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MONETARY LIQUIDITY AND BILATERAL TRADE FLOWS IN WEST AFRICA: EVIDENCE FROM AN AUGMENTED PPML GRAVITY MODEL

ABSTRACT

This study investigates the extent to which monetary liquidity affects bilateral trade flows in Nigeria, Ghana, and Côte d'Ivoire. Employing an augmented Poisson Pseudo-Maximum Likelihood (PPML) gravity model with data spanning 1990–2023, the analysis considers key macroeconomic variables including exchange rates, inflation, interest rates, GDP, and market size. The results reveal heterogeneous effects across the three countries. In Nigeria, liquidity-driven exchange rate fluctuations and inflation significantly influence bilateral trade flows, reflecting the economy's sensitivity to external shocks and its oil-dependent export structure. In Ghana, interest rate adjustments constrain trade flows, highlighting the trade-offs inherent in monetary policy, while in Côte d'Ivoire, structural factors and reliance on commodity exports limit the responsiveness of trade to liquidity conditions. The findings confirm that effective monetary liquidity management, coordinated with fiscal policy, is critical for maintaining stable bilateral trade flows and supporting sustainable external sector performance. The study concludes that country-specific and context-driven monetary liquidity strategies, alongside macroeconomic stability measures, are essential for enhancing bilateral trade outcomes in West African economies. The study thus recommends that effective monetary liquidity management, when coordinated with fiscal policy, is crucial for maintaining stable bilateral trade flows and supporting sustainable external sector performance.

Keywords: *Bilateral Trade Flows; Exchange Rate; Monetary Liquidity; PPML Gravity Model; West Africa*

JEL Classification: *F14, F31, F15, C23, O55*

1.0 Introduction

In macroeconomic management, monetary liquidity is critical for the conduct of monetary policy, financial sector soundness, and economic growth. Monetary liquidity the availability of money and readily convertible assets circulating within an economy, typically proxied by broad money supply (M2) and central bank policy rates is a cornerstone of macro-financial stability and, as this study argues, a determinant of how much a country trades with its partners.

From the central bank's point of view, managing this liquidity is central to delivering the mandate of monetary and price stability, and it does so partly through the channels that connect domestic money conditions to external trade: the exchange rate, domestic inflation, and interest rates. Adequate liquidity management promotes a sound banking and financial system, which provides a conducive environment for sustainable economic growth and, by extension, for firms engaged in cross-border trade. At the firm and macro level, monetary liquidity is a dynamic balancing act between the competing objectives of profitability, price stability, and external competitiveness (Basel Committee on Banking Supervision, 2008; Keynes, 1936).

The operational mechanics of monetary liquidity management are governed by the tools available to a central bank open market operation, reserve requirements, and the policy rate which jointly determine how much money and credit circulate in an economy at any given time. Changes in this liquidity feed into the exchange rate and domestic price level, which in turn shape the relative cost of a country's exports and imports vis-à-vis its trading partners.

On the other hand, bilateral trade flows the value of goods and services exchanged between a given pair of trading partners over a specific period area key indicator of how deeply two economies are integrated and how competitively a country's exports are priced in a specific partner market. Unlike the aggregate trade balance, which nets a country's exports and imports against the rest of the world as a single figure, bilateral trade flows capture the pattern of exchange with individual partner countries, which is the relevant unit of analysis for a gravity-model framework such as the one adopted in this study.

Kennedy (2013) argues that a country's favourable trade position does not necessarily imply economic prosperity, nor does an unfavourable one reflect economic failure. A poor country may run large trade or capital inflows due to foreign loans, foreign aid, and equity capital, while a developed country may run persistent deficits due to assistance extended to developing economies. Thus, the direction of a country's trade position per se should not be read as a sign of economic growth, prosperity, or failure. However, the longer an adverse trade position persists with a given partner, the more it may signal underlying competitiveness or liquidity constraints worth investigating.

From a mercantilist perspective, which dominated economic thought in the 16th to 18th centuries, a trade surplus is an unequivocal good. Mercantilists equated wealth with the accumulation of precious metals, and a surplus meant a net inflow of gold and silver, thereby increasing national power (Magnusson, 1994/2003). This view persists in modern political rhetoric, where chronic deficits with specific trading partners are often portrayed as a sign of economic weakness or unfair competition, and are cited to justify protectionist policies such as tariffs and quotas targeted at particular partner countries underscoring why the bilateral, partner-specific dimension of trade, rather than only the aggregate balance, matters for policy.

The nexus between monetary liquidity and bilateral trade flows in West African nations, particularly those within the West African Economic and Monetary Union (WAEMU) and the West African Monetary Zone (WAMZ), is a complex and multifaceted relationship, deeply interwoven with the

region's unique monetary architecture and economic structure. At its core, this nexus operates through several transmission channels primarily the exchange rate, domestic inflation, and interest rates which are themselves influenced by the chosen monetary policy framework and which jointly determine how much a country trades with each of its partners. For the eight WAEMU countries and the seven WAMZ nations, the approach to liquidity management diverges significantly, leading to markedly different implications for their bilateral trade positions.

1.1 Statement of the Problem

The nexus between monetary liquidity and bilateral trade flows in selected West African nations presents a critical and complex policy dilemma, where domestic monetary stability objectives often clash with external sector performance a problem acutely exacerbated by structural economic vulnerabilities and exogenous shocks. The core of the problem is that monetary authorities' management of domestic liquidity, primarily through interest rates, reserve requirements, and open market operations, directly influences exchange rates, inflation, and credit availability, which in turn shape the import-export dynamics that determine how much a country trades with each of its partners (Asongu & Nwachukwu, 2018).

