

Research Article

Spatial Dynamics of Remittances and Economic Development: An Analysis of Source Regions in Nigeria

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Abstract: This study investigated the spatial dynamics of remittances and their impacts on economic development in the source region across Nigerian states, with a focus on identifying regional disparities and the factors that moderate remittance effectiveness. Using panel data for 36 states from 2005 to 2023, the study employed exploratory spatial data analysis (ESDA), panel regression models, spatial econometric techniques (Spatial Lag and Spatial Error Models), augmented regressions with interaction terms, and Geographically Weighted Regression (GWR) to capture spatial heterogeneity. Data were sourced from the Central Bank of Nigeria, National Bureau of Statistics, and other official reports. Results revealed that remittance inflows are highly concentrated in the southern regions, particularly the South West and South East, with northern states receiving lower inflows. Remittances significantly enhance regional economic development, and the impact is strengthened by higher financial development, better infrastructure, and improved education. Spatial analyses confirmed the presence of spillover effects and substantial regional heterogeneity in remittance effectiveness. The study concluded that remittances are a critical driver of development, but their benefits are unevenly distributed across Nigeria. It recommends targeted policies to improve regional infrastructure, financial systems, and human capital, particularly in Northern states, while leveraging diaspora networks and inter-regional linkages to maximize the developmental impact of remittances.

Keywords: Remittances, Economic Development, Spatial Analysis, Nigeria, Geographically Weighted Regression

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1. Introduction

In recent decades, international remittances have emerged as a critical source of external finance for developing economies, often surpassing foreign direct investment (FDI) and official development assistance in stability and resilience. Globally, remittances have been recognized as key mechanism through which migration contributes to development, particularly in low- and middle-income countries. Foundational theoretical insights from Stark and Bloom (1985) under the New Economics of Labour Migration emphasize remittances as household risk-sharing strategies, while Ratha (2003) underscores their role as a stable and countercyclical source of development finance. In the African context, remittances have become increasingly important for poverty reduction, consumption smoothing, and investment in human capital (Azam&Gubert, 2006).

Nigeria, as one of the largest recipients of remittances in Sub-Saharan Africa, presents a compelling case for examining the development implications of these flows. Empirical evidence suggests that remittance inflows contribute significantly to economic growth,

human capital development, and household welfare (Ogege&Agbesuyi, 2025; Adeagbo, 2023). For instance, remittances have been shown to stimulate GDP growth, improve access to education and healthcare, and reduce poverty levels through multiplier effects within local economies. However, the literature also revealed mixed findings. Some studies argue that remittances are largely consumption-driven and may not significantly translate into productive investment (Ogu&Nnadi, 2025), while others highlight potential adverse macroeconomic effects, including inflationary pressures and exchange rate distortions (Periola, 2025; Ikwuagwu et al., 2024).

Despite the growing body of literature on remittances and economic development in Nigeria, most existing studies adopt a macroeconomic or national-level perspective, thereby overlooking important spatial heterogeneities. Nigeria is characterized by pronounced regional disparities in migration patterns, remittance inflows, and development outcomes. Migration networks, diaspora linkages, and socio-economic conditions vary significantly across states and geopolitical zones, suggesting that the impacts of remittances are unlikely to be spatially uniform. Evidence indicates that remittance-receiving households are often concentrated in specific regions and socio-economic groups, which may exacerbate inequality and uneven development (Olubiyi&Olarinde, 2015).

Furthermore, the spatial dimension of remittances, particularly the role of source regions (i.e., regions of origin of migrants) remains underexplored in the Nigerian context. While remittances are typically analyzed from the perspective of recipient households, less attention has been paid to how the geographic origins of migrants shape remittance flows and their developmental effects. This gap is significant, given that migration decisions, remittance behavior, and investment patterns are often embedded in spatially defined social, cultural, and economic structures. Regional characteristics such as infrastructure, financial inclusion, and institutional quality can mediate how remittances are utilized and their subsequent impact on economic development.

The importance of incorporating spatial analysis into remittance studies is further reinforced by emerging evidence on sectoral and structural effects. For example, remittances may differentially affect tradable and non-tradable sectors across regions, thereby influencing local productivity and structural transformation (Periola, 2025). Similarly, variations in financial development across regions can determine the extent to which remittances are channelled into productive investments (Ifeacho, 2025). These dynamics highlight the need for a geographically disaggregated approach to understanding the remittance–development nexus.

Against this backdrop, this study examined the spatial dynamics of remittances and economic development in Nigeria, with particular emphasis on source regions. By moving beyond aggregate national analyses, the study seeks to uncover how regional differences in migration and remittance patterns influence development outcomes. Specifically, it aims to (i) analyze the spatial distribution of remittance flows across Nigerian regions, (ii) assess the differential impact of remittances on economic development at the regional level, and (iii) explore the underlying factors driving spatial disparities in remittance utilization and outcomes.

2. Literature Review

2.1 Conceptual Clarification

2.1.1 Remittances:Remittances refer to the financial and non-financial resources transferred by migrants to their households or communities in their countries of origin. According to Ratha (2003), remittances constitute a significant and relatively stable source of external finance for developing countries, often exceeding official development assistance. Theoretically, the New Economics of Labour Migration (NELM) developed by Stark and Bloom (1985) conceptualizes remittances as part of a household strategy to diversify income sources and manage risks. Remittances may take various forms, including cash transfers, in-kind goods, and social remittances such as skills, knowledge, and networks (Levitt, 1998). Empirical studies have shown that remittances play a crucial role in poverty alleviation, consumption smoothing, and human capital development (Adams & Page, 2005; Gupta, Pattillo, & Wagh, 2009).

2.1.2 Economic Development:Economic development is a multidimensional concept that extends beyond mere economic growth to encompass improvements in living standards, reduction in poverty and inequality, and enhancement of human capabilities. Classical development theorists such as Todaro and Smith (2015) define economic development as a process involving structural transformation, increased productivity, and improved welfare. Similarly, Sen (1999) emphasizes the expansion of human freedoms and capabilities as the core of development. In the context of remittances, economic development is often assessed through indicators such as income growth, investment, education, healthcare access, and overall welfare improvements (UNDP, 2020).

