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Trade Liberalization and the Performance of the Manufacturing Subsector in Nigeria: A Nonlinear Approach

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ABSTRACT

Trade liberalization is a widely accepted policy for fostering economic growth, particularly in developing countries. Advocates argue that open economies, through increased competition, specialization, and access to global markets, outperform closed economies. However, the short-term effects on developing economies like Nigeria remain debated, especially within the manufacturing sector. Nigeria's trade policy has fluctuated between protectionism and openness, significantly influencing its manufacturing performance. Critics, drawing from dependency theory, argue that liberalization exposes weaker economies to exploitation by stronger nations, leading to trade imbalances and inhibiting industrial growth. This study investigates the nonlinear effects of trade liberalization on Nigeria's manufacturing sector, addressing a gap in the literature by employing a quadratic approach to determine threshold effects. By incorporating a quadratic form of the trade variable, the study tests the hypothesis that trade liberalization initially boosts the manufacturing sector but results in diminishing returns as openness intensifies. The research is framed within the Laffer Curve of Trade, suggesting that beyond a certain threshold, excessive openness may harm the manufacturing sector. The AutoRegressive Distributed Lag (ARDL) model is used to assess both short-run and long-run effects, with findings indicating a convex relationship between trade liberalization and manufacturing output, highlighting the critical importance of identifying optimal policy thresholds to maximize industrial growth.

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Introduction

Trade liberalization has been widely embraced as a key policy instrument in the quest for economic growth, especially in developing countries. Many economists argue that open economies tend to outperform closed ones in the long run, attributing this success to the increased competition, resource allocation efficiency, and access to global markets that openness affords (Olaniyi 2015; Briggs 2017). In theory, liberalization fosters growth by allowing countries to specialize, thus benefiting from comparative advantages and economies of scale. However, despite these perceived long-term benefits, the short-term consequences of trade liberalization, particularly for developing nations like Nigeria, remain a subject of debate.

The Nigerian manufacturing sector, a critical component of the country's economic development, has been at the heart of this debate. Trade liberalization in Nigeria has alternated between phases of protectionism and openness, leaving the performance of the manufacturing sector under scrutiny. Critics, especially those aligned with dependency theory, (Prebisch 1970), argue that liberalization exposes weaker economies to the exploitation of stronger, developed nations, further entrenching dependency and exacerbating trade imbalances. These scholars recommend inward-looking policies to protect local industries, particularly manufacturing, from the volatility of international markets and the potential negative impacts of fluctuating terms of trade.

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This raises a fundamental question regarding the extent to which trade liberalization benefits Nigeria's manufacturing sector. While existing literature, by Ugagu, (2016) and Yusuf (2015), has documented the overall economic impacts of trade liberalization in Nigeria, there is a distinct gap in understanding its nonlinear effects on specific sectors, particularly manufacturing. This study aims to address that gap by employing a nonlinear methodological approach to investigate the threshold effects of trade liberalization on the manufacturing sector.

The adoption of a nonlinear approach, particularly one that includes a quadratic form of the trade variable, is vital for identifying the threshold at which trade liberalization impacts the manufacturing sector. The inclusion of this quadratic term is not arbitrary; its significance would suggest that the relationship between trade liberalization and manufacturing output is not linear but follows a pattern of diminishing returns. The negative quadratic term would indicate that, while initial liberalization policies might boost the sector's performance, the effects taper off as liberalization intensifies. This suggests a concave relationship, whereby the benefits of openness decrease beyond a certain point. Such threshold dynamics are pivotal in shaping policy recommendations, as they provide a more nuanced understanding of the nonlinear effects of liberalization policies.

This study is framed within the context of the Laffer Curve of Trade, which postulates that while trade openness can spur economic growth, the benefits diminish beyond a specific threshold, and excessive openness may even harm economic performance. Scholars such as Denwi et al. (2022) and Zahonogo (2017) have employed this framework to explore the nonlinear effects of trade liberalization in multi-country analyses, refining the understanding of threshold points where trade policies shift from being beneficial to detrimental. Our research builds upon these studies by focusing exclusively on Nigeria, adopting a single-country analysis to pinpoint the specific threshold for the manufacturing sector.

