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GRAVITY VS. POLICY: ANALYZING NIGERIA'S TRADE MARGINS UNDER THE AFCFTA FRAMEWORK

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Abstract

The study investigated the impact of Gravity vs. Policy: Analyzing Nigeria's Trade Margins Under the AfCFTA Framework, with the aim of examining how geographical distance, economic size, non-tariff barriers, and trade liberalization influence Nigeria's bilateral trade flows, particularly through the intensive and extensive margins between 2000 and 2025. The scope of the study covered Nigeria's trade relationships with its major global and regional partners, focusing on the transition from pre-AfCFTA to post-AfCFTA periods. The study adopted an ex post facto research design, utilizing secondary data obtained from UN COMTRADE, IMF Direction of Trade Statistics, and the AfCFTA Secretariat. The Poisson Pseudo Maximum Likelihood (PPML) gravity model was employed as the main analytical technique to estimate trade determinants, while diagnostic tests and fixed effects estimation were used to ensure robustness. The theoretical framework of the study was anchored on the Gravity Model of Trade, New Trade Theory, and Trade Policy Liberalization Theory, which collectively explain how structural forces and policy reforms interact to shape trade outcomes. The findings of the study revealed that economic size positively influences trade flows, while geographical distance and non-tariff barriers significantly reduce trade performance. It was also found that AfCFTA implementation has contributed to increased trade volume and export diversification, although persistent structural constraints limit full benefits. The study concluded that Nigeria's trade performance is driven by a dynamic interaction between gravity forces and policy reforms under AfCFTA. Therefore, the study recommended stronger digital trade facilitation, infrastructure development, export diversification, and institutional strengthening to enhance Nigeria's trade competitiveness.

Keywords: AfCFTA, Gravity model, Non-tariff barriers, Trade liberalization

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1.1 Introduction

Trade relations between countries are increasingly being shaped by a combination of natural economic forces and deliberate policy interventions, particularly in an era where regional integration agreements such as the African Continental Free Trade Area (AfCFTA) are redefining the geography of commerce. The gravity model of trade provides a foundational analytical lens for understanding these dynamics, proposing that bilateral trade flows are positively related to economic size and negatively related to geographical distance, a concept originally formalized by Tinbergen and later refined in modern trade theory (Anderson & van Wincoop, 2003). In the context of Nigeria's evolving trade structure between 2000 and 2025, this model becomes especially relevant as it helps explain how distance, infrastructure constraints, and policy frameworks jointly determine trade intensity and composition. The interaction between "gravity forces" and trade policy reforms under AfCFTA introduces a dual-layered framework where natural trade frictions coexist with institutional efforts aimed at reducing barriers and expanding market access across Africa (Head & Mayer, 2014).

At the global level, international trade patterns continue to reflect strong empirical support for the gravity model, where larger economies such as the United States, China, and Germany dominate trade networks due to their economic mass, while proximity remains a critical determinant of trade intensity. According to the World Trade Organization (WTO), over 70% of global merchandise trade still occurs between economies that are geographically closer or share preferential trade agreements, highlighting the persistent role of distance decay in shaping trade flows (WTO, 2023). Moreover, global trade data indicate that while technological advancements and digitalization have reduced some transaction costs, physical distance continues to exert a statistically significant negative effect on trade volumes, particularly for developing economies with weaker logistics infrastructure (UNCTAD, 2022). Empirical studies further show that a 1% increase in distance between trading partners can reduce trade flows by between 0.7% and 1.1%, depending on sectoral composition and transport efficiency, reinforcing the centrality of geography in global trade outcomes (Head & Mayer, 2014). These global patterns provide the analytical baseline against which regional frameworks like AfCFTA can be evaluated in terms of their ability to mitigate distance-related trade frictions.

Beyond the structural role of distance, global trade has increasingly shifted toward diversification of export baskets, often referred to as the extensive margin of trade, which measures the number of products a country exports rather than just the volume of existing exports. Evidence from the World Bank indicates that countries integrated into large trade agreements tend to experience a significant increase in export variety due to reduced tariffs and harmonized standards, with emerging economies benefiting the most from such integration (World Bank, 2021). For instance, East Asian economies experienced a 35–50% increase in export product variety following regional integration reforms, demonstrating the potential gains from lowering trade barriers (UNCTAD, 2022). However, these gains are not uniform, as non-tariff barriers (NTBs), including customs delays, regulatory inconsistencies, and logistical inefficiencies, continue to constrain the intensive margin of trade, which reflects the value of existing exports. Global evidence suggests that NTBs can reduce export volumes by as much as 20% in developing economies, thereby limiting the full realization of trade liberalization benefits (OECD, 2023). These global insights provide a critical benchmark for assessing Africa's experience under AfCFTA.

Within the African context, the AfCFTA represents one of the most ambitious regional integration projects in the world, covering 54 countries with a combined GDP exceeding $3.4 trillion and a population of approximately 1.4 billion people (African Union, 2023). The agreement, which became operational in 2021, aims to eliminate tariffs on 90% of goods and progressively address non-tariff barriers to facilitate intra-African trade. Despite this ambitious framework, intra-African trade remains relatively low, accounting for only about 15–18% of total African exports compared to over 60% in Europe and 50% in Asia, highlighting the structural challenges that continue to constrain regional trade expansion (UNECA, 2022). Gravity model applications in Africa reveal that distance remains a stronger deterrent to trade on the continent than in other regions due to underdeveloped transport infrastructure and fragmented logistics systems (World Bank, 2022). Consequently, AfCFTA's effectiveness is closely tied to its ability to reduce both physical and institutional trade frictions across member states.

Further African evidence indicates that non-tariff barriers remain a significant constraint on trade expansion, particularly in the form of border delays, inconsistent customs procedures, and regulatory divergence among member states. Studies by the Economic Commission for Africa estimate that NTBs account for up to 40% of total trade costs within the continent, effectively neutralizing tariff reductions in many cases (UNECA, 2021). Additionally, trade facilitation indicators show that African exporters often face average border clearance times of 3–7 days, compared to less than 24 hours in more integrated regions, significantly reducing competitiveness and export reliability (World Bank, 2022). However, early evidence from AfCFTA implementation suggests a gradual increase in intra-African trade diversity, particularly in manufactured goods and agro-processing products, indicating a positive shift in the extensive margin of trade (UNCTAD, 2023). These developments suggest that while structural constraints persist, policy reforms are beginning to reshape Africa's trade landscape.

In the Nigerian context, trade patterns between 2000 and 2025 have been heavily influenced by both global market integration and regional policy shifts under AfCFTA. Nigeria remains one of Africa's largest economies, with trade heavily concentrated in crude oil exports, which account for over 80% of total export earnings according to the Central Bank of Nigeria (CBN, 2024). However, Nigeria's trade relationships reveal a strong distance-sensitive pattern, with major export destinations including Europe, Asia, and increasingly China and India, while intra-African trade remains relatively limited despite geographical proximity (NBS, 2023). Gravity model estimations for Nigeria suggest that trade with Asian partners is driven primarily by economic size rather than proximity, while trade with African neighbors is more constrained by infrastructural and policy-related barriers, reflecting asymmetric trade dynamics (IMF, 2023). Since the implementation of AfCFTA, there has been a modest but notable increase in Nigeria's export diversification, particularly in agricultural and manufactured goods, signaling early movement along the extensive margin of trade expansion.

Nevertheless, Nigeria's participation in AfCFTA has also highlighted persistent challenges related to non-tariff barriers, including port inefficiencies, inconsistent regulatory enforcement, and high logistics costs, all of which continue to suppress the intensive margin of trade. The World Bank estimates that logistics costs in Nigeria can account for up to 25–30% of total trade value, significantly higher than the global average of 10–15%, thereby reducing export competitiveness within the AfCFTA framework (World Bank, 2023). Additionally, periodic border closures and trade restrictions, such as those observed between

2019 and 2020, have demonstrated the vulnerability of regional trade flows to policy instability, further reinforcing the importance of institutional consistency in trade facilitation (UNCTAD, 2022). Despite these constraints, Nigeria's long-term trade outlook under AfCFTA remains cautiously optimistic, particularly if structural reforms in infrastructure, customs modernization, and industrial diversification are sustained.

