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ARTICLE

## **Impact of Capital Flows on Intra-African Trade: An Analysis of Economic Integration**

Betsy M. Oloyede<sup>1†\*</sup>; Sheriffdeen Tella<sup>1†</sup>; Esther Lawal<sup>1†</sup>

<sup>1</sup> Economics Department, Babcock University, Ilishan, Remo, Nigeria.

<sup>†</sup> Authors contributed equally.

\* Corresponding Author: [betsyoloyede24@gmail.com](mailto:betsyoloyede24@gmail.com)

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### **Abstract**

This study examines the impact of capital flows on intra-African trade, focusing on the roles of foreign direct investment (FDI), external debt, GDP, and geographical distance in shaping trade patterns across African countries. Using Poisson Pseudo-Maximum Likelihood (PPML) estimation, the analysis explores how these variables influence bilateral trade between African nations. The results show that while GDP positively influences trade, both exporting and importing FDI exhibit negative relationships with trade flows, suggesting that FDI may not always be directed toward trade-enabling sectors. External debt, however, has a positive effect on trade, potentially by financing infrastructure improvements that facilitate market access. Distance remains a significant barrier to trade, highlighting the need for investment in logistics and regional infrastructure. The study contributes to the literature on economic integration by offering a nuanced understanding of the complex interplay between capital flows and trade dynamics, providing policy implications for enhancing intra-African trade and fostering deeper economic integration on the continent.

**Keywords:** capital flow, economic integration, intra-Africa trade

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### **1. Introduction**

Africa's economic landscape is marked by a remarkable paradox: while it is home to vast natural resources and a burgeoning consumer market, intra-regional trade remains significantly underdeveloped. Historically, the continent has struggled to fully capitalize on its potential for regional trade due to numerous barriers, including infrastructural deficits, poor governance, and limited

access to financial resources. This phenomenon is increasingly recognized as a critical obstacle to Africa's economic growth and integration into the global economy. One of the central factors hindering intra-African trade is the availability and movement of capital. Capital, in its various forms—such as foreign direct investment (FDI), portfolio investments, and regional financial integration—

plays a pivotal role in facilitating trade by supporting infrastructural development, improving productivity, and enhancing the efficiency of economic processes. The impact of capital flows on trade, particularly intra-regional trade, however, remains underexplored in the African context. The advent of the African Continental Free Trade Area (AfCFTA) in 2019, aimed at boosting intra-African trade by reducing tariffs and promoting investment, has brought renewed focus to the need for robust capital flows to fully realize the benefits of regional trade liberalization (African Union, 2019).

The academic literature on trade integration in Africa has primarily focused on the role of tariffs, customs procedures, and trade agreements in facilitating or inhibiting trade. Afesorgbor (2017) suggests that while regional integration promotes trade by reducing institutional barriers, the real success of such integration depends on the availability of sufficient capital to support trade infrastructure and industries. Similarly, studies have demonstrated that financial integration can reduce transaction costs and enhance trade flows by fostering deeper economic connections and risk-sharing mechanisms (Alagidede et al., 2020).

Financial flows in the form of investments are often necessary to enable the growth of key sectors that underpin trade, including transportation, communication, and manufacturing. The lack of capital flow, particularly between African countries, contributes to the continent's low trade intensity compared to other regions like Europe and Asia. According to Gammadigbe (2021), intra-African trade lags not only due to physical barriers but also because of insufficient financial resources for industrial development and market access improvements. While regions like the European Union have benefited from financial integration leading to robust intra-regional trade, Africa's failure to achieve similar results points to the critical role of capital flows in realizing the objectives of regional integration. Another body of research investigates the relationship between capital flows and trade, with a particular focus on how foreign investments stimulate trade by increasing the productive capacity of economies. Belke and Domnick (2021) argue that capital flows and trade are not simply correlated but can act as complements when both financial and trade liberalization policies are effectively coordinated. In the African context, however, this relationship remains tenuous, as capital inflows are often directed towards a narrow range of sectors, such as extractive industries, rather than the broader trade-enabling sectors.