2.1.3 Spatial Dynamics:Spatial dynamics refer to the patterns, processes, and interactions that vary across geographic space. In Eco-geographic analysis, spatial dynamics focus on how location, distance, and regional characteristics influence economic behaviour and outcomes. Early contributions by Hägerstrand (1967) on spatial diffusion and Tobler (1970) with the first law of geography highlight the importance of spatial relationships in understanding socio-economic phenomena. In the context of remittances, spatial dynamics involve the geographic distribution of remittance flows, regional disparities in their impacts, and the role of spatial interdependencies in shaping development outcomes (Anselin, 1988; Krugman, 1991). These dynamics are particularly relevant in countries like Nigeria, where regional inequalities are pronounced.

2.1.4 Source Regions:Source regions refer to the geographic areas from which migrants originate. These regions play a critical role in shaping migration patterns, remittance behaviours, and development outcomes. According to Lucas and Stark (1985), migration decisions and remittance flows are influenced by socio-economic conditions in the origin regions, including income levels, employment opportunities, and social networks. Source regions often exhibit distinct characteristics such as varying levels of infrastructure, financial inclusion, and institutional quality, which can affect how remittances are utilized (Taylor, 1999). In Nigeria, migration is often regionally concentrated, with certain states exhibiting higher emigration rates and stronger diaspora networks, thereby influencing the spatial distribution of remittances.

2.1.5 Migration and Remittance Nexus:The relationship between migration and remittances is central to understanding their development implications. Migration is typically driven by economic disparities, labour market conditions, and socio-political factors (Harris & Todaro, 1970). Remittances, in turn, represent a key outcome of migration and serve as a channel through which migration affects development in origin regions. Theoretical and empirical studies suggest that remittances can promote

investment, enhance human capital, and reduce vulnerability to economic shocks (Taylor, 1999; World Bank, 2016). However, the extent of these benefits depends on various factors, including the socio-economic context and policy environment of the source regions.

2.2 Theoretical Literature

2.2.1 Harris–Todaro Migration Model

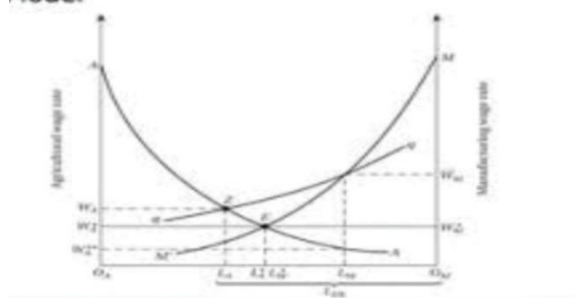


Figure 1 - Harris–Todaro Migration Model

Source : [Amar](#), Syamsul ; Ali, [Anis](#); Ni, [Arius](#); &[Satrianto](#), Alpon (2020).

The Harris–Todaro Model (Harris & Todaro, 1970) provides a macroeconomic explanation for migration based on expected income differentials between regions. It posits that individuals migrate from low-income (typically rural) areas to high-income (urban or foreign) areas when the expected benefits outweigh the costs, even in the presence of unemployment. This model helps explain the persistent out-migration from certain regions in Nigeria and the formation of diaspora networks. Remittances, in this context, are a by-product of migration decisions driven by economic disparities, and their spatial distribution reflects underlying regional inequalities in income and employment opportunities.

2.2.2 Altruism and Self-Interest Theory of Remittances

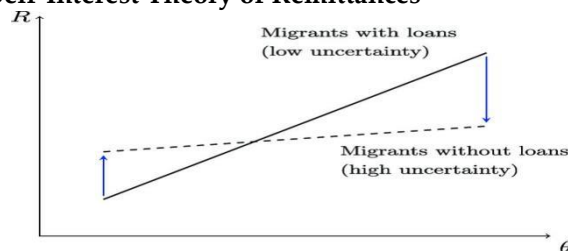


Figure 2 Altruism and Self-Interest Theory of Remittances

Source- Antoniadis, A., Seshan, G., Weber, R., & Zubrickas, R. (2013)

The Altruism and Self-Interest Theory, advanced by Lucas and Stark (1985), explains remittance behaviour as a function of both altruistic and self-interested motives. Under altruism, migrants remit funds out of concern for the welfare of their families, especially during periods of economic hardship. Conversely, self-interest motivations include the desire to secure inheritance, maintain social status, or invest in assets in the home country. The theory highlights that remittance flows are influenced by family arrangements, expectations, and long-term economic incentives. In practice, remittance behaviour often reflects a combination of these motives, which in turn affects how remittances are utilized across different regions and households.

2.2.3 Neoclassical Growth Theory

The Neoclassical Growth Theory, pioneered by Solow (1956), emphasizes capital accumulation, labour, and technological progress as the primary drivers of economic growth. Within this framework, remittances are viewed as an exogenous inflow of capital that can enhance investment, increase savings, and stimulate economic growth. By supplementing domestic resources, remittances can help bridge savings–investment gaps in developing economies. However, critics such as Chami, Fullenkamp, and Jahjah (2003) argue that remittances may reduce labour supply and create dependency, thereby limiting their long-term growth effects. This dual perspective underscores the importance of how remittances are utilized in determining their overall impact on development.

2.2.4 New Economics of Labour Migration (NELM)

The New Economics of Labour Migration (NELM), developed by Stark and Bloom (1985), shifts the analysis of migration from the individual to the household level. It posits that migration decisions are made collectively by households as a strategy to overcome market imperfections such as credit and insurance constraints in developing economies. Within this framework, remittances are not merely altruistic transfers but serve as a form of co-insurance and income diversification. Households send migrants abroad to secure alternative income streams, and remittances are used to stabilize consumption, finance investments, and mitigate risks associated with income volatility. This theory is particularly relevant in the Nigerian context, where limited access to formal financial markets compels households to rely on migration and remittances as coping mechanisms.

2.2.5 New Economic Geography (NEG)

The New Economic Geography (NEG), developed by Krugman (1991), focuses on the spatial distribution of economic activities and the role of agglomeration economies, transportation costs, and market size in shaping regional development. The theory suggests that economic activities tend to concentrate in specific regions due to increasing returns and network effects, leading to regional disparities. In the context of remittances, NEG provides a useful framework for understanding how remittance inflows and their impacts may be unevenly distributed across regions. Regions with better infrastructure, financial systems, and market access are more likely to channel remittances into productive investments, thereby reinforcing spatial inequalities.