However, this transmission mechanism is severely distorted in many West African states due to their heavy dependence on primary commodity exports, high import elasticity for essential goods and capital equipment, and shallow financial markets, creating a persistent cycle where efforts to manage one variable inadvertently destabilise the other. A primary angle of this nexus is the impact of expansionary monetary liquidity, often used to stimulate growth, which can trigger inflationary pressures and real exchange rate appreciation. This appreciation undermines export competitiveness and makes imports relatively cheaper, thereby weakening bilateral trade flows in non-commodity sectors (Velde, 2021). Conversely, contractionary monetary policy to curb inflation or defend the currency can attract short-term capital flows and appreciate the nominal exchange rate, again harming bilateral trade flows, while also constraining credit for productive sectors that could boost export capacity.

Furthermore, the problem is compounded by the reliance on central bank financing of fiscal deficits in some countries a form of liquidity injection that directly fuels inflation and puts downward pressure on the exchange rate, thereby distorting bilateral trade patterns (IMF, 2022 Regional Economic Outlook for Sub-Saharan Africa). The management of foreign exchange liquidity is another critical angle. Frequent foreign exchange scarcity, often met with administrative measures rather than market-clearing adjustments, creates significant hurdles for importers of essential inputs and exporters seeking to repatriate earnings, further distorting bilateral trade flows and hampering efficiency (Ogunleye, 2019). The problem is therefore not merely technical but deeply structural. The selected West African economies, many operating under managed-float or peg-like arrangements within WAMZ and the CFA franc zones, struggle to find a synchronised policy mix. The fundamental problem is that the imperative for central banks to ensure price and financial stability through liquidity management tools often conflicts with the need to foster competitive and stable bilateral trade flows, a conflict intensified

by commodity dependence, fiscal dominance, and weak transmission mechanisms. The study therefore seeks to examine the extent to which monetary liquidity has affected bilateral trade flows among Nigeria, Ghana, and Côte d'Ivoire.

2.0 Literature Review

2.1 Bilateral Trade Flows

Bilateral trade flows the value of exports and imports of goods and services recorded between a specific pair of countries over a given period are the relevant dependent construct in gravity-model research, distinct from the aggregate trade balance that nets a country's trade against the rest of the world as a single figure. Gravity models, in their canonical form, explain the volume of bilateral trade between two countries as a function of their economic "mass" (typically GDP) and the "distance" or frictions between them (transport costs, exchange rate misalignment, tariffs, and other trade costs). Framing the dependent variable as a bilateral flow, rather than an aggregate balance, allows the model to identify how monetary and macroeconomic conditions in a country shape its trade with each individual partner, rather than only its net position with the rest of the world (Blanchard, 2021).

A related, and sometimes conflated, concept is the trade balance fundamentally a measure of the difference between the monetary value of a nation's exports and imports of goods and services over a specific period. A positive balance, where exports exceed imports, is termed a trade surplus; a negative balance is a trade deficit. Fundamentally, a country's current account balance, of which the trade balance is a major component, is determined by the difference between its national savings and its national investment (Obstfeld, 2020). A persistent trade deficit, such as that experienced by the United States, is not necessarily a sign of economic weakness but may indicate that the country is an attractive destination for foreign capital, funding higher levels of investment than domestic savings can support, which can fuel productivity growth and future output (Furman, 2022).

However, this benign view is critically challenged by the nature of the deficits and the vulnerabilities they can create. The composition of trade flows is crucial; a deficit driven by imports of capital goods that enhance productive capacity is structurally different from one fuelled by consumption. Furthermore, persistent and large deficits can lead to an accumulation of external debt, making an economy vulnerable to sudden shifts in investor sentiment (Gopinath, 2022). The role of exchange rates further complicates the picture for bilateral trade flows specifically: traditional gravity and elasticity models posit that a depreciation of a currency should raise a country's exports to, and reduce its imports from, a given partner. Yet the empirical evidence in recent decades has been mixed, a phenomenon often linked to complex global supply chains and incomplete "currency pass-through" depreciation may raise the cost of imported components for domestic exporters, negating some of the competitive price advantage (Baldwin & Lopez-Gonzalez, 2015). Moreover, strategic trade and industrial policies, particularly by China, have fundamentally distorted global bilateral trade patterns: the use of state subsidies to create excess capacity in sectors like steel and solar panels has resulted in sustained bilateral surpluses for China and deficits for its trading partners (Lardy, 2022).

2.2 Monetary Liquidity

Monetary liquidity the discipline of ensuring an economy, and the institutions within it, have sufficient access to money and money-like assets to meet short-term obligations and finance transactions, including cross-border ones remains the bedrock of financial stability and a key determinant of trade capacity. Its critical importance, starkly highlighted by the 2007–08 Global Financial Crisis, has been further underscored by recent market events. The contemporary regulatory landscape, primarily shaped by the Basel III framework, has significantly altered the practice of liquidity management. The introduction of the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) were designed to fortify banks against short-term liquidity shocks and encourage longer-term structural funding stability (Bank for International Settlements, 2022). While these metrics have undoubtedly made the global banking system more resilient, they have also introduced complexities relevant to trade financing, since banks holding more high-quality liquid assets face a higher opportunity cost that can affect the availability and cost of trade credit.

The collapse of Silicon Valley Bank (SVB) in March 2023, despite technical compliance with LCR requirements, illustrated that the quality and risk profile of liquid assets matter as much as their quantity (Hughes & Weinstein, 2023; Bank of England, 2023). More broadly, the shift from the post-GFC quantitative easing (QE) era to the current quantitative tightening (QT) cycle is draining bank reserves and increasing the cost and competition for stable funding (ECB, 2023), with knock-on effects for the liquidity available to finance imports and exports, particularly in economies where trade financing depends heavily on bank credit.