Further complicating the issue is the financial openness of African economies. Financial integration and openness have been shown to have a positive impact on trade, but

in the case of Africa, they are often undermined by the lack of adequate regulatory frameworks and political instability. According to Bekaert et al. (2011), countries with greater financial openness tend to experience higher growth in trade, but the same openness can also expose economies to volatility, as the global financial system remains highly interconnected and susceptible to external shocks. In Africa, the challenge lies in balancing financial openness with stable and efficient financial systems that can channel capital into sectors that foster economic integration.

The implementation of AfCFTA presents an opportunity to address capital constraint by creating an integrated market that incentivizes investment flows within the continent. The African Union's Agenda 2063 (2015) envisions a future where financial markets are integrated and capital flows freely across borders, supporting economic transformation. However, achieving this vision requires not only improving the movement of capital but also addressing structural challenges such as governance, corruption, and regulatory inconsistencies that continue to undermine financial flows in the region. The World Bank (2020) recognizes that financial integration can lead to significant increases in trade, but the benefits of such integration are contingent upon improving the institutional and regulatory environment to foster investment in regional trade networks.

This study aims to examine the role of capital flows in facilitating intra-African trade, with a particular focus on understanding the impact of financial integration and investment inflows on trade growth across the continent. In doing so, the study will address several gaps in the literature by specifically focusing on how capital flows can stimulate trade in the context of Africa's regional economic integration. The findings will contribute to the ongoing discourse on Africa's economic development by providing empirical evidence on the importance of capital in promoting intra-regional trade. The importance of this study is evident in the context of Africa's broader goals of economic self-sufficiency and industrialization, as outlined in the AfCFTA and Agenda 2063. For African countries to fully benefit from regional trade agreements and economic integration, capital flows must be strategically channeled to the sectors that will reduce trade barriers, enhance competitiveness, and create value-added industries that drive trade growth. As such, the insights from this research could inform policy and contribute to the development of strategies that align capital movement with Africa's trade goals.

## 2. Review of Literature

### 2.1 Conceptual Review

This section provides a concise review of key concepts relevant to understanding the effect of capital flows on intra-African trade. These concepts include capital flows, intra-African trade, regional economic integration, and financial openness.

**Capital Flows:** Capital Flows refer to the movement of money for investment or trade purposes across national borders (Joseph et al., 2024). These flows can take the form of Foreign Direct Investment (FDI), portfolio investments, and remittances. FDI, which involves direct investment in physical assets like infrastructure, manufacturing, or services, is considered one of the most effective forms of capital flow for fostering economic development (Bekaert et al., 2011). Portfolio investments, which involve the purchase of stocks and bonds, also play a critical role in capital markets, although they are typically more volatile compared to FDI. Capital flows are integral to supporting economic activities, enhancing productivity, and providing the financial resources needed to expand trade infrastructure and industrial capacity (McKinnon & Pill, 1996).

**Intra-African Trade:** Intra-African trade refers to the exchange of goods and services between African countries. Historically, Africa's intra-regional trade has been low compared to other regions, largely due to barriers such as inadequate infrastructure, political instability, and limited access to financial resources (Afesorgbor, 2017). Regional trade integration initiatives, such as the African Continental Free Trade Area (AfCFTA), aim to reduce these barriers by promoting the free movement of goods, services, and capital (African Union, 2019). The potential for intra-African trade to drive economic growth is significant, as it allows countries to exploit their comparative advantages and access larger markets within the continent (Brixiova et al., 2015).

**Regional Economic Integration:** Regional economic integration involves the process by which countries within a particular region work together to remove trade barriers, harmonize policies, and promote economic cooperation. For Africa, regional integration has been a key strategy to overcome the constraints of fragmented national markets and to boost economic growth through the facilitation of trade. The African Union's Agenda 2063 outlines ambitious goals for economic integration, aiming for a continent-wide economic community with shared resources and a common market (African Union, 2022). Previous research indicates that successful integration can lead to trade creation, where trade increases within the region, and trade diversion, where trade is redirected from non-member countries to regional partners (Baier & Bergstrand, 2007).

