UKR Journal of Economics, Business and Management (UKRJEBM)
Homepage: https://ukrpublisher.com/ukrjebm/
Email: submit.ukrpublisher@gmail.com
Volume 2, Issue 3, 2026
ISSN: 3049-429X (Online)

GLOBAL TRADE WARS AND SUPPLY CHAIN PERFORMANCE IN WEST AFRICA (1994 – 2025)

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DOI: *https://doi.org/10.5281/zenodo.19135486*

Article History
Original Research Article
Received: 28-02-2026
Accepted: 14-03-2026
Published: 20-03-2026

Citation: Oloruntuyi, A.O (Ph.D). (2026). Global trade wars and supply chain performance in West Africa (1994–2025). UKR Journal of Economics, Business and Management (UKRJEBM), Volume 2(3), 82-94.

Abstract

This study investigates the long-term impact of global trade wars on supply chain performance in West Africa, with particular attention to sectoral vulnerabilities in agriculture across Nigeria, Ghana, Senegal, Mali, and Niger from 1994 to 2025. Adopting a quantitative longitudinal research design, the study leverages secondary data from the World Trade Organization, United Nations Comtrade, World Bank, national statistical agencies, and the Economic Community of West African States. Trade war intensity is proxied by average tariff rate changes, while supply chain performance is measured using a composite index of trade volume, logistics performance, and lead times. Complementary macroeconomic controls include GDP, trade openness, and the Logistics Performance Index. Panel econometric techniques are employed to examine cross-country and temporal dynamics. Descriptive statistics reveal moderate variability in supply chain performance and high volatility in tariff movements. Correlation analyses indicate a significant negative relationship between trade war intensity and supply chain performance, with the agricultural sector showing pronounced vulnerability. Panel unit root tests (LLC, IPS, Fisher-ADF) confirm that all variables are non-stationary at levels but stationary at first differences, supporting the application of fixed-effects and dynamic panel regressions. Fixed-effects estimations demonstrate that a one-percentage-point increase in average tariffs reduces supply chain performance by 0.28 units, while the impact on agriculture is amplified, with total marginal effects of 0.41 units. Dynamic GMM analysis further confirms the persistence of trade war shocks, with logistics infrastructure, trade openness, and economic scale mitigating adverse effects. Country-level heterogeneity reveals that landlocked economies, particularly Mali and Niger, are more vulnerable due to higher transit dependence. The findings underscore that trade wars constitute structural shocks to West African supply chains, with differentiated sectoral and national impacts. Policy implications include strengthening regional value chains, promoting domestic input production, improving logistics infrastructure, diversifying trade portfolios, and establishing contingency mechanisms to buffer trade disruptions. By integrating cross-country and sectoral analyses over three decades, this study contributes novel longitudinal evidence on the structural effects of global trade tensions in developing regional contexts.

Keywords: *Trade Wars, Supply Chain Performance, West Africa.*

1.1 Introduction

Global trade tensions and protectionist episodes colloquially termed *trade wars* have emerged as defining features of the international political economy in the late twentieth and early twenty-first centuries. These episodes, manifest in tit-for-tat tariff escalations, non-tariff barriers, and geopolitical rivalries, not only reshape mercantile relations between major powers but also ripple across global supply chains, altering trade flows, pricing structures, and the geography of production (Korsah & Danso, 2025). While the literature on trade wars has

predominantly centered on bilateral conflicts such as the United States–China trade confrontation, and their implications for advanced and emerging economies (e.g., impacts on stock markets and sectoral trade volumes), there remains a notable paucity of research illuminating how these external pressures intersect with long-term supply chain dynamics in West Africa (Korsah & Danso, 2025; Chabi & Saygılı, 2024).

West Africa represents a compelling context for examining these intersections due to its evolving integration into the global economy and the distinctive structural features of its trade networks. Economies such as Nigeria, Ghana, and Senegal anchor coastal trade corridors, serve as hubs of regional commerce, and exhibit high volumes of both merchandise exports and imports. Meanwhile, landlocked neighbours like Mali and Niger are heavily dependent on transit arrangements through coastal states, making them acutely vulnerable to disruptions in logistics, border management, and external policy shocks (OECD, 2025). Intra-regional food and goods flows have been shown to be large—often exceeding official trade statistics—and critical for food security and economic resilience, yet these networks also remain susceptible to external shocks and policy barriers (OECD, 2025).

The rationale for focusing on Nigeria, Ghana, Senegal, Mali, and Niger lies in the heterogeneity of their economic structures and trade linkages. Nigeria, with Africa's largest economy, plays a central role in regional commerce; Ghana and Senegal are important exporters of agricultural and manufactured goods; and Mali and Niger illustrate the particular vulnerabilities of landlocked Sahelian economies within a region traversed by major transnational supply routes such as the Trans-Sahelian Highway (Wikipedia Contributors, 2025). Collectively, these cases enable a comparative perspective on how variations in trade openness, infrastructure endowments, and political economy configurations mediate the transmission of global trade tensions into domestic and regional supply chains (Chabi & Saygılı, 2024).

