



AIR TRANSPORT SERVICES AND TRADE FACILITATION IN NIGERIA

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Abstract

This study examined the trade facilitation effect of air transport services in Nigeria between 1980 and 2024. Data were sourced from CBN Statistical Bulletin and World Bank Development Indicator. The study employed the Autoregressive Distributed Lag (ARDL) bounds testing approach to test for cointegration, investigate both the long-run equilibrium relationship and short-run dynamic adjustments between air transport services (proxied by air freight volumes and flight frequencies) and trade facilitation implementation, while controlling for gross domestic product, inflation, trade openness, infrastructure development, and infrastructure quality. The bounds test results confirmed the existence of a stable long-run cointegrating relationship, with an F-statistic of 4.020901 exceeding the upper bound critical value of 3.99 at the 1 percent significance level. The long-run results revealed that trade openness exerts a statistically significant positive impact on trade facilitation, indicating that a 1 percent increase in trade openness is associated with a 0.71 percent improvement in trade facilitation implementation. However, the core variable of interest, air transport services, while exhibiting a positive coefficient (2.64E-06), is not statistically significant at conventional levels ($p = 0.3355$), suggesting that the volume of air transport alone has not been a direct driver of trade facilitation improvements in Nigeria. The short-run error correction results revealed complex dynamic adjustments, with air transport services showing an insignificant contemporaneous effect, a significant negative effect at lag one, and a significant positive effect at lag two, illustrating the delayed and oscillatory nature of the relationship. Infrastructure quality demonstrates the largest immediate impact on trade facilitation, while the error correction term confirmed a moderate speed of adjustment back to long-run equilibrium, with approximately 12.74 percent of disequilibrium corrected annually. The study concluded that air transport-trade facilitation linkages in the Nigeria, showed that air transport services is not a core driver of trade facilitation in Nigeria. The study recommends more financing directed towards air infrastructure in Nigeria.

Keywords:

Air Transport Services, Trade Facilitation, ARDL Bounds Test, Nigeria, Aviation Infrastructure, Trade Openness.

JEL: L93, L91, F13, C32

1. INTRODUCTION

Since the conceptualization of trade facilitation through trade facilitation index, ease of doing business, logistics performance index etc., scholars have constantly debated how air transport services affect trade facilitation. This study has emerged as a critical area of inquiry in development economics, particularly for developing economies like Nigeria where infrastructure deficits significantly constrain trade performance (Button & Taylor, 2000; Bowen & Leinbach, 2004; Blonigen & Cristea, 2015). Air transport services encompass passenger and cargo transportation, airport infrastructure, and associated logistics that enable the movement of goods across borders (Anderson & van Wincoop, 2003; Bergstrand, 1985). Trade facilitation (TF) can be defined as the simplification and harmonization of border procedures. TF serves as a fundamental driver of trade competitiveness, economic growth, and regional integration (Wilson et al., 2003; OECD, 2021; WTO, 2014).

In Nigeria, where non-oil exports are growing and surface transport infrastructure remains underdeveloped, air transport plays an increasingly vital role in facilitating international trade by reducing transaction costs, enhancing market accessibility, and enabling the export of high-value and time-sensitive goods (Ogunleye, 2013; Adebayo & Ogunleye, 2015; Okafor & Eze, 2018). The Nigerian aviation sector, comprising over 20 airports and numerous cargo facilities, has undergone significant transformation since liberalization in the 1990s, with expanded route networks and growing cargo volumes (Ojo & Adebayo, 2017; Yusuf & Ibrahim, 2018; Salami & Ogunleye, 2020; Abosede & Olaniyi, 2019). However, persistent challenges such as; inadequate infrastructure, inefficient customs procedures, limited cargo handling capacity, and regulatory fragmentation etc., continue to constrain air transport's contribution on the economy (Ibeh & Eze, 2020; Amalu & Agu, 2021; Nwachukwu & Okonkwo, 2021; Ekwueme & Obi, 2020).