## Financial Openness

Financial openness refers to the degree to which a country allows the free flow of capital across its borders. This includes foreign investments, loans, and financial markets' integration with global capital markets. The theory of financial openness suggests that countries with more open financial systems can more easily attract capital flows, which can, in turn, foster economic development by increasing investment in productive sectors, including trade (McKinnon & Pill, 1996). However, financial openness can also increase exposure to global market fluctuations, creating both opportunities and risks for developing economies (Bekaert et al., 2011). In Africa, financial integration has been shown to be an essential factor in enabling capital to flow freely within the continent, especially in regions where financial markets are underdeveloped (Christensen, 2014).

**The Role of Capital Flows in Intra-African Trade:** The connection between capital flows and intra-African trade lies in the ability of investments to reduce trade barriers, enhance economic competitiveness, and develop trade-enabling infrastructure. Research indicates that financial integration can directly stimulate trade by improving access to financing for industries and infrastructure development (Alagidede et al., 2020). Belke and Domnick (2021) argue that capital flows and trade are not independent but complementary. Effective regional economic integration, such as that envisaged by the AfCFTA, requires a flow of capital to finance the necessary trade-related infrastructure, enhance productivity, and ensure that market access is effectively improved.

## 2.2 Theoretical Review

The Gravity Theory of International Trade, rooted in the analogy of Newtonian physics, posits that trade flows between two countries are directly proportional to their economic mass, typically represented by their GDP, and inversely proportional to the distance between them. First introduced by Jan Tinbergen in the early 1960s, the theory has evolved into one of the most influential frameworks in international trade economics. Its core premise is that larger economies with greater output tend to engage in more trade, and that geographic distance acts as a trade resistance, meaning the further countries are from each other, the less likely they are to trade.

The fundamental concept of the gravity model is that trade between two countries is influenced by their economic size, which is often measured by their Gross Domestic Product (GDP), and the physical distance that separates

them. The theory assumes that the greater the economic size of two countries, the more likely they are to trade. This is because larger economies produce more goods and services, which creates both greater supply and demand, thereby increasing the volume of trade. Furthermore, countries that are geographically closer to one another will engage in higher volumes of trade due to lower transportation and communication costs, as well as fewer non-tariff barriers such as customs delays and regulatory discrepancies.

Another critical component of the gravity model is the assumption of trade resistance, which is primarily represented by distance, but can also include other factors such as tariffs, political stability, or institutional quality. The model acknowledges that geographic distance increases trade costs, which can be both direct, such as higher transportation expenses, and indirect, such as increased uncertainty or cultural differences. Distance acts as a proxy for these barriers, reflecting not only the physical separation between countries but also the challenges that arise from differences in language, political systems, or trade regulations. The model's application relies heavily on these variables to explain the patterns and intensity of international trade flows. Over time, the basic gravity model has undergone several extensions to account for more complex realities of global trade. One of the most significant adaptations is the inclusion of multilateral resistance terms, introduced by [Anderson and van Wincoop \(2003\)](#). These terms address the reality that trade between two countries is not solely determined by bilateral factors but is also influenced by a country's broader trade relationships. For example, a country's trade with one partner might be influenced not only by its size and distance from that partner but also by its trade ties with other countries. This improvement allows for a more accurate representation of trade flows, as it adjusts for the network effects of global trade relationships.

Furthermore, the gravity model has evolved to incorporate the influence of trade agreements and regional economic integration. Countries that are part of a trade agreement or regional bloc, such as the European Union (EU) or the African Continental Free Trade Area (AfCFTA), are more likely to engage in higher volumes of trade with each other due to reduced trade barriers like tariffs and quotas. These regional agreements foster closer economic ties by creating a more predictable and favorable trading environment, which leads to trade creation within the bloc while reducing trade diversion from external markets. This aspect of the model is particularly pertinent to Africa, where initiatives like AfCFTA aim to integrate national economies, reduce tariffs, and create a more cohesive regional market.

Another important extension of the gravity model is the incorporation of financial factors, including foreign direct investment (FDI) and financial openness. Research has shown that countries with higher levels of financial openness tend to experience higher trade volumes. This is because financial integration lowers the cost of capital, facilitates investment, and enhances the ability of countries to exploit their comparative advantage in specific sectors. For instance, countries with open financial markets are better positioned to invest in infrastructure, manufacturing, and services that facilitate trade. By including financial factors in the gravity model, researchers can examine the ways in which investment flows, both direct and portfolio, influence trade dynamics and regional integration.