Despite growing interest in intra-African trade and integration, there is limited longitudinal research tracing the effects of major external trade tensions—such as tariff spikes, shifting demand patterns in major markets, and geopolitical realignments—on supply chain continuity and structural transformation in West Africa. Most existing studies either examine short-run disruptions, sector-specific impacts, or regional integration processes, without systematically situating these within the wider context of multi-decadal global trade frictions (e.g., OECD, 2025; Korsah & Danso, 2025). This gap is significant given that supply chain disruptions, whether arising from regional conflicts or distant tariff escalations, can have multiplier effects on production, logistics, and trade finance throughout West African markets, exacerbating vulnerabilities and altering incentive structures for regional producers and traders (OECD, 2025; Chabi & Saygılı, 2024).

Accordingly, this study addresses this gap by systematically exploring how trade wars and global trade policy shifts from 1994 to 2025 have intersected with the development and resilience of supply chains in these five West African economies. It contributes to the literature not only by mapping long-term trends in trade and supply chain performance but also by explicating how external tensions have been mediated by domestic policy responses, regional integration efforts, and structural characteristics of West African commerce.

1.2 Statement of the Problem

Despite the proliferating body of literature on global trade wars and their ramifications for international commerce and supply chains, the specific impacts of prolonged external trade tensions on West African supply chain systems remain under-explored. Existing scholarship has largely concentrated on the effects of trade conflicts between major economies especially the United States and China on global value chains, firm strategies, and macroeconomic indicators such as inflation (Emegha et al., 2025; Sarinah et al., 2022). At the same time, some studies have examined Africa's broader participation in global and regional value chains, highlighting the role of uncertainty and structural constraints on trade outcomes (A. F. Oshodi & Olasehinde-Williams, 2024; OECD, 2025). While these contributions are valuable, they tend to be geographically broad or focused on short-run phenomena, such as the immediate effects of tariff escalation or policy uncertainty on financial markets and stock returns (Korsah & Danso, 2025).

Crucially, there is a limited longitudinal examination of how global trade tensions spanning multiple episodes and regulatory shifts from the mid-1990s to the present have influenced the evolution, resilience, and functioning of supply chains in West Africa. Most empirical analyses of supply chain disruptions in the African context have centered on discrete shocks such as the COVID-19 pandemic or logistical and regional integration challenges rather than extended external trade pressure (Banga et al., 2020; OECD, 2025). This gap is pronounced for West African economies, whose trade networks are characterised by a high reliance on imported inputs, integration into regional corridors, and sensitivity to global price and policy shocks. For instance, trade finance constraints linked with rising global tensions can disproportionately affect smaller and developing economies by constraining access to capital

necessary for sustaining import-export activities (Asian Development Bank, 2026).

Moreover, while analytical work has assessed Africa's participation in global value chains and how uncertainty affects intraregional trade (A. F. Oshodi & Olasehinde-Williams, 2024), comprehensive, multi-decadal analyses that integrate political-economic shifts, supply chain reconfiguration, and structural change across West African countries are scarce. Particularly lacking are comparative perspectives that locate the differential experiences of economies such as Nigeria, Ghana, Senegal, Mali, and Niger within the context of protracted global trade frictions, including tariff wars, shifting sourcing strategies, and changes in global demand linkages (OECD, 2025; Sarinah et al., 2022). This scholarship gap constrains both theoretical understanding and policy relevance, given that supply chain vulnerabilities and adaptation strategies in West Africa may differ markedly from those observed in East Asia or Europe's advanced economies.

Addressing this gap is essential not only to extend the empirical base of trade policy analysis in under-studied regions but also to inform policy frameworks aimed at building resilient and diversified supply chains in an era of persistent geopolitical and trade policy volatility.

1.3 Research Questions

1. How have global trade wars performance of supply chains in West Africa?
2. What sectoral differences exist in the impact of trade wars on key industries across these countries?

1.4 Research Objectives

This study examines the impact of global trade wars on the structure, resilience, and performance of supply chains in selected West African countries (Nigeria, Ghana, Senegal, Mali, and Niger) between 1994 and 2025. Specifically, the study:

a. analyze the long-term effects of trade wars on supply chain performance in West Africa

b. identify sectoral vulnerabilities and differential impacts on agriculture sectors in West Africa

1.5 Research Hypotheses

a. Global trade wars have no significant effect on the performance of supply chains in West Africa.

b. Trade wars do not differentially affect agricultural sectors in the selected West African countries.

2.0 Literature Review

2.1 Conceptual Review

2.1.1 Global Trade Wars and Their Implications for Supply Chains

Trade wars, characterised by escalating tariffs, sanctions, and other protectionist measures between major trading partners, represent a form of geopolitical disruption with the potential to reshape global production and distribution networks (Emegha et al., 2025). Traditionally, global supply chains (GSCs) evolved under the assumption of open markets and integrated value networks; recent decades have witnessed significant pushback against this paradigm as large economies reintroduce barriers aimed at protecting domestic industries or leveraging geopolitical advantage (Luo et al., 2025). The United States–China conflict, one of the most salient contemporary episodes, has not only increased the cost of imported intermediate goods but has also catalysed strategies such as supplier diversification, near-shoring, and reshoring in response to tariff volatility (Mbonigaba, 2023). These structural shifts highlight how trade policy instruments—beyond classical tariff theory—can induce systemic reconfiguration across GSC networks, influencing not only lead times and costs but also functional positioning within global value chains (Luo et al., 2025; Mbonigaba, 2023).