For the purposes of this study, monetary liquidity is operationalised at the macroeconomic level through broad money supply (M2) and the central bank policy interest rate, consistent with the monetary approach to the balance of payments and is examined for its influence on the volume of bilateral trade flows between Nigeria, Ghana, and Côte d'Ivoire and their trading partners, rather than on the aggregate trade balance alone.

2.3 Theoretical Review

2.3.1 Monetary Approach to the Balance of Payments

The theory of the balance of payments (BoP), particularly the monetary approach, posits a fundamental nexus between a country's monetary liquidity and its trade position with its partners a relationship critically evident in selected West African nations. This approach views BoP imbalances as essentially a monetary phenomenon, where a discrepancy between the demand for and supply of money leads to changes in international reserves and, in turn, in the volume and direction of trade with specific partners (IMF, 2017). In practice, excessive domestic credit creation by a central bank a key aspect of expansionary liquidity management can lead to a surplus of money supply. Economic agents will seek to dispose of this excess liquidity by increasing expenditure on both domestic and foreign goods and services, the latter directly affecting bilateral trade flows with the countries supplying those goods.

The institutional framework of the West African Economic and Monetary Union (WAEMU), which shares the CFA franc pegged to the euro, presents a unique case study. Here, liquidity management is centrally influenced by the policies of the Central Bank of West African States (BCEAO). The fixed exchange rate regime means that individual member countries cannot use exchange rate adjustments to correct bilateral trade imbalances; instead, adjustment must occur through internal devaluation, primarily via liquidity management. For instance, when a country like Côte d'Ivoire or Senegal experiences a widening trade gap with a partner, the automatic adjustment mechanism under the peg leads to an outflow of reserves, effectively reducing the domestic money supply unless sterilised by the central bank (BCEAO, 2022).

For a larger economy like Nigeria, with its own currency and a floating exchange rate regime, the nexus operates differently but remains potent. The Central Bank of Nigeria's (CBN) aggressive use of expansionary liquidity measures, including direct lending interventions and, at times, financing of fiscal deficits, has historically contributed to pressure on the naira and altered bilateral trade flows through increased import demand from specific partners (CBN, 2023). Liquidity injections that fuel inflation can lead to a real appreciation of the currency, making imports cheaper and exports less competitive across partner markets. Recent analyses from the IMF have highlighted that the CBN's use of multiple exchange rates and foreign exchange restrictions constituted a form of liquidity management that distorted bilateral trade flows by creating artificial scarcity of foreign currency for imports, suppressing trade volumes with key partners rather than addressing the fundamental imbalance (IMF, 2022).

The theory of the balance of payments provides an essential macroeconomic framework for understanding the intrinsic nexus between monetary liquidity and bilateral trade flows in selected West African countries. At its core, the BoP is an accounting record of all monetary transactions between a country and the rest of the world, with the current account and the capital and financial accounts necessarily summing to zero. A persistent trade gap with major partners a feature common in many West African nations due to their reliance on importing manufactured goods and capital equipment while exporting primary commodities directly pressures the BoP and, by extension, the nation's foreign exchange liquidity (IMF, 2023). To finance a current account shortfall, a country must draw down its official foreign exchange reserves or attract capital inflows; a sustained deterioration in bilateral trade flows therefore depletes the pool of foreign currency available to the central bank, constraining its capacity for effective liquidity management.

The vulnerability of this nexus is acutely exposed by terms-of-trade shocks, as seen in commodity-dependent West African economies. A decline in the global price of oil or cocoa reduces export earnings to major partners, worsening bilateral trade flows with those partners and reducing foreign currency inflows, which in turn shrinks the foreign liquidity available in the banking system and strains domestic banks' ability to finance imports (BCEAO, 2022).

2.4 Empirical Review

The studies reviewed below span a range of methodologies panel VAR, ARDL, VECM, SVAR, GARCH, and panel ECM and, in most cases, use the trade balance (rather than a bilateral trade-flow measure) as their dependent variable, reflecting the conventions of the literature they were published in. They are retained here because they establish the transmission channels (exchange rate, inflation, interest rates) through which monetary liquidity affects a country's external trade position, which is the same channel logic this study applies to bilateral trade flows specifically using an augmented PPML gravity specification a methodological choice this review highlights as comparatively under-used in the West African liquidity-trade literature.

Adegbite and Alabi (2020) carried out a study on liquidity management and trade balance dynamics in West Africa. The study adopted Panel VAR with data from World Bank (1990–2018). Findings revealed that liquidity expansion (M2/GDP) worsened trade balances due to import surges; exchange rate volatility amplified negative effects. The study recommended tightening liquidity during trade deficits and coordinating fiscal-monetary policies, concluding that liquidity mismanagement exacerbates trade imbalances. The study omitted government spending and unemployment and lacked recent data (post-2018); it directly addresses liquidity-trade linkages but does not use a bilateral or gravity-model framework.

Diallo and Sarr (2021) conducted a study on fiscal-monetary interactions and external balances in UEMOA, using ARDL bounds testing with BCEAO/WDI data (1985–2020). Findings revealed that fiscal expansions deepened trade deficits and liquidity growth fuelled inflation without GDP gains. The study recommended harmonising fiscal deficits with liquidity targets and concluded that policy misalignment undermines external balances. It covered only Côte d'Ivoire (not comparative) and omitted unemployment and interest rates.

Fosu and Mensah (2022) analysed financial development, liquidity, and macroeconomic outcomes in Africa using a dynamic panel regression (ECOWAS data, 1995–2020). Findings revealed that financial depth reduced liquidity-induced GDP swings and unemployment rose with liquidity contractions. The study recommended strengthening financial systems to absorb liquidity shocks and concluded that financial development enhances liquidity management efficacy. This study excluded trade balance and government spending altogether.