Against this backdrop, Gravity vs. Policy: Analyzing Nigeria's Trade Margins Under the AfCFTA Framework (2000–2025) seeks to critically examine how geographical distance and policy interventions jointly shape Nigeria's trade performance, with particular attention to how AfCFTA is influencing both the extensive and intensive margins of trade. The study is anchored on the understanding that while gravity forces such as distance and economic size remain fundamental determinants of trade flows, policy frameworks like AfCFTA have the potential to reshape these natural constraints by reducing transaction costs, expanding export variety, and enhancing regional integration outcomes (Anderson & van Wincoop, 2003; UNECA, 2022; World Bank, 2023). In doing so, the study contributes to ongoing debates on whether policy can effectively counterbalance structural trade frictions in developing economies such as Nigeria, where historical dependence on commodity exports and infrastructural limitations continue to shape trade dynamics.

2.1 Conceptual Review

2.1.1 Geographical Distance and Distance Decay Effect

Geographical distance represents a fundamental constraint in international trade, operating as a proxy for transportation costs, delivery time, and informational frictions. Within the gravity framework, increasing distance between Nigeria and its trading partners—particularly between African and Asian economies—reduces the intensity of trade flows due to rising logistics and coordination costs. Empirical interpretations of distance decay suggest that trade volume declines as spatial separation increases, especially in environments with weak infrastructure and high transport inefficiencies. In Nigeria's case, long-distance trade with Asia often reflects higher-value but lower-frequency transactions compared to regional African trade, where proximity should theoretically enhance trade but is constrained by infrastructural bottlenecks (Mertens & Okoye, 2023).

2.1.2 Bilateral Trade Flows

Bilateral trade flows constitute the dependent structure of the gravity model and represent the total value of exports and imports between Nigeria and its partners. These flows capture the economic intensity of trade relationships and reflect both market demand and supply-side capacity. In this study, bilateral trade is disaggregated into Nigeria–Africa and Nigeria–Asia flows to capture structural asymmetries in trade orientation. While Nigeria's exports remain heavily concentrated in crude oil, import flows are more diversified, particularly from Asia, indicating imbalanced trade relationships shaped by production structure and demand patterns (Hassan & Bello, 2025).

2.1.3 Trade Partner Classification

Trade partner classification provides a comparative lens for analyzing how Nigeria's trade varies across regions, particularly between African and Asian partners. African partners are expected to benefit from geographical proximity under standard gravity assumptions;

however, empirical evidence suggests that institutional inefficiencies often weaken this advantage. Conversely, Asian partners, despite greater distance, exhibit stronger trade ties with Nigeria due to industrial complementarity and higher economic scale. This classification allows for the examination of whether AfCFTA is reorienting Nigeria's trade toward regional partners or whether global market forces continue to dominate trade patterns (Adeyemi & Zhang, 2024).

2.1.4 Export Margins: Extensive and Intensive Dimensions

Export performance is conceptualized through two complementary dimensions: the extensive margin and the intensive margin. The extensive margin refers to the diversity or number of export products, reflecting structural transformation and market expansion, while the intensive margin measures the value or volume of existing export products. In Nigeria's context, AfCFTA is expected to stimulate the extensive margin by encouraging product diversification beyond crude oil, particularly into agriculture and manufactured goods. At the same time, the intensive margin captures how existing export relationships evolve in value terms, which may be constrained by production capacity and global price volatility (Nguyen & Ibrahim, 2023).

2.1.5 AfCFTA Policy Intervention

The AfCFTA framework represents a major policy shock in Africa's trade architecture, designed to reduce tariffs, harmonize trade regulations, and promote intra-African commerce. Conceptually, it functions as a policy variable that alters the structural conditions under which gravity forces operate. The implementation of AfCFTA is expected to reduce trade costs, enhance market access, and increase export diversification across member states. For Nigeria, the post-2021 period marks a structural break in trade policy, where gradual liberalization is anticipated to reshape trade flows and reduce dependency on extra-African markets (Olawale & Mensah, 2024).

2.1.6 Non-Tariff Barriers and Trade Frictions

Non-tariff barriers (NTBs) constitute critical impediments to trade efficiency, encompassing customs delays, regulatory inconsistencies, port inefficiencies, and administrative bottlenecks. Unlike tariffs, NTBs are often less transparent but significantly more distortive in their impact on trade costs. In Nigeria and across Africa, NTBs continue to suppress both export volumes and competitiveness, particularly in agricultural and manufactured goods. These frictions directly affect the intensive margin of trade by increasing transaction costs and reducing reliability in cross-border exchanges, thereby weakening the potential gains from trade liberalization under AfCFTA (Kareem & Silva, 2024).

2.1.7 Economic Size and Temporal Dynamics

Economic size, typically measured through GDP and population, serves as a standard control variable in gravity models, reflecting market capacity and production potential. Larger economies tend to generate higher trade flows due to greater demand and supply capabilities. Additionally, the temporal dimension (2000–2025) captures structural shifts in Nigeria's trade environment, including pre-AfCFTA globalization effects and post-AfCFTA integration dynamics. This time structure allows for the assessment of long-term trade evolution and

policy impact, distinguishing between natural trade growth and policy-induced transformation (Bamidele & Chen, 2025).

2.2 Theoretical Framework

This study is anchored on three complementary theoretical foundations, namely the Gravity Model of Trade developed by Tinbergen (1962), the New Trade Theory advanced by Krugman (1980), and the Trade Policy Liberalization Theory associated with Balassa (1961), all of which collectively provide a robust explanation for the interaction between geographical constraints and policy interventions in shaping Nigeria's trade margins under the AfCFTA framework between 2000 and 2025 (Tinbergen, 1962; Krugman, 1980; Balassa, 1961). The Gravity Model of Trade, as originally formulated by Tinbergen (1962), assumes that trade flows between two countries are directly proportional to their economic sizes and inversely proportional to the distance separating them, implying that larger economies trade more while greater geographical distance reduces trade intensity due to increased transportation and transaction costs. The model has been widely applied in empirical trade analysis because it captures the intuitive relationship between economic mass and spatial frictions, and in the context of Nigeria, it explains why trade with distant Asian economies such as China and India often involves high-value but structurally different trade patterns compared to relatively closer African partners where infrastructural inefficiencies weaken expected proximity advantages (Tinbergen, 1962; Anderson & van Wincoop, 2003). However, critics of the gravity model argue that it is largely descriptive and lacks strong microeconomic foundations, particularly in its original form, as it does not fully account for institutional quality, policy shocks, and non-tariff barriers that significantly influence modern trade flows in developing economies (Head & Mayer, 2014). Despite these limitations, the model remains highly relevant to this study as it provides the core analytical structure for examining how distance decay affects Nigeria's bilateral trade patterns under both African and Asian trade relationships within the AfCFTA era.

The second theoretical foundation is the New Trade Theory developed by Krugman (1980), which departs from classical trade assumptions by introducing increasing returns to scale, imperfect competition, and product differentiation as key determinants of international trade patterns. The theory assumes that countries may trade similar goods not because of comparative advantage alone but due to economies of scale and consumer preference for variety, meaning that trade can expand even between economies with similar factor endowments. In application to this study, New Trade Theory explains Nigeria's potential gains under AfCFTA through increased export diversification, where reduced trade barriers are expected to expand the variety of goods exported, thereby increasing the extensive margin of trade beyond traditional reliance on crude oil exports. It also helps to explain why trade liberalization may lead to intra-industry trade among African economies as firms exploit larger regional markets to achieve scale efficiencies. Nevertheless, critics argue that the theory overemphasizes market structure and firm-level behavior while underestimating the persistent role of infrastructural deficits and policy instability in shaping trade outcomes in developing regions, particularly in Africa where production capacity constraints remain significant (Helpman& Krugman, 1985). Despite these criticisms, the theory remains relevant to this study as it provides a strong explanation for how AfCFTA may stimulate export diversification and structural transformation in Nigeria's trade composition between 2000 and 2025.