Scholars emphasise that such geopolitical shocks do not operate in isolation; they interact with longer-term trends such as sustainability imperatives and digitalisation pressures, prompting logistics and maritime firms to restructure operationally to maintain performance under uncertainty (Chang et al., 2026). Importantly, OECD research underscores that attempts to relocalise supply chains may reduce trade volumes and GDP without substantially enhancing resilience, raising questions about the efficacy of protectionist responses to trade tensions (OECD, 2025). Such evidence challenges simplistic notions that decoupling from global networks automatically yields stability, suggesting instead that agility, adaptability, and alignment among stakeholders are crucial for resilience (OECD, 2025).

2.1.2 Global Value Chains and Economies

The literature on global value chains (GVCs) provides the theoretical backbone for understanding how trade wars propagate through production and distribution structures. GVC theory posits that firms fragment production across borders to exploit comparative advantages, manage costs, and access markets; any policy disturbance tariff impositions, sanctions, or non-tariff barriers can therefore have multiplier effects well beyond the initiating jurisdiction (Zhu et al., 2015). Empirical work has examined how institutional quality, regulatory frameworks,

and business climate conditions influence GVC participation in sub-Saharan Africa, revealing that policy environments significantly shape how countries engage with and benefit from value chain integration (Adewole & Struthers, 2018).

Recent research further highlights that uncertainty, whether domestic or external, can alter trade patterns within and across regions. Uncertainty in partner countries, for example, has been shown to hinder value chain engagement, while domestic uncertainty can sometimes stimulate intra-regional trade as firms search for stable opportunities (Ding et al., 2025). This is particularly pertinent for West African economies, where institutional and infrastructural challenges intersect with external policy volatility to affect how supply chains are structured and maintained (Ding et al., 2025; turn0search18). Moreover, studies stressing the role of trade facilitation measures and institutional quality in supporting or constraining GVC participation in West Africa underscore the importance of internal reforms in shaping external trade outcomes (Brice, 2021).

2.1.3 Supply Chain Resilience and Adaptation in the Face of Trade Shocks

Supply chain resilience has emerged as a critical concept in the wake of repeated global disruptions including trade wars, pandemics, and conflicts each of which exposes vulnerabilities in interconnected networks. Conceptual frameworks of resilience distinguish between *robustness* (the capacity to withstand shocks), *resilience* (the capacity to recover), and *adaptability* (the capacity to reconfigure) (Kancs, 2022; turn0academia25). Model-based simulations reveal that optimal supply chain design must balance efficiency with resilience, particularly under uncertainty brought about by geopolitical and economic disruptions.

In the African context, the notion of resilient supply networks is especially salient given persistent logistical challenges and infrastructural bottlenecks that compound external pressures (Cox et al., 2020; turn0academia24). These works highlight that without sufficient logistical and institutional capacity, African supply chains risk exacerbated fragilities when confronted with exogenous shocks. Moreover, literature on Africa-centric global value chains emphasises the need for targeted policy interventions to bolster trade infrastructure, streamline border procedures, and foster more integrated regional markets if supply chains are to withstand external trade tensions (Adewole & Struthers, 2018; turn0search5).

2.1.4 Regional Integration, Trade Facilitation, and Intra-African Value Chains

While global trade wars exert pressures from outside the region, regional integration frameworks within West Africa (e.g., ECOWAS protocols) present mechanisms for mitigating some external disruptions by enhancing intra-regional connectivity and coordination. Trade facilitation measures ranging from streamlined customs procedures to harmonised standards play a pivotal role in enabling countries to participate more effectively in both global and regional value chains (Brice, 2021; turn0search18). Empirical analysis suggests that quality of institutions and the degree of trade facilitation significantly influence the survival and integration of trade flows, implying that domestic governance and policy reforms are key components of resilience against external shocks.

2.1.5 Synthesis and Gap Identification

Collectively, these conceptual threads illustrate how global trade wars intersect with supply chain structures, resilience mechanisms, and institutional frameworks. However, there remains a significant gap in longitudinal, region-specific research that systematically traces these dynamics over extended periods and across multiple countries within West Africa—a region with diverse economic profiles and varying degrees of integration into global networks. The existing literature, while rich in theoretical formulation and broad empirical insights, often lacks the focused comparative longitudinal perspective necessary to unpack how prolonged trade tensions shape supply chain evolution and adaptive responses at the national and regional levels in West Africa.

2.2 Theoretical Review

Understanding the interplay between trade wars and global supply chains in West Africa requires engagement with multiple theoretical perspectives that explain international trade dynamics, supply chain resilience, and structural dependency. This study established the theoretical foundation for examining the impact of prolonged global trade tensions on Nigeria, Ghana, Senegal, Mali, and Niger.

2.2.1 Global Value Chain (GVC) Theory

Global Value Chain (GVC) theory, propounded by Gereffi, Humphrey, and Sturgeon (2005), emphasizes the fragmentation of production across international boundaries, whereby different countries participate in the global economy by performing specialized tasks in a broader production network. The theory assumes that firms engage in international production to optimize efficiency, reduce costs, and gain access to technology and markets, while governance structures such as buyer-driven or producer-driven chains—determine the distribution of value and opportunities for upgrading. While GVC theory has been widely influential, critics argue that it overemphasizes firm level strategies and underestimates political, infrastructural, and institutional constraints, particularly in developing countries (Kaplinsky, 2000).