Gyeke-Dako (2017) assessed interest rate channels and economic performance in Ghana using SVAR with BoG/IMF data (2000–2016). Findings revealed rate hikes lowered inflation but hurt GDP and trade balances via credit crunches, recommending tiered interest rate frameworks and concluding that policy rates have asymmetric trade-offs. The study focused on a single country (Ghana) and omitted exchange rates and unemployment.

Coulibaly (2020) investigated inflation targeting and liquidity control in Francophone Africa using GARCH with BCEAO/IMF data (1990–2019). Findings revealed liquidity tightening reduced inflation but slowed GDP, with poor credibility weakening outcomes. The study recommended enhancing central bank credibility and monitoring liquidity thresholds, concluding that contextual

factors dictate policy success. The study focused on Côte d'Ivoire and excluded trade balance and unemployment.

Quartey and Afful (2021) assessed external sector adjustments and liquidity management in West Africa using a Panel ECM with WDI/IMF data (1990–2020). Findings revealed that liquidity growth worsened trade balances while FDI inflows mitigated negative impacts. The study recommended attracting FDI to buffer liquidity-induced trade shocks and concluded that external capital moderates the liquidity-trade nexus. The study omitted policy rates and inflation.

Adeyemi and Olowofeso (2020) carried out a study on liquidity management and trade balance dynamics in Nigeria, using ARDL on quarterly data (1990–2018) from the Central Bank of Nigeria and WDI. Findings revealed that excessive liquidity expansion worsened Nigeria's trade balance due to import surges, with exchange rate instability amplifying the effect. The study recommended tightening monetary policy during currency crises and concluded that liquidity management requires exchange rate stability. It is limited to Nigeria and excludes panel analysis of Ghana/Côte d'Ivoire.

Boamah and Oteng-Abayie (2019) analysed monetary policy transmission and trade balance adjustments in Ghana using SVAR models with Bank of Ghana and IMF data (2000–2018). Results showed that policy rate hikes improved trade balance via import compression but were undermined by high inflation. Recommendations advocated targeting inflation, and the conclusion highlighted policy rate limitations without fiscal support. The study is a single-country focus and omits variables like unemployment and financial development.

Kouakou and Djedje (2021) examined liquidity management, exchange rate regimes, and trade flows in Côte d'Ivoire using VECM with BCEAO and WDI data (1995–2019). Findings indicate that liquidity growth boosted exports but raised import dependency, negating trade balance gains. Recommendations urged diversified export policies, and the conclusion stressed structural economic rigidities. This is one of the few reviewed studies that explicitly frames its outcome variable as trade flows rather than only the balance, making it directly relevant to this study's bilateral framing, though it excludes Nigeria and Ghana and does not use a gravity or PPML specification.

Diop and Sene (2022) conducted a study on the macroeconomic effects of liquidity management in WAEMU using dynamic panel regression with BCEAO and WDI data (2000–2020) for 8 WAEMU states, including Côte d'Ivoire. Findings indicated that liquidity growth reduced trade deficits only with fiscal discipline, while unemployment exacerbated imbalances. Recommendations urged fiscal-monetary coordination, and the conclusion emphasised institutional weaknesses. The study excludes non-WAEMU states (Nigeria/Ghana) and omits exchange rate variables.

Alagidede and Ibrahim (2020) carried out a study on liquidity shocks and trade balances in sub-Saharan Africa, using panel VAR with IMF/WDI data (1985–2018) for 25 SSA countries, including the focal nations. Findings showed adverse liquidity shocks improved trade balances via import contraction but reduced GDP growth. Recommendations emphasised liquidity risk buffers, and the

conclusion noted trade-offs between trade balance and growth. This study uses aggregated data and does not isolate the three economies or their bilateral trade patterns.

Coulibaly (2021) examined liquidity management and macroeconomic outcomes in Francophone West Africa using fixed effects with BCEAO/IMF data (1995–2020) for 7 countries, including Côte d’Ivoire. Findings indicated that liquidity improved trade balances below 8% inflation but worsened them above this threshold, with Côte d’Ivoire outperforming neighbours. Recommendations proposed inflation-targeted liquidity policies, and the conclusion emphasised divergent country capacities. The study excludes Nigeria/Ghana and neglects Anglophone economies.

Adegbite and Alabi (2020) also conducted a study titled Liquidity Management and Trade Balance Dynamics in Nigeria, adopting a time-series ARDL model (1985–2018) using Central Bank of Nigeria data with liquidity ratio, inflation, exchange rate, and trade balance as variables. Findings revealed that liquidity management negatively correlated with trade balance in the short run but improved it long-term, with exchange rate volatility amplifying trade deficits. Recommendations included adopting forward-looking liquidity policies and stabilising exchange rates, concluding that effective liquidity management requires complementary exchange rate control. This study is limited to Nigeria and excludes panel analysis of Ghana/Côte d’Ivoire.

Coulibaly (2021) further conducted a study on liquidity constraints and macroeconomic stability in Côte d’Ivoire using an ECM model with BCEAO and IMF data (2000–2020) and policy rate, inflation, government expenditure, and trade balance as variables. Findings revealed that expansionary liquidity policies worsened trade deficits, with inflation exacerbating this effect. The study recommended tightening liquidity during high inflation and coordinating fiscal-monetary policies, concluding that liquidity management alone cannot resolve trade imbalances without inflation control. The study excludes Nigeria/Ghana and misses unemployment, exchange rates, and regional data pooling.

Diop and Osei (2022) analysed monetary policy and macroeconomic performance in WAEMU using panel VECM (including Côte d’Ivoire; 2005–2020) with BCEAO/IMF data and policy rate, inflation, unemployment, and trade balance as variables. Findings revealed tight liquidity reduced inflation but increased unemployment and trade deficits. The study recommended adopting hybrid policies balancing inflation control and employment, concluding that liquidity tools involve inflation-unemployment trade-offs. The study is limited to WAEMU (not Nigeria/Ghana) and omits GDP, exchange rates, and government spending.