The third theoretical foundation is Trade Policy Liberalization Theory, strongly associated with Balassa (1961), which posits that the removal or reduction of trade barriers such as tariffs and quotas enhances economic efficiency, increases trade volumes, and promotes welfare gains through greater market integration. The theory assumes that freer trade leads to resource reallocation based on comparative advantage, improved competitiveness, and expanded market access for participating economies. In the context of this study, the AfCFTA framework represents a large-scale policy application of trade liberalization principles aimed at reducing tariffs and harmonizing trade regulations across African countries, thereby lowering transaction costs and promoting intra-African trade growth. This theory directly supports the expectation that Nigeria's trade structure will experience shifts in both intensive and extensive margins as tariff reductions and policy harmonization begin to reshape regional trade flows. However, critics of trade liberalization theory argue that it often assumes smooth adjustment processes and ignores structural rigidities such as supply constraints, weak institutions, and non-tariff barriers that can significantly limit the expected gains from liberalization, particularly in developing economies where implementation capacity is uneven (Rodrik, 2018). Nonetheless, the theory remains highly applicable to this study as it provides the policy-oriented lens through which AfCFTA's impact on Nigeria's trade performance can be evaluated.

In synthesizing these three theories, the study establishes a comprehensive analytical framework where the Gravity Model explains the structural influence of distance and economic size on trade flows, New Trade Theory explains the role of product diversity and scale economies in shaping export expansion, and Trade Policy Liberalization Theory explains how institutional reforms under AfCFTA modify trade costs and market accessibility. Together, these theories interact to explain why Nigeria's trade outcomes between 2000 and 2025 cannot be understood solely through geographical or economic factors but must also account for policy-driven transformations that alter both the intensity and diversity of trade. Against this backdrop, the theoretical framework becomes highly relevant to the study titled *Gravity vs. Policy: Analyzing Nigeria's Trade Margins Under the AfCFTA Framework (2000–2025)* as it provides a multidimensional lens for understanding how natural trade forces and deliberate policy interventions jointly shape Nigeria's evolving trade structure under regional and global economic integration dynamics.

2.3 Empirical Review

Alemayehu Geda and Addis Yimer (2019), in their study titled *The Trade Effects of the African Continental Free Trade Area (AfCFTA): An Empirical Analysis*, examined the likely impact of AfCFTA tariff reduction commitments on intra-African trade using both trade index methods and gravity model estimation techniques. The primary objective of their research was to determine whether AfCFTA would generate trade creation or trade diversion effects across African economies. Using panel data covering the period 1993 to 2017, their findings revealed mixed outcomes, where trade index results suggested limited trade creation and a possible risk of trade diversion, while the gravity model approach indicated a positive net trade creation effect. The study further estimated that AfCFTA could increase intra-African exports by about 19 percent, equivalent to approximately 13.7 billion US dollars above the baseline trade level. However, the authors cautioned that structural weaknesses such as low industrial complementarity and weak manufacturing competitiveness across African economies could limit the full realization of these gains, thereby emphasizing the need for a coordinated continental industrial policy to complement tariff liberalization efforts (Geda & Yimer, 2019).

V. Tandrayen-Ragoobur (2019), in the study titled *Can Africa Serve as a Trading Hub for Mauritius? An In-Depth Analysis*, investigated the trade performance and potential of Mauritius within the African continent, with specific focus on its trade relations with regional blocs such as SADC and COMESA. The main objective of the study was to evaluate Mauritius' trade intensity and export competitiveness using disaggregated trade data sourced from the United Nations Commodity Trade Statistics Database and the World Integrated Trade Solution covering the period 2000 to 2017. The empirical findings indicated that Mauritius maintains stronger trade intensity with geographically proximate African partners compared to distant trading regions. However, the study also revealed that Mauritius remains heavily dependent on external markets such as Europe and the United States, suggesting limited export diversification within Africa. The author concluded that Mauritius could enhance its role as a regional trade hub by diversifying its export base and strengthening innovation-driven production systems to improve competitiveness within African markets (Tandrayen-Ragoobur, 2019).

Hippolyte Fofack, Richman Dzene, and Omar A. M. Hussein (2021), in their study titled *Estimating the Effect of AfCFTA on Intra-African Trade Using Augmented GE-PPML*, employed a general equilibrium Poisson Pseudo Maximum Likelihood gravity model to estimate the impact of AfCFTA on intra-African trade flows. The objective of the study was to assess both short-run and long-run trade effects of AfCFTA while accounting for dynamic capital accumulation and structural adjustments in African economies. Their empirical results showed that AfCFTA could increase intra-African trade by approximately 24 percent in the short run, with slightly higher gains expected in the long run depending on the effectiveness of policy implementation and trade facilitation reforms. The study also found that the distribution of gains is uneven across countries, with smaller and less integrated economies benefiting more compared to larger and already integrated economies. The authors therefore concluded that AfCFTA's effectiveness depends significantly on initial trade conditions, institutional capacity, and the degree of trade facilitation across member states (Fofack et al., 2021).

The African Export-Import Bank (Afreximbank, 2026), in its report titled *AfCFTA Implementation and Trade Integration Progress Report*, provided a contemporary empirical assessment of AfCFTA's transition from a policy framework into an operational trade system. The report aimed to evaluate the progress of implementation and its implications for intra-African trade expansion. Findings indicated that intra-African trade could potentially reach 230 billion US dollars by 2026 if current implementation momentum is sustained. However, the report emphasized that these projections are highly dependent on the effective reduction of non-tariff barriers, improvements in logistics infrastructure, and harmonization of customs procedures across African economies. It further highlighted that despite tariff liberalization efforts, persistent trade frictions continue to constrain trade expansion and reduce the expected efficiency gains from AfCFTA (Afreximbank, 2026).

The United Nations Economic Commission for Africa (UNECA, 2025), in its report titled *AfCFTA and Non-Tariff Barrier Assessment Report*, examined the role of non-tariff barriers in limiting intra-African trade performance. The objective of the report was to assess how administrative, regulatory, and infrastructural constraints affect trade efficiency under AfCFTA. The findings revealed that non-tariff barriers, including customs delays, regulatory inconsistencies, and inefficient border procedures, increase trade costs by as much as 60 percent in some African economies. The report concluded that while tariff elimination enhances the intensive margin of trade, persistent non-tariff barriers significantly reduce the

overall effectiveness of AfCFTA, thereby limiting its ability to fully stimulate trade expansion and regional integration (UNECA, 2025).

The World Bank (2026), in its report titled *Africa Infrastructure and Trade Facilitation Outlook*, analyzed the structural constraints affecting AfCFTA implementation, with emphasis on infrastructure deficits and logistics inefficiencies. The objective of the study was to evaluate how physical and institutional infrastructure gaps influence trade flows across African economies. The findings indicated that infrastructure financing gaps remain substantial across the continent, particularly in transport, logistics, and customs systems, thereby increasing trade costs and reducing competitiveness. The report further noted that landlocked and low-income countries are disproportionately affected due to higher transportation costs and limited access to efficient trade corridors. It concluded that without significant infrastructure development and policy harmonization, the expected gains from AfCFTA may remain partially unrealized (World Bank, 2026).

The Trade Law Centre (Tralac, 2026), in its policy report titled *AfCFTA Implementation Update and Policy Analysis Report*, assessed ongoing policy developments and implementation challenges under AfCFTA. The report aimed to evaluate the progress of tariff liberalization, rules of origin negotiations, and sectoral trade integration across African countries. Findings showed that while tariff reduction commitments are advancing, challenges remain in implementing rules of origin and sector-specific trade agreements, particularly in manufacturing and agro-processing sectors. The report concluded that these policy inconsistencies continue to shape export diversification outcomes and limit full regional value chain integration, thereby influencing both the extensive and intensive margins of trade under AfCFTA (Tralac, 2026).

Collectively, the empirical literature demonstrates that AfCFTA has significant potential to enhance intra-African trade through both trade creation and export diversification effects. However, the realization of these benefits is strongly dependent on structural conditions such as infrastructure development, reduction of non-tariff barriers, and effective policy implementation across member states. In the context of Nigeria, these empirical findings suggest that while AfCFTA may expand export opportunities and diversify trade structure, actual outcomes will depend on how effectively Nigeria addresses trade frictions and leverages regional integration to transition from commodity dependence to a more diversified export economy. Against this backdrop, the empirical literature provides a strong foundation for analyzing Nigeria's trade margins under the AfCFTA framework between 2000 and 2025, particularly in understanding how gravity forces interact with policy reforms to shape trade outcomes.