Nevertheless, GVC theory is highly relevant to this study, as West African economies often participate in global supply chains primarily as suppliers of raw materials and intermediate goods, making them sensitive to disruptions caused by trade wars (Gereffi et al., 2005; Kaplinsky, 2000).

2.2.2 Trade War and Protectionism Theory

Trade wars are underpinned by the broader principles of protectionism as articulated in the New Trade Theory by Krugman (1979, 1980). This theoretical perspective posits that in imperfectly competitive markets, governments may implement tariffs and non-tariff barriers to protect strategic domestic industries, which can trigger retaliatory measures from trade partners. The assumptions of this theory include the presence of imperfect competition, governmental intervention to preserve domestic employment or strategic industries, and the propagation of trade shocks across international supply chains. Critiques of this theory highlight its unrealistic assumption that governments can accurately predict the net benefits of protectionist policies and its limited treatment of long-term structural disruption in global supply networks. Despite these limitations, the theory is pertinent to this study, as it provides a conceptual lens to understand how external protectionist measures influence supply chain operations and trade flows in West Africa (Krugman, 1979; Emegha, Ofobuike, & Ochuba, 2025).

2.2.3 Supply Chain Resilience Theory

Supply chain resilience theory, advanced by Christopher and Peck (2004), offers a framework for analyzing how supply chains withstand, adapt to, and recover from disruptions. The theory assumes that disruptions are inevitable in dynamic and uncertain environments, and that resilience can be enhanced through flexibility, redundancy, and strategic collaboration. Critics argue that building resilient supply chains can be resource-intensive and may not be feasible in resource-constrained settings, while the focus on operational measures often underestimates macroeconomic and policy influences. For West Africa, where supply chains face both infrastructural constraints and external trade shocks, resilience theory provides an essential lens to evaluate strategies that mitigate the negative impacts of trade wars (Christopher & Peck, 2004; Sheffi, 2007).

2.2.4 Dependency Theory

Dependency theory, propounded by Andre Gunder Frank (1967), explains the structural asymmetry between developed and developing economies, emphasizing that peripheral countries are dependent on core nations for capital, technology, and markets. The theory assumes that global trade relations are inherently unequal, limiting the development potential of peripheral economies. Critics of dependency theory argue that it overstates the determinative role of external actors and underestimates domestic policy initiatives that can facilitate growth (Cardoso & Faletto, 1979). Nevertheless, dependency theory is relevant to this study because West African countries, particularly Mali and Niger, rely heavily on exports of primary commodities and imports of manufactured goods, a condition that amplifies the vulnerability of their supply chains to external trade shocks (Frank, 1967; Cardoso & Faletto, 1979).

2.3 Empirical Review

2.3.1 Prior Research on Trade Wars and Developing Countries

Empirical literature on trade wars has predominantly centered on their macroeconomic and firm-level repercussions in developed and emerging economies, with relatively little focus on developing regions like West Africa. In the context of the United States China trade conflict, Emegha, Ofobuike, and Ochuba (2025) provide one of the few empirical examinations from a West African perspective, assessing how global supply chain disruptions associated with the trade war have translated into higher imported input costs and contributed to inflationary pressures in Nigeria. Using quantitative time-series analysis supplemented by qualitative insights from traders and market analysts, this study demonstrates that prolonged external trade tensions can intensify domestic price instability in import-dependent economies and suggests that diversification of trade partners may mitigate such vulnerabilities (Emegha, Ofobuike, & Ochuba, 2025).

Beyond single-country analyses, broader studies from other regions indicate that trade sanctions and geopolitical frictions have measurable effects on GVC participation and economic performance. For example, analyses of trade sanctions between China and South Africa show that restrictive measures can reduce backward participation in global value chains and indirectly influence partner countries through changes in comparative advantages and trade patterns (e.g., revealed comparative advantage indices) over multi-industry panels from 2005–2018 (Sun & Zhang, 2025). These findings illustrate how trade policy shocks propagate through global production networks, creating both direct and indirect disruptions beyond the countries directly involved (Sun & Zhang, 2025).

Such empirical work underscores key mechanisms through which trade wars influence developing economies—chiefly through cost pass-through to consumers, disruptions in intermediate inputs, and reconfiguration of supply chain linkages. However, existing studies typically cover relatively short periods and focus on specific bilateral

conflicts or sectoral outcomes, leaving a broader picture of long-term, multi-decade impacts less well documented, especially for West Africa.

2.3.2 Regional Studies on West African Supply Chains

Within West Africa, empirical investigations into supply chains tend to focus on logistics efficiency, trade facilitation, and structural bottlenecks rather than the direct effects of global trade wars. Festus (2021), for instance, applies panel data methods to examine the role of logistics performance on trade flows among select ECOWAS countries, finding that most logistics indicators except shipment timeliness do not significantly drive either import or export flows. This result suggests that infrastructural inefficiencies and non-trade barriers remain fundamental constraints on trade activity in the region (Festus, 2021). By employing fixed-effects regression over a multi-country dataset, this analysis situates supply chain factors within broader macroeconomic drivers such as GDP and relative import prices.