Across the studies reviewed, two gaps stand out that this study seeks to address. First, the overwhelming majority use the aggregate trade balance as the dependent variable and estimate it with time-series or standard panel techniques (ARDL, VECM, SVAR, ECM), rather than a gravity-model framework capable of capturing bilateral, partner-specific trade dynamics. Second, very few studies apply the Poisson Pseudo-Maximum Likelihood (PPML) estimator, which is now the standard in the gravity-trade literature for handling zero trade flows and heteroskedasticity, to the West African liquidity-trade nexus. This study addresses both gaps by applying an augmented PPML gravity model to examine monetary liquidity and bilateral trade flows in Nigeria, Ghana, and Côte d’Ivoire.

3.0 Methodology

3.1 Research Design

This study employs a quantitative research design, utilising panel econometric techniques to empirically investigate the impact of monetary liquidity on bilateral trade flows in selected West African countries namely Nigeria, Ghana, and Côte d'Ivoire over the period 1990–2023. A quantitative approach is optimal for this inquiry as it facilitates the analysis of secondary macroeconomic and trade data, enables the testing of hypotheses derived from economic theory, and permits the derivation of evidence-based policy implications. The panel data methodology is particularly well-suited, as it amalgamates time-series and cross-sectional dimensions, thereby increasing the degrees of freedom, controlling for unobserved country-specific heterogeneity, and allowing for a more robust examination of dynamic adjustments and long-run equilibrium relationships.

The research relies exclusively on secondary data. The core variable of interest is bilateral trade flow ($Trade_{ij}$) the value of trade recorded between countries i and its trading partner(s) as the dependent variable, estimated via an augmented PPML gravity specification. Key independent variables encompass monetary liquidity indicators, such as broad money supply (M2) and the central bank policy rate. Control variables selected based on established theoretical models (e.g., the Mundell-Fleming model and the monetary approach to the balance of payments) include gross domestic product (GDP) growth, the real effective exchange rate, inflation, and a measure of market/geographic gravity (distance/market-size gap). This selection ensures the model accounts for major determinants of bilateral trade beyond monetary factors.

Data were sourced from reputable international and regional institutions to ensure credibility, consistency, and cross-country comparability. Primary sources include the World Bank's World Development Indicators (WDI), the International Monetary Fund's International Financial Statistics (IFS) and Direction of Trade Statistics (DOTS), and the African Development Bank (AfDB) database. Supplementary data were extracted from the statistical bulletins and annual reports of the respective central banks (Central Bank of Nigeria, Bank of Ghana, and BCEAO for Côte d'Ivoire).

3.2 Population of the Study

The population of the study comprises the 15 West African countries that are members of the Economic Community of West African States (ECOWAS). These countries were selected because of their geographical proximity, economic integration, and participation in regional trade activities. The study covers Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. These countries collectively provide an appropriate population for examining monetary liquidity and bilateral trade flows within the West African region using an augmented PPML gravity model.

Table 1: ECOWAS Members Countries

S/N	Country	ECOWAS Entry Year	Official Language	Membership Status
1	Benin	1975	French	Founding member
2	Burkina Faso	1975	French	Founding member; withdrew 2025
3	Côte d'Ivoire	1975	French	Founding member
4	The Gambia	1975	English	Founding member
5	Ghana	1975	English	Founding member
6	Guinea	1975	French	Founding member
7	Guinea-Bissau	1975	Portuguese	Founding signatory; ratified 1976
8	Liberia	1975	English	Founding member
9	Mali	1975	French	Founding member; withdrew 2025
10	Mauritania	1975	Arabic	Founding signatory; ratified 1976; withdrew 2000
11	Niger	1975	French	Founding member; withdrew 2025
12	Nigeria	1975	English	Founding member
13	Senegal	1975	French	Founding member
14	Sierra Leone	1975	English	Founding member
15	Togo	1975	French	Founding member

Source: *Economic Community of West African States. (n.d.). Creation (history). ECOWAS. [ECOWAS official source](#)*

3.3 Sample Population

The sample population of the study comprises Côte d'Ivoire, Ghana, and Nigeria, selected from the 15 ECOWAS member countries. The three countries were purposively selected to provide a focused sample for examining the relationship between monetary liquidity and bilateral trade flows in West Africa using an augmented PPML gravity model.

Table 2: ECOWAS Members Countries

S/N	Country	ECOWAS Entry Year	Major/Official Language
1	Côte d'Ivoire	1975	French
2	Ghana	1975	English
3	Nigeria	1975	English

Source: *Economic Community of West African States. (n.d.). Creation (history). ECOWAS. [ECOWAS official source](#)*

The selection of the three countries is based on the following three major reasons:

- i. Nigeria, Ghana, and Côte d'Ivoire are among the major economies in West Africa and play significant roles in regional and international trade. Their substantial trade activities make them suitable for analysing bilateral trade flows.
- ii. The selected countries have relatively comprehensive and consistent data on monetary liquidity, bilateral trade, GDP, exchange rates, population, and other variables required for the augmented PPML gravity model, thereby supporting reliable empirical estimation.

- iii. The three countries exhibit differences in their monetary, financial, and economic structures. This variation provides useful cross-country evidence for assessing how monetary liquidity influences bilateral trade flows within West Africa.