The proposed model incorporates a quadratic form of the trade variable in the methodological framework of the AutoRegressive Distributed Lag (ARDL) to identify the threshold at which the manufacturing sector in Nigeria responds to liberalization policies. The inclusion of the quadratic term is pivotal, with anticipated negativity and statistical significance. Such anticipation holds significant implications, suggesting the presence of a convex relationship and indicating a nonlinear or threshold effect in the model. Specifically, the negative quadratic term implies diminishing returns or decreasing marginal effects of trade liberalization on the output of the manufacturing sub-sector. As trade liberalization intensifies, the impact on the sector's performance initially accelerates but at a diminishing rate. The significance of the quadratic term is crucial, signifying that its curvature is not random but holds meaningful explanatory power in the model. This underscores that the observed relationship is not purely linear. Moreover, the significance of the quadratic term suggests the potential existence of a threshold effect, indicating a critical point beyond which the relationship between variables undergoes a discernible change in direction or strength. This study thus aims to contribute to the literature by not only examining the effects of trade liberalization on the manufacturing sub-sector in Nigeria but also investigating the threshold at which this sector responds to trade policies.

Literature Review

The empirical literature on the effects of trade liberalization on economic growth and the manufacturing sector presents a diverse array of findings. In Nigeria, research shows varied results regarding the impact of trade liberalization. Duru et al. (2020) applied the ARDL Bounds technique and found no support for economic growth resulting from trade liberalization, suggesting the need for balanced strategies, export diversification, price stability, and investment incentives. Similarly, Onakoya, & Effeni (2020) used Johansen and Impulse Response tests and found no significant effect on manufacturing output, recommending extended manufacturing incentives, a special foreign exchange window, the discontinuation of non-tariff measures, and enhanced export promotion. Elijah & Musa (2019) also used ARDL and concluded that trade liberalization did not spur growth. Emerenini and Ohadinma (2018), employing ECM, reported that trade liberalization did not significantly improve manufacturing output and had short-run negative effects, recommending encouragement of local production and more openness to foreign trade. In contrast, Nduka (2016) and Lioness (2015), using OLS, found that trade openness had a significant impact on economic growth, with Lioness highlighting a positive relationship and recommending internal dynamic corrections for sustained growth. Lateef et al. (2022) observed insignificant and negative effects trade on economic growth in Nigeria using the Gauss Markov Switching model and recommended a return to import substitution policies. Muhammed, Okafor, & Itodo (2022) found that net exports negatively and significantly impact GDP in Nigeria using OLS regression. Adeyemo and Ogwu (2023) revealed a complex relationship between trade openness and economic growth in Nigeria, with an ARDL framework. Agu, Udoka & Okoroafor (2022) noted a positive but statistically insignificant impact of globalization, including trade liberalization, on manufacturing value added in Nigeria using ARDL and ECM.

Conversely, several studies have highlighted positive impacts of trade liberalization. Mohammed (2023) reported that trade positively influences growth in Nigeria, South Africa, Ghana, and Kenya, using an ARDL framework with data from 1990-2019. Dragusha et al. (2023) found that trade liberalization positively affects economic growth, exports, and imports in Albania using an OLS model with data from 1994-2019. Sunde, Blessing, and Anthony (2023) observed positive effects of exports and trade openness on economic growth in Namibia, using the ARDL cointegration method. In Nigeria, In Pakistan, Muhammad & Ugur (2023) found that increased trade liberalization negatively affects economic growth in the long run when using a nonlinear ARDL model. Ogundipe and Adenekan (2022) found that trade liberalization policies encourage economic growth using ARDL and co-integration tests. Uche and Olayinka (2022) reported improvements in manufacturing value added in ECOWAS countries using fixed and random effects models. Adel (2022) identified a positive relationship between trade openness and economic growth in Côte d'Ivoire using OLS, Johansen cointegration, and Granger causality tests. Neoh & Lai (2021) demonstrated that trade openness significantly boosts manufacturing production growth in Malaysia using a distributed lag model. Atseye et al. (2022) confirmed a positive and significant impact of trade

openness on economic growth in Nigeria using OLS regression. Finally, Oludayo and Samson (2020) highlighted the significant impact of trade liberalization on manufacturing sector productivity in Nigeria using ARDL and Pairwise Granger Causality tests.

Additional country-specific studies provide further context. Dragusha et al. (2023) found positive impacts in Albania using OLS regression and cointegration tests. Similarly, Sunde, Blessing, and Anthony (2023) reported positive effects in Namibia with the ARDL framework. Uche and Olayinka (2022) highlighted positive effects on manufacturing value added in ECOWAS countries using fixed and random effects models. Adel (2022) established positive relationships in Côte d'Ivoire using OLS and cointegration tests. Neoh & Lai (2021) demonstrated that trade openness boosts manufacturing production in Malaysia despite economic crises. Muhammad & Ugur (2023) found negative long-term impacts in Pakistan using a nonlinear ARDL model.