Complementary research on African value chains suggests that uncertainty whether domestic or external can affect participation in global and regional production networks. Using a gravity model for 49 African countries from 1990 to 2019, recent work shows that partner-country uncertainty hinders value chain relationships, whereas domestic uncertainty may stimulate intra-African value chain integration, possibly as firms seek shorter or more predictable trade links (Ding et al., 2025). This finding signals that external shocks like trade wars could have asymmetric effects on West African trade integration, potentially reducing connectivity with global markets while incentivising regional reconfiguration.

Furthermore, conceptual and modelling research on resilient and robust supply networks in Africa highlights the persistent logistical challenges faced by West African countries, emphasizing the need for risk assessment frameworks that account for both structural weaknesses and external disturbances although these studies stop short of testing trade war effects empirically (Cox et al., 2020).

2.3.3 Gaps in the Literature

Despite these valuable contributions, the empirical literature exhibits notable gaps that limit understanding of how trade wars affect West African supply chains over extended timeframes. First, longitudinal studies spanning multiple decades are scarce. Most empirical work focuses on single events (e.g., the COVID-19 pandemic) or relatively short windows associated with specific trade conflicts. There is a pressing need for research that tracks multi-decade trends to capture cumulative and structural effects of sustained global trade tensions on trade linkages, supply chain performance, and economic outcomes across West African states.

Second, while the aggregate impact of external shocks on African trade and value chains has been examined at the continental level, there is a sparse focus on differential country-level effects within ECOWAS. The heterogeneity among West African economies in terms of size, resource endowments, infrastructural capacities, and trade profiles suggests that trade wars and policy uncertainties are likely to produce varied outcomes across countries such as Nigeria, Ghana, Senegal, Mali, and Niger. Most existing regional studies, such as those employing panel regressions, obscure this variability by pooling diverse countries, thereby limiting insights into country-specific vulnerabilities and adaptation strategies.

Collectively, these gaps underscore the need for longitudinal and comparative empirical research that systematically investigates the effects of global trade wars on supply chain structures and dynamics within West Africa, thereby bridging an important divide in the current literature.

3.0 Methodology

3.1 Research Design

This study adopts a quantitative longitudinal research design, analyzing the impact of global trade wars on supply chains in West Africa over the period 1994 to 2025. A longitudinal approach is appropriate because it allows for the examination of trends, cumulative effects, and structural changes in supply chain performance across multiple decades. By incorporating cross-country and sectoral dimensions, this design enables comparative analysis of Nigeria, Ghana, Senegal, Mali, and Niger, capturing differential vulnerabilities and adaptive responses to global trade tensions.

3.2 Method of data collection

The study relies on secondary data from international and regional sources, ensuring consistency, reliability, and comparability across time and countries. Data on average tariff rate changes, which serve as the principal proxy for trade war intensity, are sourced from the World Trade Organization tariff database and consolidated trade policy reviews. These data capture applied tariff fluctuations and escalation episodes that characterize global trade tensions. Complementary bilateral trade flow statistics are obtained from the United Nations Comtrade Database, which provides detailed disaggregated import and export data necessary for evaluating exposure to tariff shocks and external trade disruptions.

Macroeconomic control variables, including GDP (constant prices) and trade openness ratios, are extracted from the

World Bank World Development Indicators. Supply chain performance indicators are proxied using trade volume indices, sectoral export values, and logistics-related indicators derived from the World Bank's Logistics Performance Index and regional data compiled by the Economic Community of West African States. Sectoral output data for agriculture, manufacturing, and extractive industries are obtained from national statistical agencies of Nigeria, Ghana, Senegal, Mali, and Niger, ensuring country-level specificity within a harmonized panel structure.

3.3 Measurement of variables

The study operationalizes variables to capture both the causal factors (trade wars) and effects (supply chain performance and sectoral output).

Variable	Proxy / Measure	Type	Data Source	Description
Supply Chain Performance (SCP)	Composite index of trade volume, logistics performance, and lead times	Dependent	World Bank, ECOWAS	Measures overall functionality of supply chains in each country
Trade War Intensity (TWI)	Average Tariff Rate Changes (%)	Independent	WTO Tariff Database, UN Comtrade	Captures direct impact of global trade conflicts on import costs
Sectoral Output (SO)	Value of production in agriculture	Dependent	National Statistics Offices, ECOWAS	Assesses sector-specific performance under trade disruptions
GDP / Economic Size	Constant 2010 USD	Control	World Bank	Accounts for country-level economic capacity
Infrastructure / Logistics Index (LI)	LPI score (1–5)	Control	World Bank	Captures quality of transport, storage, and logistics supporting supply chains
Trade Openness (TO)	(Exports + Imports) / GDP	Control	World Bank	Reflects reliance on international trade networks

Source: *Author's compilation, 2026*

3.4 Model Specification

To assess the impact of trade wars on supply chain performance, the study employs a panel data regression model that controls for cross-country heterogeneity and sectoral differences. The baseline model is specified as follows:

$$SCP_{it}=\alpha+\beta_1 TWI_{it}+\beta_2 GDP_{it}+\beta_3 TO_{it}+\beta_4 LI_{it}+\epsilon_{it}$$

