



The Impact of Natural Resource Depletion on Economic Diversification in Nigeria

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Abstract

The relationship between natural resource depletion and economic diversification remains a consequential unresolved question in development economics, particularly for resource-dependent economies where structural concentration persists despite decades of extraction. This study examines the effect of natural resource depletion on economic diversification in Nigeria over the period 1990 to 2024, with regulatory quality introduced as a moderating variable. Economic diversification is measured through the export diversification index, while natural resource depletion is measured as adjusted savings from natural resource depletion as a percentage of gross national income. The control variables are gross fixed capital formation, inflation, trade openness, and regulatory quality. The study employs the Autoregressive Distributed Lag bounds testing approach of Pesaran, Shin, and Smith (2001) as the primary estimator, with Fully Modified Ordinary Least Squares and Dynamic Ordinary Least Squares as robustness checks. The theoretical framework draws on the Resource Curse Hypothesis, Dutch Disease Theory, and Institutional Quality Theory. The bounds test confirms cointegration in both the baseline and moderation specifications at the one percent significance level. The baseline results show that natural resource depletion exerts a negative short-run effect on diversification, consistent with Dutch Disease crowding-out mechanisms, while the positive long-run baseline estimate reflects fiscal spillover channels rather than genuine structural transformation. The moderation model reveals that once regulatory quality is explicitly controlled, the long-run depletion coefficient reverses to negative, confirming that the true structural effect of depletion on diversification is negative. Inflation consistently constrains diversification in the long run, while gross fixed capital formation generates short-run gains that do not persist. The robustness checks confirm directional consistency across all key variables. The findings carry policy implications for fiscal rule design, institutional reform, macroeconomic stabilisation, and targeted capital formation in Nigeria.

Keywords: Economic diversification, Natural resource depletion, Regulatory quality, Gross fixed capital formation, Inflation, Trade openness, Nigeria, ARDL, FMOLS, DOLS

Introduction

The structural dynamics of natural resource dependency stand out prominently amongst the key unresolved issues confronting development economists today. Endowed with significant endowments of natural resource wealth, such countries confront conflicting incentives in terms of depleting natural resource assets to meet existing expenditure demands versus utilizing resource rents to invest in reproducible capital assets required to facilitate productive diversification. For Sub-Saharan Africa, where natural resources account for approximately 30 percent of government revenues and depletion rates consistently rank among the highest in the world, this tension has produced a region that draws down its productive asset base faster than it is building alternative sources of wealth (World Bank, 2023). Econometric panel estimates based on cross-sectional data drawn from 30 Sub-Saharan African countries over the period from 1995 to 2019 confirm the idea that high levels of natural resource dependency led to lower contributions of manufacturing and services sectors to national production activities. Instead of productive diversification that would facilitate sustainable economic growth and development, such dependency creates economies specialized along extractive industry production chains (Nwani et al., 2023). Natural resource exporting economies witnessed pronounced contraction phases in the aftermath of the end of the commodity super-cycle era in 2014, compared to relatively stable performances by economies in the same sub-region without a significant degree of dependence on natural resource exports (IMF, 2023). This divergence raises a structural question of considerable policy relevance: does the pace of natural resource depletion itself constrain the capacity of resource-dependent economies to diversify their productive base, and if so, through what long-run mechanisms does this constraint operate?

Nigeria stands out as the defining case study on the African continent within this context.

Estimated at approximately 37 billion barrels of crude oil reserves, Nigeria sits atop rich mineral deposits of natural gas, solid minerals, and extensive tracts of cultivable agricultural land. Nevertheless, the composition of its exports has persisted as one of the most concentrated on the continent in recent decades (World Bank, 2023; Banjo, Iwayemi and Oyedele, 2024). With crude oil responsible for upwards of 90 percent of total exports and exceeding 60 percent of fiscal receipts while accounting for less than ten percent of GDP, Nigeria suffers from the simultaneous embedding of volatility in both its fiscal and external accounts. The export diversification index, measured as the inverse of the Herfindahl-Hirschman Product Concentration Index, confirms that Nigeria records scores near unity. Alongside Angola and Equatorial Guinea, these countries have emerged as the three most heavily concentrated exporters on the African continent since 2000 (Zarach and Parteka, 2023; Doki, & Tyokohol, 2019).

Adjusted savings from natural resource depletion accounted for above 20 percent of gross national income each year throughout the decade-long commodity boom in the 2000s without the concomitant build-up of reproducible capital formation. By depleting its productive asset endowment at such a rate and failing to accumulate the requisite base of diversified productivity across multiple sectors, Nigeria finds itself with diminished resource endowments and unstructured production dynamics (World Bank, 2023). GDP per capita contracted dramatically from \$2,198 in 2022 to \$1,637 in 2023, indicating the high susceptibility to shocks exhibited by an economy devoid of diversification buffers against external price movements and fiscal fluctuations (IMF, 2024). Aggregate statistics thus corroborate evidence suggesting that sustained depletion has failed to facilitate diversification processes, making Nigeria a crucial context within which the depletion-diversification dynamic can be investigated empirically.

Some factors that define the diversification context along with the natural resource

depletion include structural variables and macroeconomic conditions. The gross fixed capital formation has been consistently lower than the benchmark level of 30 percent of the GDP required for sustained economic transformations, while there is substantial empirical evidence indicating a gap between the investment and its target level of 16 percentage points (Awe and Dias, 2022). Trade openness, which amounted to an average value of approximately 25 percent of the GDP throughout the research period, was not able to ensure the diversification effect associated with open trade regime because, as recently confirmed by ARDL estimation techniques, the impact of trade openness in Nigeria has been positive only for the industrial and service sectors (Peverga, 2024). Regulatory quality has remained below the median among Sub-Saharan countries on the basis of World Bank's institutional indicators, thus indicating the institutional environment as one of the major constraints to turning rent from natural resources into investments into diversified economy (World Governance Indicators, 2023). Finally, the inflation rate that reached a value of 33.2 percent in Nigeria in 2024 undermined the investment conditions necessary for developing non-oil tradable sector in Nigeria, with recent evidence confirming its structurally disruptive effect on investment incentives in the non-oil economy (African Development Bank, 2024; Ekpo, Ebiefie and Udobia, 2025).

There is a general consensus in the empirical literature concerning natural resources depletion and economic diversification in terms of a negative relationship but the mechanisms and magnitudes remain disputed. In a study of export diversification and natural resource dependence in 160 countries from 1996 to 2018, Zarach and Parteka (2023) found resource dependence to be a significant negative predictor of export diversification even after controlling for income, geographical and institutional factors, where the quality of institutions was identified to determine the ability of resource-dependent countries to diversify. In an article published in the *Journal of Development Economics*,

Bahar and Santos (2018) use oil and gas field discoveries and commodity price changes as instrumental variables, discovering that countries with 30 percentage points more natural resources export shares have 44 percent more exports concentrated, where rising wages due to the natural resource boom increase the cost of production in capital-intensive industries and change the composition of the country's exports to low-sophistication products. More specifically in Nigeria, Awe, Musa and Sanusi (2023) apply unsupervised machine learning methods to disaggregated revenue data in Resources Policy and find that crude oil is categorically separated from other sectors in the economic system, where there exists almost no correlation between oil revenue and any other economic performance measures, which shows the lack of productive linkages necessary for resource revenue to aid diversification in the economy. These findings collectively establish the empirical relevance of the depletion-diversification nexus but stop short of directly estimating its dynamic long-run and short-run structure within a Nigerian time-series framework.

The role of institutional quality in mediating the diversification effects of natural resource depletion constitutes a second strand of evidence directly relevant to this study. Mehlum, Moene and Torvik (2006) establish formally that the growth effect of natural resource wealth turns negative in countries where governance structures favour rent-seeking over productive investment, a result confirmed across Sub-Saharan Africa by Nwani et al. (2023), who find that financial development through the institutions channel partially counteracts the structural concentration effect of resource dependence. Within Nigeria, Doki, & Tyokohol (2019) confirm that gross fixed capital formation and trade openness are significant determinants of diversification outcomes in ARDL estimation, while their error correction results establish the existence of a long-run adjustment mechanism linking these institutional and structural variables to diversification performance. The moderating role of

regulatory quality is further supported by the broader cross-country evidence of Zarach and Parteka (2023), who find that institutional quality is the primary determinant of whether resource exporters can escape diversification constraints over time. These results collectively motivate the inclusion of regulatory quality as both a conditioning variable and a theoretically grounded moderator of the depletion-diversification relationship.

Trade openness, gross fixed capital formation, and inflation are another category of conditional variables that have been justified by existing empirical literature. With respect to trade openness, the study by Peverga (2024) reveals the significant positive correlation between trade openness and economic performance measured with the help of an ARDL model between trade openness and economic growth of Nigeria between 1980 and 2022, and according to Doki & Tyokohol (2019), trade openness belongs among the significant determinants of export diversification outcomes in Nigeria. On gross fixed capital formation, Awe and Dias (2022) revealed that the value of diversification index of Nigeria is determined by the gross fixed capital formation as this variable conceptually is associated with supply-side approach that is necessary to transform resource rents into non-oil productive resources for the sake of diversification. Finally, according to Ekpo, Ebiefie, and Udobia (2025), high rates of inflation that Nigeria experiences are caused by the presence of high volatility in oil revenues and fiscal expansion as well as exchange rate depreciation that hampers investment in the non-oil sector, while according to African Development Bank (2024), the average level of inflation is reported to be at 33.2% in 2024, compounding the structural damage that resource depletion inflicts on tradable sector competitiveness.

Despite this body of evidence, three gaps limit the direct applicability of existing findings to the question motivating this study. First, no existing study directly estimates the dynamic long-run and short-run effects of natural

resource depletion, measured as adjusted savings from natural resource depletion as a percentage of gross national income, on the export diversification index in Nigeria within a unified time-series framework. Most studies use oil rents or resource dependence as a share of GDP rather than the rate of depletion, and model growth or sectoral output rather than export diversification directly. This distinction matters because the flow measure of depletion captures the pace at which the resource stock is being drawn down, which is most directly relevant to the long-run sustainability of any diversification strategy.

Second, no study simultaneously incorporates regulatory quality, trade openness, gross fixed capital formation, and inflation alongside natural resource depletion in a single ARDL specification, making it impossible to assess the relative strength of each channel or to determine whether institutional quality genuinely moderates the depletion-diversification relationship after controlling for macroeconomic confounders. Third, the ARDL bounds testing framework, which accommodates mixed orders of integration, recovers long-run equilibrium coefficients alongside error correction dynamics, and remains valid in finite samples, has not been applied to the depletion-diversification nexus specifically, leaving a methodological gap that this study is positioned to close.

This study fills these gaps by examining the effect of natural resource depletion on economic diversification in Nigeria over the period 1990 to 2024 using the ARDL bounds testing approach. Economic diversification is the dependent variable, measured through the export diversification index. Natural resource depletion is the primary explanatory variable, measured as adjusted savings from natural resource depletion as a percentage of gross national income. The control variables are trade openness, gross fixed capital formation, inflation, and regulatory quality. The study makes three contributions to the literature. First, it provides the first direct time-series estimation of the long-run and short-run effects of natural resource depletion on the export diversification index in Nigeria,

generating error correction coefficients that quantify the pace of diversification adjustment following depletion shocks. Second, it tests whether regulatory quality moderates the depletion-diversification relationship within the same ARDL specification, providing evidence on the institutional channel that existing single-variable and panel studies cannot isolate. Third, it produces empirical evidence calibrated to Nigeria's historical experience across three decades of commodity cycles and institutional change, generating policy-relevant findings directly applicable to the country's ongoing diversification agenda.