The methodologies across these studies vary. The ARDL framework was frequently used by Mohammed (2023), Adeyemo and Ogwu (2023), Sunde, Blessing, and Anthony (2023), Agu, Udoka & Okoroafor (2022), and Oludayo and Samson (2020) to explore trade liberalization's impact. OLS regression was employed by Dragusha et al. (2023), Muhammed, Okafor, & Itodo (2022), and Adel (2022) to estimate these effects. Cointegration and causality tests were used by Dragusha et al. (2023) and Adel (2022) to analyze long-term relationships and causality. Uche and Olayinka (2022) utilized fixed and random effects models for manufacturing value added analysis. The Gauss Markov Switching model was applied by Lateef et al. (2022) for Nigeria's economic growth, and Neoh & Lai (2021) used a distributed lag model for manufacturing in Malaysia.

The empirical literature on trade liberalization and its effects on economic growth and the manufacturing sector in Nigeria presents a fragmented picture, with studies yielding mixed results. Several works have employed linear models such as the ARDL Bounds test, Johansen cointegration tests, and OLS regression to examine the relationship between trade liberalization and economic growth. A notable observation from the studies by Duru et al. (2020), Adegbemi and Lydia (2020), and Elijah & Musa (2019) is the absence of significant positive effects of trade liberalization on economic growth and manufacturing output in Nigeria. These findings suggest that trade liberalization alone does not automatically spur growth or enhance the manufacturing sector without complementary strategies such as export diversification, investment incentives, and price stability. On the contrary, Nduka (2016) and Lioness (2015) found positive relationships between trade openness and economic growth, recommending policies aimed at internal corrections to sustain growth, while Lateef et al. (2022) called for a return to import substitution policies due to the negative effects observed in their Gauss Markov Switching model.

What remains relatively unexplored, however, is the nonlinear relationship between trade liberalization and manufacturing performance in Nigeria. The existing studies predominantly utilize linear frameworks (e.g., ARDL, OLS, cointegration) and are thus limited in capturing potential threshold effects or asymmetries in how trade liberalization impacts the manufacturing sector. The manufacturing sector may not respond uniformly to trade liberalization policies across all levels of trade openness or economic conditions. For instance, certain thresholds may exist where trade openness begins to positively influence manufacturing output, while beyond or below these thresholds, the effects could be insignificant or even negative. This complexity, which is essential for policy formulation, remains inadequately addressed in the literature. Moreover, previous studies have largely focused on overall economic growth rather than dissecting how trade liberalization specifically affects the manufacturing subsector, which is vital for Nigeria's industrial development.

Additionally, most studies have not accounted for the role of temporal dynamics in the trade-manufacturing relationship, which could reveal how the impact of liberalization evolves over time. The focus has typically been on static relationships, leaving room for research that considers how manufacturing performance reacts in different phases of trade liberalization, considering both short- and long-term effects.

This study addresses this by adopting a nonlinear approach to analyze the impact of trade liberalization on Nigeria's manufacturing sector. A threshold analysis will be employed to capture the nonlinearities and identify specific levels of trade openness that optimize manufacturing output. By focusing on the manufacturing subsector and considering the unique economic context of Nigeria, this research will offer fresh insights into how trade liberalization can be managed to support industrial growth. This approach contrasts with the linear models prevalent in the existing literature, allowing for a more nuanced understanding of the trade-manufacturing relationship.

Thus, the gap this study addresses is twofold: (1) the under-exploration of nonlinear relationships and threshold effects of trade liberalization on the manufacturing subsector and (2) the insufficient focus on temporal dynamics and sector-specific impacts of trade liberalization in Nigeria's manufacturing industry. By adopting a nonlinear methodology, this study will contribute to more targeted policy recommendations that are aligned with Nigeria's industrialization goals.

Methodology

Model specification

The framework of this study is deposited on the Laffer Curve of Trade, an extension of the well-known Laffer Curve in economics. The theory suggests that the fellowship between trade openness and economic growth follows a curve, that increasing trade openness positively influences economic growth up to a certain threshold. Beyond this threshold, however, the benefits of further trade liberalization diminish, and excessive openness may even have negative effects on economic growth. The Laffer (1981) Curve of Trade highlights the importance of the non-linear nature of the relationship between trade policies and economic outcomes. This

framework was further built upon by Denwi, *et al.*, (2022) and Zahonogo (2017) they refine and extend their models in assessing the intricate relationship between trade liberalization and economic growth in a multi-country analysis. While Denwi et al. (2022) explored the broad impact of trade liberalization and various factors on the growth of the real sector in a multi-country analysis and extends beyond mere influence to ascertain the specific threshold at which these effects become either efficient or inefficient in driving the performance of the real sector. Our model follows suit in a single country analysis.