3.4 Model Specification

The inclusion of monetary liquidity as the independent variable is justified by its central role in shaping monetary conditions that influence trade (Dornbusch, 1976). The control variables exchange rates, interest rates, inflation, and GDP growth are essential because they account for other macroeconomic factors that influence trade flows, preventing omitted variable bias. These factors are extensively discussed in both the Monetary and Keynesian approaches to the balance of payments, where monetary conditions interact with real economic indicators to determine trade outcomes (Frenkel & Johnson, 1976). The augmented PPML gravity model is specified as:

$$Trade_{ijt} = f(LMG_{ijt}, EXR_{it}, INT_{it}, INF_{it}, GDP_{it}) \dots \dots \dots 3.1$$

$$Trade_{ijt} = \exp[\beta_0 + \beta_1 LMG_{ijt} + \beta_2 EXR_{it} + \beta_3 INT_{it} + \beta_4 INF_{it} + \beta_5 GDP_{it} + u_{ij} + \lambda_t] + \varepsilon_{it} \dots \dots \dots 3.2$$

Where:

$Trade_{ijt}$ = Bilateral trade flow between country i and its trading partner(s) at time t.

LMG_{ijt} = Gravity/market-gap term (proxying the market-size and distance frictions between trading partners) in country i at time t.

EXR_{it} = Exchange rate of the local currency against a major foreign currency in country i at time t.

INT_{it} = Central bank policy interest rate in country i at time t.

INF_{it} = Inflation rate in country i at time t.

GDP_{it} = Gross Domestic Product in country i at time t.

μ_i = Individual specific/fixed effect, and ε_{it} = idiosyncratic error term.

i = Country (Nigeria, Ghana, Côte d'Ivoire); t = Time period (1990–2024).

Table 3: Variable Definition and Measurement

Variable	Symbol	Measurement
Bilateral Trade Flow	Trade _{ijt}	Value of trade recorded between country i and partner(s) j at time t (PPML gravity dependent variable)
Monetary Liquidity / Gravity-Market Gap	LMG	Money-supply/market-gap indicator proxying liquidity and market-size frictions
Exchange Rate	EXR	Local currency value against a major foreign currency
Interest Rate	INT	Central bank policy rate
Inflation Rate	INF	Annual percentage change in the general price level
Gross Domestic Product	GDP	Real GDP, current US\$ or local currency equivalent

***Note:** this table has been added to summarise the variables already described narratively in the original model specification; it did not previously exist as a standalone table.*

3.3 Method of Data Analysis

Given the panel nature of the dataset, the study employs dynamic panel econometric techniques. Conventional static models such as pooled OLS or fixed-effects estimation are insufficient because they cannot adequately account for endogeneity, persistence in inflation, or dynamic adjustments. To overcome these limitations, the study adopts Panel Autoregressive Distributed Lag (Panel ARDL) approaches (heterogeneous estimators) including Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effects (DFE), alongside the augmented PPML gravity estimator for the bilateral trade flow specification.

Since the dataset spans over three decades, non-stationarity and long-run relationships are anticipated. To address this, the study employs the Panel ARDL framework as proposed by Pesaran, Shin, and Smith (1999). The Pooled Mean Group (PMG) estimator is particularly attractive because it assumes homogeneous long-run coefficients across countries while allowing short-run dynamics and error variances to differ reasonable given the expectation of a common long-run equilibrium relationship between monetary liquidity and bilateral trade flows in West Africa, even though adjustment speeds may vary across Nigeria, Ghana, and Côte d'Ivoire due to structural and policy differences.

The Mean Group (MG) estimator provides robustness by fully allowing for heterogeneity across countries, estimating separate regressions for each cross-section and averaging the coefficients. In contrast, the Dynamic Fixed Effects (DFE) model imposes homogeneity on slope coefficients across countries while permitting only intercepts to vary. To decide between these estimators, a Hausman test is conducted, where the null hypothesis supports the efficiency of PMG over MG. The ARDL specification also allows the study to distinguish between short-run causality (captured by differenced variables) and long-run equilibrium relationships (captured by lagged levels and error correction terms).

Prior to estimation, stationarity of variables is examined using a battery of panel unit root tests, including Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Breitung (2000), Fisher-ADF and Fisher-PP (Maddala & Wu, 1999), and Hadri (2000). For co-integration, the study applies Pedroni (1999, 2004), Kao (1999), and Westerlund (2007) panel co-integration tests, ensuring robustness in detecting whether a long-run equilibrium relationship exists among monetary liquidity, bilateral trade flows, and control variables.

4.0 Presentation and Discussion of Results

Table 4: Cross-Sectional Dependence (CSD) Result for Bilateral Trade Flows between Côte d'Ivoire, Ghana and Nigeria

	CD	CDw	CDw+	CD*
OPN	-0.030 (0.978)	2.440 (0.015)	6.460 (0.000)	9.40e+30 (0.000)
GDP	8.580 (0.000)	-3.600 (0.000)	11.250 (0.000)	2.60e+31 (0.000)
Trade (TBAL)	-2.080 (0.037)	2.640 (0.008)	7.210 (0.000)	4.20e+30 (0.000)
INF	5.020 (0.000)	-0.500 (0.615)	8.190 (0.000)	7.20e+32 (0.000)
EXR	5.370 (0.000)	-3.230 (0.001)	6.060 (0.000)	6.50e+30 (0.000)
INT	6.540 (0.000)	-1.970 (0.048)	9.360 (0.000)	1.30e+32 (0.000)

p-values in parentheses. References — CD: Pesaran (2015, 2021); CDw: Juodis & Reese (2021); CD: Pesaran & Xie (2021) with PC(s).*

The cross-sectional dependence results in Table 4 show that the economic variables of Côte d'Ivoire, Ghana, and Nigeria move closely together, a pattern that mirrors their current economic realities. In recent years, all three countries have faced similar external shocks rising global inflation, volatile commodity prices, tighter global financial conditions, and exchange-rate pressures causing their GDP, inflation, bilateral trade flows, and exchange rates to react in comparable ways. For example, Nigeria's sharp currency depreciation in 2023–2024, Ghana's debt restructuring crisis, and Côte d'Ivoire's exposure to cocoa-price fluctuations all fed into broader regional inflation and trade disruptions, creating spillovers across their economies. The significant cross-sectional dependence detected in almost all variables reflects the present economic environment in West Africa, where macroeconomic and trade outcomes are increasingly interconnected, making coordinated policy responses more important than ever.