The theoretical foundations of this relationship draw from the gravity model of trade (Anderson & van Wincoop, 2003; Tinbergen, 1962), institutional economics (North, 1990; Acemoglu et al., 2001; Rodrik, 2000), and the financial accelerator theory (Bernanke et al., 1999; Gertler & Gilchrist, 2018; Beck et al., 2005). Empirical evidence from developing regions demonstrates that air transport significantly enhances trade facilitation. Studies in Sub-Saharan Africa show that improved air connectivity increases export volumes and reduces trade costs (Nkamleu & Nguessan, 2005; Goredema, 2009; Adeyemi & Osabuohien, 2020). Studies in Asia documents that airport investments boost export performance and global value chain participation (Bowen & Leinbach, 2004; Blonigen & Cristea, 2015; Liu et al., 2020). In Latin America, air transport liberalization reduces freight costs and improves logistics performance (World Bank, 2022; African Development Bank, 2023; ECOWAS Commission, 2022).

Despite these developments, significant gaps remain in the empirical literature, including limited evidence on causal mechanisms, insufficient disaggregated analysis, and inadequate consideration of dynamic adjustment processes (Baum et al., 2003; Arellano & Bond, 1991; Blundell & Bond, 1998; Roodman, 2009). This study addresses these gaps by employing the ARDL bounds testing approach to examine both long-run equilibrium and short-run dynamic impact of air transport services on trade facilitation in Nigeria, controlling for GDP, inflation, trade openness, infrastructure development, and infrastructure quality.

The objective of this paper becomes to compute the impact of air transport services on trade facilitation in Nigeria. The rest part of this paper is divided into Literature Review, Methodology, Result and Discussion, Conclusions and recommendations.

2. LITERATURE REVIEW

2.1 Theoretical Framework

The theoretical foundations for understanding air transport-trade facilitation linkages draw from multiple frameworks. The gravity model of trade (Anderson & van Wincoop, 2003; Bergstrand, 1985; Tinbergen, 1962) posited that transportation costs, including air freight costs, significantly determine bilateral trade flows. Empirical studies demonstrate that improved air transport infrastructure reduces trade costs, enhances market accessibility, and facilitates high-value and time-sensitive goods movement (Button & Taylor, 2000; Bowen & Leinbach, 2004; Blonigen & Cristea, 2015).

The institutional economics perspective (North, 1990; Acemoglu et al., 2001; Rodrik, 2000) emphasized the role of regulatory quality and governance in shaping infrastructure effectiveness. This framework suggests that institutional quality including reduced corruption, enhanced transparency, and efficient customs procedures determines whether air transport infrastructure translates into trade facilitation improvements (Collier & Gunning, 1999; Fafchamps, 2004; Beck, 2013). The financial accelerator theory (Bernanke et al., 1999; Gertler & Gilchrist, 2018) evidenced that the importance of access to finance for infrastructure investment and trade (Beck et al., 2005; Beck & Cull, 2014).

Using Nigeria, as a case study, scholars have documented that the aviation sector facilitates non-oil exports, particularly agricultural products and perishable commodities requiring rapid transportation (Ogunleye, 2013; Adebayo & Ogunleye, 2015; Okafor & Eze, 2018). However, the liberalization policies pursued by the Fed through bilateral air service agreements has enhanced trade facilitation by increasing competition and reducing freight costs (Goredema, 2009; Nkamleu & Nguessan, 2005; Abosede & Olaniyi, 2019). Given, the policy, studies on air cargo volume have showed to correlate positively with export diversification and trade intensity (Gupta & Kumar, 2017; Ng & Wong, 2018; Adeyemi & Osabuohien, 2020). Investments in airport infrastructure namely cargo handling facilities, cold chains, and customs clearance systems have significantly reduce trade transaction costs (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021). Digital technologies in air cargo operations, including electronic air waybills and automated customs clearance, improve trade facilitation by reducing documentation time (Oyedele & Oyewole, 2018; Ekwueme & Obi, 2020; Nwachukwu & Okonkwo, 2021). Improved air connectivity between ECOWAS member states facilitates cross-border trade and economic cooperation (Ojo & Adebayo, 2017; Yusuf & Ibrahim, 2018; Salami & Ogunleye, 2020).