In adapting their methodology, our study employs a singular-country approach, focusing its analysis exclusively on Nigeria. The motivation behind this lies in the conviction that there is a threshold to which trade liberalization is effective on the performance of the manufacturing sub-sector in Nigeria. Our model is founded on the premise that the efficiency or inefficiency of the effect of trade liberalization on the manufacturing sub-sector can be better understood by considering the interplay of the threshold factor.

Furthermore, our model is strategically designed to address the pull factors associated with globalization and trade. By delving into the dynamics of these forces, we aim to provide a more comprehensive understanding of how they interact with and influence the performance of the manufacturing sub-sector in Nigeria. This analysis not only contributes to the ongoing discourse on trade liberalization but also offers insights that are specifically tailored to the unique economic landscape of Nigeria.

The model is casted as follow:

$$Y_t = \alpha_{i,} + X_t'\beta + Z_t'\beta + \mu_t \qquad (1)$$

Where:
Y_t is the annual contribution of the manufacturing sub-sector output to the real sector in Nigeria and is measure in monetary terms.
X_t' is the proxies of trade liberalization, measure as the degree of openness of the Nigerian economy to the rest of the world,
Z_t' is the controlled variables condition on macroeconomic and social behaviours of Nigeria, $\alpha\ and\ \beta$ are model coefficients and μ_t is the unforeseen factors that affected the models or the stochastics error term.
To analyse the enduring and immediate associations between Liberalization and the performance of the Manufacturing sub-sector in Nigeria, this study employed the AutoRegressive Distributional Lag (ARDL) estimator proposed by Pesaran, Shin & Smith (1999). The models utilized the cointegration framework of the ARDL estimation, permitting variations in intercepts, short-run coefficients, and cointegrating terms across time (Pesaran & Smith, 1995). Thus, we have.

$$\Delta Y_t = \varphi EC_t + \sum_{j=0}^{k-1} \Delta X_{t-j'} B_j + \sum_{j=0}^{p-1} \pi_{j^*} \Delta Y_{t-j} + \in_t \qquad (2)$$

$$EC_t = Y_{t-1} - X_{t'}\theta \qquad (3)$$

The adjustment coefficient (φ) and the long-run coefficient (θ) are computed using the Log-Likelihood methods, as outlined by Pesaran et al. (1999) The adjustment coefficient is expected to be negative and significant to confirm the long-run relationship between trade and the output of the manufacturing sub-sector in Nigeria.

Building upon the research conducted by Denwi, et al., (2022) and Zahonogo (2017), we enhance the treatment of endogeneity by incorporating lags of both the factor variables and the objective variable. Consequently, the transformation of equation (1) is as follows:

$$\Delta Y_t = \emptyset_i\left(Y_{t-1} - \sum_{p=1}^{k} \varphi_p Z_{t-1}^p - \delta_1 X'_{t-1} - \delta_2 X'^2_{t-1}\right) - \sum_{p=1}^{k} \alpha_{pi} \Delta Z_{t-1}^p - \gamma_1 \Delta X'_{t-1} - \gamma_2 \Delta X'^2_{t-1} + \varepsilon_t \qquad (4)$$

A crucial adjustment has been implemented in equation (4) of this study to emphasize the exclusion of country-specific effects. Please refer to Zahonogo (2017) for the underlying rationale and justification behind this modification. In equation (4) ε_t is the error term, φ_p, $\delta_1$and δ_2 capture the dynamic of long-run effects, while α_p, γ_1 and γ_2 capture the short-run dynamics. Finally, the quadratic form is introduced to capture the nonlinear relationship or threshold effect between trade Liberalization and the output of the manufacturing sub-sector in Nigeria. The incorporation of the quadratic term is paramount, and it's anticipated to be both negative and statistically significant. This anticipation carries substantial implications as it signals the presence of either a concave or convex relationship, thereby suggesting a nonlinear or threshold effect in the model.

The negativity of the quadratic term specifically implies a concave relationship between the variables. In the context of this model, it signifies diminishing returns or decreasing marginal effects of trade liberalization on the output of the manufacturing sub-sector. As trade liberalization intensifies, the impact on the performance of the manufacturing sub-sector initially accelerates but at a diminishing rate.