Table 5: Fixed Effect and Bilateral Trade Flow Result

	FE	PPML Trade
Dependent Variable: Trade _{ijt}		
LMG	-0.000816*** (0.000164)	-0.000779*** (0.000148)
EXR	2.509e+07*** (8.825e+06)	2.199e+07*** (7.641e+06)
INT	9.991e+07 (2.406e+08)	2.562e+08 (1.627e+08)
INF	1.477e+07 (8.088e+07)	1.031e+08 (6.991e+07)
GDP	0.0545*** (0.0131)	0.0629*** (0.0126)
OPN	-4.147e+07 (6.817e+07)	-1.556e+08*** (4.457e+07)
Constant	-3.158e+09 (5.555e+09)	-1.999e+09 (5.035e+09)
Observations	105	105
R-squared	0.254	—
Number of cid	3	3

*Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' computation using Stata 17, 2026.*

The fixed effects and bilateral trade flow estimates in Table 5 reveal that trade performance in Côte d'Ivoire, Ghana, and Nigeria is strongly shaped by market size, exchange-rate movements, and openness dynamics. The coefficient on LMG is negative and highly significant in both models, suggesting that increases in market distance, or trade frictions continue to reduce bilateral trade flows. This finding aligns with the recent challenges in West Africa, where high transport costs, logistical bottlenecks, and weak regional infrastructure still weaken export competitiveness and increase import dependency.

Exchange rate effects are also positive and significant. The very large coefficients indicate that currency movements have substantial influence on bilateral trade flows. This aligns with present conditions: Nigeria's recent naira depreciation, Ghana's cedi instability, and Côte d'Ivoire's pressures within the CFA franc zone have all reshaped import costs and export revenues. The strong sensitivity of bilateral trade flows to exchange rates suggests that exchange-rate volatility remains a major source of external imbalance in the region.

GDP shows a positive and highly significant effect on bilateral trade flows in both models, indicating that as national output expands, trade performance improves reflecting the region's current pattern where GDP growth in Côte d'Ivoire and the post-contraction recovery in Nigeria and Ghana help support export capacity and moderate import pressures.

Trade openness, however, displays contrasting results. While insignificant in the fixed-effects model, it becomes strongly negative and significant under the PPML bilateral trade specification. This

suggests that increased openness without corresponding improvements in domestic production tends to worsen bilateral trade flows, consistent with current realities where all three countries import far more manufactured goods than they export, causing trade deficits with major partners to widen as borders become more open. Inflation and interest rates are not statistically significant, indicating that in the present regional context, monetary conditions affect trade mainly through their influence on exchange rates and domestic output rather than through direct channels.

Table 6: Comparative Analysis of Bilateral Trade Flows

Dependent Variable: Trade _{ijt}	Côte d'Ivoire	Ghana	Nigeria
LMG	-0.000338** (0.000145)	0.0179 (0.0240)	-0.00143*** (0.000378)
EXR	-388,984 (1.591e+06)	1.901e+08 (6.772e+08)	5.507e+07** (2.112e+07)
INT	6.292e+07 (3.541e+08)	5.276e+07 (6.154e+07)	-9.694e+08 (9.787e+08)
INF	3.750e+07 (4.348e+07)	1.232e+07 (2.084e+07)	2.543e+07 (1.643e+08)
GDP	0.0621 (0.0430)	-0.0655** (0.0258)	0.0686** (0.0276)
OPN	-1.890e+07 (2.883e+07)	-1.991e+07 (1.640e+07)	—
Constant	7.032e+08 (3.527e+09)	-1.654e+09 (1.996e+09)	2.201e+10 (2.273e+10)
Observations	35	35	35
R-squared	0.351	0.574	0.387

*Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' computation using Stata 17, 2026.*

The comparative results in Table 6 show that the determinants of bilateral trade flows differ notably across Côte d'Ivoire, Ghana, and Nigeria, reflecting the structural and macroeconomic realities currently shaping their external sectors. For Côte d'Ivoire and Nigeria, the LMG coefficient is negative and statistically significant, indicating that increases in market distance, or trade frictions continue to weaken their bilateral trade flows. Ghana's LMG effect, although positive, is not significant, suggesting that market-size factors play a weaker role in its trade dynamics.

Exchange-rate effects also differ across the three economies. Nigeria's coefficient is positive and significant, showing that naira depreciation especially the sharp adjustment of 2023–2024 has moderately improved bilateral trade flows through higher export receipts and compressed imports. Côte d'Ivoire's exchange rate effect is negative but insignificant, reflecting the stability of the CFA franc, which limits competitive gains through depreciation. Ghana's exchange-rate effect is positive but highly unstable, mirroring the country's recent currency volatility during its debt restructuring period.

GDP influences bilateral trade flows differently across the region. Nigeria and Côte d'Ivoire both exhibit positive GDP effects, indicating that economic growth supports export performance and strengthens trade positions, consistent with Nigeria's slow recovery and Côte d'Ivoire's sustained growth momentum. Ghana, however, shows a significantly negative GDP coefficient, suggesting that growth in recent years has been associated with higher import demand rather than improved export capacity, aligned with Ghana's import-dependent consumption pattern and weak non-traditional export diversification.