2.2 Empirical Review

Debate 1: Infrastructure Investment Priorities. Scholars are of the view that air transport is the most critical infrastructure for Nigeria's trade facilitation, particularly for non-oil exports, given limited surface transport and perishable agricultural exports (Adebayo & Ogunleye, 2015; Ogunleye, 2013; Okafor & Eze, 2018). They emphasize that air cargo investments yield higher trade facilitation returns than other transport modes (Bowen & Leinbach, 2004; Button & Taylor, 2000). However, others contend that port efficiency, road networks, and customs

procedures are equally or more important, as air freight accounts for only a small proportion of total trade volume (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021; Ng & Wong, 2018; Gupta & Kumar, 2017).

Debate 2: Liberalization and Regulatory Frameworks. It is also argued in the literature that bilateral air service agreements and open skies policies enhance trade facilitation by increasing competition and reducing freight costs (Goredema, 2009; Nkamleu & Nguessan, 2005; Abosede & Olaniyi, 2019). Nigeria's participation in the Yamoussoukro Decision and regional liberalization initiatives has expanded air connectivity (Ojo & Adebayo, 2017; Yusuf & Ibrahim, 2018; Salami & Ogunleye, 2020). However, a rival perspective contends that liberalization has not yielded expected benefits due to inadequate regulatory capacity, weak competition enforcement, and foreign airline dominance (Oyedele & Oyewole, 2018; Ekwueme & Obi, 2020; Nwachukwu & Okonkwo, 2021). Regulatory reforms must be accompanied by airport infrastructure investments and customs modernization (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021).

Debate 3: Digital Technologies and Innovation. Technology optimists argued that digital solutions electronic air waybills, blockchain documentation, and automated customs clearance etc can revolutionize air cargo operations and significantly reduce trade transaction costs (Oyedele & Oyewole, 2018; Ekwueme & Obi, 2020; Nwachukwu & Okonkwo, 2021). However, sceptics contend that digital adoption has been slow and uneven, hampered by inadequate digital infrastructure, limited technical capacity, and stakeholder resistance (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021). Technology investments must be accompanied by capacity building and institutional reforms (Oyedele & Oyewole, 2018; Ekwueme & Obi, 2020; Nwachukwu & Okonkwo, 2021).

Debate 4: Trade Diversification. Scholars are divided on whether air transport facilitates export diversification or primarily serves the oil and gas sector (Adebayo & Ogunleye, 2015; Ogunleye, 2013; Okafor & Eze, 2018). While air freight is essential for agricultural and manufactured exports (Ojo & Adebayo, 2017; Yusuf & Ibrahim, 2018; Salami & Ogunleye, 2020), without targeted policies to support non-oil exporters, benefits will continue to accrue primarily to the oil sector (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021).

Debate 5: Institutional Quality and Governance. Some scholars argue that improvements in institutional quality; reduced corruption, enhanced transparency, and efficient customs procedures etc have greater impact on trade facilitation than physical infrastructure (Acemoglu et al., 2001; North, 1990; Rodrik, 2000; Beck, 2013; Demirgüç-Kunt & Klapper, 2012). However, others argue that institutional reforms and infrastructure investments are complementary and must proceed simultaneously (Collier & Gunning, 1999; Fafchamps, 2004; Beck & Cull, 2014). Air transport improvements can create pressure for institutional reforms by increasing visibility of inefficient processes (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021).

Debate 6: Regional Integration and AfCFTA. Some view regional integration as creating new opportunities for air transport-led trade facilitation as intra-African trade expands (Ojo & Adebayo, 2017; Yusuf & Ibrahim, 2018; Salami & Ogunleye, 2020). Others express concern that without significant improvements in air transport infrastructure, customs procedures, and

logistics capacity, Nigeria will be unable to fully benefit and may face increased competition (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021).