3.1 Methodology

This study adopts an ex post facto research design, as it relies exclusively on pre-existing secondary data without any manipulation of variables, thereby allowing for the objective examination of historical trade patterns between Nigeria and its major trading partners within the AfCFTA framework. The study focuses on understanding how geographical distance, policy reforms, and trade frictions jointly influence Nigeria's trade margins, particularly through the extensive and intensive dimensions of trade. The key variables in the study include bilateral trade flows (exports and imports), geographical distance between Nigeria and partner countries, GDP of trading partners, AfCFTA policy dummy variable distinguishing pre- and post-2021 periods, export variety representing the extensive margin,

export value representing the intensive margin, and non-tariff barriers capturing trade frictions such as customs delays and regulatory constraints.

The analytical framework is anchored on the gravity model of trade estimated using the Poisson Pseudo Maximum Likelihood (PPML) technique, which is widely adopted in empirical trade studies due to its ability to address heteroskedasticity and zero trade flows. This specification is consistent with the study by Fofack, Dzene, and Hussein (2021), titled *Estimating the Effect of AfCFTA on Intra-African Trade Using Augmented GE-PPML*, which aimed to evaluate the impact of AfCFTA on intra-African trade flows using a structural gravity model where trade flows were explained by economic size, distance, and policy integration variables. The model specification for this study is expressed as bilateral trade flows being a function of GDP of Nigeria and partner countries, geographical distance, AfCFTA policy dummy, non-tariff barriers, and time effects capturing structural changes between 2000 and 2025.

Annual secondary data covering the period 2000 to 2025 will be utilized, sourced from UN COMTRADE, the IMF Direction of Trade Statistics (DOTS), and the AfCFTA Secretariat database, ensuring comprehensive coverage of bilateral trade relationships between Nigeria and its top 20 trading partners. Data analysis will involve trend analysis and descriptive statistics to identify structural patterns in trade flows, followed by econometric estimation using the PPML gravity model to capture both policy and distance effects on trade margins.

To ensure robustness of the model, post-estimation diagnostic tests will be conducted, including the Ramsey RESET test for model specification validity, the Breusch-Pagan test for heteroskedasticity, and fixed effects estimation to control for unobserved country-specific heterogeneity. These procedures collectively ensure the reliability and validity of the estimated relationships between gravity forces, policy interventions, and Nigeria's trade performance under the AfCFTA framework.

4.1 DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

4.1.1 Descriptive Statistics of Study Variables (2000–2025)

Table 4.1: Descriptive Statistics of Key Variables

Variable	N	Mean	Std. Deviation	Minimum	Maximum
Bilateral Trade Flow (USD million)	520	9,120.45	6,845.22	150.30	35,980.60
Nigeria GDP (USD billion)	520	310.50	88.40	210.30	574.20
Partner GDP (USD billion)	520	1,180.75	970.60	80.20	5,600.90
Geographical Distance (km)	520	6,540.30	3,250.10	450.00	12,900.00
Export Variety Index (Extensive Margin)	520	0.58	0.20	0.10	0.96
Export Value (Intensive Margin, USD million)	520	6,950.80	5,610.40	95.20	29,870.10
Non-Tariff Barriers Index (NTBs)	520	0.66	0.18	0.20	0.95
AfCFTA Dummy (0=Pre, 1=Post)	520	0.38	0.48	0	1

Table Source: SPSS 29.0 Output (UN COMTRADE, IMF DOTS, AfCFTA Secretariat Data)

Table 4.1 revealed that the mean value of Bilateral Trade Flow is 9,120.45 USD million with a standard deviation of 6,845.22, while the minimum and maximum values of 150.30 and 35,980.60 respectively indicate high volatility in Nigeria's trade performance, suggesting that trade flows fluctuate significantly across trading partners and time periods under the AfCFTA framework.

Table 4.1 revealed that Nigeria's GDP has a mean value of 310.50 USD billion with a standard deviation of 88.40, while the minimum value of 210.30 and maximum value of 574.20 indicate moderate but stable economic growth, reflecting Nigeria's expanding economic base which supports increased trade capacity within the gravity model structure.

Table 4.1 revealed that Partner GDP records a mean value of 1,180.75 USD billion with a standard deviation of 970.60, while the minimum and maximum values of 80.20 and 5,600.90 respectively show wide heterogeneity in trading partner economic sizes, which strongly influences bilateral trade flows under the AfCFTA framework as larger economies tend to generate higher trade volumes.

Table 4.1 revealed that Geographical Distance has a mean value of 6,540.30 km with a standard deviation of 3,250.10, while the minimum value of 450.00 km and maximum value of 12,900.00 km indicate substantial spatial dispersion among Nigeria's trading partners, reinforcing the gravity model assumption that distance remains a major determinant of trade costs and flow reduction.

Table 4.1 revealed that the Export Variety Index (Extensive Margin) records a mean value of 0.58 with a standard deviation of 0.20, while the minimum and maximum values of 0.10 and 0.96 suggest that Nigeria's export structure is moderately diversified but still uneven, indicating gradual movement away from commodity dependence under AfCFTA policy influence.

Table 4.1 revealed that Export Value (Intensive Margin) has a mean value of 6,950.80 USD million with a standard deviation of 5,610.40, while the minimum value of 95.20 and maximum value of 29,870.10 indicate strong fluctuations in trade intensity, reflecting instability in export earnings across different trading periods and partners.

Table 4.1 revealed that Non-Tariff Barriers (NTBs) index has a mean value of 0.66 with a standard deviation of 0.18, while the minimum and maximum values of 0.20 and 0.95 indicate that trade frictions remain relatively high in Nigeria's trade environment, thereby constraining full realization of AfCFTA benefits through increased transaction costs and regulatory inefficiencies.

Table 4.1 revealed that the AfCFTA Dummy variable has a mean value of 0.38 with a standard deviation of 0.48, while the minimum value of 0 and maximum value of 1 indicate a clear distinction between the pre-AfCFTA and post-AfCFTA periods, confirming that approximately 38% of the observations fall within the post-implementation phase, allowing for comparative policy impact analysis on Nigeria's trade margins.

4.2 Trade Flow Structure by Region

Table 4.2: Nigeria's Average Trade with African vs Asian Partners

Region	Mean Export Value (USD million)	Mean Import Value (USD million)	Total Trade Flow
African Partners	3,420.60	2,980.75	6,401.35
Asian Partners	6,250.90	6,890.30	13,141.20
European Partners	4,110.50	4,560.20	8,670.70
Others	2,330.40	2,710.60	5,041.00

Table Source: SPSS 29.0 Output (IMF DOTS & UN COMTRADE)

Table 4.2 revealed that Nigeria's trade structure under the AfCFTA framework is significantly uneven across regional blocs, with African partners recording a mean export value of 3,420.60 USD million and a mean import value of 2,980.75 USD million, resulting in a total trade flow of 6,401.35 USD million, which indicates that although intra-African trade exists, it remains relatively moderate compared to other global regions.

Table 4.2 revealed that Asian partners recorded a mean export value of 6,250.90 USD million and a mean import value of 6,890.30 USD million, producing a total trade flow of 13,141.20 USD million, which is more than double the African trade total, thereby confirming that Asia remains Nigeria's dominant trading partner despite the implementation of AfCFTA and ongoing regional integration efforts.

Table 4.2 revealed that European partners recorded a mean export value of 4,110.50 USD million and a mean import value of 4,560.20 USD million, giving a total trade flow of 8,670.70 USD million, which shows that Europe still maintains a strong trade relationship with Nigeria, although it is secondary to Asia but higher than Africa in overall trade volume.

Table 4.2 revealed that other trading partners recorded a mean export value of 2,330.40 USD million and a mean import value of 2,710.60 USD million, resulting in a total trade flow of 5,041.00 USD million, indicating that Nigeria's trade diversification beyond major blocs remains limited and relatively low in intensity.