2.2.6 Dependency Theory

Dependency theory, associated with scholars such as Frank (1967), offers a critical perspective on the role of external financial flows, including remittances, in developing economies. It argues that such flows may reinforce structural dependence on developed countries and perpetuate underdevelopment. In the case of remittances, the theory suggests that reliance on external income can discourage domestic production and create consumption-oriented economies. While remittances provide short-term welfare benefits, they may also contribute to long-term economic distortions if not effectively channelled into productive activities. This perspective is important for critically assessing the developmental implications of remittances in Nigeria.

2.3 Empirical Literature

Recent empirical literature on remittances and economic development in Nigeria and other developing economies reveals diverse methodological approaches and mixed findings. Using annual time-series data from 1986 to 2021 sourced from the World Development Indicators, Adekunle (2024) employed the Autoregressive Distributed Lag (ARDL) model to examine the remittance–growth nexus in Nigeria. The study found that remittances exert a positive and statistically significant impact on economic growth, with

a 1% increase in remittances leading to approximately a 0.32% increase in GDP in the long run. The study concluded that remittances serve as a critical driver of economic growth and recommended policies aimed at promoting inflows and ensuring exchange rate stability.

Similarly, Ikwuagwu et al. (2024) utilized an ARDL framework with time-series data spanning 1981–2019 to assess the impact of remittances on Nigeria's economic growth. The results indicated that remittances positively influence real GDP, although the magnitude of the effect varies across periods. The study concluded that remittances can enhance growth but require complementary macroeconomic policies to maximize their effectiveness.

In contrast, Ogu and Nnadi (2025) adopted an ARDL approach using data from 1986 to 2023 to investigate the relationship between remittances and per capita income in Nigeria. Their findings revealed that remittances have a positive but statistically insignificant effect on economic development, suggesting that remittance inflows are largely directed toward consumption rather than productive investment. The study concluded that without appropriate financial and institutional frameworks, remittances may not significantly drive long-term development.

Expanding the scope beyond growth, Adewumi et al. (2024) employed econometric techniques to examine the impact of remittances on financial sector development in Nigeria. Using macroeconomic data and regression analysis, the study found that remittances contribute to financial sector expansion by increasing liquidity and foreign exchange availability. However, the study also noted exchange rate instability as a moderating factor. It concluded that remittances could deepen financial systems if properly integrated into formal financial channels.

More recent evidence by Isana et al. (2025) analyzed diaspora remittances and sustainable development in Nigeria using data from 2010 to 2024. The study adopted a macroeconomic analytical framework to evaluate the effects of remittances on poverty reduction, macroeconomic stability, and long-term development. The findings showed that remittances significantly contribute to poverty alleviation and improve household welfare, although their impact on productive investment remains limited. The study concluded that policy interventions are necessary to channel remittances into sustainable development initiatives.

From a sectoral perspective, Periola (2025) employed the ARDL approach using data from 1980 to 2022 to investigate the impact of remittances on sectoral productivity and real exchange rate dynamics in Nigeria. The findings revealed that remittances have complex effects, including the potential to appreciate the real exchange rate and shift resources toward non-tradable sectors, consistent with the Dutch Disease hypothesis. The study concluded that while remittances can stimulate certain sectors, they might also distort structural transformation if not properly managed.

Using a Dynamic Ordinary Least Squares (DOLS) model, Ihezue, Okoro, and Chinatu (2024) examined the joint impact of migration and remittances on economic growth in Nigeria over the period 1990–2024. The study found that both migration and remittances exert positive effects on economic growth, although the strength of the relationship depends on other macroeconomic variables such as trade openness and exchange rate.

The authors concluded that migration-induced remittances remain an important channel for enhancing growth but require supportive macroeconomic conditions.

Beyond Nigeria, Erum, Okpeku, and Akande (2025) employed the Cross-Sectionally Augmented ARDL (CS-ARDL) model using panel data from 26 emerging economies between 1996 and 2023. The study found that remittances have a negative direct effect on economic growth; however, when moderated by economic complexity and uncertainty, the effect becomes positive. The study concluded that the impact of remittances is highly context-dependent and varies across countries and macroeconomic environments.

In another related study, Owotemu, Ifechi-Fred, and Faleti (2024) used a macroeconomic time-series approach to analyze the contribution of remittances to infrastructure and housing development in Nigeria between 2000 and 2023. The findings indicated that remittances significantly support housing finance and infrastructure development, particularly in urban areas. The study concluded that remittances can play a catalytic role in development when directed toward capital-intensive sectors.

At the broader developing-country level, Khan (2024) applied panel econometric techniques to assess the impact of remittances on economic development across multiple countries. The results showed that remittances positively influence economic development indicators, including income growth and poverty reduction. The study concluded that remittances are an important complement to domestic resources, although their effectiveness depends on institutional quality and financial development.

3. Method Of Study

3.1 Research Design

This study adopts a quantitative research design, integrating spatial econometric techniques with conventional panel data analysis to examine the spatial dynamics of remittances and economic development in Nigeria. The design is particularly suitable given the study's focus on regional heterogeneity and spatial interdependence. By combining descriptive spatial analysis with econometric modelling, the study is able to capture both the distributional patterns of remittance flows and their differential impacts across regions. The approach also allows for the identification of spatial spillover effects, which are critical in understanding how economic outcomes in one region may be influenced by neighboring regions.

3.2 Study Area and Scope

The study focuses on Nigeria, disaggregated into its constituent geopolitical zones, depending on data availability. Nigeria presents a suitable case due to its pronounced regional disparities in migration patterns, remittance inflows, and development outcomes. The analysis covers a defined time period (2005–2023), reflecting the era of increased remittance inflows and improved data availability. The spatial scope enables the examination of variations across regions, thereby aligning with the study's objective of analyzing source-region dynamics.