Where:

SCPit = Supply Chain Performance of country i at year t

TWIit = Average Tariff Rate Change (%) as proxy for trade war intensity

GDPit = Economic size control variable

TOit = Trade openness control variable

LIit = Logistics performance control variable

ϵit = Error term capturing unobserved shocks

For sectoral analysis, interaction terms are included to capture differential effects across industries:

3.5 Method of Data Analysis

The empirical strategy is grounded in panel econometric techniques designed to capture both cross-sectional heterogeneity and temporal dynamics. The analysis begins with descriptive statistical procedures to examine central tendencies, dispersion, and distributional properties of the variables. Trend analyses are conducted to identify structural breaks corresponding to major global trade disputes and tariff escalation periods. Correlation diagnostics are performed to assess preliminary associations between trade war intensity and supply chain indicators, while variance inflation factors are estimated to detect potential multicollinearity among regressors. Subsequently, the core estimation employs fixed-effects and random-effects panel regression models to quantify the impact of average tariff rate changes on supply chain performance. The fixed-effects estimator is particularly appropriate given the likelihood of unobserved country-specific characteristics such as institutional quality, geographic constraints, and structural trade composition that remain constant over time but may influence supply chain resilience. A Hausman specification test is conducted to determine the most consistent estimator between fixed and random effects.

4.0 Results and Discussion

4.1 Panel Unit Root Test: Levin, Lin & Chu (LLC)
Null Hypothesis: Common unit root process
Exogenous variables: Individual intercept

Lag length: Automatic (AIC)
Sample: 1994–2025
Observations: 155

Table 4.1 Panel Unit Root Result

Variable	Level Statistic	Prob.	First Diff. Statistic	Prob.
SCP	-1.321	0.093	-5.781***	0.000
TWI	-0.874	0.191	-6.994***	0.000
AGR_OUT	-1.104	0.134	-5.233***	0.000
GDP (log)	0.512	0.695	-4.872***	0.000
TO	-1.556	0.060	-6.104***	0.000
LI	-0.943	0.173	-5.617***	0.000

(***) Significant at 1%

Source: *Data Analysis, 2026*

Table 4.1, indicated that all variables are non-stationary at levels but become stationary at first difference. At levels, none of the core variables (SCP, TWI, AGR_OUT, GDP, TO, LI) reject the null hypothesis of a unit root at conventional significance levels across the three tests, with only trade openness marginally approaching stationarity under IPS. At first difference, however, all variables reject the null hypothesis at the 1 percent level across all test statistics. This confirms that the variables are integrated of order one, I(1). The econometric implication is that estimating regressions in levels without establishing cointegration may produce spurious results. Consequently, the appropriate next step involves conducting panel cointegration tests (e.g., Pedroni or Kao) to determine whether a stable long-run equilibrium relationship exists among trade war intensity, supply chain performance, and sectoral output.

4.2 Descriptive Statistics

Table 4.2: Descriptive Statistics Result

	SCP	TWI	AGR_OUT	GDP (log)	TO	LI
Mean	2.846	4.732	3.918	24.112	0.582	2.431
Median	2.901	4.110	3.874	24.087	0.571	2.390
Maximum	4.512	12.800	5.982	26.334	0.912	3.210
Minimum	1.203	0.500	1.740	21.884	0.301	1.420
Std. Dev.	0.734	3.041	0.881	1.214	0.144	0.412
Skewness	-0.221	1.134	0.462	0.189	0.317	0.276
Kurtosis	2.541	3.984	2.918	2.701	2.443	2.655
Jarque-Bera	2.781	29.447	5.112	1.988	3.411	2.216
Probability	0.249	0.000	0.077	0.370	0.182	0.330

Source: *Data Analysis, 2026*

Note: SCP = Supply Chain Performance, TWI = Average Tariff Rate Changes (Trade War Intensity), AGR_OUT = Agricultural Output (log), TO = Trade Openness and LI = Logistics Index

Table 4.2, provided preliminary insights into the distributional properties and variability of the key variables across the five West African economies over the 31-year period. The mean Supply Chain Performance (SCP) score of 2.846, with a standard deviation of 0.734, suggests moderate variability across countries and time. The proximity between the mean and median indicates a relatively symmetric distribution. The slight negative skewness (−0.221) implies marginal concentration of higher performance values, likely reflecting improvements in trade facilitation reforms in later years. Trade War Intensity (TWI), proxied by average tariff rate changes, exhibits a mean of 4.732 percent and a relatively high standard deviation of 3.041, indicating significant volatility in tariff movements over time.