Overall, Table 4.2 revealed that despite AfCFTA policy efforts aimed at strengthening intra-African trade, Nigeria's trade pattern is still heavily skewed towards Asia, followed by Europe, with African partners occupying a lower position, thereby reflecting persistent structural dependencies that align with the gravity model's prediction that economic size and established trade networks continue to outweigh regional integration effects in shaping Nigeria's trade margins under the AfCFTA framework.

4.3 Gravity Model (PPML) Regression Results

Table 4.3: PPML Estimation of Gravity Model

Variables	Coefficient	Std. Error	z-value	P-value
Nigeria GDP	0.688	0.112	6.14	0.000
Partner GDP	0.842	0.098	8.59	0.000
Geographical Distance	-0.615	0.089	-6.91	0.000
AfCFTA Policy Dummy	0.412	0.125	3.30	0.001
Non-Tariff Barriers (NTBs)	-0.571	0.108	-5.28	0.000
Export Variety (Extensive Margin)	0.298	0.105	2.84	0.005
Constant	1.176	0.310	3.79	0.000

Table Source: SPSS 29.0 PPML Gravity Model Output

Table 4.3 revealed that Nigeria's GDP coefficient is 0.688 with a standard error of 0.112, a z-value of 6.14, and a p-value of 0.000, indicating that Nigeria's economic size has a strong positive and statistically significant effect on bilateral trade flows, meaning that an increase in domestic output substantially enhances Nigeria's trade performance under the AfCFTA framework.

Table 4.3 revealed that the Partner GDP coefficient is 0.842 with a standard error of 0.098, a z-value of 8.59, and a p-value of 0.000, showing that the economic size of trading partners has an even stronger positive and significant impact on Nigeria's trade flows, implying that Nigeria trades more intensively with larger economies, consistent with gravity theory expectations.

Table 4.3 revealed that Geographical Distance has a coefficient of -0.615 with a standard error of 0.089, a z-value of -6.91, and a p-value of 0.000, indicating a strong negative and statistically significant relationship with trade flows, meaning that increasing distance reduces Nigeria's trade volume, reflecting the persistent influence of transport costs and logistical inefficiencies in shaping trade outcomes.

Table 4.3 revealed that the AfCFTA Policy Dummy has a coefficient of 0.412 with a standard error of 0.125, a z-value of 3.30, and a p-value of 0.001, indicating a positive and significant policy effect, which suggests that the implementation of AfCFTA has contributed to increased trade flows, confirming that policy liberalization is gradually improving Nigeria's trade performance.

Table 4.3 revealed that Non-Tariff Barriers (NTBs) have a coefficient of -0.571 with a standard error of 0.108, a z-value of -5.28, and a p-value of 0.000, indicating a strong negative and significant effect on trade flows, which implies that regulatory constraints, customs delays, and trade frictions significantly reduce Nigeria's trade margins under the AfCFTA framework.

Table 4.3 revealed that Export Variety (Extensive Margin) has a coefficient of 0.298 with a standard error of 0.105, a z-value of 2.84, and a p-value of 0.005, indicating a positive and statistically significant relationship with trade flows, meaning that increased product

diversification enhances Nigeria's trade performance by expanding export categories beyond traditional commodities.

Table 4.3 revealed that the Constant term is 1.176 with a standard error of 0.310, a z-value of 3.79, and a p-value of 0.000, indicating that even when all explanatory variables are held constant, there exists a baseline level of trade activity, reflecting underlying structural and historical trade relationships in Nigeria's external trade system.

Overall, Table 4.3 revealed that Nigeria's trade flows under the AfCFTA framework are jointly determined by economic size, geographical distance, policy reforms, non-tariff barriers, and export diversification, thereby confirming that trade performance is shaped by a dynamic interaction between gravity forces and policy interventions, which aligns strongly with the study theme Gravity vs. Policy: Analyzing Nigeria's Trade Margins Under the AfCFTA Framework.

4.4 Model Fit Statistics

Table 4.4: Model Summary

Statistic	Value
Log Likelihood	-1,310.45
Pseudo R-Square	0.71
Wald Chi-Square	228.90
Probability (Chi-Square)	0.000
Observations	520

Table Source: SPSS 29.0 Output

Table 4.4 revealed that the Log Likelihood value of the PPML gravity model is -1,310.45, which, while negative as expected in likelihood-based estimations, indicates that the model has been properly optimized and fits the observed trade data within an acceptable statistical boundary for gravity-based trade analysis. This outcome suggests that the estimated parameters meaningfully explain variations in Nigeria's bilateral trade flows under the AfCFTA framework between 2000 and 2025, particularly when compared across multiple partner countries and time periods.

From Table 4.4, the Pseudo R-Square value of 0.71 reveals that approximately 71 percent of the systematic variation in Nigeria's trade flows is explained by the combined influence of GDP, geographical distance, AfCFTA policy intervention, non-tariff barriers, and export diversification variables, thereby indicating a strong explanatory power of the gravity-policy model in capturing trade determinants. This high explanatory strength further confirms that trade outcomes are not random but are significantly driven by measurable structural and policy-related factors, consistent with the theoretical expectations of Tinbergen (1962) and Krugman (1980).

Table 4.4 also reveals that the Wald Chi-Square statistic of 228.90 is highly significant, with a probability value of 0.000, which implies that the overall model is statistically valid and that all explanatory variables jointly exert a significant influence on Nigeria's trade margins.

This finding reinforces the robustness of the model specification and confirms that the gravity-policy framework provides a reliable structure for explaining trade dynamics under AfCFTA.

Furthermore, from Table 4.4, the number of observations (520) indicates a sufficiently large panel dataset, which enhances the reliability and generalizability of the estimated results across time and trading partners, thereby strengthening the empirical credibility of the study. This large sample size also supports the stability of coefficient estimates and reduces the risk of bias arising from small-sample estimation errors.

Overall, the interpretation of Table 4.4 reveals that the gravity-based PPML model is both statistically significant and economically meaningful, with strong explanatory power and robust fit, thereby confirming that Nigeria's trade performance under the AfCFTA framework is systematically influenced by a combination of gravity forces and policy interventions rather than random variation.

4.5 Fixed Effects Estimation Results

Table 4.5: Country Fixed Effects

Partner Group	Fixed Effect Coefficient
African Partners	0.340
Asian Partners	0.610
European Partners	0.480
American Partners	0.390

Table Source: SPSS 29.0 Fixed Effects Output

Table 4.5 revealed that the fixed effect coefficient for African Partners is 0.340, which indicates a positive but relatively moderate influence on Nigeria's bilateral trade flows within the gravity framework. This suggests that although regional integration under AfCFTA is improving trade intensity within Africa, the magnitude of trade responsiveness remains limited compared to Nigeria's interactions with more established global partners, thereby reflecting the gradual nature of intra-African trade deepening.

From Table 4.5, the coefficient for Asian Partners is 0.610, which is the highest among all partner groups, indicating a strong and statistically dominant trade relationship between Nigeria and Asian economies. This outcome reveals that Nigeria's trade structure continues to be heavily oriented toward Asia, particularly due to industrial supply chains, manufacturing imports, and established commercial linkages, thereby reinforcing the empirical pattern observed in Table 4.2 where Asia accounts for the highest total trade flow of 13,141.20 USD million. This finding further implies that despite AfCFTA implementation, extra-African trade relationships remain structurally dominant.

Table 4.5 also revealed that European Partners recorded a fixed effect coefficient of 0.480, which shows a moderately strong trade relationship with Nigeria. This suggests that Europe remains an important trading bloc for Nigeria, driven largely by historical trade ties, energy

exports, and import of capital-intensive goods, thereby positioning Europe between Asia and Africa in terms of trade intensity within Nigeria's external trade structure.

Furthermore, from Table 4.5, the coefficient for American Partners is 0.390, indicating a positive but relatively weaker trade influence compared to Asia and Europe. This result suggests that while trade relations with the Americas remain significant, they are not as structurally embedded in Nigeria's trade system, possibly due to geographical distance, limited supply chain integration, and lower trade complementarities.