The relevance of the Gravity Theory of International Trade is particularly pronounced when applied to Africa. The continent's low intra-regional trade has long been a subject of concern, with barriers such as high transportation costs, limited infrastructure, and fragmented markets hindering deeper economic integration. The model provides a useful framework for understanding the persistent barriers to intra-African trade and highlights the importance of addressing trade resistance factors such as tariffs, transport inefficiencies, and lack of regional financial integration. Studies on intra-African trade, such as those by [Gammadigbe \(2021\)](#), have demonstrated that despite Africa's significant economic size, trade between its countries is lower than expected, largely due to these geographic and institutional barriers. Moreover, the ongoing efforts to enhance trade liberalization through initiatives like AfCFTA, which aims to reduce tariff and non-tariff barriers among African nations, align well with the gravity model's prediction that reducing trade costs can increase trade volumes. By facilitating easier access to markets, AfCFTA seeks to minimize the friction caused by distance and institutional barriers, fostering greater economic integration across the continent. This aligns with the model's assertion that trade will increase when barriers are reduced, leading to a more connected and economically integrated Africa.

However, while the gravity model is widely accepted, it is not without limitations. One of its major criticisms is its simplicity, as it primarily relies on two factors—economic mass and distance—to explain trade flows, often neglecting other influential variables such as institutional quality, governance, and regional political dynamics. For example, even with similar levels of GDP and geographic proximity, countries with poor governance or weak institutions may still face significant barriers to trade, which the basic gravity model does not fully capture. Furthermore, the model assumes that all countries

operate in similar economic conditions, disregarding variations in development, economic structure, and industry specialization. Its application to regional integration efforts, such as those in Africa, offers valuable insights into how trade can be fostered by addressing institutional and infrastructural barriers. Despite its limitations, the gravity model remains a central tool in international trade theory, particularly when exploring the dynamics of global trade and the impact of regional trade agreements.

### 2.3 Empirical Review

A growing body of empirical literature has applied the Gravity Theory of International Trade to understand the factors that drive trade flows both globally and within specific regions. Research focusing on Africa has provided insightful evidence regarding the role of economic mass, distance, and trade barriers in shaping intra-regional trade dynamics.

Several studies confirm the core predictions of the gravity model in the African context. For example, [Afesorgbor \(2017\)](#) employed a gravity model to assess the impact of regional integration on African trade. The study found that both economic mass (GDP) and proximity positively influence trade flows, while trade barriers such as tariffs and institutional inefficiencies act as significant trade deterrents. These findings emphasize the need for improved regional integration and infrastructure to enhance intra-Africa trade.

Further empirical evidence from [Gammadigbe \(2021\)](#) highlights the persistent challenge of low intra-African trade, despite the continent's economic size. The study shows that geographical distance, high transportation costs, and political instability continue to inhibit trade between African nations, even when accounting for the effect of regional trade agreements. This supports the gravity model's assertion that distance and trade resistance are substantial factors in limiting trade.

In the context of regional economic integration, research by [Baier and Bergstrand \(2007\)](#) demonstrated that free trade agreements (FTAs) significantly boost trade flows by reducing tariff and non-tariff barriers. Their analysis, while focused on global trade, offers relevant insights for Africa, particularly with initiatives like the African Continental Free Trade Area (AfCFTA), which seeks to reduce these barriers and foster greater economic integration. Studies have shown that regions with FTAs experience trade creation, where trade within the bloc increases due to lower costs and more favorable terms.

The role of financial integration in promoting trade has also been explored. Research by [Alagidede et al. \(2020\)](#)

found that financial integration in sub-Saharan Africa enhances structural transformation by facilitating trade and investment. By improving financial access and reducing capital costs, financial integration encourages cross-border trade and investment, aligning with the gravity model's assertion that financial openness supports trade flows.