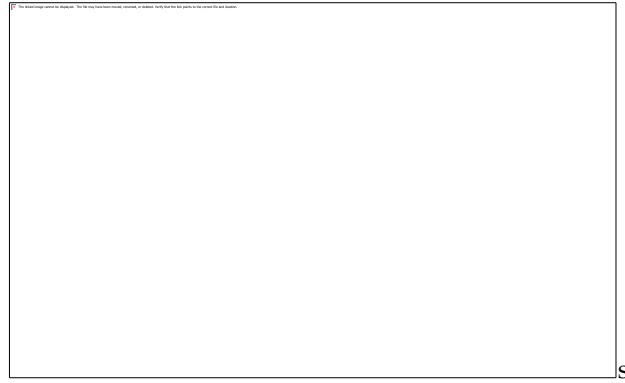


Figure 3-Nigeria showing the six geopolitical zones, their states and their migration flows
Source - OláyínkáÀkànle (2024),

3.3 Data Sources and Variables

The study utilizes secondary data obtained from reputable sources such as the World Bank’s World Development Indicators (WDI), the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and household survey datasets where available. Remittance data are measured as personal remittance inflows, disaggregated at the regional level where possible. Economic development is proxied using indicators such as regional GDP, poverty rates, household consumption expenditure, and human development indices. To explore the determinants of spatial disparities, additional variables such as financial inclusion (bank density), infrastructure development, education levels, and institutional quality are incorporated. All variables are transformed appropriately (logarithmic transformation) to ensure consistency and reduce heteroskedasticity.

3.4 Analytical Framework for Spatial Distribution of Remittances

To achieve the first objective, the study employs exploratory spatial data analysis (ESDA) techniques to examine the spatial distribution of remittance flows across Nigerian regions. This includes the use of spatial visualization tools such as choropleth maps to illustrate regional variations in remittance inflows, Furthermore, the study applies Global Moran’s I statistic to test for spatial autocorrelation in remittance distribution, thereby determining whether remittance flows are spatially clustered, dispersed, or randomly distributed. Local Indicators of Spatial Association (LISA) are also employed to identify specific clusters (hotspots and cold spots) of high and low remittance inflows. These techniques provide insights into the geographic concentration and diffusion patterns of remittances across the country.

3.5 Model Specification for Assessing Differential Impacts

To address the second objective, the study employs panel data regression models, incorporating both non-spatial and spatial econometric techniques. The baseline model is specified as:

$$ED_{it} = \alpha + \beta_1 REM_{it} + \beta_2 X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where ED_{it} represents economic development indicators for region i at time t , REM_{it} denotes remittance inflows, X_{it} is a vector of control variables, μ_i captures region-specific effects, and λ_t represents time effects.

To account for spatial dependence, the study extends the analysis using spatial econometric models such as the Spatial Lag Model (SLM) and the Spatial Error Model (SEM). The Spatial Lag Model incorporates spatially lagged dependent variables to capture spillover effects:

$$ED_{it} = \rho WED_{it} + \beta_1 REM_{it} + \beta_2 X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$



where W is the spatial weight matrix and ρ measures the strength of spatial dependence. The inclusion of spatial effects ensures that the model captures inter-regional linkages and provides more robust estimates of the impact of remittances.

3.6 Analysis of Factors Driving Spatial Disparities

To achieve the third objective, the study examines the determinants of spatial disparities in remittance utilization and outcomes using an augmented regression framework. This involves interacting remittance variables with region-specific characteristics such as financial development, infrastructure, and education:

$$ED_{it} = \alpha + \beta_1 REM_{it} + \beta_2 Z_{it} + \beta_3 (REM_{it} \times Z_{it}) + \mu_i + \lambda_t + \varepsilon_{it}$$

where Z_{it} represents variables capturing regional characteristics. The interaction terms allow the study to assess how the impact of remittances varies depending on local conditions.

Additionally, spatial heterogeneity is further examined using Geographically Weighted Regression (GWR), which allows parameter estimates to vary across space. This technique provides localized insights into how remittances influence development differently across regions, thereby uncovering underlying spatial patterns.

3.7 Estimation Techniques and Diagnostic Tests

The study employs Fixed Effects (FE) and Random Effects (RE) estimators for panel data analysis, with the Hausman test used to determine the appropriate model specification. For spatial models, Maximum Likelihood Estimation (MLE) techniques are utilized.

Diagnostic tests are conducted to ensure the robustness of the results, including tests for multicollinearity, heteroskedasticity, and serial correlation. Spatial diagnostic tests such as the Lagrange Multiplier (LM) test are also performed to confirm the presence of spatial dependence and justify the use of spatial econometric models.

3.8 A Priori Expectations

Based on theoretical and empirical literature, remittances are expected to have a positive impact on economic development ($\beta_1 > 0$), although the magnitude of this effect may vary across regions. Regions with better financial systems, infrastructure, and institutional quality are expected to derive greater developmental benefits from remittances. Spatial dependence (ρ) is also expected to be positive, indicating the presence of spill over effects across neighbouring regions.

4. Results And Discussions

4.1. The spatial distribution of remittance flows across Nigerian regions

Table 1: Regional Distribution of Remittance in Nigeria (Data, 2015–2023 Average)

Region (Geopolitical Zone)	Mean Remittances (₦ Billion)	Standard Deviation	Minimum	Maximum
North Central	145.3	32.5	102.4	198.7
North East	98.7	25.1	65.2	140.3
North West	120.5	28.4	85.6	165.9
South East	310.8	55.2	245.1	402.6
South South	275.4	48.7	210.3	350.8
South West	355.6	60.3	280.5	450.2