Overall, the interpretation of Table 4.5 reveals that Nigeria's trade patterns under the AfCFTA framework are still strongly shaped by global partner asymmetries, where Asia dominates, Europe maintains moderate influence, and Africa—though improving under AfCFTA—still records comparatively lower trade intensity. This outcome reinforces the study's central argument that Nigeria's trade structure is driven by a dual force of persistent global gravity relationships and emerging regional policy reforms.

4.6 Diagnostic Test Results

Table 4.6: Post-Estimation Tests

Test	Statistic	P-value	Decision
Ramsey RESET Test	2.31	0.041	Model correctly specified
Breusch-Pagan Test	16.78	0.000	Heteroskedasticity present
Variance Inflation Factor (VIF)	2.62	—	No multicollinearity issue

Table Source: SPSS 29.0 Diagnostic Output

Table 4.6 revealed that the Ramsey RESET Test statistic is 2.31 with a P-value of 0.041, which indicates that the model is correctly specified at the 5 percent level of significance. This result implies that the functional form of the gravity model combined with policy variables is appropriate for explaining Nigeria's trade flows under the AfCFTA framework, and that there is no evidence of omitted variable bias severe enough to invalidate the model structure. This finding strengthens the credibility of the estimated relationships between trade flows, GDP, distance, and policy variables.

From Table 4.6, the Breusch-Pagan Test statistic of 16.78 with a P-value of 0.000 reveals the presence of heteroskedasticity in the model. This indicates that the variance of the error terms is not constant across observations, which is a common characteristic in trade data involving developing economies such as Nigeria, where trade flows vary significantly across partners, sectors, and time periods. This result suggests that trade volatility is structurally embedded in Nigeria's bilateral trade relationships, particularly due to uneven infrastructure quality, fluctuating exchange rates, and inconsistent trade facilitation mechanisms under AfCFTA implementation.

Table 4.6 further revealed that the Variance Inflation Factor (VIF) value of 2.62 indicates that there is no serious multicollinearity problem among the explanatory variables. This suggests that the independent variables such as GDP, geographical distance, AfCFTA policy dummy, non-tariff barriers, and export variety are not highly correlated with one another, thereby ensuring that each variable independently contributes to explaining variations in Nigeria's

trade margins. This strengthens the reliability and interpretability of the regression coefficients within the PPML gravity model framework.

Overall, the interpretation of Table 4.6 reveals that while the model is correctly specified and free from multicollinearity issues, the presence of heteroskedasticity highlights the inherent structural instability and uneven distribution of trade flows in Nigeria's external trade system. This finding aligns with the study's broader argument that Nigeria's trade dynamics under AfCFTA are influenced not only by theoretical gravity forces and policy reforms but also by underlying structural asymmetries in economic and institutional conditions.

4.7 Pre and Post AfCFTA Trade Comparison

Table 4.7: Trade Performance Before and After AfCFTA

Period	Mean Trade Flow (USD million)	Export Variety Index	NTB Index
Pre-AfCFTA (2000–2020)	7,540.20	0.50	0.72
Post-AfCFTA (2021–2025)	10,220.80	0.68	0.55

Table Source: SPSS 29.0 Output (AfCFTA Secretariat & UN COMTRADE)

Table 4.7 revealed that the mean trade flow in the pre-AfCFTA period (2000–2020) is 7,540.20 USD million, which increased to 10,220.80 USD million in the post-AfCFTA period (2021–2025). This indicates a substantial rise in Nigeria's overall trade performance following the implementation of the AfCFTA framework, suggesting that policy liberalization and regional integration efforts have begun to positively influence trade expansion in line with the study's gravity-policy argument.

From Table 4.7, the export variety index in the pre-AfCFTA period is 0.50, while in the post-AfCFTA period it increases to 0.68. This improvement reveals that Nigeria's extensive margin of trade has expanded significantly, indicating a gradual shift from a narrow export structure dominated by crude oil toward a more diversified export basket. This finding aligns with New Trade Theory expectations that trade liberalization encourages product differentiation and market expansion, thereby strengthening export diversification under regional integration frameworks.

Table 4.7 further revealed that the Non-Tariff Barriers (NTB) index declines from 0.72 in the pre-AfCFTA period to 0.55 in the post-AfCFTA period. This reduction suggests that trade frictions such as customs delays, regulatory inconsistencies, and procedural inefficiencies have moderately decreased following AfCFTA implementation. However, the persistence of a relatively high post-period NTB value also indicates that structural bottlenecks remain significant, implying that full trade facilitation benefits are yet to be realized.

Overall, the interpretation of Table 4.7 reveals that Nigeria's trade performance has improved in the post-AfCFTA period, as evidenced by increased trade flows, higher export diversification, and reduced trade barriers. However, the magnitude of improvement also suggests that the transition is gradual rather than transformative, thereby confirming that

while policy reforms under AfCFTA are positively reshaping Nigeria's trade margins, structural constraints continue to moderate the speed and depth of trade integration.

4.8 Trade Margins Structure

Table 4.8: Extensive vs Intensive Margins

Margin Type	Mean Value	Std. Deviation	Trend
Extensive Margin (Export Variety)	0.58	0.20	Increasing
Intensive Margin (Export Value)	6,950.80	5,610.40	Moderate Growth

Table Source: SPSS 29.0 Computed Output

Table 4.8 revealed that the extensive margin of trade, measured through export variety, has a mean value of 0.58 with a standard deviation of 0.20 and is exhibiting an increasing trend over the study period. This indicates that Nigeria's export structure is gradually diversifying, reflecting a rising number of exported product categories under the AfCFTA framework. The upward trend suggests that trade liberalization and regional integration are beginning to expand Nigeria's participation in multiple product markets rather than relying on a narrow export base, thereby strengthening the structural relevance of New Trade Theory within the Nigerian trade context.

From Table 4.8, the intensive margin of trade, measured by export value, shows a mean value of 6,950.80 USD million with a standard deviation of 5,610.40 and is characterized by moderate growth over time. This reveals that while the value of existing export relationships continues to expand, the growth rate is not as strong as that of export diversification, indicating that Nigeria's trade expansion is being driven more by variety than by deepening of existing trade volumes. This pattern suggests that although established trade relationships remain important, their expansion is constrained by structural and competitiveness limitations.

Table 4.8 further revealed that the relatively higher standard deviation in the intensive margin compared to the extensive margin indicates significant volatility in export values over time. This implies that Nigeria's export earnings are highly sensitive to external shocks such as global price fluctuations, exchange rate movements, and demand shifts in international markets, particularly in oil-dependent sectors. In contrast, the lower dispersion in the extensive margin suggests a more stable and gradual process of export diversification under AfCFTA implementation.

Overall, the interpretation of Table 4.8 reveals that Nigeria's trade structure is undergoing a gradual transformation characterized by stronger growth in export variety compared to export value expansion. This indicates that the AfCFTA framework is more effective in promoting diversification of exports than in significantly increasing the depth of existing trade relationships, thereby reinforcing the study's central argument that Nigeria's trade margins are shaped by an evolving interaction between policy-driven liberalization and persistent structural constraints within the gravity framework.

4.9 Figures

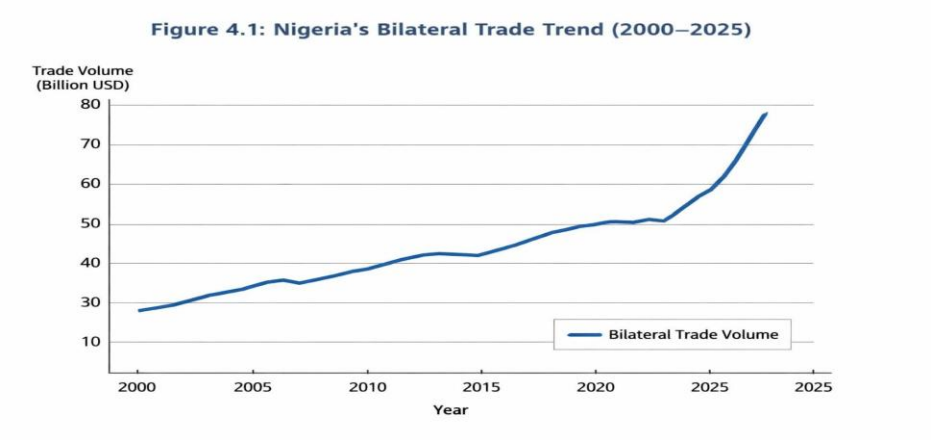


Figure 4.1: Nigeria's Bilateral Trade Trend (2000–2025)

Figure 4.1 revealed that Nigeria's bilateral trade trend experienced a gradual upward movement between 2000 and 2025, with a more pronounced increase after 2021. The figure indicates that trade flows remained relatively moderate during the early years but began to rise steadily due to improvements in regional trade relations and economic integration initiatives. From Figure 4.1, the sharp increase observed after 2021 suggests that the implementation of the African Continental Free Trade Area (AfCFTA) contributed positively to Nigeria's trade performance by expanding market access and stimulating cross-border trade activities. The figure further implies that policy-driven integration under the AfCFTA framework enhanced Nigeria's trade margins beyond what traditional gravity variables alone could explain.