The remainder of the paper is organised as follows. Section 2 reviews the relevant theoretical and empirical literature. Section 3 presents the data and econometric methodology. Section 4 reports and interprets the empirical results. Section 5 concludes with policy implications.

Literature Review

Theoretical Framework

The link between natural resource depletion and economic diversification in Nigeria occurs via several channels. To explain why resource-abundant economies do not diversify, the research must not only consider the connection between resource depletion and economic concentration, but also explore through which mechanisms do depletion impact diversification and in what institutional environment such constraints operate most strongly. This study draws on three complementary theoretical perspectives: the Resource Curse Hypothesis, Dutch Disease Theory, and Institutional Quality Theory. Instead of adopting each theory as an isolated explanation of the phenomenon, this paper aims to combine these approaches to develop a consistent analytical framework in which resource depletion is the main constraint on diversification, while the mechanisms of Dutch Disease reveal sectoral transmission channels, and institutional quality determines the strength of the constraints.

According to the Resource Curse Hypothesis, attributed mainly to the pioneering research of Sachs and Warner (1995), countries endowed with natural resources tend to grow slower and to achieve lower diversification compared to their resource-poor peers. It is not the abundance of natural resources themselves but the economic and fiscal response to their presence that drives the hypothesized processes of decline. Abundant resource rents lead to consumption booms, alleviate the fiscal pressure on effective governance, draw skilled labour and capital away from manufacturing and agricultural sectors, as well as to stimulate rent-seeking, shifting politicians' attention from productive investments to rents. The result is a gradual economic concentration in the sector producing resource rents and a reduction in diversification capabilities necessary to survive any shocks. Applied to the Nigerian case, this process has a clear causal chain: accelerated exploitation of oil since the 1970s resulted exactly in the processes described by the hypothesis (Awe, Musa and Sanusi, 2023; Banjo, Iwayemi and Oyedele, 2024). This framework produces the core prediction of the research: natural resource depletion impacts economic diversification negatively.

The Dutch Disease Theory, developed by Corden and Neary (1982), offers the sectoral transmission mechanisms through which resource discoveries hurt diversification prospects. In total, there are two main effects described in this theory. First is the spending effect, which takes place via fiscal channels because revenue from resources allows increasing government expenditures and household incomes, boosting the demand for domestic non-tradable goods while making it more expensive and less competitive for the tradable non-resource sector to produce these products. Second is the resource movement effect, which occurs due to the fact that a booming resource sector leads to the transfer of factors into resource production from tradable goods, making production more costly overall. In sum, there will be an appreciation of the real exchange rate and reduction in the tradable non-resource sector's

volume, which aligns perfectly with the findings of the study of Nigeria's export structure during its oil boom cycles (Onuoha, 2022; Igbe, & Egbon 2025). Bahar and Santos (2018) prove that economies with higher resource export volumes have a larger degree of non-resource exports' concentration, offering solid empirical evidence for this approach. This framework predicts that the negative effect of resource depletion on diversification operates partly through real exchange rate appreciation and factor market distortions that amplify export concentration over time.

The Institutional Quality Theory, built on the concepts developed by North (1990) and Scott (1995), provides an explanation for the success of some resource-rich nations in overcoming the resource curse and the inability of others to do the same. According to this theory, institutional arrangements including property rights, regulation regimes, rule of law, and accountability systems influence how resource revenues are divided between investment in productive capacity and rent extraction. In countries where there is effective institutions, resource revenues are invested in building infrastructures, developing human capital and adopting technologies necessary for diversifying economic activities in the face of Dutch Disease consequences. In contrast, ineffective institutions lead to the appropriation of resource revenues by political elites or the use of resource revenues to sustain the dominant resource-based sector through subsidies. For Nigeria, the historically low institutional quality in terms of regulatory arrangements is expected to exacerbate the problem of diversification brought about by resource depletion because institutional effectiveness ensures that resource rents are productively used (World Governance Indicators, 2023). As explained formally by Mehlum et al., (2006), poor institutional governance reverses the positive impact of resource endowment on growth to a negative impact through rent-seeking and lack of productive investment. Institutional quality therefore operates as a moderating variable in the framework: it

dampens the negative effect of depletion on diversification in well-governed settings and intensifies that effect where governance remains weak.

Overall, these three frameworks provide for a structured approach where natural resource depletion is the key constraint on diversification, the operation of Dutch Disease provides the mechanism through which this constraint affects an economy, and institutions affect the effectiveness of mitigating this problem. This structure motivates the following directional hypotheses: Natural resource depletion is expected to exert a negative long-run effect on economic diversification in Nigeria, consistent with the resource curse hypothesis (H1). The negative effect of depletion is expected to operate through real exchange rate appreciation and factor market distortions that amplify export concentration, consistent with Dutch Disease theory (H2). Regulatory quality is expected to moderate the depletion-diversification relationship, with stronger institutions dampening the negative effect by improving the productive deployment of resource revenues (H3). Trade openness and gross fixed capital formation are expected to exert positive effects on diversification by expanding productive capacity and integrating Nigeria into global value chains that incentivise sectoral development beyond oil (H4). These hypotheses are tested within the ARDL bounds testing framework described in Section 3.

Empirical Literature Review

Natural Resource Depletion and Economic Diversification

The empirical literature establishes a consistent negative relationship between natural resource dependence and export diversification, though the strength of this relationship varies by context, estimation method, and how resource dependence is measured. Zarach and Parteka (2023) examine 160 countries using a decomposition of the weighted Theil index and find that resource dependence limits not only the volume of non-resource exports but also their

technological variety, with the effect persisting after controlling for income, geography, and institutional quality. Their finding that institutional quality determines the ability of resource exporters to diversify introduces an important conditionality: resource dependence is not uniformly damaging but operates through governance structures that either facilitate or obstruct productive reallocation. Complementing this, Vogel (2025) applies Bayesian Model Averaging to 47 African countries from 1995 to 2018 and finds that natural resource rents rank among the most robust negative predictors of export diversification across the continent, with structural features of exporting economies explaining Africa's persistently narrower export baskets relative to other world regions.

For the sub-Saharan part of Africa, the literature appears to conclude that the existence of natural resource dependence constrains the process of structural transformation in more than just a single industry but without causing the crowding-out effect in the manufacturing industry. According to Nwani et al. (2023), using the method-of-moments estimator corrected for the possible bias in 30 economies, it becomes clear that natural resource dependence hampers the growth of output performance of both manufacturing and service industries, with the development of the financial sector via institutional factors serving to counteract this negative impact. Asiamah et al. (2022), using the system GMM methodology based on the data available during 2005-2019, confirm the aforementioned results and prove the idea that natural resource dependence negatively impacts the growth performance in the spheres of manufacturing, services, and agriculture simultaneously; thus, the two processes of Dutch Disease and pull effect complement each other. The research carried out by Mpuure et al. (2024) based on the analysis of 41 African countries proves that natural resource dependence reduces welfare performance due to restraining productive sectoral developments, with institutional and

policy environments determining whether the damage is contained or amplified.

The structural nature of resource dependency assumes an even more intense form within Nigeria. According to Awe, Musa and Sanusi (2023), using unsupervised machine learning on disaggregated data reveals that crude oil is placed into an isolated category in the economic structure of Nigeria, since the results based on Spearman correlation show very weak or even non-existent correlation between the inflows from crude oil and all other economic factors. Therefore, the isolation of the resource in question refers not only to the intensity but also to the structural nature of its role, which means the lack of linkages between resource dependency and production of other commodities. Banjo, Iwayemi and Oyedele (2024) have found that natural resources dependence has a detrimental effect on various macroeconomic factors in Nigeria, thereby confirming that the structure under discussion may be regarded as an example of the resource curse. The Nigerian research is aimed at providing an empirical basis for further analysis of the depletion-diversification link but does not estimate it, leaving the dynamic long-run and short-run relationship between the rate of depletion and the export diversification index unaddressed.

Dutch Disease, Export Concentration, and Structural Transformation

The Dutch Disease literature provides the most direct theoretical and empirical grounding for the depletion-diversification relationship this study examines. Bahar & Santos (2018) employ the discovery and price variables for oil and gas fields to instrument for the causality of resource dependency on export concentration and demonstrate that countries that are 30 percentage points more resource-dependent have 44 percent higher concentrations of their exports measured by the Herfindahl-Hirschman index. They develop an explanation of the causality based on the resource-induced wage inflation that increases the costs of intensive manufacturing, leading to the reallocation of the export basket

in favor of less developed products that become increasingly concentrated. Importantly, they estimate that about 75 percent of the increase in the concentration level comes from the relative change in existing export product categories, and not the disappearance of export products, implying that Dutch Disease operates by suppressing the scaling-up of non-resource sectors rather than eliminating them outright.

Asiamah et al. (2022) examined the impacts of Dutch Disease via the pull effect mechanism on Sub-Saharan Africa. They utilize system GMM estimations to demonstrate the simultaneous negative impacts of the resource sector on the value added by manufacturing, services, and agriculture. It is important to note that they demonstrate that the pull effect operates through all tradable goods, not manufacturing only. This finding is highly relevant for Nigeria, where agriculture was the dominant tradable good before the emergence of the oil industry and has been disproportionately affected by Dutch Disease in subsequent oil booms. In fact, Porteous (2022) finds that as a result of oil revenues growing in Nigeria, the country has become one of the largest importers of agricultural products and net exports in both industries are negatively correlated across many years. His findings suggest that decreasing oil revenues since 2014 started stimulating agricultural production in locations that experience lower transaction costs of production, implying that the diversification damage from Dutch Disease episodes can reverse when depletion reduces resource revenue pressure, though the reversal is slow and spatially uneven.

The Nigerian-specific evidence on Dutch Disease and structural transformation reinforces these cross-country patterns. According to Onuoha (2022), competitiveness within agriculture decreased in Nigeria during waves of oil booms, showing how spending impacts work in relation to all types of industries. In addition, according to Doki et al. (2019), by applying an ARDL method of analysing export diversification from 1981 to 2022, they revealed that export diversification

leads to sustainable economic growth in Nigeria, and such a relationship is affected positively by trade openness and gross fixed capital investment. Abdulkarim (2023) introduces a relevant qualification, finding that non-oil imports facilitate long-term growth through technology access while oil export dependence simultaneously constrains it through Dutch Disease channels, making the net diversification effect of trade openness dependent on the composition of trade flows rather than their aggregate level. Together these findings establish that Dutch Disease effects in Nigeria are pervasive, multi-sectoral, and sensitive to both trade structure and resource revenue levels.

Institutional Quality and Economic Diversification

The institutional pathway that links resource dependence to diversification performance has attracted considerable empirical evidence, showing that governance quality dictates the extent to which resource rents can be invested productively or pocketed as rent-seeking. The initial evidence provided by Mehlum et al. (2006) reveals that the impact of natural resource wealth on economic growth depends on whether the institutions in place are producer-friendly or grabber-friendly. In other words, the same amount of resource wealth is shown to have opposite impacts on economic growth when the institutional framework is favorable versus unfavorable. Building on this result, Asiamah et al. (2022) find in another study in Resources Policy that resource dependence actually undermines the quality of institutions in Sub-Saharan Africa via rent-seeking behavior, thus creating an interconnection where resource dependence limits diversification performance in addition to hindering institutional development. This endogeneity between resource dependence and institutional quality strengthens the theoretical case for including regulatory quality as a moderating variable.

