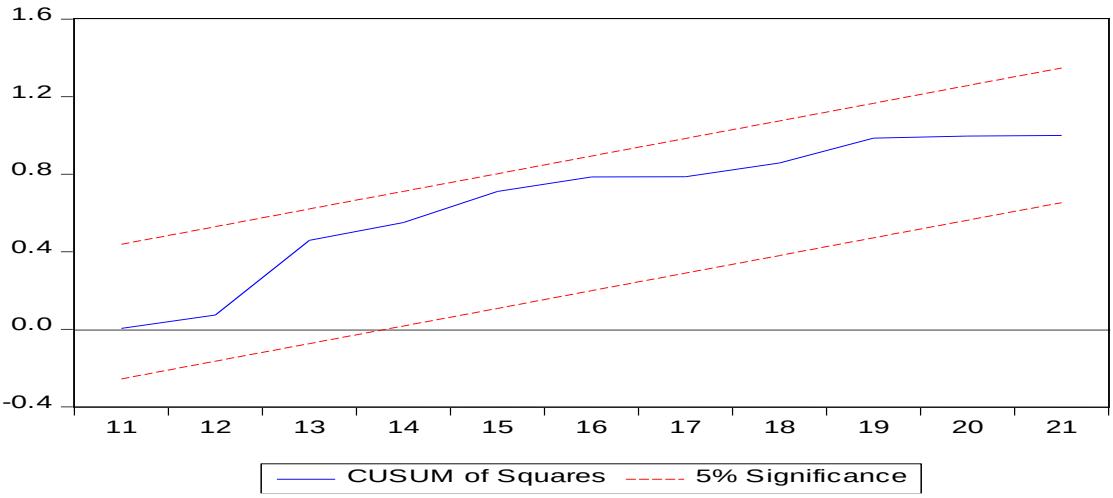

Figure 2: CUSUMQ (critical bounds at 5% significance level)

Source: Authors' estimation