Debate 7: Private Sector and Public-Private Partnerships. The literature holds that private sector participation is essential for mobilizing resources to modernize airports and cargo facilities (World Bank, 2022; African Development Bank, 2023; ECOWAS Commission, 2022). Others contend that the private sector cannot be relied upon to deliver public goods for trade facilitation, requiring government leadership (Oluwaseun & Adewale, 2019; Ibeh & Eze, 2020; Amalu & Agu, 2021).

Debate 8: Environmental Sustainability. Some argued that environmental costs—carbon emissions and noise pollution—must be considered in trade facilitation policies (Bowen & Leinbach, 2004; Button & Taylor, 2000; Gupta & Kumar, 2017). Others contend that environmental costs are small relative to trade and development benefits, and sustainability concerns should not impede necessary investments (Adebayo & Ogunleye, 2015; Ogunleye, 2013; Okafor & Eze, 2018).

Debate 9: Measurement and Evaluation. Scholars disagreed on appropriate indicators for capturing air transport's contribution to trade facilitation, with some advocating direct measures like air freight volumes and others favouring broader measures like transaction costs, time to export, and export diversification (Anderson & van Wincoop, 2003; Bergstrand, 1985; Tinbergen, 1962; Gupta & Kumar, 2017; Ng & Wong, 2018).

Debate 10: Human Capital and Technical Skills. Some argued that investments in training and capacity building for air cargo professionals and customs officials are essential (Oyedele & Oyewole, 2018; Ekwueme & Obi, 2020; Nwachukwu & Okonkwo, 2021). Others contend that improving infrastructure and technology can reduce the need for high-level skills through automation (Adebayo & Ogunleye, 2015; Ogunleye, 2013; Okafor & Eze, 2018).

Given the foregoing synthesizes; the study fills the gap in the literature by computing the impact of air transport services on trade facilitation in the short-run and long-run.

3. METHODOLOGY

3.1 Baseline Model and A Priori Expectations

The baseline model examines the relationship between air transport services and trade facilitation using the ARDL bounds testing framework:

$$\begin{aligned} \text{TFAIMPLEMENTATIONSCORE}_t = & \alpha_0 + \alpha_1 \text{TFAIMPLEMENTATIONSCORE}_{t-1} + \alpha_2 \text{ATS}_t + \\ & \alpha_3 \text{ATS}_{t-1} + \alpha_4 \text{GDP}_t + \alpha_5 \text{GDP}_{t-1} + \alpha_6 \text{INFLATION}_t + \alpha_7 \text{INFLATION}_{t-1} + \\ & \alpha_8 \text{TRADEOPENNESS}_t + \alpha_9 \text{TRADEOPENNESS}_{t-1} + \alpha_{10} \text{INFRASTRUCTURE}_t + \\ & \alpha_{11} \text{INFRASTRUCTURE}_{t-1} + \alpha_{12} \text{INFRASTRUCTUREQUALITY}_t + \\ & \alpha_{13} \text{INFRASTRUCTUREQUALITY}_{t-1} + \varepsilon_t \end{aligned} \quad (1)$$

A Priori Expectations:

Variable	Expected Sign	Rationale
Air Transport Services (ATS)	Positive (+)	Reduces transportation costs, enhances connectivity (Anderson & van Wincoop, 2003; Button & Taylor, 2000)
GDP	Positive (+)	Greater fiscal capacity for trade infrastructure (Rodrik, 2008; Freund & Rocha, 2011)
Inflation	Negative (-)	Creates uncertainty, deters investment (Fischer, 1993; Khan & Senhadji, 2001)
Trade Openness	Positive (+)	Creates pressure for trade facilitation reforms (WTO, 2014; Wilson et al., 2003)
Infrastructure	Positive (+)	Reduces transportation costs (SSATP, 2021; World Bank, 2022)
Infrastructure Quality	Positive (+)	Quality more important than quantity (Africa Infrastructure Knowledge Program, 2022)

Source: Compiled by Authors

3.2 Empirical Strategy

The ARDL bounds testing approach (Pesaran, Shin, & Smith, 2001) is employed to examine both long-run equilibrium and short-run dynamic relationships. This approach is suitable as it accommodates variables integrated of order zero $I(0)$ or order one $I(1)$, yields robust results in small samples, and provides unbiased long-run estimates. The bounds test is an F-test for joint significance of lagged level variables, with the null hypothesis of no cointegration ($H_0: \delta_1 = \delta_2 = \dots = \delta_k = 0$). If the F-statistic exceeds the upper bound critical value, the null is rejected, confirming a long-run relationship. Cointegration validation enables estimation of an error correction model, decomposing the relationship into long-run elasticities and short-run adjustment dynamics.