Furthermore, the significance of the quadratic term is of utmost importance. Its statistical significance indicates that the curvature it represents is not by chance but holds meaningful explanatory power in the model. This underscores that the observed relationship is not purely linear. Additionally, the significance of the quadratic term suggests the potential existence of a threshold effect. In practical terms, this implies the likelihood of a critical point or threshold beyond which the relationship between the variables undergoes a discernible change in direction or strength.

The trade threshold (ℵ) is calculated as

$$\aleph = e^{-\delta_1/2\delta_2} \qquad (5)$$

Variable in the Model

The paper us six variables based on literature from Denwi et al. (2022), Ikue et al. (2020), Zahonogo (2017), Ulasan (2015), Were (2015), and Jouini (2015). The dependent variable is the manufacturing output, measured annually in monetary terms. Trade liberalization, the independent variable, is represented by trade openness (OPN), including the ratios of exports and imports to GDP (EPN and IPN). Control variables are financial system openness (FSE), interest rate spread (INR), domestic price stability (INF), and exchange rates (EXR). The data, covering 1981-2022, was sourced from the CBN website, Statistical Bulletin 2022, and the World Development Indicators (WDI).

Stylize Facts

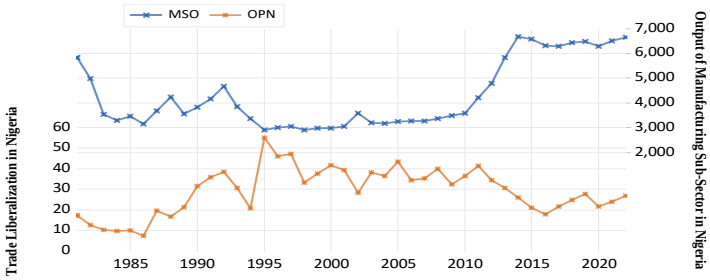

Figure 1: Trend of Trade Liberalization (OPN) and the Output of the Manufacturing Sub-sector in Nigeria, 1981-2022.

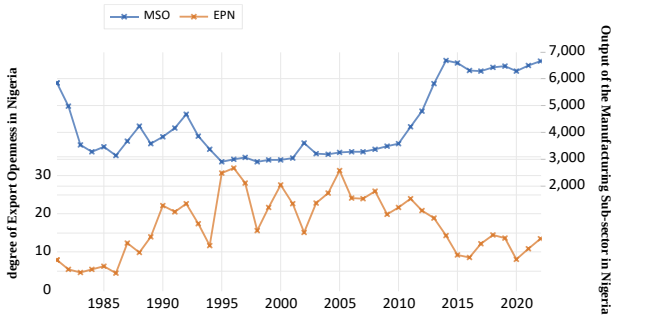

Figure 2: Trend of Export Liberalization (EPN) and the Output of the Manufacturing Sub-sector in Nigeria, 1981-2022.

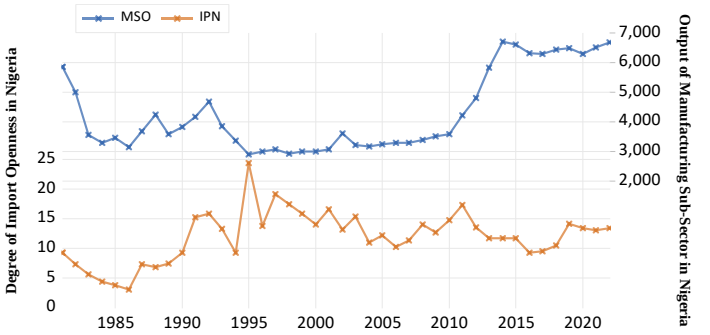

Figure 3: Trend of Import Liberalization (IPN) and the Output of the Manufacturing Sub-sector in Nigeria, 1981-2022

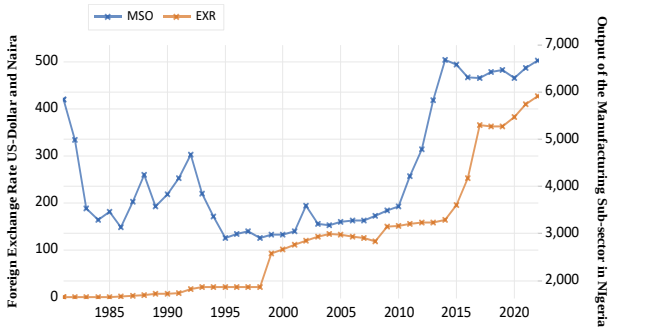

Figure 4: Trend of Exchange Rate and the Output of the Manufacturing Sub-sector in Nigeria, 1981-2022