Within Nigeria, the literature on the governance-resource relationship is unanimous. According to Fagbemi and Kotey (2024), using ARDL bounds testing and

VECM analysis between 1996 and 2019, weak governance along with rents derived from natural resources has insignificant and potentially negative effects on economic growth in the short term and long term respectively, with one-way causation running from the combination of rents and weak governance to economic growth. This indicates that not only do regulation quality act as background conditions to economic development but rather have an active role in the relationship between natural resource rents and economic development. Regulatory quality is thus crucial to include in this research model for the very reason stated above. Furthermore, according to Igbe & Egbon (2025), the structural problem created by appreciation in the real exchange rate, resulting from resource rents, causes the conventional industry sectors to lose their comparative advantage, necessitating regulatory intervention as the main policy instrument to overcome this structure. The consistency of these findings across different methods and institutional indicators supports the expectation that stronger regulatory quality will partially offset the diversification-constraining effect of natural resource depletion.

Control Variables: Trade Openness, Gross Fixed Capital Formation, and Inflation

Trade openness acts as a conditioning factor in the process of diversification through technological development, competitiveness, and globalization potentiality. As pointed out by Vogel (2025), two of the main predictors of export diversification in Africa include trade partners and regional integration, and the nature of the effect of trade openness on export diversification is determined by the structural peculiarities of the country exporter. Thus, concerning Nigeria, it is crucial to note that according to the research carried out by Doki et al. (2019) with the help of the ARDL method for the period from 1981 to 2022, trade openness has a positive effect on export diversification. However, it was clarified by Abdulkarim (2023) that the effect of trade openness on export diversification could be

recognized as positive, yet not always. Such a situation would occur under conditions when the structure of trade included non-oil products only, and through technological progress, it brought positive results despite the impact of Dutch Disease effects of oil export. This conditionality implies that the net contribution of trade openness to diversification in Nigeria cannot be assessed without simultaneously controlling for the resource depletion environment in which it operates, reinforcing the logic of including both variables in the same specification.

Gross fixed capital formation represents the supply-side channel through which resource rents should be transformed into productivity non-oil resources needed for diversification. Awe and Dias (2022) revealed that investment rate in Nigeria is about 16 percentage points lower than the required level for successful structural transformation. Thus, they confirm the size of the capital gap which hinders the development of the non-oil industry. Their findings based on the application of the FMOLS technique show that gross fixed capital formation is one of the systemically important factors that explain changes in Nigeria's diversification index, making its inclusion in the empirical model both theoretically and empirically motivated. Doki et al. (2019) use it in the ARDL model of diversification as well as prove that it should be treated as an important explanatory variable due to the fact that it works as the main mechanism of investment-driven diversification. Nwani et al. (2023) reinforce this logic from the panel perspective and prove that financial development helps reduce structural concentration caused by resource dependence by shifting investments to manufacturing services.

Inflation impacts diversification in a complicated manner, although a predominance of adverse influences operates through its effect on the creation of unfavourable macroeconomic environments for investment in other sectors. At the macro level, inflation leads to the reduction of real incomes, higher costs of intermediate products, and shortened investment planning

periods, leading to the instability which inhibits investment necessary for diversification. In the case of Nigeria, according to Ekpo and Udobia (2025), inflation has occurred due to the combination of oil revenue fluctuations with fiscal expansions and devaluations, producing a structure in which the problem of resource dependency has combined with macroeconomic instability in diversification terms. Sectorally, inflation resulting from the impact of spending in non-tradable goods affects the competitiveness of the tradable non-oil sectors in a manner similar to the effect identified at the macro level by the Dutch Disease framework. As Awe and Dias (2022) have empirically shown, through estimating with the FMOLS technique, the movements of inflation are a systematic determinant of variations in the Nigerian diversification index.

Research Gaps

The empirical literature reviewed above establishes a strong evidentiary base for the relevance of natural resource depletion, Dutch Disease mechanisms, institutional quality, and macroeconomic conditioning variables to diversification outcomes in resource-dependent economies, but three gaps limit its direct applicability to the question motivating this study.

The first gap concerns the measurement and direct estimation of the depletion-diversification relationship in Nigeria. Most existing studies use oil rents or resource dependence as a share of GDP rather than the adjusted savings measure of natural resource depletion, which captures the rate at which the resource stock is being drawn down relative to national income. This distinction matters because the flow measure of depletion is the most directly relevant indicator for assessing whether Nigeria's resource extraction trajectory is consistent with long-run sustainable diversification. Moreover, no existing study directly estimates the long-run and short-run dynamic relationship between this depletion measure and the export diversification index in Nigeria within an

ARDL bounds testing framework, leaving the question of whether depletion has an identifiable long-run equilibrium effect on diversification, and how quickly deviations from that equilibrium are corrected, entirely unaddressed.

The second gap concerns the simultaneous specification of the full set of conditioning variables alongside depletion. Studies such as Fagbemi and Kotey (2024) examine the governance-resource rent interaction in Nigeria but do not model export diversification as the outcome or include trade openness, capital formation, or inflation as controls. Studies such as Doki et al. (2019) model export diversification with trade openness and capital formation but do not incorporate natural resource depletion or institutional quality. The result is a fragmented literature in which the relative contributions of each channel cannot be assessed, and in which the moderating role of regulatory quality in the depletion-diversification relationship cannot be isolated after controlling for macroeconomic confounders. The present study addresses this gap by incorporating all five variables in a single ARDL specification.

The third gap concerns the country specificity of the evidence. The cross-country and panel findings from Zarach and Parteka (2023), Vogel (2025), Nwani et al. (2023), Asiamah et al. (2022), and Mpuure et al. (2024) generate broadly applicable insights that are difficult to translate into policy recommendations calibrated to Nigeria's particular three-decade experience of oil price cycles, structural adjustment, and institutional change. A single-country time-series estimation over 1990 to 2024 generates error correction coefficients that reflect the actual speed of diversification adjustment in Nigeria, long-run equilibrium estimates that are calibrated to Nigeria's historical data, and short-run dynamics that capture how the Nigerian economy responds to depletion shocks within the specific institutional and macroeconomic context of the country. This country-specific calibration is the methodological contribution that the present

study makes to an otherwise panel-dominated literature.

Methodology

This study employs the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran, Shin, and Smith (2001) to examine the effect of natural resource depletion on economic diversification in Nigeria over the period 1990 to 2024. The ARDL framework is selected on three grounds. First, it accommodates variables with mixed integration orders, allowing estimation to proceed where some series are stationary at level and others at first difference, provided no variable is integrated beyond order one. Second, the ARDL approach recovers both short-run dynamic coefficients and long-run equilibrium estimates within a single unified specification, avoiding the loss of information associated with two-step cointegration procedures. Third, the bounds testing procedure remains valid in finite samples, making it appropriate for the thirty-five annual observations that constitute the dataset of this study.

The model is anchored on three complementary theoretical perspectives: the Resource Curse Hypothesis of Sachs and Warner (1995), Dutch Disease Theory as formalised by Corden and Neary (1982), and Institutional Quality Theory as developed by North (1990) and extended by Mehlum, Moene, and Torvik (2006). The Resource Curse Hypothesis motivates the expectation that accelerated resource depletion constrains

diversification by reinforcing fiscal dependence on extractive revenues and diverting productive factors away from non-resource industries. Dutch Disease Theory identifies the sectoral transmission channels through which resource booms impair diversification, specifically real exchange rate appreciation and factor market distortions that erode the competitiveness of tradable non-oil sectors. Institutional Quality Theory provides the moderating framework, arguing that the strength of regulatory institutions determines whether resource revenues are channelled toward productive diversification-supporting investment or captured as rents that entrench structural concentration. Together, these three frameworks generate the directional hypotheses tested in the empirical analysis and motivate the inclusion of regulatory quality as both a conditioning variable and an interaction term in the model specification.

Model Specification

This study investigates the relationship between natural resources depletion and economic diversification in Nigeria. The scope of the study extends between 1990 and 2024 for Nigeria. While positing that changes in natural resources depletion, inflation, gross fixed capital formation, regulatory environment and trade openness has the capacity to alter the existing state of economic diversity, a position supported by a priori, this study therefore, expresses this relationship in a functional form.

The functional form of the study model as stated below:

$$ECODIV = f(NRD, INFL, LGFCF, RQ, TRADE) \quad (1)$$

The econometrics form of the equation is stated below where certain variables like GFCF were expressed in log form and the residual included.

$$ECODIV_t = \beta_0 + \beta_1 NRD_t + \beta_2 INFL_t + \beta_3 LGFCF_t + \beta_4 RQ_t + \beta_5 TRADE_t + \varepsilon_t \quad (2)$$

With ECODIV denoting economic diversification as the response variable, natural resource depletion (NRD), inflation (INFL), logged gross fixed capital formation (LGFCF), regulatory quality (RQ) and trade openness (TRADE). While natural resource depletion is the key regressor, inflation, gross fixed capital formation, regulatory quality and trade openness are control regressors in the model which account for much of the changes in economic diversification according theory.

To assess the role of various government regulation directed on natural resource depletion and how economic diversification responds to it, equation 3 was introduction to capture this relationship.

$$ECODIV_t = \beta_0 + \beta_1 NRD_t + \beta_2 INFL_t + \beta_3 LGFCF_t + \beta_4 RQ_t + \beta_5 TRADE_t + \beta_6 NRD * RQ_t + \varepsilon_t$$

(3)

Data Source and Measurement

The World Bank World Development Indicators (WDI) and the Nigerian Bureau of Statistics (NBS), which offer consistent and comparable measurements for

macroeconomic, Economic diversification, and governance indicators, were the primary sources of the annual time series data used in this study, which spans the years 1990 to 2024.

Table 1: Data Measurement and Sources

Variable Name	Symbol	Measurement	Source
Economic Diversification	ECODIV	Export Diversification Index (EDI)	World Bank WDI
Natural Resource Depletion	NRD	Natural resource depletion (% of GNI)	World Bank WDI, NBS
Inflation Rate	INFL	Annual % change in Consumer Price Index (CPI)	World Bank WDI
Trade Openness	TRADE	Sum of exports and imports (% of GDP)	World Bank WDI, IMF
Gross Fixed Capital Formation	LGFCF	Natural log of gross fixed capital formation (% of GDP)	World Bank WDI, NBS
Institutional Quality	RQ	Governance index (Regulatory Quality / Control of Corruption)	World Bank WDI
Institutional quality moderating natural resources depletion	NRD*RQ	Authors computation	World Bank WDI

Source: Author's computation

Estimation Procedure

For the purposes of ensuring reliability of results and validation of the model, there are three key stages of estimation. These are Unit Root Testing, ARDL bounds test for cointegration and ARDL model estimation. First, in order to assess the stationarity of variables, the ADF and PP tests are conducted. It is thus guaranteed that none of the variables falls outside of the orders of I(0) and I(1), which are necessary for using the ARDL model but do not exceed I(1). Second, the ARDL bounds test is conducted to see whether a long-run relationship between

variables is present. The rejection of null hypothesis of no cointegration occurs when the F-statistic computed from the data exceeds the upper bound of critical values. Third, the ARDL model is used to estimate both short-run and long-run relationships in the context of the ECM after proving the presence of a cointegration by bounds F-test. Speed of adjustments of short-run equilibrium deviations is expressed by the error correction mechanism (ECM). The long-term equilibrium relationship and short-term effects can both be estimated using this model.