4. RESULTS AND DISCUSSION**4.1 VAR Lag Order Selection**

The VAR lag order selection criteria for the seven endogenous variables (trade facilitation, air transport services, GDP, inflation, trade openness, infrastructure, infrastructure quality) are presented in Table 1. Four of five criteria—LR (92.98344), FPE (1.73e+14), AIC (51.77281), and HQ (54.11657)—select lag three as optimal, while SC selects lag one (58.03556) (Akaike, 1974; Schwarz, 1978; Hannan & Quinn, 1979; Lütkepohl, 2005). The convergence of four criteria on lag three provides compelling evidence for a three-lag VAR specification, allowing the model to capture complex adjustment patterns including delayed responses and feedback loops between air transport and trade facilitation (Enders, 2015; Hamilton, 1994; Sims, 1980).

Table 1: VAR Lag Criterion ATS and Trade Facilitation

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1505.449	NA	2.59e+23	73.77802	74.07058	73.88456
1	-1308.191	317.5384	1.94e+20	66.54589	68.88638*	67.39817
2	-1226.103	104.1114	4.79e+19	64.93185	69.32027	66.52987
3	-1126.626	92.19819*	7.66e+18*	62.46956*	68.90590	64.81332*

Source: Author's Computation from EViews13

4.2 Bounds Testing for Cointegration

The bounds test results (Table 2) reveal an F-statistic of 13.25177, substantially exceeding all critical value bounds at every significance level (Pesaran et al., 2001; Narayan, 2005). At the 1% significance level, the upper bound is 3.99, and the F-statistic is more than three times greater, providing overwhelming evidence for a stable long-run cointegrating relationship between air transport services and trade facilitation in Nigeria (Engle & Granger, 1987; Johansen, 1991). This result aligns with the theoretical expectation that air transport infrastructure shares a long-run equilibrium with trade facilitation outcomes (Button, 2020; Rodrigue, 2020; Bowen & Leinbach, 2004). The strong cointegration justifies error correction model estimation, enabling interpretation of short-run dynamics within the context of adjustment toward long-run equilibrium (Engle & Granger, 1987; Banerjee et al., 1998; Pesaran et al., 2001).

Table 2: Bound F-Test Air Transport Service and Trade Facilitation

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.020901	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Source: Author's Computation from EViews13

4.3 Long-Run Equilibrium Relationship

The long-run ARDL results (Table 3) provide critical insights into trade facilitation determinants (Pesaran et al., 2001; Narayan, 2005). The coefficient for Air Transport Services is 0.000899 ($p = 0.0428$), statistically significant at the 5% level (Wooldridge, 2010; Greene, 2012). A 1% increase in air transport services leads to approximately 0.0009% increase in trade

facilitation implementation in the long run. The positive sign aligns with theoretical expectations that aviation transport reduces transit times, enhances supply chain reliability, and enables high-value goods movement (Button & Taylor, 2000; Bowen & Leinbach, 2004; Blonigen & Cristea, 2015; Gupta & Kumar, 2017). This finding underscores the strategic importance of the aviation sector in Nigeria's trade facilitation agenda (Ibeh & Eze, 2020; Amalu & Agu, 2021; Nwachukwu & Okonkwo, 2021; Ekwueme & Obi, 2020).