[Malick \(2020\)](#) investigated the effects of the Common External Tariff (CET) on intra-regional trade within the West African Economic and Monetary Union (WAEMU) and the Economic Community of West African States (ECOWAS). Using an augmented gravity model and specifically OLS, the research found out that both sub-regional and regional CETs coexist in West Africa, with eight out of fifteen countries being members of both entities. The results of the gravity model confirmed the influence of GDP and distance on trade, with WAEMU having a positive impact on trade creation, while ECOWAS' effect on trade remains less clear. Notably, a few countries, such as Nigeria, Côte d'Ivoire, and Ghana, account for the majority of trade within these regions.

[Aviat et al \(2020\)](#) investigated the impact of trade and financial integration on structural transformation in 28 sub-Saharan African countries. The methodological approach employed in this study involved the use of the system generalized method of moments (Sys-GMM) with a dataset encompassing 28 countries in sub-Saharan Africa during the period from 1985 to 2015. Additionally, the study uncovers a complementary relationship between trade and financial integration, suggesting that these two factors operate synergistically rather than independently to influence the process of structural transformation in sub-Saharan Africa.

However, while these studies confirm the utility of the gravity model, they also highlight its limitations. For instance, research by [Bekaert et al. \(2011\)](#) and [Christensen \(2014\)](#) notes that the model does not fully capture the complexities of financial flows and their indirect effects on trade. Financial flows, such as FDI, can enhance infrastructure and productivity, thereby indirectly boosting trade, yet the gravity model often overlooks these dynamic effects, focusing primarily on static factors like GDP and distance.

In conclusion, the empirical evidence broadly supports the relevance of the Gravity Theory in understanding intra-African trade dynamics. While the model successfully captures the importance of economic mass and distance, additional factors such as trade agreements, financial integration, and institutional quality must be incorporated for a more nuanced understanding of regional trade flows. As Africa continues to pursue greater economic

integration, initiatives like AfCFTA and financial sector reforms will likely play a critical role in enhancing intra-

regional trade, with the gravity model serving as a foundational framework for future research.

### 3. Methodology

#### 3.1 Model Specification

The functional form of the model is specified as (3.6):

$$trade_{ijt} = f \left( lnfdi_{it}^{\alpha_1}, lnfdi_{jt}^{\alpha_2}, lndebit_{it}^{\alpha_3}, lndebit_{jt}^{\alpha_4}, gdp_{it}^{\alpha_5}, gdp_{jt}^{\alpha_6}, dist_{it}^{-\alpha_7} \right) \dots \dots \dots (1)$$

Taking the logarithm of the independent variables the model is captured in equation (2)

$$trade_{ijt} = \alpha_0 + \alpha_1 lnfdi_{it} + \alpha_2 lnfdi_{jt} + \alpha_3 lndebit_{it} + \alpha_4 lndebit_{jt} + \alpha_5 lngdp_{it} + \alpha_6 lngdp_{jt} - \alpha_7 lndist_{ijt} + \mu_{ijt} \dots \dots \dots (2)$$

This is derived from the work of [Osabuohien et al. \(2019\)](#) in their analysis of bilateral trade performance in West Africa.

Where,  $trade_{ij}$  is the total trade volume between country pairs,  $lnfdi_{it}$  is the natural logarithm of the foreign direct investment of the exporting country,  $lnfdi_{jt}$  is the natural logarithm of the foreign direct investment of the importing country,  $lndebit_{it}$  is the natural logarithm of the external debt of the exporting country,  $lndebit_{jt}$  is the natural logarithm of the external debt of the importing country,  $lngdp_{it}$  represents the natural logarithm of the gross domestic products of the exporting country,  $lngdp_{jt}$  represents the natural logarithm of the gross domestic products of the importing country, and  $lndist_{ijt}$  represents the bilateral distance between the importing and exporting country.  $\alpha_{1-5}$  denotes the coefficient of the independent variables,  $\mu_{ijt}$  is the error term or unobserved variable,  $it$  represents the exporting country at time (t) and  $jt$  represents the importing country at time (t).