The maximum value of 12.8 percent corresponds to major global tariff escalation episodes. The positive skewness (1.134) and statistically significant Jarque-Bera statistic (p = 0.000) indicate a non-normal distribution, characterized by occasional extreme tariff shocks. This aligns with the episodic nature of global trade wars. Agricultural output (log-transformed) shows a mean of 3.918 and moderate dispersion (Std. Dev. = 0.881). The near-normal distribution (Jarque-Bera p = 0.077) suggests relative stability in agricultural production trends, though subject to periodic trade-related disturbances. GDP (log) demonstrates limited dispersion (Std. Dev. = 1.214) and a near-symmetric distribution. This reflects gradual economic expansion across the region, albeit at heterogeneous rates. Trade openness averages 58.2 percent of GDP, confirming substantial integration into global trade networks. However, the relatively wide range (0.301 to 0.912) highlights structural differences between coastal and landlocked economies. The Logistics Index (LI) exhibits modest variation (Std. Dev. = 0.412), indicating persistent infrastructure gaps across the sample. The distribution is approximately normal, suggesting incremental rather than abrupt changes in logistics performance. Importantly, only Trade War Intensity fails the normality assumption at the 1 percent level, implying the presence of structural breaks or episodic tariff spikes. This justifies the subsequent use of robust panel estimators and dynamic specifications in the regression analysis.

4.3 Correlation Matrix

Table 4.3: Correlation Matrix Result

	SCP	TWI	AGR_OUT	GDP (log)	TO	LI
SCP	1.000	-0.421	0.533	0.602	0.489	0.654
TWI	-0.421	1.000	-0.551	-0.238	-0.192	-0.317
AGR_OUT	0.533	-0.551	1.000	0.614	0.458	0.472
GDP (log)	0.602	-0.238	0.614	1.000	0.521	0.588
TO	0.489	-0.192	0.458	0.521	1.000	0.446
LI	0.654	-0.317	0.472	0.588	0.446	1.000

Source: *Data Analysis, 2026*

Table 4.3, The correlation matrix provides preliminary evidence regarding the direction and strength of linear associations among the variables prior to multivariate estimation. Supply Chain Performance (SCP) exhibits a moderately strong negative correlation with Trade War Intensity (TWI) (r = −0.421). This inverse association suggests that tariff escalations and global trade tensions are systematically associated with reductions in supply chain efficiency and trade throughput in West Africa. While correlation does not imply causation, the magnitude indicates economically meaningful co-movement consistent with theoretical expectations. Agricultural Output (AGR_OUT) shows an even stronger negative correlation with TWI (r = −0.551), reinforcing the hypothesis that agriculture is disproportionately vulnerable to tariff shocks. This likely reflects dependence on imported intermediate inputs such as fertilizers, agrochemicals, and machinery, as well as exposure to commodity price volatility transmitted through global markets. SCP is positively correlated with Logistics Infrastructure (LI) (r = 0.654), indicating that improvements in transport efficiency, customs clearance, and trade facilitation are strongly associated with enhanced supply chain performance. This represents the strongest positive correlation in the matrix and suggests that infrastructure quality may serve as a mitigating mechanism against external trade disruptions. GDP (log) demonstrates a strong positive correlation with both SCP (r = 0.602) and AGR_OUT (r = 0.614), implying that larger economies within the region tend to exhibit more

resilient supply chains and stronger agricultural productivity. Trade Openness (TO) also shows positive associations with SCP (r = 0.489) and AGR_OUT (r = 0.458), confirming the importance of integration into global markets for sectoral performance. Importantly, correlations among independent variables remain below 0.70, suggesting no severe multicollinearity concerns. The highest inter-regressor correlation occurs between GDP and AGR_OUT (r = 0.614), which is theoretically expected given agriculture's contribution to national income in these economies. However, the magnitude does not approach levels that would undermine regression stability.

4.4 Panel Regression Results

4.4.1 Objective 1: Long-Term Effects of Trade Wars on Supply Chain Performance

The fixed-effects model is selected based on the Hausman test (χ^2 significant at $p < 0.05$), indicating that country-specific unobserved heterogeneity correlates with regressors.

Table 4.4 Fixed-Effects Estimation Results

Dependent Variable: Supply Chain Performance (SCP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Average Tariff Rate Changes (TWI)	-0.284***	0.072	-3.94	0.000
GDP (log)	0.193**	0.081	2.38	0.018
Trade Openness	0.147**	0.065	2.26	0.025
Logistics Index	0.412***	0.094	4.38	0.000
Constant	-1.762			

R^2 (within) = 0.61

F-statistic significant at 1%

(*) $p < 0.01$, () $p < 0.05$

Source: *Data Analysis, 2026*

Table 4.4, The coefficient of −0.284 for Average Tariff Rate Changes indicates that a one-percentage-point increase in tariffs reduces supply chain performance by approximately 0.28 units in the long run, holding other factors constant. The magnitude is economically meaningful, suggesting persistent disruption effects rather than transitory shocks. Logistics infrastructure exerts the strongest positive effect, confirming that transport efficiency mitigates trade war shocks. GDP and trade openness enhance supply chain resilience, implying that economic scale and diversification buffer external tariff shocks. The negative and statistically significant coefficient on trade war intensity confirms that prolonged tariff escalations structurally weaken supply chains in West Africa.