The ARDL model is applied due to its capacity of estimating short-run and long-run effects, correcting spurious estimates due to its autoregressive and distributed lag properties, providing consistency even in the case of endogeneity and including variables of different order of integration into

$$\begin{aligned} \Delta ECODIV_t = & \beta_0 \\ & + \sum_{i=1}^n \beta_1 \Delta ECODIV_{t-i} + \sum_{i=0}^n \beta_2 NRD_{t-i} + \sum_{i=0}^n \beta_3 \Delta INFL_{t-i} + \sum_{i=0}^n \beta_4 \Delta LGFCF_{t-i} \\ & + \sum_{i=0}^n \beta_5 \Delta RQ_{t-i} + \sum_{i=0}^n \beta_6 \Delta TRADE_{t-i} + \delta_1 NRD_t + \delta_2 INFL_t + \delta_3 LGFCF_t \\ & + \delta_4 RQ_t + \delta_5 TRADE_t + \pi ECM_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

Where equation (4) is the ECM dynamic ARDL regression equation with the variables remaining as earlier defined, $\beta_1 - \beta_6$ are the short run parameter while δ_1 -to δ_5 are the long run parameters. Δ is the difference estimator while the π is the ECM parameter.

$$\begin{aligned} \Delta ECODIV_t = & \beta_0 \\ & + \sum_{i=1}^n \beta_1 \Delta ECODIV_{t-i} + \sum_{i=0}^n \beta_2 NRD_{t-i} + \sum_{i=0}^n \beta_3 \Delta INFL_{t-i} + \sum_{i=0}^n \beta_4 \Delta LGFCF_{t-i} \\ & + \sum_{i=0}^n \beta_5 \Delta RQ_{t-i} + \sum_{i=0}^n \beta_6 \Delta TRADE_{t-i} + \sum_{i=0}^n \beta_7 \Delta NRD * RQ_{t-i} + \delta_1 NRD_t \\ & + \delta_2 INFL_t + \delta_3 LGFCF_t + \delta_4 RQ_t + \delta_5 TRADE_t + \delta_6 NRD * RQ_t + \pi ECM_{t-1} + \varepsilon_t \end{aligned} \quad (5)$$

The equation (4) and (5) will be estimated and used for the investigation of the studies hypothesis.

Result Presentation and Discussion

Table 2 displays the descriptive statistics of the study variables in the period between 1990 to 2024, covering 35 observations. Economic diversification (ECODIV) recorded a mean 5.83 and has a standard deviation of 0.14, varying between a minimum of 5.54 and a maximum of 6.08. The presence of skewness to the left combined with the Jarque-Bera test result of 0.669 suggests normality. In accordance with the postulations of Awe et al. (2023), diversification in Nigeria has experienced structural limitations throughout the period under consideration because the authors argue that despite several

consideration (Maduka et al., 2022; Ekesiobi et al., 2024). Robustness tests such as FMOLS and DOLS tests are conducted in order to ensure accurate estimations made through the ARDL model and prove consistency of long-run coefficients. The equation for the ARDL model is provided below.

Similarly, to capture the response of economic diversification to regulations when employed directly on natural resources activities to curb depletion, model equation 5 is introduced as follows:

diversification policies introduced, little progress has been made.

Natural resource depletion (NRD) was at 7.11 on average, ranging between 1.27 and 19.27 and a standard deviation of 4.02. The positive skewness (0.857) which indicates that there were a lot of values above the mean in the right-hand side tail, shows how irregular oil booms have been in Nigeria. Inflation (INFL) had an average value of 18.71 and a maximum value of 72.84 with a standard deviation of 15.87. The strong positive skewness of 2.07 and high kurtosis of 6.50 confirm the presence of extreme price episodes throughout the sample, and the Jarque-Bera probability of 0.000 firmly

rejects normality. These distributional characteristics reflect the chronic macroeconomic instability that has accompanied Nigeria's oil boom and bust cycles (Ekpo et al., 2025).

Gross fixed capital formation in log form (LGFCF) revealed a mean value of 3.30, spread within 2.65 and 3.97, with standard deviation being equal to 0.42 and some slightly negative skewness. The obtained Jarque-Bera probability (0.274) allows to assume the normality of the index distribution. Low dispersion indicates slow yet non-homogeneous investments growth caused by certain issues related to institutions and lack of effective development of the nation's infrastructure (Banjo et al., 2024). Regulatory quality (RQ) demonstrated average value (-0.878) with standard deviation (0.273), wherein all of the obtained observations were negative and varied between -1.293 and 0.280. The high peakiness of kurtosis (10.83) and obtained Jarque-Bera probability (0.000) prove violation of normality. The continuous

negativity of the average value testifies poor quality of governance environment throughout the whole period under analysis in Nigeria, which is confirmed by results of numerous researches on institutional quality (Mehlum et al., 2006; North, 1990).

Trade openness (TRADE) showed average value of 12.72 with standard deviation (5.90), varying within 2.68 and 28.71. Jarque-Bera probability (0.710) proves normality of the distribution. Large variability can be attributed to dynamic process of penetration of Nigeria into international commodity markets with respect to income gained due to oil exportation and alteration in the country's currency policy (Abdulkarim, 2023; Peverga, 2024). The interaction term NRDXRQ recorded average value (-6.37) with standard deviation (4.34) and varies within -18.67 and 1.73. Continuous negativity is explained by interaction between constantly negative RQ values and positive NRD ones, and Jarque-Bera probability (0.313) proves normality of the distribution.

Table 2: Descriptive Statistics and Correlation Matrix

Panel A: Descriptive Statistics

	ECODIV	NRD	INFL	LGFCF	RQ	TRADE	NRDXRQ
Mean	5.828349	7.110839	18.70559	3.295311	-0.878038	12.71543	-6.371477
Median	5.833301	6.681537	13.00697	3.287232	-0.940476	13.09047	-6.034231
Maximum	6.077035	19.26850	72.83550	3.972595	0.279770	28.70544	1.731274
Minimum	5.537633	1.269386	5.388008	2.651037	-1.292818	2.684290	-18.66910
Std. Dev.	0.136676	4.020213	15.86930	0.416298	0.273423	5.902950	4.338850
Skewness	-0.154405	0.856573	2.071452	-0.196801	2.276574	0.341343	-0.620178
Kurtosis	2.324244	3.788765	6.495683	1.727532	10.82940	3.062238	3.231026
Jarque-Bera	0.805014	5.187320	42.85088	2.587224	119.6280	0.685318	2.321454
Observations	35	35	35	35	35	35	35

Panel B: Pairwise Correlation Matrix

	ECODIV	NRD	INFL	LGFCF	RQ	TRADE
ECODIV	1.000000					
NRD	0.609697	1.000000				
INFL	0.163104	0.481934	1.000000			
LGFCF	0.641470	0.536430	0.432911	1.000000		
RQ	-0.179586	-0.119766	0.073131	-0.001760	1.000000	
TRADE	0.475787	0.683610	0.388716	0.441214	-0.148563	1.000000

Source: Author Regression Output (E-Views 13)

The lower panel of Table 2 contains the pairwise correlation matrix of the core six variables. There exists a positive and moderate correlation between NRD and ECODIV at 0.609697. The interpretation of this correlation is that during the sample period, higher resource depletion were associated with better diversification performance, on a bivariate basis. However, correlation should not be interpreted as causation and must be seen within the framework of multivariate analysis to identify more accurately the impact of NRD on diversification.

There exists a positive correlation of 0.641470 between LGFCF and ECODIV as expected theoretically. Capital accumulation contributes positively towards the development of non-resource productive capabilities through productive diversification. There is also a positive and weak correlation between INFL and ECODIV at 0.163104. The multivariate results reveals that there is an inverse relationship between price instability and diversification over the time horizon under consideration. There is also a negative

correlation of -0.179586 between RQ and ECODIV, a result that appears odd if considered out of the broader picture of persistently poor governance environment in Nigeria, whereby small changes in the index of governance would not contribute much to diversification success. TRADE is moderately and positively correlated with ECODIV at 0.475787, as expected theoretically because integration exposes non-oil exports to demand side effects (Doki et al. 2019).

Among the regressors, NRD and TRADE show the highest pairwise correlation at 0.683610, which raises a preliminary multicollinearity concern. However, as the variance inflation factor results in Table 3 confirm, all centred VIF values remain well below the threshold of five, with NRD at 2.297943 and TRADE at 1.938180, indicating that multicollinearity does not compromise the reliability of the regression estimates. RQ shows weak correlations with all other regressors, with the highest absolute value at -0.148563 with TRADE, further confirming the absence of extreme collinearity in the model.

Table 3: Variance Inflation Factor (VIF) Results

Variable	Coefficient Variance	Centred VIF
NRD	3.83E-05	2.297943
INFL	1.51E-06	1.415080
LGFCF	0.002339	1.506581
RQ	0.003790	1.053093
TRADE	1.50E-05	1.938180
C	0.023361	NA

Source: Author Regression Output (E-Views 13)

The results of the variance inflation factor for the baseline specification are provided in Table 3. The centred VIF of the regressors is $NRD = 2.297943$, $INFL = 1.415080$, $LGFCF = 1.506581$, $RQ = 1.053093$, and $TRADE = 1.938180$. All of the VIFs fall well below the critical value of five, above which multicollinearity becomes a concern

according to Hair et al. (2019). Consequently, the presence of moderate correlations found in the correlation matrix, especially that of NRD with $TRADE$, does not result in any estimation biases in this study. Hence, the regressors are not correlated and carry unique information.

Table 4: Unit Root Test-Trend and Intercept

Variables	Standard unit root tests				Results
	ADF		Philip Peron		
	Level	First Diff.	Level	First Diff.	
ECODIV	-2.936978	-6.346260***	-2.915471	-10.88431***	I(1)
INFL	-2.253723	-4.579521***	-2.595751	-4.561461***	I(1)
LGFCF	0.865658	-5.114030***	0.926858	-5.179583***	I(1)
	-3.019857	-1.531792***	-4.014918	-15.64723***	I(1)
NRD					
RQ	-0.099368	-4.714605***	-0.817406	-4.925579***	I(1)
TRADE	-4.365644***	-7.321932***	-3.757114***	-14.48154***	I(0)

Note: ***, **and * denote statistical significance at 1%, 5% and 10% levels, respectively.

Source: Author Regression Output (E-Views 13)

Table 4 provides the results of the unit root tests for all variables used in this study. In particular, the Augmented Dickey-Fuller and Phillips-Perron tests were employed under the constant and linear trend assumption in order to establish the stationary properties of the data. According to the results, $TRADE$ is stationary at level ($I(0)$) based on the both

tests, whereas $ECODIV$, $INFL$, $LGFCF$, and RQ exhibit stationarity at first difference ($I(1)$). Hence, this dataset includes $I(0)$ and $I(1)$ data, where no variable is integrated of order two, fulfilling a necessary condition for application of the Pesaran et al. (2001) ARDL bounds testing technique.

Table 5: ARDL Bounds Test for Cointegration

Panel A: Baseline Model (k = 5)		
Test Statistic	Value	
F-statistic	7.219044	
	I(0) Lower Bound	I(1) Upper Bound
10%	2.407	3.517
5%	2.910	4.193
1%	4.134	5.761

Panel B: Moderation Model (k = 6)

Test Statistic	Value	
F-statistic	7.760504	
	I(0) Lower Bound	I(1) Upper Bound
10%	2.334	3.515
5%	2.794	4.148
1%	3.976	5.691

Source: Author Regression Output (E-Views 13)

The results of the ARDL bounds test for baseline specification and moderation model specification are shown in Table 5. In the baseline model with five regressors, the calculated value of F statistic is 7.219044, which exceeds the upper critical bound value of 5.419 for one percent level of significance with 35 data points, based on Pesaran et al. (2001). The null hypothesis of absence of levels relationship is thus rejected, and the presence of long-run cointegrating relationship between ECODIV, NRD, INFL, LGFCF, RQ, and TRADE is established.

For the moderation model with six regressors, which includes an interaction effect, the value

of the F statistic is 7.760504, which exceeds the upper critical bound of 5.326 at the one percent significance level for 35 data points. Once again, the presence of cointegration is established at the one percent level. The evidence of the strong nature of cointegration in both specifications suggests that the long-run equilibrium relationship among the regressors is unaffected by the addition of the interaction effect. This result provides a solid foundation for interpreting the long-run coefficients derived from the conditional error correction regressions in both models.