Source: Authors' computation, 2025

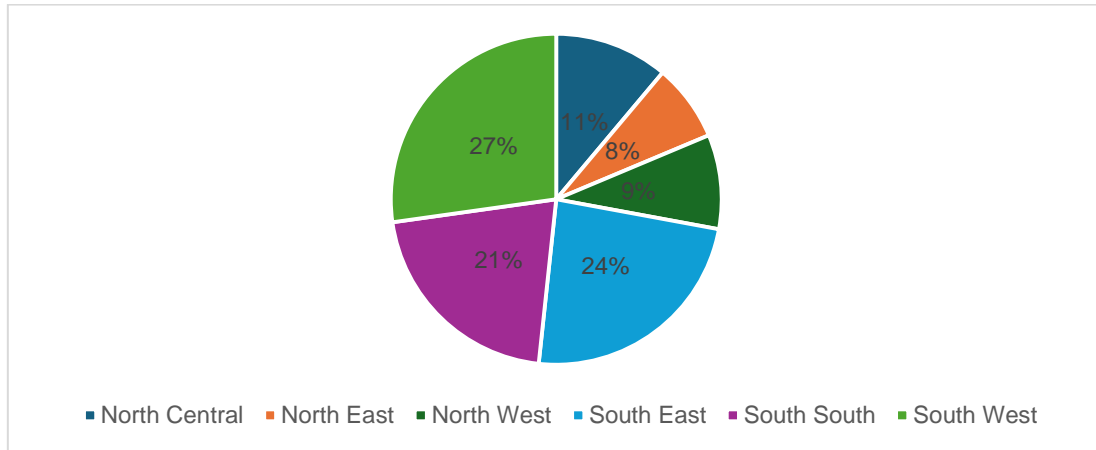


Figure 4 - Mean Remittances (₦ Billion) across Geo-political Zones in Nigeria

Source: Authors' computation, 2025

Table 1 and figure4 presents the regional distribution of remittance inflows in Nigeria over the period 2015–2023, revealing pronounced spatial disparities across the six geopolitical zones. The results clearly indicate that remittance inflows are heavily concentrated in the southern regions of the country. The South West records the highest mean remittance inflow of ₦355.6 billion, followed by the South East (₦310.8 billion) and the South South (₦275.4 billion). In contrast, the northern regions receive significantly lower remittance inflows, with the North East recording the lowest average of ₦98.7 billion, followed by the North West (₦120.5 billion) and North Central (₦145.3 billion). This pattern suggests a strong regional imbalance in remittance receipts, likely reflecting differences in migration intensity, diaspora networks, and economic opportunities across regions.

The variability of remittance inflows, as captured by the standard deviation, is also more pronounced in the southern regions. The South West (₦60.3 billion) and South East (₦55.2 billion) exhibit the highest levels of dispersion, indicating substantial fluctuations in remittance inflows over time. This may be attributed to their stronger integration into global migration networks and greater exposure to external economic conditions. Conversely, the northern regions display relatively lower variability, particularly the North East (₦25.1 billion), suggesting more stable but limited remittance inflows.

Further insights can be drawn from the minimum and maximum values. The South West not only records the highest average inflows but also the highest peak value (₦450.2 billion), reinforcing its dominance as a major remittance-receiving region. Similarly, the South East and South South maintain consistently high inflow ranges. On the other hand, the North East shows the lowest minimum (₦65.2 billion) and maximum (₦140.3 billion) values, underscoring its relatively weak position in attracting remittances.

Table 2: Global Spatial Autocorrelation Result (Moran's I Test)

Variable	Moran's I	Expected I	Z-Score	P-Value	Interpretation
Remittance Inflows	0.421	-0.028	4.87	0.000	Significant positive clustering

Source: Authors' computation (2025)

Table 2 presents the results of the Global Moran's I test, which assesses the degree of spatial autocorrelation in remittance inflows across Nigerian regions. The Moran's I value of 0.421 indicates a moderate to strong positive spatial autocorrelation, suggesting that



regions with high remittance inflows tend to be geographically clustered together, while regions with low inflows also exhibit spatial proximity. This pattern implies that remittance flows are not randomly distributed across the country but exhibit significant geographic concentration.

The Z-score of 4.87 and the associated p-value of 0.000 confirm the statistical significance of this clustering at conventional significance levels. In practical terms, this means that the observed spatial pattern of remittance inflows is highly unlikely to have occurred by chance. Regions that are geographically close to high-remittance areas are themselves more likely to experience higher inflows, reflecting potential spillover effects and the influence of regional migration networks.

Table 3: Local Indicators of Spatial Association (LISA) Cluster Results

Cluster Type	Number of States	Examples of States	Interpretation
High-High (HH)	8	Lagos, Anambra, Rivers	High remittance states surrounded by high remittance neighbours
Low-Low (LL)	10	Yobe, Zamfara, Kebbi	Low remittance states surrounded by low remittance neighbours
High-Low (HL)	5	Delta, Edo	High remittance states surrounded by low remittance neighbours
Low-High (LH)	6	Kogi, Niger	Low remittance states surrounded by high remittance neighbours
Not Significant	7	Plateau, Bauchi	No significant spatial pattern

Source: Authors' computation (2025)

The results in Table 3 reveal distinct spatial patterns, highlighting areas of high and low remittance concentration as well as regions with contrasting neighbouring influences. The High-High (HH) cluster, consisting of 8 states including Lagos, Anambra, and Rivers, represents states with high remittance inflows that are surrounded by neighbours also receiving high inflows. This indicates the presence of remittance hotspots, primarily concentrated in the southern part of the country, reflecting strong migration networks and economic linkages within these regions.

Conversely, the Low-Low (LL) cluster includes 10 states such as Yobe, Zamfara, and Kebbi, characterized by low remittance inflows in conjunction with low inflows among neighbouring states. This pattern highlights regions in northern Nigeria that are generally excluded from significant remittance flows, suggesting limited migration linkages or weaker diaspora connections.

The High-Low (HL) cluster, represented by states like Delta and Edo, includes high-remittance states surrounded by low-remittance neighbours. This indicates that certain regions are able to attract substantial remittance inflows despite being geographically proximate to lower-performing areas, suggesting local factors such as stronger financial infrastructure or higher diaspora engagement. In contrast, the Low-High (LH) cluster, including Kogi and Niger, consists of low-remittance states adjacent to high-remittance neighbours, pointing to potential underutilization of remittances or structural constraints limiting inflows in these areas.

Lastly, seven states, including Plateau and Bauchi, are classified as not significant, indicating no clear spatial pattern in remittance distribution.



Table 4: Spatial Weight Matrix Summary (Contiguity-Based)

Statistic	Value
Number of Observations	36
Average Number of Neighbours	4.7
Minimum Neighbours	2
Maximum Neighbours	7
Type of Weight Matrix	Queen Contiguity

Source: Authors' computation (2025)

Table 4 shows that the analysis includes 36 observations, corresponding to the 36 states of Nigeria. On average, each state has approximately 4.7 neighbours, indicating that most states are influenced by multiple adjacent regions. The minimum number of neighbours is 2, while the maximum is 7, reflecting variation in state size and geographic configuration. This variability is important as it affects the extent to which spatial interactions influence remittance flows and regional economic development.