Table 7: Poisson Pseudo-Maximum Likelihood (PPML) Augmented Gravity Result for Comparative Analysis of Bilateral Trade Flows

Dependent Variable:	Trade	Côte d'Ivoire	Ghana	Nigeria
$Trade_{ijt}$				
LMG	0**	-0	-0***	0***
EXR	-5.91e-05 (0.000244)	-0.000134 (9.22e-05)	0.233** (0.0938)	-0.000247* (0.000128)
INT	0.00725 (0.00506)	-0.0730** (0.0336)	0.0203*** (0.00625)	0.00658 (0.00680)
INF	0.00282 (0.00331)	0.0118*** (0.00355)	-0.00141 (0.00270)	0.0319*** (0.00214)
GDP	-0*** (0)	-0 (0)	-0 (0)	-0** (0)
Constant	4.084*** (0.154)	4.611*** (0.235)	3.619*** (0.259)	2.087*** (0.184)
Observations	105	35	35	35
R-squared	0.628	0.558	0.430	0.957

*Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Authors' computation using Stata 17, 2026.*

The augmented PPML gravity model in Table 7 was employed to examine the determinants of bilateral trade flows for Côte d'Ivoire, Ghana, and Nigeria. The results reveal notable heterogeneity in the effects of key macroeconomic indicators across the three economies, reflecting their distinct structural and policy environments.

In the case of Côte d'Ivoire, the model suggests that traditional determinants such as market size and GDP exert minimal influence on bilateral trade flows, while exchange rate and inflation appear statistically insignificant. This outcome may reflect the relatively stable and export-oriented nature of the Ivorian economy, where trade dynamics are strongly shaped by commodity exports particularly cocoa and coffee rather than short-term macroeconomic fluctuations. Conversely, Ghana exhibits sensitivity to interest rates and inflation, with higher interest rates significantly constraining bilateral trade flows, while inflation appears positively associated with them. This pattern may indicate that Ghana's trade sector responds to domestic monetary conditions, possibly through the financing costs of trade-related credit and inflation-driven adjustments in export prices, reflecting the country's ongoing efforts to stabilise its currency and maintain trade competitiveness amidst domestic price pressures.

Nigeria presents a markedly different profile, with exchange rate fluctuations exerting a significant positive effect on bilateral trade flows, consistent with the country's heavy reliance on oil exports and the sensitivity of trade flows to currency movements. Inflation similarly exhibits a positive relationship with bilateral trade flows, which may reflect pass-through effects to export prices and the role of domestic demand in driving non-oil trade. Interestingly, GDP and market size have negligible effects, suggesting that short-term trade responsiveness in Nigeria is dominated by external macroeconomic factors rather than overall economic scale. The exceptionally high explanatory power of the model for Nigeria ($R^2 = 0.957$) underscores the dominant influence of these variables in shaping Nigeria's bilateral trade flows.

4.1 Discussion of Findings

This study set out to determine the extent to which monetary liquidity affects bilateral trade flows in Nigeria, Ghana, and Côte d'Ivoire. The PPML augmented gravity model results reveal that liquidity-related macroeconomic indicators particularly exchange rates, inflation, and interest rates significantly influence bilateral trade flows, though the effects differ across countries, reflecting structural and policy-specific contexts. In Nigeria, exchange rate fluctuations emerged as a key determinant, with depreciation significantly affecting trade flows. This finding aligns with prior studies (Okafor & Ezeaku, 2018; Uzonwanne, 2019), which documented that liquidity-driven depreciation affects trade balances, underscoring the critical role of stable monetary liquidity and exchange rate management in sustaining Nigeria's largely oil-dependent export flows. Inflation also exerts a positive effect on trade flows, consistent with Boamah and Mensah (2019), highlighting the nuanced trade-offs between liquidity expansion and price stability.

In Ghana, interest rates were found to have a significant negative impact on bilateral trade flows, indicating that tighter monetary conditions constrain trade by increasing financing costs. This corroborates the work of Boamah and Oteng-Abayie (2019) and Mensah and Kouakou (2019), who emphasise that liquidity management through policy rates has important implications for trade performance. Conversely, in Côte d'Ivoire, standard liquidity indicators such as GDP and market size were largely insignificant, reflecting the country's reliance on commodity exports and structural trade rigidities (Kouakou & Djedje, 2021; Coulibaly, 2021).

The findings suggest that monetary liquidity affects bilateral trade flows in a context-specific manner. While expansionary liquidity can stimulate trade in some settings, misaligned policies particularly in interest rates, inflation, and exchange rates can weaken trade flows with key partners. These results support the study's objective by demonstrating that effective monetary liquidity management, coupled with coordinated fiscal-monetary policies, is crucial for enhancing bilateral trade performance in the three countries, highlighting the need for country-specific strategies that balance macroeconomic stability and external sector objectives (Quartey & Afful, 2021; Owusu & Danso, 2018).

5.0 Conclusion and Recommendations

This study examined the extent to which monetary liquidity affects bilateral trade flows in Nigeria, Ghana, and Côte d'Ivoire. The findings indicate that monetary liquidity plays a significant role in shaping bilateral trade outcomes, though the effects vary across the three countries due to differences in economic structure and policy environments. In Nigeria, exchange rate fluctuations and inflation mediate the impact of liquidity on bilateral trade flows, reflecting the sensitivity of its oil-dependent economy to currency movements and external shocks. In Ghana, interest rate adjustments were found to constrain bilateral trade flows, highlighting the trade-offs involved in monetary liquidity management, while in Côte d'Ivoire, traditional economic indicators such as GDP and market size had limited influence, suggesting that structural factors and reliance on commodity exports reduce the immediate effects of liquidity policies on bilateral trade.

The study recommends that effective monetary liquidity management, when coordinated with fiscal policy, is crucial for maintaining stable bilateral trade flows and supporting sustainable external sector performance. Accordingly, policymakers should pursue strategies that stabilise liquidity, control inflation, and align interest rate policies with bilateral trade objectives, while simultaneously addressing structural constraints and diversifying economic activities. Such context-specific and coordinated approaches will enhance the efficacy of monetary liquidity management in promoting balanced bilateral trade across the three countries.

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