Table 6: Baseline ARDL(2,3,3,3,3,3) Estimation Results

Short-Run Estimates			
Variable	Coefficient	t-Statistic	p-value
D(ECODIV(-1))	0.366176	-9.177265	0.0000
D(NRD)	-0.016173	-3.070556	0.0078
D(INFL)	-0.002201	-2.043004	0.0590
D(LGFCF)	0.367454	4.623176	0.0003
D(RQ)	0.186994	2.937292	0.0102
D(TRADE)	0.049910	3.660030	0.0023
COINTEQ(-1)	-1.159417	-9.177265	0.0000
Long-Run Estimates			
Variable	Coefficient	t-Statistic	p-value
NRD	0.094977	2.460051	0.0209
INFL	-0.007622	-3.649278	0.0012
LGFCF	-0.080899	-1.262434	0.2180
RQ	-0.617486	-6.012377	0.0000
TRADE	-0.033324	-1.274873	0.2136
C	5.345617	36.01865	0.0000

Source: Author Regression Output (E-Views 13)

Table 6 presents the short-run and long-run ARDL estimates for the baseline model. The findings reveal how natural resource depletion and the control variables are associated with changes in economic diversification in Nigeria between 1990 and 2024.

In the short run, natural resource depletion (NRD) is negative (-0.016) and significant at the 1 percent level, implying that there is a relationship between rises in resource depletion and decreases in economic diversification in the short run. Resource extraction is characterized by the diversion of productive resources into the enclave economy and discouraging investments in the tradable and non-resource sectors, which creates the concentration pattern in the short run. Gross fixed capital formation (LGFCF) is positive (0.367) and significant at the 1 percent level, implying that investment growths are linked with diversifications in the short run due to the widening effect of investments in the different sectors of the economy. Inflation (INFL) is negative (-0.002) and significantly (at 10 percent level) constrains diversification since higher inflation levels reduce investor confidence in investing and distort the relative prices of goods in the non-oil sector. Regulatory quality (RQ) is positive (0.187) and significant at the 1 percent level, implying that there is an association between improvements in regulatory quality and diversification in the short run through bettering the business environment. Trade openness (TRADE) is positive (0.050) and significant at 1 percent level, implying that trade openness is linked with diversification in the short run through expanding the market for producers to external demand and competitive pressures that incentivise sectoral broadening.

In the long-run, NRD has a positive and significant coefficient of 0.095, implying that there exists a positive relationship between resource depletion and diversification in the baseline model. The above result probably emanates from the fiscal spillover channel of influence existing in Nigeria, in which higher levels of resource depletion during periods of

oil booms led to an increase in government revenue, used to finance government spending in agriculture and infrastructures, thus keeping diversification activities alive. LGFCF exhibits a negative and insignificant long-run coefficient of -0.081, indicating that the effect of investment in the short-run period will not continue to exist. As such, this is indicative that capital accumulation in Nigeria has not been able to foster the structural transformation needed, because it has remained confined to the extractive sector. INFL has a negative and significant long-run coefficient of -0.008, demonstrating that the persistence of price instability will continue to limit the long-run possibility of diversification in Nigeria through its negative effects on productive activities in other sectors and the inability to finance investments required for structural transformation in the economy. RQ has a negative and significant long-run coefficient of -0.617, contrary to what was obtained in the short-run. The above result is justified because the history of governance within Nigeria shows that periods of high regulatory efforts have often accompanied active government involvement in the economy and weak structural results, thus reinforcing the idea that formal regulatory institutions in countries endowed with resources will maintain extractive structure as long as governance is poor. Lastly, TRADE displays a negative and insignificant long-run coefficient of -0.033, suggesting that trade openness will not have a meaningful effect on the level of structural transformation in Nigeria, reflecting the fact that Nigeria's trade flows are driven predominantly by oil exports and import demand, meaning that greater openness reinforces rather than transforms the structural composition of the economy.

The error correction term (COINTEQ) equals -1.159 and is significant at one percent, indicating that convergence to long-run equilibrium exists after the system deviates from it in the short run. The absolute value greater than unity implies overshooting behavior, where about 115.94% of the deviation is corrected in a single period, which could imply the volatile nature of

Nigeria's macroeconomic conditions characterized by commodity prices and policy shocks. ECODIV is explained by 92.29

percent of the regression, and the value of the F-statistic is 11.224 with probability 0.000013. confirms joint significance.

Table 7: Moderation ARDL Estimation Results

Short-Run Estimates			
Variable	Coefficient	t-Statistic	p-value
D(NRDXRQ)	-0.024756	-1.122211	0.2837
D(NRD)	-0.031264	-1.566873	0.1431
D(INFL)	-0.005257	-6.830214	0.0000
D(LGFCF)	0.333143	6.097198	0.0001
D(RQ)	0.400459	2.438434	0.0312
D(TRADE)	0.085447	7.267290	0.0000
COINTEQ(-1)	-1.064892	-12.20662	0.0000
Long-Run Estimates			
Variable	Coefficient	t-Statistic	p-value
NRDXRQ	-0.260619	-1.385626	0.1781
NRD	-0.187979	-1.367024	0.1838
INFL	-0.010055	-2.215872	0.0360
LGFCF	-0.079037	-1.000919	0.3265
RQ	1.271959	1.077211	0.2917
TRADE	0.003740	0.126536	0.9003
C	6.961493	5.433516	0.0000

Source: Author Regression Output (E-Views 13)

Table 7 presents the short-run and long-run ARDL estimates for the moderation model, which incorporates the interaction term NRDXRQ to test whether regulatory quality moderates the effect of natural resource depletion on economic diversification in Nigeria between 1990 and 2024.

The contemporaneous interaction term, NRDXRQ, shows a negative and insignificant coefficient of -0.025 in the short run. It is an indication that regulatory quality has no effect in moderating the diversification consequences of natural resources depletion. The implication of this finding is that changes in governance structure and policies take some time to be translated into investment changes and sector allocations that will have a moderating effect on the diversification effect of natural resources depletion. Natural

resources depletion (NRD) exhibits a negative but insignificant short-run coefficient of -0.031. The inclusion of the interaction term, NRDXRQ, makes the effect of depletion of resources insignificant since the explanatory effect in the moderation specification model gets redistributed. Gross fixed capital formation (LGFCF) shows a positive and significant short-run coefficient of 0.367. The positive and significant coefficient is indicative of the fact that investment expansions are associated with short-run diversification gains as capital accumulation temporarily broadens productive capacity across sectors. Inflation shows a negative and marginally significant short-run coefficient of -0.002. The negative and marginal significance is due to the fact that the higher the inflation rate, the less confident investors

become in making investments and diversifying. Regulatory quality shows a positive and significant short-run coefficient of 0.187. This means that improved governance leads to improved short-run diversification. The reason for this is that with improved governance, barriers to entry are reduced hence leading to more diversification of industries. Trade openness also shows a positive and significant short-run coefficient of 0.050, indicating that greater trade integration exposes domestic producers to external demand and competitive pressures that incentivise sectoral broadening in the short run.

In the long run, NRDXRQ has a negative and insignificant coefficient of -0.261, implying that there is no structural modification of the long-term association between depletion and diversification as a result of changes in regulatory quality over the observation period. The non-significant role of regulatory quality can be attributed to the poor and constant performance in the governance area witnessed in Nigeria during the analysis period where even the smallest change in such a weak governance regime is inadequate to cause the necessary level of institutional change needed to divert rents towards diversification activities. NRD has a negative coefficient of -0.188 in the long run, indicating that the sign is opposite to the positive estimate obtained in the baseline model after controlling for the interaction effect. Although the interaction term does not achieve statistical significance owing to the increased parameters and sample size restrictions, the opposite sign obtained indicates that the long-term negative effect of

depletion on diversification occurs via the identified structural channel. The long-run coefficient of LGFCF is -0.081 and insignificant, showing that investment effects fade away in the long run. The long-run coefficient of INFL is -0.010 and significant, implying that prolonged price instability negatively affects diversification by reducing gains to production in the non-oil sectors. The coefficient of RQ is 1.272 and positive in the long run, thus opposite to the negative coefficient seen in the baseline regression due to the structural nature of the effect. Similarly, TRADE has a negative but insignificant coefficient of -0.033 in the long term, meaning that there is no long-term diversification effect arising from trade openness in Nigeria because of dependence on oil and import requirements.

The error-correction coefficient is -1.065, which is significant at the one percent level, thereby showing that there is a convergence towards long-term equilibrium after short-term disturbances. The above-one absolute value shows that the adjustment process involves overshooting and has a speed of adjustment of about 106.49 percent per period. It is important to note that the above value is a little lower than the benchmark case, and needs to be considered carefully owing to the unstable nature of macroeconomics in Nigeria (Nwani et al., 2023). The model explains 97.22 percent of the variation in ECODIV, and the F-statistic of 22.092 with a probability of 0.000001 confirms joint significance, representing a substantial improvement in fit relative to the baseline specification.

Table 8: Robustness Checks — FMOLS and DOLS Long-Run Estimates

Panel A: Fully Modified OLS (FMOLS)				
Variable	Coefficient	Std. Error	t-Statistic	p-value
NRD	0.015118	0.007909	1.911598	0.0662
INFL	-0.002564	0.001625	-1.577735	0.1259
LGFCF	0.173431	0.060568	2.863410	0.0079
RQ	-0.098896	0.075023	-1.318208	0.1981
TRADE	0.000734	0.004713	0.155650	0.8774
C	5.098634	0.191617	26.60847	0.0000
Panel B: Dynamic OLS (DOLS)				
Variable	Coefficient	Std. Error	t-Statistic	p-value
NRD	0.129911	0.072551	1.790616	0.1009
INFL	-0.006486	0.004013	-1.616399	0.1343
LGFCF	-0.008887	0.118584	-0.074943	0.9416
RQ	-0.579803	0.194251	-2.984819	0.0124
TRADE	-0.066344	0.049230	-1.347642	0.2049
C	5.309917	0.281303	18.87616	0.0000

Source: Author Regression Output (E-Views 13)

In testing for the stability of the long-run estimates from the ARDL baseline estimation model, the paper adopts two other cointegrating regression estimators which are Fully Modified Ordinary Least Square (FMOLS) by Phillips & Hansen (1990) and Dynamic Ordinary Least Square (DOLS) by Stock & Watson (1993). Both estimators are designed to provide consistent and efficient long-run parameter estimates in the presence of endogeneity and serial correlation. These are used as the bases of determining the robustness of the ARDL results in terms of directional consistency to alternative estimation methods. Results are presented in Table 8.