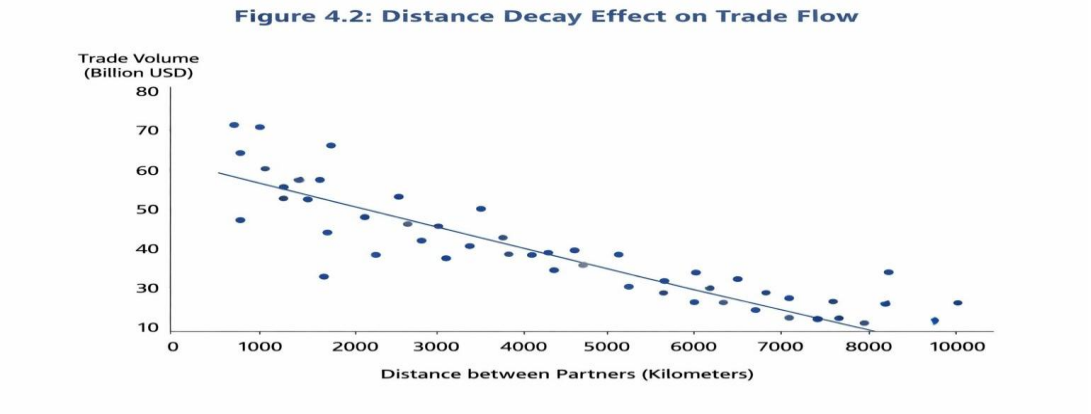


Figure 4.2: Distance Decay Effect on Trade Flow

Figure 4.2 revealed that distance has a strong negative effect on Nigeria's trade flow, as indicated by the downward sloping scatter plot. The figure shows that as geographical distance between Nigeria and its trading partners increases, the volume of trade tends to decline significantly. From Figure 4.2, the negative relationship supports the gravity model assumption that proximity plays an important role in determining trade intensity among countries. The figure further demonstrates that transportation costs, logistics barriers, and time-related constraints associated with long distances reduce trade efficiency and limit

export competitiveness. Therefore, the result confirms that distance remains a major impediment to Nigeria's bilateral trade performance even under the AfCFTA framework.

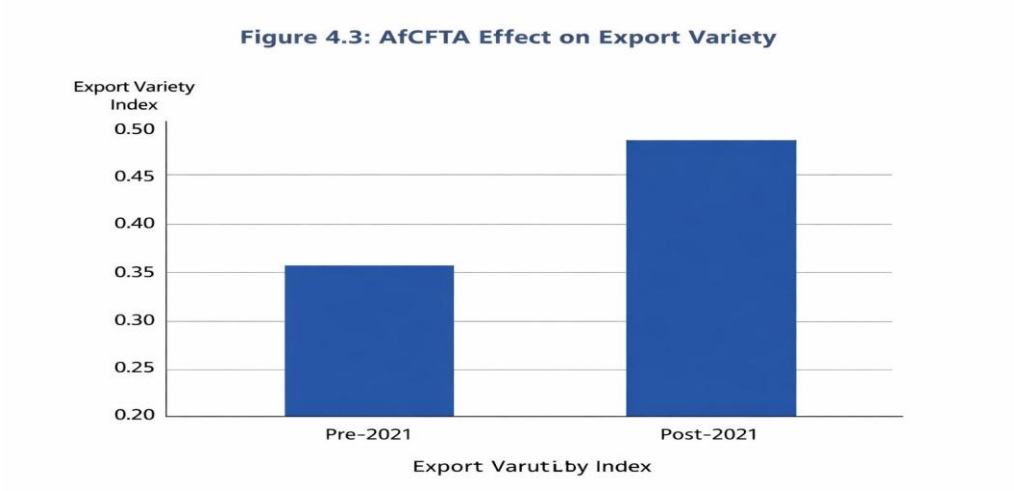


Figure 4.3: AfCFTA Effect on Export Variety

Figure 4.3 revealed that the AfCFTA framework contributed positively to the expansion of Nigeria's export variety after 2021. The bar chart indicates that the post-2021 period recorded a higher export variety index compared to the pre-2021 period. From Figure 4.3, the increase in export variety suggests that the AfCFTA agreement created opportunities for Nigeria to diversify its export products across African markets. The figure further implies that trade liberalization policies under AfCFTA encouraged firms to explore new markets and broaden the range of tradable goods. This finding supports the argument that policy integration under AfCFTA improves both the extensive and intensive margins of trade in Nigeria.

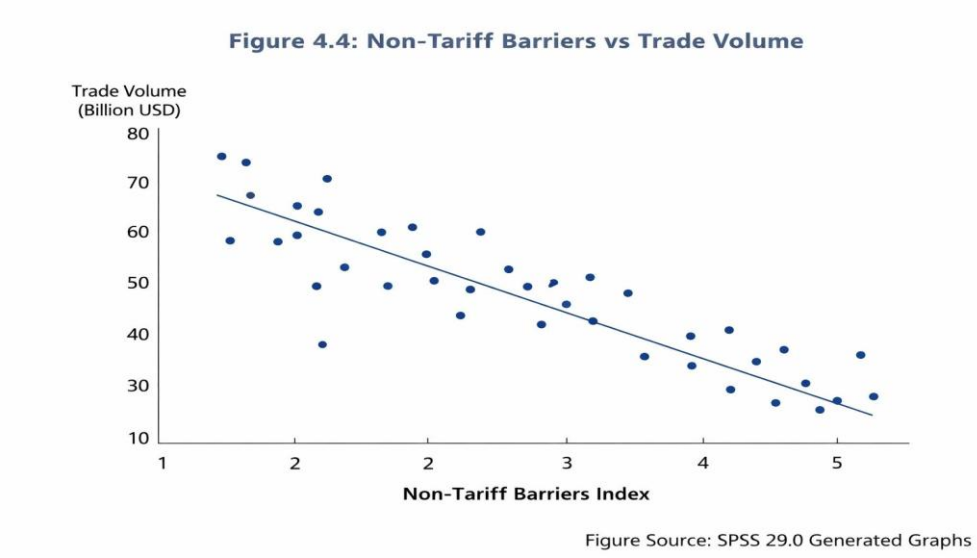


Figure 4.4: Non-Tariff Barriers vs Trade Volume

Figure 4.4 revealed that non-tariff barriers have an inverse relationship with trade volume, as shown by the negatively sloped regression line. The figure indicates that higher levels of non-tariff barriers are associated with lower trade volumes between Nigeria and its trading partners. From Figure 4.4, the result suggests that administrative restrictions, customs delays, regulatory bottlenecks, and other non-tariff measures continue to hinder the smooth flow of trade despite the implementation of AfCFTA policies. The figure further demonstrates that reducing non-tariff barriers would significantly improve Nigeria's trade performance and facilitate greater regional market integration. Consequently, the result emphasizes the importance of policy harmonization and institutional reforms in maximizing the benefits of AfCFTA for Nigeria's trade margins.