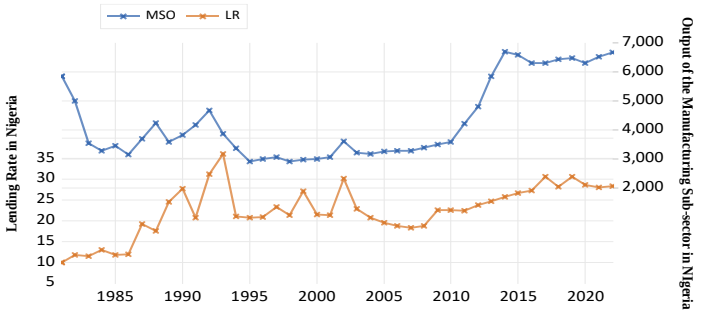

Figure 5: Trend of Lending Interest and the Output of the Manufacturing Sub-sector in Nigeria, 1981-2022

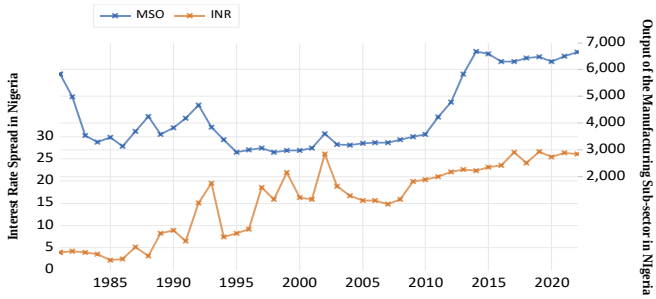

Figure 6: Trend of Interest Rate Spread and the Output of the Manufacturing Sub-sector in Nigeria, 1981-2022

The findings reveal a complex interplay between trade liberalization, monetary policy, and manufacturing output in Nigeria, as illustrated by several key figures. Figure 1 shows that, before the Structural Adjustment Program (SAP), Nigeria's move towards a more closed economy led to a decline in manufacturing output. However, with the advent of SAP and increased trade liberalization, Figure 1 highlights a notable upswing in manufacturing performance, indicating a positive relationship between trade openness and manufacturing output.

Figures 2 and 3 provide a deeper insight into the effects of different dimensions of trade openness. Figure 2 illustrates that increased export openness is positively correlated with higher manufacturing output. Conversely, Figure 3 shows that greater import openness also corresponds with an increase in manufacturing output. These figures suggest that both exporting and importing activities contribute positively to the manufacturing sector, though anomalies in 1990 and 1995, as indicated in Figure 3, point to specific years where policy changes or economic events had distinct impacts. Figure 4 examines the relationship between exchange rate policy and manufacturing output. The figure reveals a lack of correlation during the tightly controlled exchange rate regime before 1999.

However, after the shift to a more flexible exchange rate policy post-1999, Figure 4 shows a positive correlation with manufacturing output, highlighting the significant impact of democratic transitions and exchange rate liberalization on manufacturing performance. Finally, Figure 5 addresses the role of lending rates. Before SAP, an inverse relationship was observed between lending rates and manufacturing output. Post-SAP, this relationship reversed, as depicted in Figure 5, showing that higher lending rates were now associated with increased manufacturing output. Figure 6 further explores the influence of monetary policy by focusing on the interest rate spread, revealing a positive correlation with manufacturing output. This suggests that monetary policy considerations, particularly the interest rate spread, have a lasting impact on the performance of the manufacturing sector. Overall, the figures collectively illustrate how trade and monetary policies have shaped the dynamics of Nigeria's manufacturing output over time.

Table 1: Unit Root Test Statistics

	Part I: ADF Statistics			Part II: PP Statistics			
Variables	Level	1st-diff.	Critical-Val.	Level	1st-diff.	Critical-Val.	Decision
MSO	-1.1527	-4.7494***	2.9350	-1.2991	-4.7439	2.9350	I(1)
OPN	-2.5348	-8.5849***	2.9350	-2.3170	-9.6436***	2.9350	I(1)
EPN	-2.4956	-5.6449***	2.9350	-2.4144	-7.7949***	2.9350	I(1)
IPN	-3.084**	-5.1861***	2.9350	-2.9923**	-10.945***	2.9350	I(0)
INF	-3.0505**	-6.6367***	2.9350	-2.9921**	-10.664***	2.9350	I(0)
EXR	-2.1940	-5.4027***	2.9350	-2.3649	-5.4028***	2.9350	I(1)
INR	-1.6866	-8.5403***	2.9350	-1.3210	-19.926***	2.9350	I(1)
FSE	-1.0371	-5.9116***	2.9350	-0.8892	-4.6267***	2.9350	I(1)

Source: Author Computation. The variables are tested with the 0.05 level of significance. Therefore, *** implies the variable is significant at 1% and ** implies the variable is significant at 5%.