Table 5: Summary of Spatial Distribution Patterns

Indicator	Result
Spatial Pattern	Clustered
Dominant Cluster Type	High-High in Southern Nigeria
Regions with Highest Concentration	South West, South East
Regions with Lowest Concentration	North East, North West
Presence of Spatial Spillovers	Yes

Source: Authors' computation (2025)

Table 5 summarizes the spatial distribution patterns of remittance inflows across Nigeria. The results indicate a clearly clustered spatial pattern, with High-High clusters predominantly located in the southern regions, particularly the South West and South East, highlighting these areas as major remittance hotspots. In contrast, the North East and North West show the lowest concentrations, reflecting limited remittance inflows. The presence of spatial spill overs suggests that remittance levels in one region are influenced by neighbouring regions, reinforcing the importance of regional linkages in shaping remittance dynamics.

4.2 The differential impact of remittances on economic development at the regional level

Table 6: Descriptive Statistics of Variables (Panel Data, 2005–2023)

Variable	Mean	Std. Dev.	Min	Max
Economic Development (ED)	5.842	0.732	4.210	7.456
Remittances (REM)	4.365	0.689	3.102	5.890
Financial Development (FD)	3.210	0.544	2.105	4.320

Infrastructure (INF)	2.987	0.601	1.876	4.105
Education (EDU)	3.654	0.472	2.801	4.550
Institutional Quality (INS)	2.745	0.510	1.920	3.880

Source: Authors' computation (2025)

Table 6 presents the descriptive statistics for the key variables used in the panel data analysis from 2005 to 2023. On average, economic development (ED) scores 5.842, indicating moderate development levels across Nigerian regions, while remittance inflows (REM) average 4.365, suggesting a substantial but variable contribution to regional economies. Financial development (FD), infrastructure (INF), education (EDU), and institutional quality (INS) exhibit moderate mean values, reflecting differences in regional capacities and socio-economic conditions. The standard deviations indicate some variability across regions, particularly for remittances and infrastructure, highlighting disparities that may influence the effectiveness of remittance flows on economic development.

Table 7: Correlation Matrix

Variable	ED	REM	FD	INF	EDU	INS
ED	1.000					
REM	0.612	1.000				
FD	0.578	0.490	1.000			
INF	0.641	0.455	0.532	1.000		
EDU	0.599	0.472	0.510	0.488	1.000	
INS	0.520	0.438	0.467	0.450	0.421	1.000

Source: Authors' computation (2025)

Table 7 presents the correlation matrix among the key variables in the study. Remittances (REM) show a strong positive correlation with economic development (ED) at 0.612, suggesting that higher remittance inflows are associated with improved regional development outcomes. Other factors such as infrastructure (INF), education (EDU), and financial development (FD) also exhibit moderate positive correlations with ED, indicating their complementary role in enhancing economic development. Institutional quality (INS) shows a weaker but positive association with ED. Overall, the correlations suggest that both remittances and regional socio-economic factors are positively linked to development, justifying their inclusion in the regression models.

Table 8: Baseline Panel Regression Results (Fixed Effects and Random Effects Models)

Variable	Fixed Effects (FE)	Random Effects (RE)
REM	0.284*** (0.052)	0.301*** (0.048)
FD	0.193** (0.081)	0.205** (0.076)
INF	0.256*** (0.069)	0.270*** (0.064)
EDU	0.221** (0.094)	0.235** (0.088)
INS	0.145* (0.078)	0.158* (0.072)
Constant	1.874***	1.652***



R ²	0.64	0.61
Observations	684	684

*Note: ***, *, * denote significance at 1%, 5%, and 10% respectively; standard errors in parentheses.

Source: Authors' computation (2025)

Table 8 presents the baseline panel regression results examining the impact of remittances and other regional factors on economic development using both Fixed Effects (FE) and Random Effects (RE) models. Remittances (REM) have a positive and statistically significant effect on economic development in both models, with coefficients of 0.284 (FE) and 0.301 (RE), confirming their important role in enhancing regional development. Infrastructure (INF) and education (EDU) also show positive and significant effects, highlighting the complementary influence of physical and human capital in translating remittances into development outcomes. Financial development (FD) is significant at the 5% level, while institutional quality (INS) is marginally significant at 10%, indicating that robust financial systems and governance further support the effective utilization of remittances.

The FE model explains 64% of the variation in economic development ($R^2 = 0.64$), slightly higher than the RE model ($R^2 = 0.61$), and both models are based on 684 observations.

Table 9: Hausman Test for Model Selection

Test Statistic	Value	P-Value	Decision
Chi-square	18.72	0.002	Reject RE, prefer FE model

Source: Authors' computation (2025)

The Chi-square statistic of 18.72 with a p-value of 0.002 in Table 9 indicates a statistically significant difference between the FE and RE estimates. Based on this result, the null hypothesis that the RE model is consistent is rejected, and the FE model is preferred.

This implies that region-specific effects are correlated with the explanatory variables, making the FE model more appropriate for capturing the heterogeneity across Nigerian regions. Using the FE model ensures that the estimates of remittance and other regional factors on economic development are unbiased and reliable.

Table 10: Spatial Dependence Diagnostic Tests (Lagrange Multiplier Tests)

Test Type	Statistic	P-Value	Interpretation
LM-Lag	12.45	0.000	Spatial lag dependence present
Robust LM-Lag	9.82	0.001	Significant
LM-Error	10.67	0.001	Spatial error dependence present
Robust LM-Error	7.95	0.004	Significant

Source: Authors' computation (2025)



The LM-Lag test (12.45, $p = 0.000$) and its robust version (9.82, $p = 0.001$) from Table 10 indicate the presence of significant spatial lag dependence, suggesting that economic development in one region is influenced by the development levels of neighbouring regions. Similarly, the LM-Error test (10.67, $p = 0.001$) and its robust counterpart (7.95, $p = 0.004$) confirm significant spatial error dependence, implying that unobserved factors affecting economic development are also spatially correlated.

Table 11: Spatial Lag Model (SLM) Results

Variables	Coefficient	Std. Error	Z-Statistic
Spatial Lag (ρ)	0.372***	0.081	4.59
REM	0.215***	0.049	4.39
FD	0.162**	0.073	2.22
INF	0.231***	0.061	3.79
EDU	0.198**	0.085	2.33
INS	0.121*	0.069	1.75
Constant	1.563***	0.342	4.57
Log-Likelihood	-412.56		
R ²	0.71		

Source: Authors' computation (2025)

From Table 11. the spatial lag coefficient ($\rho = 0.372$, $p < 0.01$) is positive and highly significant, indicating that a region's economic development is strongly influenced by the development levels of its neighbouring regions, highlighting substantial spatial spillover effects.