#### Poisson Pseudo-Maximum Likelihood (PPML)

The choice of Poisson Pseudo-Maximum Likelihood (PPML) as the estimation technique is particularly well-suited for analyzing trade data, especially in the context of bilateral trade models. This method has gained significant attention in recent years due to its ability to address several common issues encountered in trade flow data, such as the presence of zero trade values, heteroskedasticity, and the non-linear nature of trade relationships. In bilateral trade models, the dependent variable—trade flows between country pairs—is typically skewed, with many observations of zero trade or small trade volumes and a few extreme outliers with very large values. Ordinary Least Squares (OLS) or other linear regression techniques are often inappropriate in this context because they fail to handle the zero trade values and produce biased estimates. The PPML estimator, on

the other hand, is a suitable method for modeling count data or non-negative data, as it is based on the Poisson distribution, which naturally deals with the presence of zeros and over-dispersion (when the variance of the dependent variable exceeds its mean).

PPML is particularly effective because it can be used in models where the dependent variable is censored or truncated, such as trade flows that may contain many observations of zero (countries that do not trade with each other) or small positive values. The Poisson distribution, which underlies PPML, is appropriate because it models count data where the outcome (in this case, trade flow) is non-negative and exhibits discrete, often skewed, distributions. Another advantage of PPML is its efficiency in dealing with the multiplicative nature of trade relationships. The relationship between trade and its determinants—such as GDP, distance, FDI, and debt—is often non-linear. PPML models these relationships more effectively by directly estimating the multiplicative effects, rather than relying on linear approximations.

PPML also avoids the need to transform the data into logarithmic form, which is a common practice in other estimators like Ordinary Least Squares (OLS) and Fixed Effects models. In traditional gravity models, taking the natural logarithm of trade flows and explanatory variables is often required to handle the skewness of the data.

#### Data Discussion

The data under consideration focuses on factors that influence bilateral trade flows between two countries over time. These factors are central to understanding the trade relationships within regions and across nations. Specifically, the model incorporates country-specific characteristics, such as economic size and external debt, as well as spatial factors like geographical distance. The total trade volume between country pairs forms the dependent variable in the analysis. It reflects the amount of goods and services exchanged between the two

countries, offering an essential measure of economic interaction and trade dependency.

Two key variables related to economic size are the Gross Domestic Product (GDP) of both the exporting and importing countries. GDP is an indicator of the economic capacity of a country. Larger economies typically have more resources to produce goods and services, which can be traded. Additionally, they offer larger markets for imports. As such, countries with higher GDP are generally expected to engage in more trade due to their larger production and consumption capabilities. The data captures the economic size of both trading partners, reflecting how their economic activity can influence trade flows. A higher GDP in either country typically implies a greater potential for trade due to the scale of production and market size.

The external debt of both the exporting and importing countries is another crucial data point. This variable captures the amount of debt that each country owes to foreign creditors. External debt can have a complex impact on trade. On one hand, higher debt levels might constrain the country's ability to invest in infrastructure and other factors that could promote trade, such as developing transportation networks or improving trade policies. On the other hand, debt can sometimes be used to fund critical projects that enhance trade, particularly if the borrowed funds are invested in trade-enabling infrastructure. Analyzing the data on external debt helps us to understand the financial constraints that may limit or enhance trade activities.

The distance between the two countries is another fundamental variable in the data. Distance typically correlates negatively with trade volume, meaning that countries farther apart are likely to engage in less trade. This is due to the higher costs associated with long-distance transportation, increased risks, and logistical challenges. In the context of this analysis, distance serves as a proxy for all these barriers to trade, capturing not just the physical distance but also other intangible barriers such as cultural differences or trade frictions.

By examining these data points together, the analysis helps to illuminate the various factors that shape trade flows. The interactions between the economic size of both countries, their debt levels, and the distance separating them provide valuable insights into the dynamics of bilateral trade. A country with a large economy, low external debt, and proximity to its trade partner will likely engage in higher trade volumes, all other things being equal. This dataset is particularly relevant for understanding trade relationships in regions where external constraints, such as high debt levels or poor

infrastructure, can hinder trade potential. The inclusion of external debt, for instance, allows the model to assess how financial conditions impact the capacity of countries to trade with one another. Similarly, by incorporating geographical factors, the data captures the critical role of location and the physical challenges posed by distance.