Table 1 presents the results of the unit root tests, with Part I showing the Augmented Dickey-Fuller (ADF) and Part II the Phillips-Perron (PP) test statistics. The PP test validates the ADF results, helping mitigate biases as noted by Neaime (2014) and Ikue et al. (2021). The unit root tests cover eight variables, revealing a mixed order of integration (I(0) and I(1)). The I(0) series includes import openness and inflation rate, indicating their resilience to shocks.

Table 2: Summary of Cointegration Statistics

Model for Trade Openness and Output of the Manufacturing Sub-sector				
Test Statistic	Value	Significant Levels	I(0)	I(1)
F-statistic	7.7547***	10%	1.99	2.94
		5%	2.27	3.28
K	6	2.5%	2.55	3.61
		1%	2.88	3.99
Model for Export Openness and Output of the Manufacturing Sub-sector				
Test Statistic	Value	Significant Levels	I(0)	I(1)
F-statistic	6.0883***	10%	1.99	2.94
		5%	2.27	3.28
K	6	2.5%	2.55	3.61
		1%	2.88	3.99
Model for Import Openness and Output of the Manufacturing Sub-sector				
Test Statistic	Value	Significant Levels	I(0)	I(1)
F-statistic	11.7911***	10%	1.99	2.94
		5%	2.27	3.28
K	6	2.5%	2.55	3.61
		1%	2.88	3.99

Null Hypothesis: No levels relationship: Source: Author Computation

Table 2 shows that the calculated F-statistics for all three models exceeded the upper limit (I(1)) at a 0.05 significance level, indicating a possible cointegrating relationship. This rejection of the null hypothesis suggests a stable long-term relationship among the variables.

Table 3: Summary Statistics of Coefficients of the Estimated Models

Part I: Models	Model_1		Model_2		Model_2	
Variables	Coefficient	t-Value	Coefficient	t-Value	Coefficient	t-Value
OPN	0.0216***	5.4483	0.0619***	4.3521	0.0516	0.6838
OPN^2	-0.0023***	-6.5736	-0.0057***	-5.1492	-0.0057**	-2.5114
LOG(EXR)	-0.2972***	-4.1409	0.2185***	3.3299	-0.5029***	-4.5147
INR	0.0460***	3.2054	-0.0626***	-3.3528	0.1761***	3.5689
INF	0.0072**	2.6001	0.0024	0.7556	0.0301***	3.2214
FSE	0.0592***	5.9089	0.0385***	3.6409	-0.0044	-0.1795
C	6.3760***	22.507	7.2586***	37.046	7.1387***	21.434
ecm_{t-1}	-0.7366***	-10.269	-0.6255***	-9.3054	-0.4068***	-13.735
Part II: Models Diagnostic Statistics						
	Values	P-Values	Values	P-Values	Values	P-Values
R^2	0.9938	-	0.9918	-	0.9978	-
F-Statistic	59.237***	0.0000	38.078***	0.0000	105.21***	0.0000
Durbin-Watson	2.9023	-	2.8844	-	2.4019	-
Normality Test	0.3911	0.8224	0.4979	0-7796	1.5372	0.4636
Autocorrelation Test	3.9761	0.0633	4.5434	0.0943	1.3252	0.1036
Heteroscedasticity Test	1.9079	0.1421	1.1623	0.4301	0.2925	0.9917

Source: Author Computation

Table 4: Results of threshold effects

	Indicators of Trade		
	OPN	EPN	IPN
Output of the Manufacturing Sub-sector (א)	109.47	228.11	92.42

Source: Author Computation. Notes: The א values are in percentage of GDP derive from model_1, Model_2 and Model_3 in Table 3.