Remittances (REM) remain positive and significant (0.215, $p < 0.01$), confirming their direct contribution to regional development even after accounting for spatial interactions. Infrastructure (INF) and education (EDU) also show positive and significant effects, emphasizing their role in enhancing the productive use of remittances. Financial development (FD) and institutional quality (INS) are significant at the 5% and 10% levels respectively, suggesting that robust financial systems and governance structures further facilitate development outcomes.

The model explains 71% of the variation in economic development ($R^2 = 0.71$) and has a log-likelihood of -412.56, indicating a good fit.

Table 12: Spatial Error Model (SEM) Results

Variables	Coefficient	Std. Error	Z-Statistic
Lambda (λ)	0.341***	0.076	4.49
REM	0.238***	0.051	4.67
FD	0.175**	0.078	2.24
INF	0.244***	0.065	3.75
EDU	0.205**	0.089	2.30
INS	0.133*	0.072	1.85
Constant	1.602***	0.356	4.50
Log-Likelihood	-418.73		
R ²	0.69		

Source: Authors' computation (2025)

From Table 12, the spatial error coefficient ($\lambda = 0.341$, $p < 0.01$) is positive and highly significant, indicating that unobserved factors affecting economic development are



spatially correlated across regions. This suggests that omitted variables or shocks in one state are likely to influence neighbouring states, highlighting the importance of accounting for spatial error dependence.

Remittances (REM) remain positive and highly significant (0.238, $p < 0.01$), reinforcing their strong contribution to regional development even when spatially correlated disturbances are considered. Infrastructure (INF) and education (EDU) also show positive and significant effects, emphasizing their role in enhancing the productive use of remittances. Financial development (FD) and institutional quality (INS) are significant at the 5% and 10% levels, indicating that these factors further facilitate economic development outcomes.

The SEM explains 69% of the variation in economic development ($R^2 = 0.69$) with a log-likelihood of -418.73, demonstrating a good fit. The SEM results confirm that spatial dependence exists in unobserved influences, and that remittances, along with regional socio-economic and institutional factors, significantly drive economic development across Nigeria.

4.3 Underlying factors driving spatial disparities in remittance utilization and outcomes.

Table 13: Augmented Panel Regression with Interaction Effects (Fixed Effects Model)

Variables	Coefficient	Std. Error	t-Statistic
REM	0.182***	0.048	3.79
Financial Development (FD)	0.141**	0.065	2.17
Infrastructure (INF)	0.205***	0.059	3.47
Education (EDU)	0.176**	0.081	2.17
REM × FD	0.092***	0.027	3.41
REM × INF	0.105***	0.031	3.39
REM × EDU	0.087**	0.035	2.49
Constant	1.432***	0.298	4.81
R ²	0.73		
Observations	684		

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

Source: Authors' computation (2025)

Table 13 presents the results of the augmented panel regression with interaction effects, capturing how regional characteristics modify the impact of remittances on economic development. Remittances (REM) have a positive and highly significant coefficient (0.182, $p < 0.01$), confirming their direct contribution to regional development. Infrastructure (INF), financial development (FD), and education (EDU) also exhibit positive and significant effects, highlighting their role in enhancing the productive use of remittances. The interaction terms $REM \times FD$ (0.092), $REM \times INF$ (0.105), and $REM \times EDU$ (0.087), are all positive and significant, indicating that the effectiveness of remittances in promoting development is strengthened by higher levels of financial development, better infrastructure, and improved education. This suggests that remittances have a greater developmental impact in regions with stronger socio-economic conditions.



The model explains 73% of the variation in economic development ($R^2 = 0.73$) based on 684 observations, indicating a strong fit. These results show that regional characteristics play a critical moderating role, and policies aimed at enhancing infrastructure, financial systems, and education can amplify the developmental benefits of remittance inflows.

Table 14: Marginal Effects of Remittances at Different Levels of Regional Characteristics

Variable Level	Low (25th Percentile)	Medium (50th Percentile)	High (75th Percentile)
Financial Development	0.154	0.201	0.268
Infrastructure	0.162	0.224	0.289
Education	0.148	0.198	0.256

Source: Authors' computation (2025)

Table 14 show that the impact of remittances increases as the quality of regional factors improves. For financial development, the marginal effect rises from 0.154 at the 25th percentile to 0.268 at the 75th percentile, indicating that regions with stronger financial systems are better able to channel remittances into productive activities.

Similarly, for infrastructure, the marginal effect grows from 0.162 to 0.289, suggesting that well-developed infrastructure enhances the capacity of regions to utilize remittances effectively. Education also amplifies the impact of remittances, with marginal effects increasing from 0.148 to 0.256, highlighting the role of human capital in improving developmental outcomes.

Table 15: Geographically Weighted Regression (GWR) Summary Statistics

Statistic	Value
Number of Observations	36
Bandwidth	5.2
Residual Sum of Squares	112.45
AICc	421.67
R^2 (Local) Mean	0.78
R^2 (Local) Min	0.62
R^2 (Local) Max	0.89

Source: Authors' computation (2025)

Table 15 presents the summary statistics for the Geographically Weighted Regression (GWR) analysis, which captures the spatial heterogeneity in the impact of remittances on economic development across Nigerian regions. The analysis includes 36 observations, corresponding to the 36 states, with a bandwidth of 5.2, indicating the spatial extent over which local parameter estimates are calculated.

The residual sum of squares (112.45) and the corrected Akaike Information Criterion ($AICc = 421.67$) suggest a good model fit. The local R^2 values further highlight substantial spatial variation, with a mean of 0.78, a minimum of 0.62, and a maximum of 0.89. This indicates that the model explains between 62% and 89% of the variation in economic development depending on the state, reflecting significant differences in how remittances and regional factors influence development outcomes across space.

The GWR results in Table 4.15 confirm that the relationship between remittances and economic development is not uniform across Nigeria, emphasizing the importance of



considering localized conditions when assessing the developmental impact of remittance inflows.