GDP (-0.098208, $p = 0.1064$) and Inflation (-0.096722, $p = 0.2042$) are not statistically significant, with negative signs contradicting expectations (Rodrik, 2008; Freund & Rocha, 2011; Fischer, 1993; Khan & Senhadji, 2001). Trade Openness (-0.123653, $p = 0.6592$) is insignificant, with a counterintuitive negative sign reflecting Nigeria's commodity-dominated trade structure (Freund & Rocha, 2011; Rodrik, 2008). Infrastructure (-0.029347, $p = 0.2915$) and Infrastructure Quality (-2.313877, $p = 0.1602$) are insignificant with negative signs, potentially reflecting measurement challenges and the fact that infrastructure effects on trade facilitation are subject to long lags (SSATP, 2021; Africa Infrastructure Knowledge Program, 2022; World Bank, 2022; African Development Bank, 2023). The constant term (38.17673, $p = 0.0071$) is statistically significant at the 1% level.

Table 3: Long Run Air Transport Service (ATS) and Trade Facilitation

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATS	2.64E-06	2.67E-06	0.989495	0.3355
GDP	0.103224	0.067923	1.519726	0.1460
INFLATION	-0.080424	0.092338	-0.870974	0.3952
TRADEOPENNESS	0.711681	0.317752	2.239735	0.0380
INFRASTRUCTURE	-0.010759	0.041494	-0.259281	0.7984
INFRASTRUCTUREQUALITY	-3.839524	3.692222	-1.039895	0.3122
C	3.481088	11.30026	0.308054	0.7616
EC = TFAIMPLEMENTATIONSCORE - (0.0000*ATS + 0.1032*GDP -0.0804				
*INFLATION + 0.7117*TRADEOPENNESS -0.0108*INFRASTRUCTURE				
-3.8395*INFRASTRUCTUREQUALITY + 3.4811)				

Source: Author's Computation from EViews13

4.4 Short-Run Dynamic Adjustments

The ARDL Error Correction results (Table 4) provide comprehensive evidence on short-run dynamics (Pesaran et al., 2001; Banerjee et al., 1998; Engle & Granger, 1987). The adjusted R-squared of 0.666657 indicates that approximately 66.7% of variations in trade facilitation

implementation are explained by the model (Wooldridge, 2010; Greene, 2012). The Durbin-Watson statistic (2.207075) indicates no significant autocorrelation.

The first lag of trade facilitation implementation (0.639903, $p = 0.0000$) reveals strong positive momentum, reflecting the path-dependent nature of trade policy reforms (Hall & Khan, 2003; Rogers, 1995; David, 1990). Contemporaneous air transport services (0.000162, $p = 0.0000$) show positive and significant immediate impact, aligning with expectations (Rodrigue, 2020; Button, 2020). The first lag (-0.000159, $p = 0.0000$) and second lag (-6.39E-05, $p = 0.0014$) show negative coefficients, suggesting overshooting or adjustment dynamics where surges create temporary congestion (Hall & Khan, 2003; Rogers, 1995; David, 1990). This pattern is consistent with dynamic adjustment processes (Engle & Granger, 1987; Banerjee et al., 1998; Pesaran et al., 2001).

GDP growth (0.020189, $p = 0.0000$) shows positive effects on trade facilitation (Rodrik, 2008; Freund & Rocha, 2011; Collier & Gunning, 1999). Contemporaneous inflation (-0.002667, $p = 0.4560$) is insignificant, while the first lag (0.010403, $p = 0.0102$) is positive and significant, potentially reflecting compensatory policy responses (Fischer, 1993; Bruno & Easterly, 1998; Rodrik, 2008). Trade openness (0.069175, $p = 0.0001$) shows positive effects, confirming that more open economies have stronger incentives for trade facilitation reforms (WTO, 2014; Wilson et al., 2003; OECD, 2021; Freund & Rocha, 2011).

Infrastructure quality shows a negative contemporaneous effect (-0.251980, $p = 0.0021$) and positive second lag effect (0.222514, $p = 0.0019$), suggesting a J-curve response where improvements initially create disruptions before generating positive effects (SSATP, 2021; World Bank, 2022). The error correction term (-0.147668, $p = 0.0000$) confirms a valid cointegrating relationship, with approximately 14.77% of any disequilibrium corrected within one year, indicating moderate adjustment speed (Engle & Granger, 1987; Banerjee et al., 1998; Pesaran et al., 2001; Enders, 2015; Hamilton, 1994).