#### 4. Result and Discussion

This section presents and discusses the findings from the results of both the PPML and OLS, though the major focus of discussion and inference is on the PPML result which is essentially the best technique in estimating gravity model. The results presented in Table 1 provide insights into the relationship between capital flows and intra-African trade, using both Ordinary Least Squares (OLS) and Poisson Pseudo-Maximum Likelihood (PPML) estimation methods. A comparison of the two estimation techniques reveals several important nuances, with PPML providing more reliable and consistent results, especially in addressing issues related to zero trade values and heteroskedasticity, which are common in trade flow data.

In the case of Foreign Direct Investment (FDI), the OLS results show no significant effect from the exporting or importing countries' FDI on trade, as indicated by the very high p-values (0.807 and 0.896, respectively). However, when using the PPML estimator, both the `Exporter_FDI` and `Importer_FDI` variables exhibit negative and statistically significant coefficients, with p-values of 0.021 and 0.007, respectively. The negative signs suggest that higher FDI in either the exporting or importing country reduces trade volume between the two countries. These findings contradict the typical expectation that FDI should positively influence trade by enhancing production capacity, improving market access, and fostering technology transfer. One possible explanation is that FDI might be directed towards sectors unrelated to trade, such as resource extraction or infrastructure, rather than sectors that promote trade in goods and services. This is consistent with the findings of [Gammadigbe \(2021\)](#), who suggested that the effects of FDI on trade can be more complex than traditionally assumed, especially in developing regions like Africa, where FDI often focuses on natural resources rather than trade-enabling sectors.

The coefficients for External Debt show significant positive relationships with trade flows in both OLS and PPML estimations, indicating that higher levels of external debt in both the exporting and importing countries lead to increased trade. In the OLS model, the `Exporter_Debt` and `Importer_Debt` coefficients are 0.488 and 0.388, respectively, both highly significant with p-values of 0.000. In the PPML estimation, these coefficients increase to

0.733 and 0.490, respectively, with equally significant p-values of 0.001. This finding suggests that contrary to the typical view of external debt as a constraint on economic activity, external debt may be facilitating trade by funding investments in trade-related infrastructure or by promoting greater integration into the global trade system.

This result aligns with the findings of Alagidede et al. (2020), who argued that, in some cases, external debt can enable countries to invest in the necessary infrastructure that promotes trade, such as transportation networks, ports, and logistics.

Table 1 Estimation Results (Capital Flows and Intra-African Trade)

Variable	OLS	PPML
Exporter_FDI	-0.010 (0.807)	-0.150** (0.021)
Importer_FDI	-0.005 (0.896)	-0.150*** (0.007)
Exporter_Debt	0.488*** (0.000)	0.733*** (0.001)
Importer_Debt	0.388*** (0.000)	0.490*** (0.001)
Exporter_GDP	0.812*** (0.000)	0.561*** (0.004)
Importer_GDP	0.560*** (0.000)	0.340*** (0.000)
Bilateral Distance	-2.432*** (0.000)	-1.036*** (0.000)
Exporter-Time Effect	Yes	Yes
Importer-Time Effect	Yes	Yes
Constant	-23.058*** (0.000)	-24.835*** (0.000)
R-Squared	0.529	0.697
F-test	187.74*** (0.000)	
Wald Chi-Squared		507.87*** (0.000)

**Source: Researcher's Computation:** NB: Significance is indicated as follows: \*\*\*, \*\* and \* for 1%, 5% and 10% respectively.

Turning to Gross Domestic Product (GDP), the results show a consistent positive relationship between GDP and trade flows. In both the OLS and PPML models, Exporter\_GDP and Importer\_GDP have highly significant positive coefficients, with the exporter's GDP coefficient being larger than that of the importer, as expected. Specifically, in the PPML estimation, the Exporter\_GDP coefficient is 0.561 and the Importer\_GDP coefficient is 0.340, both statistically significant at the 1% level. These findings are in line with the gravity model of trade, which posits that larger economies tend to trade more due to their greater capacity for production and market demand. The significant positive effect of GDP on trade corroborates the work of [Anderson \(2011\)](#) and other studies in international trade that highlight the central role of economic size in driving trade flows. Larger economies not only produce more goods but also have larger domestic markets that attract imports, further promoting trade between nations.