Results and Discussions

Table 3 highlights the estimated sign, size, and significance of coefficients across the three models: total trade openness, export openness, and import openness. These models examine the impact of trade liberalization on Nigeria's manufacturing subsector, aiming to identify thresholds for effective policy interventions. Our models adhere to core econometric principles: zero mean, constant variance, and no serial correlation. Part II of Table 4 confirms these standards, with the Jarque-Bera (JB) Normality Test, heteroscedasticity, and autocorrelation tests showing that the residuals are unbiased. Additionally, Part II highlights metrics enhancing credibility: the R-Square coefficient indicates strong explanatory power, the F-Statistics confirm statistical soundness, and the Durbin-Watson Statistics (around 2) show no significant autocorrelation. These metrics collectively demonstrate that our models are both explanatory and statistically robust.

The three models, reveals insightful findings with notable implications for the economy. Firstly, the positive impact on the manufacturing sector's output indicates that as Nigeria engaged in more external trade, particularly through liberalization measures, there is a discernible improvement in the manufacturing subsector. However, the observed relationships being inelastic implies that the responsiveness of the subsector output to changes in external trade is less than proportional. This inelasticity suggests that while trade liberalization positively influences the subsector, the magnitude of this impact is not extremely high. The significance of the findings in Model 1 and Model 2 underscores the importance of export-oriented policies. Opening the economy to exports appears to have a more substantial effect on the development of the subsector.

Furthermore, the insignificance of the elasticity of import openness implies that the subsector's output is not significantly influenced by increased importation. This challenges the notion that a higher volume of imports necessarily translates to a more robust manufacturing sector. In the broader economic context, these findings align with economic theories of liberalization that argue for increased openness leading to enhanced economic output. The positive relationship observed is in line with the expectations of liberalization proponents and with most of the empirical literatures and is indicative that, for Nigeria, trade liberalization, particularly through export-oriented measures, holds promise for the development of the subsector. However, careful consideration of the inelastic nature of the relationship and the varying significance in different models is essential for formulating effective and targeted economic policies.

The inclusion of the quadratic term was pivotal with anticipated negativity and statistical significance. The results from the three models show that the quadratic form of trade included in the models was negative and statistically significant. This implies the presence of curvature relationship or diminishing marginal effects of trade liberalization on the output of the manufacturing subsector. As trade liberalization intensifies, the impact on the subsector's performance initially accelerates but at a diminishing rate. The significance of the quadratic term bears great importance, indicating that the observed curvature is not arbitrary but possesses meaningful explanatory power within our models. This emphasizes that the observed relationship lacks pure linearity, suggesting the

potential existence of a threshold effect. This threshold effect implies a critical point at which the relationship between the output of the manufacturing subsector experiences a noticeable change in direction or strength. This observation aligns with the theoretical argument of the Laffer Curve of Trade (see also, Bojanic, 2012; Falvey, Foster, & Greenaway, 2012; Nasreen & Anwar, 2014; Zahonogo, 2016, and Denwi et al., 2022). According to this perspective, trade openness propels growth of the real sector up to a certain level or threshold, beyond which the impact of trade openness on growth becomes negative. Importantly, this finding remains robust across alternative measures of trade openness, such as exports as a share of nominal GDP and imports as a share of nominal GDP.

Table 4 illustrates threshold values for the three measures of trade openness. For the combined sum of exports and imports as a share of GDP, the estimated threshold is 109.47%. In Nigeria, economic expansion is feasible through trade openness, but caution is advised not to exceed this threshold, as surpassing it could diminish output levels in the real sector, particularly in manufacturing. Regarding the second measure, exports as a share of GDP, the estimated threshold is 228.11%. Beyond this point, the negative impact of export openness on output growth becomes evident. Maintaining export openness below this threshold stimulates growth in the manufacturing subsector. Finally, the estimated threshold coefficient for import openness is 92.42% of GDP. Sustainable output growth through trade is achievable if imports do not surpass this percentage. However, when imports exceed 92.42% of GDP, the trade's effect on output growth becomes negative.

Conclusion

In conclusion, this study has yielded crucial insights into the relationship between trade liberalization and the manufacturing sub-sector in Nigeria, spanning the period from 1981 to 2022. The key findings underscore the nature of this connection, revealing both positive and negative influences that are contingent on specific contextual factors. A pivotal revelation from the analysis is the existence of threshold effects in the relationship between trade openness and manufacturing sector output. The identification of critical threshold values for the sum of exports and imports, exports alone, and imports alone provides policymakers with tangible guidance. Beyond these thresholds, the impact of trade openness on manufacturing sector growth tends to be negative. This finding highlights the importance of adopting a strategic and calibrated approach to trade liberalization to maximize its benefits while avoiding potential pitfalls. To stimulate output growth through international trade, Nigeria should implement competitive policies that enhance its manufacturing base, limiting imports to only comparative cost-disadvantaged commodities.

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