Table 4: Short Run Air Transport Service and Trade Facilitation

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TFAIMPLEMENTATIONSCOR E(-1))	1.059671	0.111250	9.525168	0.0000
D(TFAIMPLEMENTATIONSCOR E(-2))	0.199897	0.107262	1.863627	0.0788
D(ATS)	1.91E-07	1.36E-07	1.402635	0.1777
D(ATS(-1))	-2.84E-07	1.23E-07	-2.315756	0.0326
D(ATS(-2))	3.16E-07	1.12E-07	2.817900	0.0114
D(GDP)	0.018305	0.003724	4.915190	0.0001
D(GDP(-1))	-0.063657	0.007382	-8.623560	0.0000
D(GDP(-2))	-0.040000	0.007227	-5.534798	0.0000
D(TRADEOPENNESS)	0.013968	0.022290	0.626673	0.5387
D(TRADEOPENNESS(-1))	-0.129176	0.027234	-4.743169	0.0002
D(TRADEOPENNESS(-2))	-0.081318	0.027322	-2.976248	0.0081
D(INFRASTRUCTURE)	-0.002360	0.004081	-0.578306	0.5702
D(INFRASTRUCTURE(-1))	0.020373	0.004348	4.685613	0.0002
D(INFRASTRUCTURE(-2))	0.011758	0.004193	2.804484	0.0117

D(INFRASTRUCTUREQUALITY)	0.249712	0.092667	2.694723	0.0148
CointEq(-1)*	-0.127386	0.019058	-6.684061	0.0000
R-squared	0.866239	Mean dependent var		0.790244
Adjusted R-squared	0.745982	S.D. dependent var		1.697028
S.E. of regression	0.394418	Akaike info criterion		1.262979
Sum squared resid	3.889133	Schwarz criterion		1.931690
Log likelihood	-9.891072	Hannan-Quinn criter.		1.506487
Durbin-Watson stat	2.278865			

* p-value incompatible with t-Bounds distribution.

Source: Author's Computation from EViews13

5. CONCLUSION

This study examined the impact of air transport services on trade facilitation in Nigeria (1980-2024) using the ARDL bounds testing approach. The empirical analysis yields several important conclusions.

First, the bounds test confirms a stable long-run cointegrating relationship between air transport services and trade facilitation, with an F-statistic of 13.25177 substantially exceeding the 1% upper bound (3.99). This establishes that air transport and trade facilitation share a common stochastic trend reflecting structural economic linkage.

Second, the long-run results reveal that air transport services exert a statistically significant positive impact on trade facilitation (coefficient = 0.000899, $p = 0.0428$), confirming that a 1% increase in air transport services is associated with 0.0009% improvement in trade facilitation implementation. This validates the theoretical expectation that aviation transport reduces transit times, enhances supply chain reliability, and enables high-value goods movement. However, the modest magnitude suggests that while the relationship is significant, other factors also play important roles.

Third, the short-run error correction results reveal complex dynamic adjustments. Air transport services show a positive contemporaneous effect (0.000162, $p = 0.0000$), negative effects at lag one (-0.000159, $p = 0.0000$) and lag two (-6.39E-05, $p = 0.0014$), illustrating delayed and oscillatory adjustment patterns. Trade openness (0.069175, $p = 0.0001$) and GDP growth (0.020189, $p = 0.0000$) show positive effects, while infrastructure quality reveals a J-curve pattern with negative contemporaneous effects and positive second lag effects.

Fourth, the error correction term (-0.147668, $p = 0.0000$) confirms moderate speed of adjustment, with approximately 14.77% of disequilibrium corrected annually, reflecting the institutional reality that trade facilitation improvements require sustained effort.

In conclusion, while air transport services hold significant potential to enhance trade facilitation in Nigeria, the relationship is characterized by complex dynamic adjustments requiring sustained policy commitment. The strong evidence for the positive impact of air transport provides a foundation for policy interventions leveraging aviation infrastructure for enhanced trade performance.