The Bilateral Distance variable shows a significant negative relationship with trade flows in both models, consistent with the gravity model's prediction that greater

distances reduce trade due to higher transportation and transaction costs. In the OLS estimation, the distance coefficient is -2.432, while in the PPML estimation, it is -1.036, both highly significant with p-values of 0.000. The smaller coefficient in the PPML estimation suggests that distance remains an important barrier to trade but may have a somewhat less pronounced effect when using a model that accounts for the non-linearity and zero trade observations in the data. This result is consistent with the findings of studies like those by [Baier and Bergstrand \(2007\)](#), who emphasized the negative impact of distance on trade, particularly in regions with underdeveloped infrastructure.

The results also highlight the robustness of the models in accounting for time effects, as both the Exporter-Time Effect and Importer-Time Effect are included in both OLS and PPML specifications. These time-fixed effects account for any unobserved factors that vary over time but are constant across countries, such as global economic shocks or changes in international trade policies, which could influence trade flows. The inclusion of these effects ensures that the results are not driven by time-varying

factors that could bias the estimates. Finally, the goodness-of-fit statistics reveal a stronger model fit for the PPML estimator compared to OLS. The R-squared value for the OLS model is 0.529, while for PPML, it increases to 0.697. This higher R-squared indicates that the PPML model better explains the variation in trade flows. Additionally, the Wald chi-squared statistic for the PPML model is much higher than the F-test for OLS, further emphasizing the superiority of PPML in terms of model fit and efficiency.

The findings from this study align with and expand upon existing literature on the determinants of intra-African trade. The significant negative effect of FDI on trade, particularly in the PPML model, is somewhat unexpected, as most literature suggests a positive relationship between FDI and trade. However, similar results have been observed in studies like [Gammadigbe \(2021\)](#), where the impact of FDI on trade was found to be more complex, particularly in African economies where FDI often targets resource extraction or infrastructure rather than trade-related sectors. The positive relationship between external debt and trade in both the OLS and PPML models further corroborates the work of [Alagidede et al. \(2020\)](#), who argued that external debt could facilitate trade by funding infrastructure that enhances market access. Additionally, the strong positive relationship between GDP and trade aligns with the gravity model's predictions, where larger economies tend to engage in higher levels of trade, as confirmed by [Anderson \(2011\)](#) and [Baier and Bergstrand \(2007\)](#).

The negative effect of distance on trade found in both estimations is also consistent with the gravity model and studies by [Baier and Bergstrand \(2007\)](#), which emphasize the significant role of geographical distance in limiting trade flows, particularly in regions with underdeveloped infrastructure. Overall, the results contribute to the understanding of the dynamic and

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sometimes counterintuitive factors influencing intra-African trade, reinforcing the importance of using robust estimation methods like PPML to address challenges in trade data.

## 5. Conclusion and Recommendations

This study explores the impact of capital flows on intra-African trade, with a focus on the role of foreign direct investment (FDI), external debt, GDP, and geographical distance in shaping trade patterns across the continent. The analysis, utilizing Poisson Pseudo-Maximum Likelihood (PPML) estimation, reveals that while GDP continues to be a strong driver of trade, the effects of FDI and external debt are more nuanced. Specifically, the negative relationship between FDI and trade suggests that FDI may not always be directed toward sectors that enhance trade, such as manufacturing or infrastructure, but rather towards resource extraction. On the other hand, external debt appears to facilitate trade by funding infrastructure projects that improve market access. Distance remains a persistent barrier to intra-African trade, underscoring the need for improved logistics and infrastructure. The results highlight the complexities of economic integration in Africa, where capital flows play a vital, though multifaceted, role in promoting trade. The study's findings underscore the importance of using advanced estimation techniques like PPML to address the challenges posed by zero trade values and heteroskedasticity in trade data.

This analysis contributes to a deeper understanding of the factors that drive intra-African trade and the role of capital flows in fostering economic integration across the continent. By highlighting the intricate relationship between FDI, external debt, GDP, and distance, the study provides valuable insights for policymakers striving to enhance Africa's economic integration and reduce trade barriers.

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