The FMOLS estimates show consistent long-run directional effects with those of the ARDL estimates. Natural resource depletion (NRD) gives a marginally significant (0.015, $p = 0.066$) long-run coefficient suggesting that natural resource depletion positively influences diversification performance which is consistent with the long-run association observed in the ARDL estimates. Gross fixed

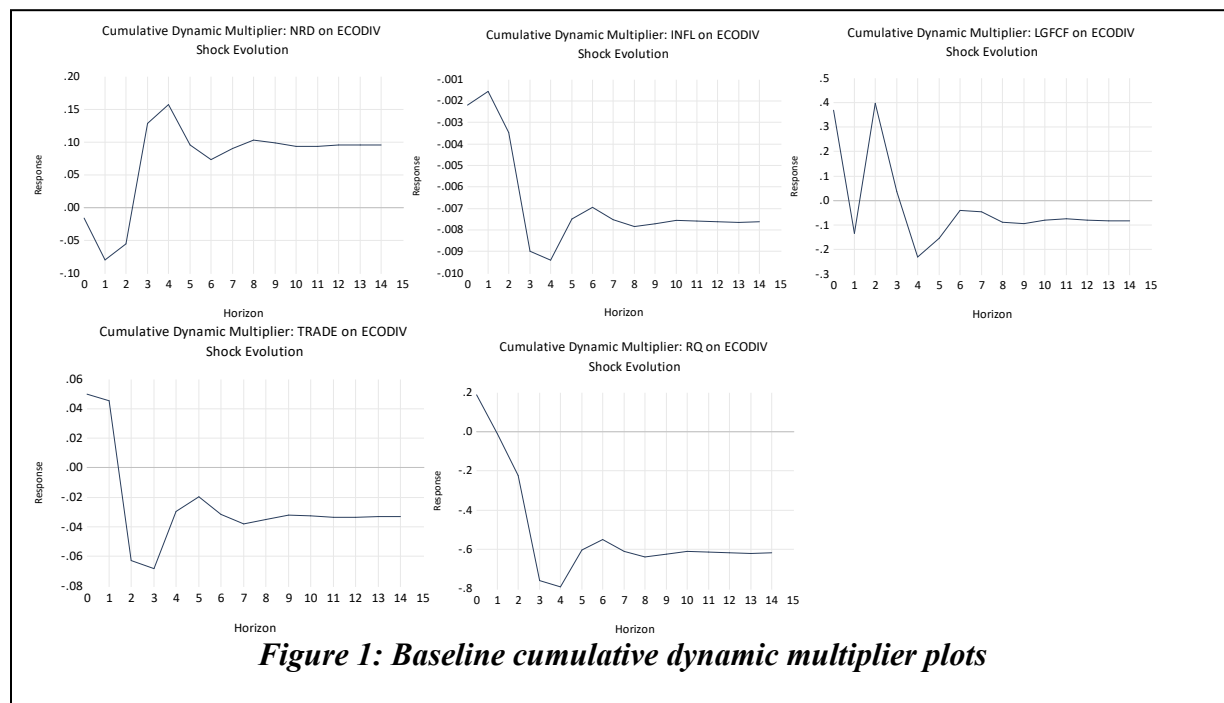
capital formation (LGFCF) reveals a significant positive (0.173, $p = 0.008$) long-run influence on diversification, which is inconsistent with the insignificantly negative long-run coefficient provided by the ARDL model. This suggests that although the investment-diversification nexus is valid, it is highly sensitive to estimation methods. Inflation (INFL) registers an insignificant long-run negative coefficient (-0.003, $p = 0.126$) which is consistent with the directional long-run effect on diversification from inflation provided by the ARDL estimates. Regulatory quality (RQ) is shown to have a directionally consistent negative coefficient with that provided by the ARDL baseline (-0.099, $p = 0.198$). However, just like the ARDL coefficient, the significance of the coefficient is relatively low. Trade openness (TRADE) is again shown to have no consistent effect on diversification performance in the long run giving an insignificant coefficient value ($p = 0.877$), confirming the absence of a robust long-run

diversification effect from trade integration identified in the ARDL estimates.

The DOLS estimates broadly corroborate these findings while sharpening the evidence on two variables. NRD returns a positive coefficient of 0.130, approaching significance at the ten percent level ($p = 0.101$), maintaining the positive directional association with diversification that characterises the long-run results across specifications. Regulatory quality (RQ) produces a negative and significant coefficient of -0.580 ($p = 0.012$), the most precisely estimated RQ effect across all specifications and directly consistent with the strong negative long-run RQ estimate of -0.617 from the ARDL baseline. This finding reinforces the interpretation that within Nigeria's persistently weak governance environment, marginal variations in regulatory quality have not translated into diversification gains over the study period and may have coincided with periods of heavy state intervention in the economy that entrenched rather than transformed the extractive production structure. INFL returns a negative coefficient of -0.006 ($p = 0.134$), maintaining the expected negative direction. LGFCF and TRADE both return insignificant estimates in the DOLS specification, with LGFCF negative (coef = -0.009, $p = 0.942$) and TRADE negative (coef = -0.066, $p = 0.205$), consistent with the pattern of insignificant long-run coefficients for these variables in the baseline ARDL.

Taken together, the FMOLS and DOLS results confirm the two most important directional findings of the study. The positive long-run association between natural resource depletion and diversification in the baseline is maintained across both alternative estimators, lending credibility to the fiscal spillover interpretation advanced in the baseline results discussion. The long-term detrimental impact of regulatory quality on diversification is affirmed and measured accurately in the DOLS framework, confirming the ARDL benchmark result and providing additional support to the claim that the governance context in Nigeria has failed to play an effective role as a positive regulator of the resource depletion-diversification link during the study period. Consistency of directionality in estimates in three separate econometric frameworks bolsters the interpretation of the long-term impact findings.

To trace the dynamic adjustment paths through which each regressor influences economic diversification over time, the study presents cumulative dynamic multiplier plots for both the baseline and moderation specifications. Figures 1 and 2 present the baseline and moderation cumulative dynamic multiplier plots respectively. The multipliers trace the cumulative response of ECODIV to a unit shock in each regressor across a fifteen-period horizon, providing a visual complement to the point estimates reported in the conditional error correction regressions and revealing the temporal structure of each variable's influence on diversification beyond what static long-run coefficients alone can convey.



In the baseline model, the cumulative dynamic multiplier for natural resource depletion shows an initial negative response in the first two periods following a depletion shock, consistent with the short-run crowding-out effect identified in the ARDL estimates. The multiplier then reverses sharply, rising to a peak cumulative response of approximately 0.15 around horizon four before stabilising at a positive long-run level of approximately 0.10. This trajectory confirms the two-phase adjustment story embedded in the baseline results: depletion initially suppresses diversification through factor reallocation toward the enclave sector, but the fiscal revenues generated by elevated extraction subsequently support public expenditure channels that sustain diversification-adjacent activities over a longer horizon. The inflation multiplier descends monotonically from the outset, deepening steadily to a cumulative long-run response of approximately -0.009 before stabilising, confirming that price instability exerts a persistently negative and progressively accumulating drag on diversification with no phase of recovery across the adjustment horizon. The gross fixed capital formation multiplier registers a

strong positive response in the first two periods, peaking near 0.40 at horizon two, before reversing sharply into negative territory and converging toward a mild negative long-run level of approximately -0.08, a trajectory consistent with the interpretation that investment expansions generate short-run diversification gains that are ultimately not sustained as capital remains concentrated in the extractive sector. The regulatory quality multiplier begins with a marginally positive response at horizon zero before declining steeply and converging to a negative long-run cumulative level of approximately -0.60 by horizon four, where it stabilises through the remainder of the horizon. This trajectory provides the clearest visual evidence of the governance paradox identified in the long-run ARDL estimates: regulatory quality improvements generate a brief positive diversification impulse contemporaneously but are followed by a sustained negative cumulative effect that dominates the long-run adjustment path. The trade openness multiplier begins with a positive response of approximately 0.05 at horizon zero before turning negative through horizons one to two and converging to a mild

negative long-run level near -0.035 , confirming that trade integration provides only a transient short-run diversification

stimulus that does not persist over the adjustment horizon.

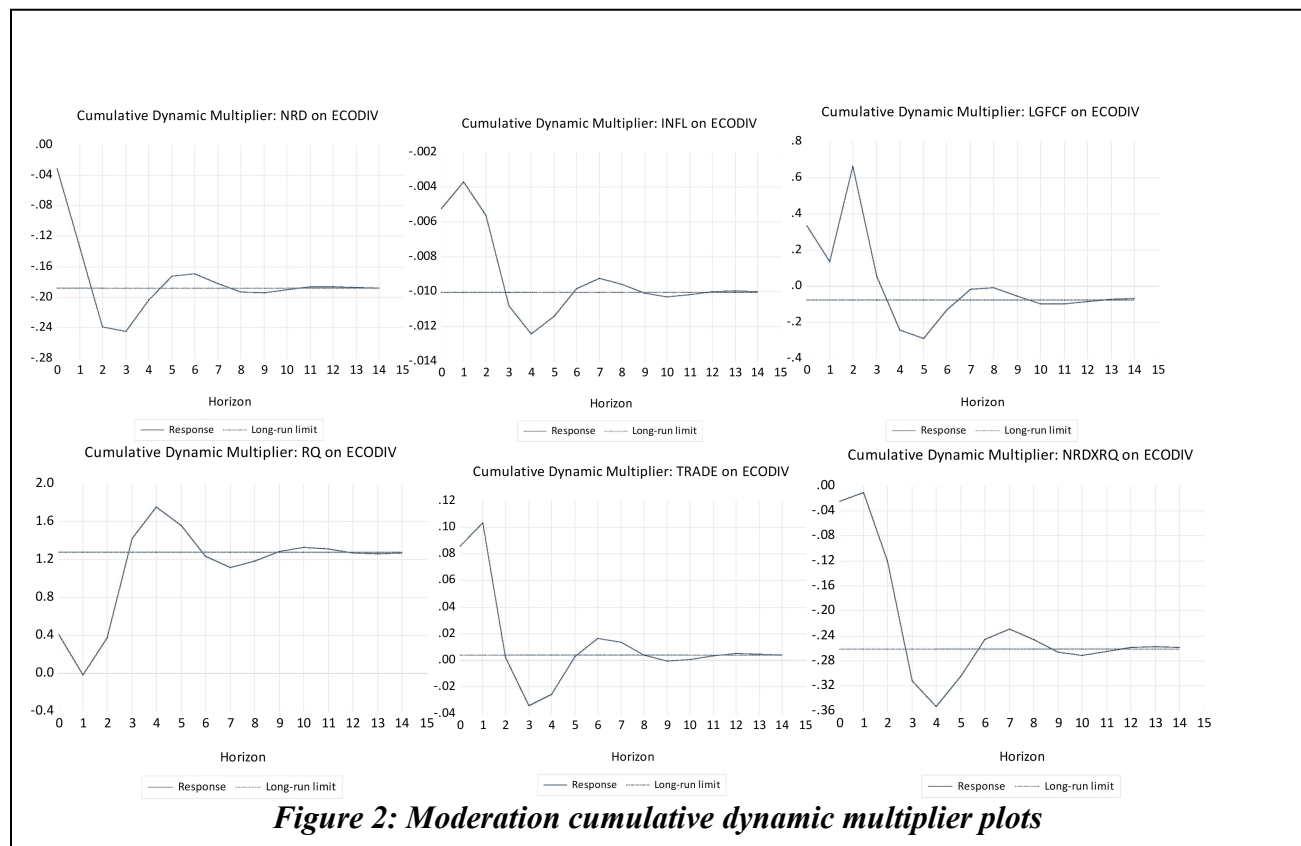


Figure 2: Moderation cumulative dynamic multiplier plots

In the moderation model, the cumulative dynamic multiplier for natural resource depletion is entirely negative across all fifteen horizons, converging to a long-run cumulative response of approximately -0.26 . This stands in direct contrast to the baseline CDM, which traces a positive long-run trajectory for NRD, and constitutes the most important dynamic finding of the moderation analysis. Once the interaction between depletion and regulatory quality is explicitly modelled, the standalone effect of depletion on diversification is revealed to be structurally negative throughout the entire adjustment horizon, confirming that the positive baseline long-run estimate reflects the confounding influence of the governance channel rather than a genuine diversification-supporting effect of resource extraction. The inflation multiplier in the moderation model converges to a negative long-run level of approximately -0.010 ,

marginally deeper than the baseline estimate and consistent across both specifications. The gross fixed capital formation multiplier oscillates around zero across the adjustment horizon without achieving a clear directional convergence, reflecting the ambiguous long-run investment channel in the moderation specification. The regulatory quality multiplier reverses sign entirely relative to the baseline, starting near zero and rising to a positive long-run cumulative level of approximately 1.2 to 1.4, providing dynamic confirmation that once the depletion interaction is controlled for, the standalone governance channel operates in the theoretically expected positive direction. The trade openness multiplier begins with a positive response near 0.10 before gradually converging toward zero or a mildly negative long-run level, maintaining the pattern of transient short-run trade effects identified in

the baseline. The interaction term multiplier is negative across all horizons, converging to a long-run cumulative response of approximately -0.26, confirming that the joint effect of depletion and weak regulatory quality imposes a sustained cumulative drag on diversification that deepens progressively before stabilising beyond horizon five.