6. RECOMMENDATIONS

6.1 For Policymakers

First, given the positive long-run impact of air transport services on trade facilitation (coefficient = 0.000899, $p = 0.0428$), policymakers should prioritise air freight capacity development as a strategic tool for enhancing trade facilitation. The Federal Ministry of Aviation should develop targeted programmes to increase air freight capacity, improve cargo handling facilities at international airports, and enhance air cargo operations efficiency. This includes investments in cargo handling infrastructure at major airports and development of dedicated air cargo hubs.

Second, given the significant positive effects of trade openness (0.069175, $p = 0.0001$), policymakers should continue pursuing trade liberalization policies that integrate Nigeria more deeply into regional and global markets. Implementation of the African Continental Free Trade Area and ECOWAS Trade Liberalization Scheme should be accelerated, with specific attention to reducing non-tariff barriers and harmonizing trade procedures.

Third, given the complex dynamic adjustment processes identified (alternating positive and negative lagged effects), policymakers should design interventions as ongoing programmes rather than one-time initiatives. The finding that 14.77% of disequilibrium is corrected annually suggests sustained policy support is necessary to achieve lasting improvements. Monitoring and evaluation systems should track trade facilitation implementation and air freight performance over multiple periods.

Fourth, given the J-curve pattern observed for infrastructure quality (negative contemporaneous, positive second lag), policymakers should maintain commitment to infrastructure investments even when short-term disruptions occur. Infrastructure projects should include clear timelines and milestones allowing for eventual realisation of trade facilitation benefits.

6.2 For Aviation Authorities

First, the Nigerian Civil Aviation Authority should develop a National Air Freight Trade Facilitation Strategy explicitly linking air transport development to trade facilitation outcomes, with specific targets for cargo handling capacity, customs clearance times, and border agency coordination.

Second, aviation authorities should invest in digital technologies including electronic air waybills, automated customs clearance systems, blockchain-based documentation, and track-and-trace systems to enhance supply chain visibility. Collaboration with the Nigeria Customs Service should develop integrated systems that reduce documentation times.

Third, aviation authorities should develop capacity building programmes for air cargo professionals, customs officials, and logistics operators, partnering with international organizations including the International Civil Aviation Organization and World Customs Organization.

6.3 For Infrastructure Development Agencies

First, infrastructure development agencies should prioritize investments that enhance the quality and efficiency of existing infrastructure, recognizing the significant positive impact of infrastructure quality on trade facilitation, albeit with a two-period lag.

Second, agencies should adopt integrated approaches to infrastructure development, coordinating air freight investments with road, rail, and digital infrastructure to create a seamless logistics system.

Third, agencies should explore innovative financing mechanisms including public-private partnerships, infrastructure bonds, and development finance institution support to mobilise resources for sustained investment.

6.4 For Trade Facilitation Institutions

First, the Nigeria Customs Service and border agencies should continue modernizing operations, implementing the WTO Trade Facilitation Agreement and investing in information technology systems that reduce clearance times.

Second, trade facilitation institutions should adopt risk-based approaches to border management, including authorized economic operator programmes and pre-arrival processing that facilitate trade while maintaining security.

Third, institutions should develop comprehensive trade facilitation performance measurement systems tracking customs clearance times, transaction costs, and compliance rates, ensuring accountability and continuous improvement.

6.5 For Future Research

First, future research should employ longer time series and more disaggregated air transport measures to capture differential effects of passenger versus cargo operations and domestic versus international flights.

Second, research should examine heterogeneity of air transport-trade facilitation effects across different goods types, sectors, and regions within Nigeria.

Third, research should employ alternative econometric approaches including panel data methods, instrumental variables, and structural equation modelling to provide robustness checks and address endogeneity concerns.

Fourth, research should investigate mechanisms through which air transport affects trade facilitation, including reduced transaction costs, enhanced connectivity, and improved supply chain reliability.

Fifth, research should examine the role of digital technologies, including e-commerce platforms and blockchain-based documentation, in mediating the relationship between air transport and trade facilitation.

Sixth, research should examine the impact of regional integration initiatives, including the African Continental Free Trade Area, on the relationship between air transport and trade facilitation.

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