4.4.2 Objective 2: Sectoral Vulnerabilities – Focus on Agriculture

To evaluate sectoral heterogeneity, interaction terms between TWI and Agriculture (Dummy were introduced)

Table 4.5 Sectoral Fixed-Effects Model

Dependent Variable: Sectoral Output Growth (Agriculture)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TWI	-0.176**	0.071	-2.48	0.014
TWI × Agriculture	-0.231***	0.067	-3.45	0.001
GDP	0.214**	0.082	2.61	0.010
Logistics Index	0.337***	0.089	3.79	0.000

R^2 (within) = 0.58

Source: *Data Analysis, 2026*

Table 4.5, The base effect of TWI (−0.176) suggests that trade wars negatively affect overall sectoral output. However, the interaction term (−0.231) indicates that agriculture suffers an additional contraction relative to other sectors. The total marginal effect of tariff increases on agriculture is: −0.176 + (−0.231) = −0.407 This implies that agricultural output declines by approximately 0.41 units for each percentage-point increase in tariffs, demonstrating substantial vulnerability. Landlocked countries (Mali and Niger) show the largest negative coefficients in country-specific subsample regressions, reflecting higher transport dependency and import reliance on agricultural inputs.

4.5 Long-Run Dynamic Effects (GMM Estimation)

To address endogeneity and persistence, a dynamic panel GMM model incorporating lagged SCP was estimated.

Table 4.6 Long-Run Dynamic Effects (GMM Estimation)

Variable	Coefficient	Prob.
Lagged SCP	0.63***	0.000
TWI	-0.219***	0.003
Logistics Index	0.298**	0.021

Source: *Data Analysis, 2026*

Table 4.6, show the significant lagged dependent variable confirms strong persistence in supply chain performance. Trade war effects remain negative and significant even after controlling for dynamic adjustment, indicating structural long-term consequences rather than short-term volatility. The Hansen test confirms instrument validity ($p > 0.10$), and AR(2) test indicates no second-order serial correlation.

4.6 Discussion of Findings

The empirical results provide robust evidence that trade wars exert statistically and economically significant long-term negative effects on supply chain performance in West Africa. The magnitude of the impact is amplified in the agricultural sector, underscoring structural vulnerability linked to import dependence on intermediate goods and global commodity price transmission. The findings further reveal heterogeneity across countries, with coastal and diversified economies (Ghana, Senegal) displaying relatively stronger resilience compared to landlocked and commodity-dependent economies (Mali, Niger). Logistics infrastructure consistently mitigates adverse tariff effects, highlighting the centrality of transport connectivity and customs efficiency in buffering global trade tensions.

5.1 Conclusion

This study examined the long-term effects of trade wars on supply chain performance in West Africa, with particular emphasis on sectoral vulnerabilities in agriculture across Nigeria, Ghana, Senegal, Mali, and Niger over the period 1994–2025. Using panel econometric techniques, including descriptive statistics, correlation analysis, unit root diagnostics, and fixed-effects and dynamic estimations, the findings reveal robust and consistent evidence that trade war intensity proxied by average tariff rate changes exerts a statistically significant and economically meaningful negative impact on supply chain performance in the region. The empirical results indicate that tariff escalations disrupt trade flows, increase input costs, and weaken logistics efficiency, thereby reducing overall supply chain performance.

The dynamic panel estimates further confirm that these effects are not merely short-term fluctuations but have persistent structural implications. Supply chain performance exhibits strong inertia, meaning that shocks induced by trade wars tend to have prolonged consequences. Sectoral analysis demonstrates that agriculture is disproportionately vulnerable to trade war shocks. The interaction effects reveal that agricultural output contracts more sharply relative to other sectors when tariff intensity increases. This heightened vulnerability reflects structural characteristics common to West African economies: reliance on imported intermediate inputs (fertilizers, machinery, agrochemicals), exposure to global commodity price volatility, and limited value addition within domestic production chains. Landlocked economies such as Mali and Niger appear particularly exposed due to transport dependency and transit costs.

Conversely, the analysis shows that logistics infrastructure quality, trade openness, and economic scale significantly mitigate the adverse effects of global trade tensions. Countries with relatively stronger port infrastructure, diversified trade structures, and higher logistics performance exhibit greater resilience to tariff shocks. These findings underscore the critical role of structural capacity and regional integration in buffering external trade disturbances. Overall, the evidence confirms that trade wars constitute a structural external shock to West African supply chains, with differentiated sectoral and country-level impacts. The results highlight the need for strategic

policy responses aimed at strengthening resilience, diversification, and intra-regional integration.

5.2 Policy Recommendations

West African economies should deepen intra-regional trade under the framework of the Economic Community of West African States and leverage the African Continental Free Trade Area to reduce excessive dependence on extra-regional supply chains. Expanding regional value chains in agriculture and agro-processing would mitigate exposure to global tariff disputes and reduce vulnerability to external trade shocks. Given the pronounced vulnerability of the agricultural sector, governments should promote domestic production of key agricultural inputs, including fertilizers and processing equipment. Incentivizing agro-industrial clusters and investing in value addition would reduce reliance on imported intermediate goods and stabilize sectoral output during global trade disruptions. The strong positive effect of logistics performance on supply chain resilience suggests that investments in transport corridors, port modernization, customs digitalization, and cross-border trade facilitation are essential. Expanding trade partnerships beyond dominant global blocs can minimize exposure to bilateral tariff conflicts. Strategic trade diplomacy and participation in multilateral negotiations through the World Trade Organization can also provide institutional safeguards against discriminatory trade measures. Governments should create contingency mechanisms, such as tariff adjustment funds or supply chain stabilization programs, to support affected industries during periods of global trade tension.

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