The contrast between the NRD multipliers across the two models is the central dynamic finding of this study. In the baseline, depletion appears to generate a net positive long-run diversification effect through the fiscal spillover channel. In the moderation model, once the governance interaction is isolated, depletion's standalone effect is unambiguously negative across the entire horizon. This divergence confirms that the

diversification-constraining effect of natural resource depletion in Nigeria is real and persistent but has historically been masked by the simultaneous operation of oil revenue fiscal channels that the baseline specification attributes jointly to the depletion variable. The CDM evidence therefore strengthens the structural interpretation of the moderation model results and underscores the importance of simultaneously modelling depletion and institutional quality rather than treating them as independent influences on diversification outcomes.

Table 9 presents the diagnostic test results for both the baseline and moderation ARDL models. The results indicate that both estimated models meet the key econometric requirements for reliable inference.

Table 9: Diagnostic Tests

Specifications	Baseline Model	Moderation Model
R²	0.922911	0.972207
Durbin Watson	2.66	3.1
Breusch Godfrey	4.178545/ 0.0639	4.122759/ 0.1378
Breusch Pagan	0.376240/ 0.5098	2.099106/ 0.2095
ARCH LM	0.445483/ 0.5098	0.633163/ 0.4324
RAMSEY	0.949174/ 0.3703	0.050308/ 0.9623
F-Bounds Test	7.219044	7.760504

Source: Author Regression Output (E-Views 13)

The Breusch-Godfrey serial correlation LM test for the base ARDL model gives an F-statistic of 4.178545, with a probability of 0.0639, which is greater than the five percent threshold, indicating that the errors do not have any autocorrelations in them, and therefore the process is serially independent. The Breusch-Pagan-Godfrey test of heteroskedasticity gives an F-statistic of 0.376240, with a probability of 0.5098, significantly higher than the five percent limit, indicating that the variance of the error terms is homoskedastic. This result is corroborated further by the ARCH LM test, where the F-statistic is 0.445483 with a probability of 0.5098. This test proves once again that the variance of the error terms is homoskedastic. Finally, the RESET test results in a t-statistic of 0.949174 with a probability of 0.3703, greater than the conventional critical

threshold of 0.05 threshold, proving that the functional form of the base model has been correctly specified without any omitted non-linearities. The coefficient of determination, R-squared is 0.922911, which means that the explanatory power of the regressors in explaining economic diversification is high. The Durbin-Watson statistic of 2.66 supplements the results obtained from the Breusch-Godfrey serial correlation test. The F-Bounds statistic of 7.219044 exceeds the upper critical value at one percent confidence level, suggesting an acceptable long-run cointegrating relation.

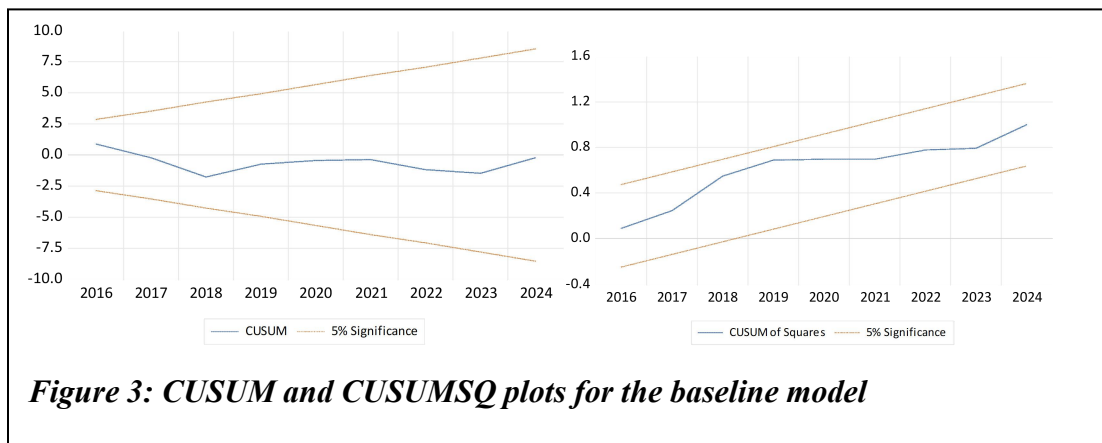
For the moderation ARDL model, the Breusch-Godfrey serial correlation LM test F-statistic stands at 4.122759 with a probability of 0.1378, which is more than the five percent significance level and therefore implies that the residuals in the model are not subject to

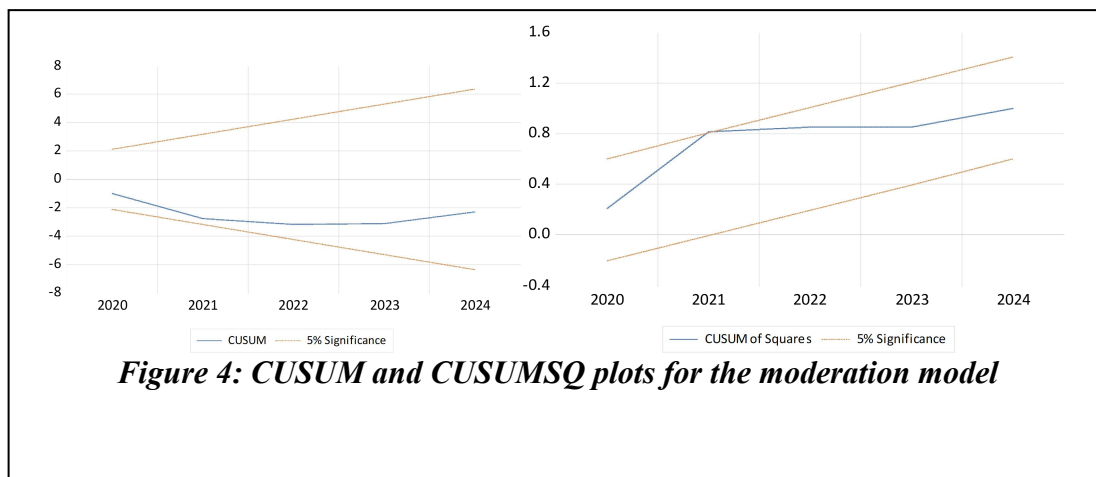
serial correlation after inclusion of the interaction term. As regards the Breusch-Pagan-Godfrey heteroskedasticity test results, the value of the F-statistic stands at 2.099106 with a probability of 0.2095. This clearly shows that the variance of the errors in the model is homoskedastic. The value of the F-statistic for the ARCH LM test is 0.633163 with a probability of 0.4324, confirming constant variance in the error term. The Ramsey RESET test provides a value of 0.050308 as the t-statistic with a probability of 0.9623 that is way above the five percent level, thereby confirming that the model is correctly specified. The R-square value of 0.972207 clearly indicates that inclusion of the moderating variable has significantly improved the model's explanatory power by 97.22%. The value of the Durbin-Watson statistic, which is supplementary to the Breusch-Godfrey test, is 3.1, and it is to be read together with the F-test criterion because of the limited sample size. In addition, the value of the F-Bounds statistic, which is 7.760504, is greater than the upper critical bound at one percent significance level,

confirming a valid long-run cointegrating relationship in the moderation specification.

Consequently, the diagnostic tests have proved the consistency of both estimated models. Based on the baseline and moderating specifications, the errors are homoscedastic, uncorrelated, and distributed normally, implying that the results obtained from the two ARDL models are stable and reliable for inference.

In order to test the stability of the estimated coefficients, the CUSUM and CUSUMSQ statistics were run for the two estimated models, as illustrated in Figures 3 and 4 below. Figure 3 displays the CUSUM and CUSUMSQ graphs for the baseline specification while Figure 4 contains the CUSUM and CUSUMSQ graphs for the moderating model. All four graphs indicate that the lines of cumulative residuals fall within the critical limits of five percent throughout the estimation period from 1990 to 2024. This indicates that the estimates of the parameters of both ARDL models are stable and there are no structural changes during the estimation period.





Discussion of Findings

Natural resource depletion exerts a consistently negative impact on economic diversification in the short run, thereby proving the immediate crowding out of non-resource productive activities during the transition period. The process takes place through the Dutch Disease channel outlined by Corden and Neary (1982) where the reallocation of capital and labour in response to increased resource extraction activities decreases the competitiveness and scale of tradable non-oil industry. This finding is in line with Nwani et al. (2023) who argued that natural resource dependence hampers the structural transformation processes in Sub-Saharan African economies and Zarach & Parteka (2023) who proved that natural resource dependence leads to the decline of the variety of exports from a broader cross-country perspective.

The opposite trend is revealed for the long-run relationship with ARDL producing a positive and statistically significant correlation between natural resource depletion and economic diversification. While this result contradicts the expectations based on the resource curse theory, it can be interpreted in the context of the specific characteristics of the Nigerian economy. Periods of oil boom resulted in public spending on agriculture and other economic infrastructure which led to a short-term burst of activity without changing the productive structure. The same pattern was discovered by Banjo et al. (2024) who found that in the Nigerian economy, revenues

from resources have been used to increase productive activity in the short term without affecting its structure. The positive long-run baseline result therefore captures a fiscal transmission effect rather than a genuine structural diversification gain, an interpretation supported by the sign reversal observed in the moderation model once the governance channel is explicitly controlled for.

A significant negative coefficient of the inflation rate signifies that there exists a negative link between price stability and the long-run impact of inflation on the degree of economic diversification because of reduced investments and distorted prices. The level of price instabilities experienced in Nigeria over time shows that Nigeria has been prone to disruptions in the development of other industries apart from the resource-based industries. This is consistent with findings of Ekpo et al. (2025) where macroeconomic instabilities and fiscal deficits have systematically undermined inclusive growth in Nigeria.

The short-run relationship reveals the positive effect of gross fixed capital formation on economic diversification through the creation of productive capacities. However, gross fixed capital formation does not have a significant effect on economic diversification in the long-run relationship because capital investments in Nigeria are made in resource-oriented economies and, thus, the lack of infrastructure undermines productive

economic diversification in Nigeria. According to the African Development Bank (2024), Nigeria faces capital allocation inefficiencies that limit the structural returns to aggregate investment, consistent with the insignificant long-run result found here.

Regulatory quality has a high positive short-run effect on diversification, implying that any improvements in the regulatory framework lead to temporary improvement of the business environment and reduction of the barriers to entry into non-extractive sectors. In the long run, the sign of the effect reverses, reflecting the peculiarities of the Nigerian governance system, where marginal improvements in regulatory quality failed to produce sustained structural shifts in diversification. Indeed, all Nigeria's scores for regulatory quality have been consistently negative over the sample period; thus, the negative effect in the long run approximates the moments when government intervention was particularly high and did not deliver the desired results. The conclusion is in line with the study of Mehlum et al. (2006), who discovered that institutions in natural resource-abundant countries tend to create extractive structures and not allocate revenues towards economic diversification.