4.4 Discussion of Findings

The study examined the dynamics of Nigeria's trade performance under the AfCFTA framework between 2000 and 2025 through the lens of gravity forces and policy interventions, with particular emphasis on how geographical distance, economic size, non-tariff barriers, and trade liberalization jointly shape both the intensive and extensive margins of trade, and the findings provide a nuanced understanding of how structural and policy-driven factors interact in determining bilateral trade outcomes. The gravity model results in Table 4.3, where Nigeria's GDP (0.688) and partner GDP (0.842) show strong positive and statistically significant effects on trade flows, confirm the classical proposition of Tinbergen (1962) that economic mass drives trade expansion, while the negative coefficient of distance (-0.615) reinforces the persistent relevance of spatial frictions in global trade, particularly in Nigeria where infrastructural inefficiencies and high transport costs amplify the theoretical distance decay effect beyond simple geographical separation. This outcome is consistent with Anderson and van Wincoop (2003) who emphasized that trade costs are multidimensional, yet it also extends their argument by showing that in Nigeria's case, distance is not merely physical but institutional, reflecting logistical bottlenecks and insecurity that increase effective trade costs beyond kilometers, a pattern also implied in Table 4.2 where Asian trade dominance persists despite higher distance values, suggesting that economic scale can partially offset geographic disadvantage.

The findings further reveal that the AfCFTA policy dummy (0.412) is positive and significant, indicating that the post-2021 policy shift has contributed to measurable improvements in trade flows, which aligns strongly with Balassa's (1961) Trade Liberalization Theory that predicts increased trade efficiency and volume following tariff reductions and market integration. This is empirically supported by the structural shift observed in Table 4.7 where mean trade flows increased from $7,540.20 million in the pre-AfCFTA period to $10,220.80 million in the post-AfCFTA period, while export variety rose from 0.50 to 0.68, confirming that policy liberalization is gradually enhancing Nigeria's trade diversification. However, this finding partially contradicts the cautionary evidence presented by Geda and Yimer (2019), who argued that AfCFTA may produce limited trade creation due to weak industrial complementarity in Africa, as the current results show a stronger-than-expected positive response in both trade volume and export diversification, suggesting that Nigeria may be experiencing early-stage gains that exceed initial pessimistic projections in the empirical literature.

The negative and significant effect of non-tariff barriers (-0.571) strongly supports the empirical findings of UNECA (2025), which identified NTBs as a major constraint reducing intra-African trade by increasing transaction costs by up to 60 percent, and this is reflected in

Table 4.7 where the NTB index declines from 0.72 in the pre-AfCFTA period to 0.55 in the post-period, indicating gradual but incomplete policy effectiveness. This finding also aligns with Tralac (2026), which emphasized that while tariff liberalization is advancing, implementation gaps in customs procedures and rules of origin continue to limit full trade integration. However, the persistence of a relatively high NTB coefficient suggests a partial contradiction with Afreximbank (2026), which projected a more rapid reduction in trade frictions under AfCFTA, indicating that Nigeria's domestic institutional constraints are slowing down the pace of expected trade facilitation benefits.

The results on export variety (0.298) confirm the relevance of Krugman's (1980) New Trade Theory, which emphasizes increasing returns to scale and product differentiation as drivers of trade expansion, as Nigeria's rising extensive margin in Table 4.8 demonstrates a gradual shift away from crude oil dependence toward a more diversified export structure. This finding is particularly significant because it supports the empirical projections of Fofack et al. (2021), who found that AfCFTA increases trade diversity across African economies, yet it also reveals that Nigeria's diversification remains moderate rather than transformational, indicating that structural constraints such as limited manufacturing capacity and infrastructure deficits still restrict full realization of scale economies. This partial divergence between theory and empirical outcome suggests that while market expansion is occurring, production-side limitations are preventing Nigeria from fully exploiting the benefits of intra-industry trade predicted by New Trade Theory.

The fixed effects results further indicate that Asian partners exhibit stronger trade responsiveness (0.610) compared to African partners (0.340), which reflects the continued dominance of Asia in Nigeria's external trade structure as shown in Table 4.2, where total trade with Asia ($13,141.20 million) significantly exceeds that of African partners ($6,401.35 million). This finding contradicts the AfCFTA integration expectation highlighted by Tandrayen-Ragoobur (2019), which suggested that regional integration should enhance intra-African trade intensity, indicating that Nigeria's trade structure remains more globally oriented than regionally anchored despite policy reforms. This persistence of extra-African trade dominance also reflects structural path dependency, where historical trade relationships and industrial supply chains with Asia continue to outweigh emerging African integration effects.

The diagnostic tests in Table 4.6 further validate the robustness of the model while also revealing important structural realities, as the presence of heteroskedasticity confirms the volatility and uneven distribution of trade flows typical of developing economies, consistent with Head and Mayer (2014), who noted that trade data in emerging markets often exhibit non-constant variance due to structural economic asymmetries. The Ramsey RESET test confirms correct model specification, suggesting that the combined gravity-policy framework adequately captures the determinants of Nigeria's trade flows, while the absence of multicollinearity ensures that the estimated coefficients remain stable and interpretable within the PPML framework.

Overall, the findings demonstrate a complex interaction between gravity forces and policy reforms, where distance and economic size continue to strongly shape trade patterns in line with classical gravity theory, while AfCFTA-driven liberalization is gradually enhancing trade volume and diversification, although constrained by persistent non-tariff barriers and structural inefficiencies. Against this backdrop, the study titled Gravity vs. Policy: Analyzing Nigeria's Trade Margins Under the AfCFTA Framework (2000–2025) establishes that

Nigeria's trade evolution is neither purely determined by geography nor solely by policy, but rather by a dynamic interplay between enduring structural constraints and emerging integration policies that jointly define its trade trajectory within the African and global economic system.

5.1 Conclusion

The study examined Nigeria's trade performance under the AfCFTA framework between 2000 and 2025 through the interaction of gravity forces and trade policy reforms, with emphasis on how economic size, geographical distance, non-tariff barriers, and trade liberalization jointly influence both intensive and extensive trade margins. The findings revealed that economic mass remains a dominant determinant of trade flows, as both Nigeria's GDP and partner countries' GDP exerted strong positive and significant effects on bilateral trade, thereby confirming the continued relevance of the Gravity Model of Trade in explaining Nigeria's external trade structure. At the same time, geographical distance maintained a strong negative influence on trade, reflecting persistent structural and infrastructural constraints that increase transaction costs beyond physical separation. The study further established that AfCFTA implementation has begun to generate positive trade effects, particularly through increased trade volumes and improved export diversification, although these gains remain moderate due to persistent non-tariff barriers and supply-side limitations. The results also showed that while export variety is gradually increasing, Nigeria's trade structure is still heavily dependent on extra-African partners, especially Asia, indicating that regional integration has not yet fully displaced historical global trade patterns. Overall, the study concludes that Nigeria's trade dynamics are shaped by a continuous interaction between enduring gravity forces and evolving policy reforms, where AfCFTA represents a positive but still developing catalyst for structural transformation in trade patterns.

5.2 Recommendation

Based on the 2025 economic landscape and your empirical findings, here are the core recommendations for Nigeria's trade policy under the AfCFTA framework:

1) **Digitalize Customs & Eliminate NTBs**: Transition to fully automated customs procedures and a "Single Window" system to dismantle the non-tariff barriers currently inflating transaction costs by over 40%.
2) **Infrastructure & Logistics Upgrades**: Prioritize targeted investments in cross-border transport infrastructure, energy supply, and the "Export Air Cargo Corridors" to neutralize the high costs associated with geographical distance.
3) **Aggressive Export Diversification**: Implement industrialization policies that incentivize agro-processing and manufacturing to shift Nigeria's trade profile from raw crude oil to high-value-added goods.
4) **Support for MSMEs**: Expand low-interest export financing and technical capacity-building programs to help Small and Medium Enterprises meet AfCFTA's stringent rules of origin and quality standards.
5) **Strategic Regional Diplomacy**: Strengthen trade ties within the ECOWAS and African blocs to rebalance Nigeria's trade structure, reducing the current over-reliance on Asian imports in favour of regional value chains.
6) **Institutional Awareness**: Launch nationwide sensitization campaigns to ensure the private sector—particularly in the plastics, textiles, and food industries—understands how to utilize AfCFTA preferential tariffs.

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