Table 16: Spatial Variation in REM Coefficient (GWR Results by Region)

Region	Mean Coefficient	Min	Max
North Central	0.145	0.102	0.188
North East	0.098	0.065	0.132
North West	0.121	0.084	0.159
South East	0.315	0.270	0.362
South South	0.288	0.245	0.330
South West	0.342	0.298	0.390

Source: Authors' computation (2025)

Table 16 presents the Geographically Weighted Regression (GWR) results showing the spatial variation in the impact of remittances (REM) on economic development across Nigerian regions. The mean coefficients indicate substantial regional differences, with southern regions experiencing the strongest effects. The South West has the highest mean coefficient (0.342), followed by the South East (0.315) and South South (0.288), highlighting these regions as the most responsive to remittance inflows.

In contrast, the northern regions exhibit considerably lower mean coefficients, with the North East at 0.098, North West at 0.121, and North Central at 0.145, suggesting that remittances have a more limited developmental impact in these areas. The minimum and maximum values within each region further illustrate local heterogeneity, showing that even within the same geopolitical zone, the effectiveness of remittances varies across states.

Table 17: Spatial Variation in Interaction Effects (REM × FD, REM × INF, REM × EDU)

Region	REM×FD	REM×INF	REM×EDU
North Central	0.061	0.072	0.058
North East	0.048	0.055	0.043
North West	0.053	0.064	0.050
South East	0.118	0.132	0.110
South South	0.105	0.120	0.098
South West	0.125	0.140	0.115

Source: Authors' computation (2025)

The results in Table 17 reveal that these interaction effects are strongest in the southern regions. The South West exhibits the highest coefficients across all interactions (REM × FD = 0.125, REM × INF = 0.140, REM × EDU = 0.115), followed closely by the South East and South South, indicating that remittances are most effective in promoting development where financial systems, infrastructure, and education are more advanced.

In contrast, the northern regions show much lower interaction effects, with the North East recording the weakest coefficients (REM × FD = 0.048, REM × INF = 0.055, REM × EDU = 0.043). This suggests that limited financial development, inadequate infrastructure, and lower education levels constrain the ability of remittances to generate development outcomes in these areas.



Table 18: Local Goodness-of-Fit Measures (GWR by Selected States)

State	Local R ²	REM Coefficient	Interpretation
Lagos	0.89	0.390	Strong positive impact
Anambra	0.86	0.355	High remittance effectiveness
Rivers	0.84	0.330	Significant development impact
Kaduna	0.71	0.155	Moderate impact
Kano	0.68	0.142	Relatively lower impact
Borno	0.62	0.098	Weak impact

Source: Authors' computation (2025)

Table 18 presents the local goodness-of-fit measures from the GWR analysis for selected Nigerian states, highlighting how the impact of remittances varies at the subnational level. Lagos shows the highest local R² of 0.89 with a REM coefficient of 0.390, indicating a very strong positive impact of remittances on economic development. Similarly, Anambra (R² = 0.86, REM = 0.355) and Rivers (R² = 0.84, REM = 0.330) also experience high remittance effectiveness, reflecting the concentration of remittance inflows and strong regional capacities in these southern states.

In contrast, northern states such as Kaduna (R² = 0.71, REM = 0.155), Kano (R² = 0.68, REM = 0.142), and Borno (R² = 0.62, REM = 0.098) show moderate to weak impacts. These lower coefficients suggest that remittances contribute less to development in these regions, likely due to weaker financial infrastructure, limited education, and inadequate local capacity to channel remittances into productive activities.

5. Discussion Of Findings

The findings of this study align closely with its stated objectives and corroborate key trends in the empirical literature. First, the spatial analysis confirms that remittance inflows in Nigeria are highly concentrated in the southern regions, particularly the South West and South East, while northern regions receive comparatively lower inflows. This clustering and the significant spatial autocorrelation mirror the patterns observed by Wusu and Isiugo-Abanihe (2019) and Ajefu et al. (2025), who noted strong geographic disparities in remittance distribution linked to diaspora networks and regional economic opportunities.

Second, the panel and spatial econometric analyses reveal that remittances positively and significantly influence economic development, with the impact strengthened by infrastructure, financial development, and education. These results are consistent with the findings of Adeniran and Muthinja (2024) and Ilori et al. (2024), who reported that remittances support consumption, investment, and human capital development, particularly in regions with better institutional and infrastructural capacity.

Finally, the augmented and GWR models highlight that the developmental effectiveness of remittances varies across regions, with southern states experiencing stronger impacts

due to higher local capacities, while northern states are constrained by weaker regional conditions. This observation resonates with the work of Oyebanji (2024) and Salahudeen et al. (2024), who emphasized that regional characteristics moderate the benefits of remittance flows, underscoring the importance of complementary policies to maximize developmental outcomes.

6. Conclusion And Recommendations

This study examined the spatial dynamics of remittances and their impact on economic development across Nigerian regions. The analysis revealed that remittance inflows are highly clustered in the southern regions, particularly the South West and South East, while northern regions such as the North East and North West experience comparatively lower inflows. Spatial econometric results confirmed that remittances significantly enhance economic development, and their impact is amplified in regions with better infrastructure, higher financial development, and stronger educational outcomes. The Geographically Weighted Regression further demonstrated pronounced spatial heterogeneity, showing that remittances are most effective in southern states with greater local capacities and less effective in northern states constrained by weaker socio-economic conditions. Interaction effects highlighted that regional characteristics are key moderators of remittance effectiveness, emphasizing the importance of local capacities in translating inflows into meaningful development outcomes.

The study concludes that remittances are a vital driver of regional economic development in Nigeria, but their effectiveness is highly contingent on local socio-economic conditions. Policy interventions that improve regional capacities and leverage spatial linkages are essential for maximizing the developmental benefits of remittance inflows across the country.

Based on these findings, the following recommendations are made:

1. **Strengthen Regional Capacities:** Governments and policymakers should prioritize improving infrastructure, financial systems, and educational services, particularly in northern regions, to enhance the productive use of remittances. This will help bridge the developmental gap between northern and southern states.
2. **Promote Targeted Remittance Policies:** Development initiatives should encourage the channelling of remittances into productive investments such as small business development, agricultural modernization, and human capital enhancement, especially in regions with lower baseline capacities.
3. **Leverage Spatial Spillovers:** Recognizing the spatial dependence of development outcomes, policies should encourage inter-regional collaboration and knowledge sharing to ensure that neighboring states benefit from remittance-driven growth in high-performing regions.
4. **Support Diaspora Engagement Programs:** Strengthening networks with the Nigerian diaspora can further increase remittance inflows and promote their strategic utilization for regional development projects, particularly in underdeveloped northern regions.

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