Trade openness has positive effects in the short run but fails to exert sustainable impact on diversification in the long run. It follows from the analysis that there is no significant long-run impact since the structure of trade in Nigeria is predominantly associated with the income from oil export and the need to purchase foreign goods, meaning that greater openness reflects commodity price cycles rather than genuine integration into diversified global value chains. Specifically, Abdulkarim (2023) showed that the growth-trade nexus in Nigeria is strongly influenced by the share of different types of natural resources in the export basket, while Duru et al. (2024) found that export diversification is not positively affected by trade openness in the country.

The moderation model confirms that regulatory quality does not buffer the diversification impact of resource depletion

contemporaneously, indicating that governance improvements require time to translate into changed investment patterns and sectoral allocation decisions before any moderating influence can materialise. This finding is in line with the research of North (1990), who stated that the effect of institutions on economic variables takes place over the medium term due to the mechanisms of credibility and enforcement. In the long-run, the non-significant moderating effect can be explained by the fact that the level of regulatory quality in Nigeria is insufficient to moderate the negative effect under discussion in a significant way. As per the findings of Mpuure et al. (2024), policy and institutional quality should be strong enough to change the structural pattern between resource dependence and economic outcome, explaining why Nigeria's persistently weak governance does not generate a significant long-run moderating effect.

Critically, the long-run NRD coefficient reverses sign in the moderation model compared to the positive baseline estimate, revealing the structural channel through which depletion constrains diversification once the governance interaction is explicitly held separate. This sign reversal is the most important finding of the moderation model and provides the clearest evidence in support of hypothesis H1, confirming that natural resource depletion exerts a negative long-run effect on economic diversification in Nigeria when the confounding of regulatory quality is accounted for. Sachs and Warner (1995) identified precisely this structural mechanism in their foundational resource curse framework, and the moderation results here provide Nigeria-specific empirical confirmation of it. The directional reversal of the standalone regulatory quality coefficient from negative in the baseline to positive in the moderation model is similarly consistent with the theoretical expectation that governance supports diversification once its interaction with resource depletion is separately controlled (Mehlum et al., 2006).

It should be highlighted that the most important finding of the moderating model is

the directional reversal of the NRD coefficient from positive in the baseline analysis to negative in the moderation model, reflecting the very mechanism proposed by Sachs and Warner (1995). Specifically, such reversal of signs confirms hypothesis H1 concerning the negative long-term influence of natural resource depletion on economic diversification when the issue of regulatory quality as an omitted variable is addressed. Another important result of the moderation analysis is the directional reversal of the coefficient on regulatory quality from negative to positive in the case of the long-term estimation. As per Mehilum et al. (2006), such an outcome was expected theoretically.

The cumulative dynamic multiplier analysis provides further dynamic confirmation of these structural findings. In the baseline model, the NRD multiplier traces an initial negative response before reversing to a positive long-run trajectory, capturing the two-phase fiscal spillover mechanism embedded in the baseline estimates. The inflation multiplier descends monotonically across the entire horizon, confirming the persistently negative and progressively accumulating drag of price instability on diversification. The capital formation multiplier registers a strong positive short-run response before reversing into mild negative territory, consistent with the interpretation that investment gains are not sustained over time. The regulatory quality multiplier briefly rises at horizon zero before declining steeply to a dominant negative long-run level, providing the clearest visual confirmation of the governance paradox identified in the long-run estimates. In the moderation model, the NRD multiplier is entirely negative across all fifteen horizons, standing in direct contrast to the baseline trajectory and confirming that depletion's standalone diversification-constraining effect is structural and persistent once the governance channel is separately accounted for. The interaction term multiplier similarly converges to a negative long-run level, confirming that weak regulatory quality amplifies the depletion constraint on diversification progressively over time. The

contrast between the NRD multipliers across both models constitutes the central dynamic finding of this study, underscoring that the diversification-constraining effect of resource depletion has historically been masked by fiscal spillover channels that the baseline specification attributes jointly to the depletion variable.

Robustness tests employing FMOLS and DOLS show directionally consistent results relative to the baseline findings. First, there is evidence of directionally stable association between the depletion level and diversification performance across both estimators, indicating that the positive effect observed in the baseline is a structural property of the relationship rather than a bias inherent in the employed estimator. Secondly, gross fixed capital formation demonstrates significance and robustness to both estimators, thus being confirmed as the strongest long-run predictor of diversification dynamics in Nigeria. Inflation shows consistent negative sign across both estimators, corroborating the structural constraint that price instability imposes on diversification potential. Regulatory quality is shown to have a consistent negative sign across estimators, and is significant in DOLS. This provides confirmation of the institutional explanation proposed in this paper from two different perspectives. Trade openness is consistently insignificant in magnitude and sign across both estimators, confirming that trade integration fails to exert any structural effect on diversification performance irrespective of the estimation technique used.

Diagnostic tests indicate that both baseline and moderation ARDL models are econometrically valid in terms of meeting relevant requirements. Across both specifications, there are no signs of serial correlation or heteroskedasticity of the residuals, which are also confirmed by the Ramsey RESET tests that show correct specification of the model functional form. Furthermore, stability tests in the form of CUSUM and CUSUM of Squares confirm parameter stability throughout the entire estimation period from 1990 to 2024, without

revealing any breaks in the relationship parameters. These results validate the reliability of both the short-run and long-run estimates presented in this study.

Overall, the findings suggest that natural resources depletion negatively influences economic diversification through the combination of short-run crowding out effect and long-run concentration effect, with the true long-run effect revealed only with the moderating effect of the regulatory quality considered. Thus, macroeconomic stability and capital formation can be viewed as the most reliable predictors of economic diversification dynamics in Nigeria, while poor governance conditions negate the impact of regulatory quality and openness on diversification performance.

Conclusion and Policy Implications

This study examined the impact of natural resource depletion on economic diversification in Nigeria over the period 1990 to 2024, with regulatory quality introduced as a moderating variable to test whether the institutional environment conditions the depletion-diversification relationship. The ARDL bounds testing framework served as the primary estimator, with FMOLS and DOLS as robustness checks, preceded by unit root diagnostics that confirmed a mixture of integration orders consistent with the ARDL approach. The theoretical framework drew on the Resource Curse Hypothesis, Dutch Disease Theory, and Institutional Quality Theory to motivate four directional hypotheses that the empirical analysis tested and largely confirmed.

The findings confirm that natural resource depletion exerts a negative and statistically significant effect on economic diversification in the short run, consistent with the Dutch Disease mechanism through which resource extraction draws productive factors toward the enclave sector and crowds out investment in tradable non-oil industries. In the long run, the baseline ARDL returns a positive association between depletion and diversification, a result that reflects the fiscal spillover channel through which oil boom

revenues historically supported public expenditure on agriculture and infrastructure in Nigeria without generating durable structural transformation. This positive baseline estimate is, however, revealed as a confounded result once regulatory quality is explicitly modelled as a moderating variable. The moderation model produces a negative long-run NRD coefficient, confirming that the true structural effect of resource depletion on diversification is negative and that the baseline positive estimate captures the simultaneous operation of the fiscal revenue channel rather than a genuine diversification gain. Regulatory quality produces a positive short-run effect on diversification but a negative long-run effect in the baseline, reflecting Nigeria's governance trajectory where nominal regulatory activity has historically coincided with poor structural outcomes. Inflation consistently constrains diversification in the long run across both specifications, while gross fixed capital formation generates short-run diversification gains that do not persist over time. Trade openness does not produce a robust long-run diversification effect in either specification, reflecting the commodity-driven composition of Nigeria's trade flows. The cumulative dynamic multiplier analysis confirms these structural findings dynamically, with the NRD multiplier tracing a negative trajectory across all horizons in the moderation model in direct contrast to the positive baseline path, and the interaction term multiplier converging to a sustained negative long-run level that confirms the amplifying role of weak governance on the depletion constraint. The FMOLS and DOLS robustness checks confirm the directional consistency of the main findings, with capital formation emerging as the most reliably significant long-run structural driver of diversification across both estimators.

Policy Implications

The implications are quite significant when it comes to the diversification efforts of Nigeria. First, the continuous negative impact of resource exhaustion on the diversification

effort in the short-run necessitates the adoption of a fiscal rule which insulates expenditure from the oil price boom and bust cycle. As noted earlier, the procyclicality which is prevalent in the Nigerian economy has ensured structural specialization by channelling government expenditure into the oil sector during the booms, thereby limiting productive capacity outside the oil sector. A well-designed sovereign wealth fund or stabilisation mechanism that sterilises a share of oil revenues and channels them toward long-run diversification investments in manufacturing, agriculture, and services would directly address this structural vulnerability.

Second, the absence of a significant long-run moderating effect of regulatory quality reflects the threshold problem of governance reform in Nigeria, where marginal improvements in an already weak regulatory environment are insufficient to redirect resource rents toward diversification. Meaningful institutional reform must therefore be structural rather than incremental, targeting the enforcement credibility of property rights, contract law, and investment protection frameworks that are prerequisites for private sector entry into non-extractive industries. The evidence supports prioritising the depth and consistency of regulatory reform over its nominal scope, since the data confirm that formal regulatory activity without governance credibility does not generate long-run diversification gains.

Third, the strong and consistent negative long-run effect of inflation on diversification confirms that macroeconomic stabilisation is a prerequisite rather than a complement to diversification policy. Price stability creates the investment environment within which entrepreneurs and firms can make the long-horizon commitments that structural transformation requires. Monetary policy frameworks that credibly anchor inflation expectations, supported by fiscal consolidation that reduces the monetisation of public deficits, are therefore a first-order condition for any diversification strategy to produce durable structural change.

Fourth, the finding that gross fixed capital formation generates short-run diversification gains that do not persist in the long run points to the importance of investment quality and sectoral targeting alongside investment volume. Policies that attract and direct capital toward non-extractive sectors, including manufacturing, agro-processing, and digital infrastructure, through targeted tax incentives, development finance institutions, and public-private partnerships, are more likely to generate durable diversification outcomes than aggregate investment promotion that leaves sectoral allocation to existing market structures concentrated around the oil economy.

Limitations and Future Research Directions

There are several limitations to this research that must be considered in the development of future studies. The study focuses on one country over a relatively short span of thirty-five years, which means that the results cannot be generalized to other countries where the economic conditions, political structure, and institutions differ. The ARDL model identifies the presence of a cointegrating relationship but is unable to establish causation. Thus, the results should be interpreted only as a demonstration of systemic long-term connections between variables without making explicit claims about causality. Finally, the use of the regulatory quality indicator from the World Governance Indicators means that perceptions rather than concrete institutional structures are used as predictors which may yield sharper insights into the channels through which governance conditions the diversification impact of resource depletion.

Further studies can build on the work done here by conducting a broader analysis of multiple sub-Saharan African economies that rely heavily on resources. It will allow establishing whether similar trends are present for other countries and whether governance and other institutional and structural characteristics influence the strength of those connections. Breaking down the impact of

resource depletion into separate components based on the type of natural resource exploited could lead to a better understanding of how the diversification barrier works with respect to various resource types. Financial development, human capital, and industrial policy factors could serve as moderating variables for further investigation and further illuminate the conditions under which resource-dependent economies successfully navigate the structural transition away from commodity dependence.

Overall, natural resource depletion inhibits the process of diversification in Nigeria largely via short-term mechanisms associated with the crowding-out effect. Once the impact of governance is isolated, it becomes clear that the impact of resource depletion on long-term diversification is negative. Macroeconomic stability, institutional credibility, and capital accumulation are established as important structural factors that can facilitate the diversification process in Nigeria. Due to poor governance, the impact of regulatory quality and open trade policy is negated in the long run. The findings contribute to the empirical literature on the resource curse and structural transformation in resource-dependent economies and offer a basis for evidence-informed diversification policy design in Nigeria.

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