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Trade Openness and Economic Growth in West African Countries: Does Human Capital Matter?

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ABSTRACT

This study investigates the impact of human capital on the relationship between trade openness and economic growth in 13 West African countries from 1990 to 2023. It investigates whether differences in economic outcomes from trade openness arise due to varying levels of human capital. Using the panel threshold model developed by Hansen, the research identifies a critical threshold for human capital at 38.9090%, above which trade openness has a significantly positive impact on economic growth. Below this threshold, however, trade openness fails to produce meaningful economic growth benefits. These findings highlight that the successful transfer and utilisation of knowledge and technology through international trade depend critically on a country's absorptive capacity, driven primarily by the quality of its human capital. Consequently, the study recommends targeted policy reforms to improve human capital, suggesting increased governmental investment in education and training. By doing so, West African countries can effectively capitalise on the benefits of global trade integration, thereby promoting sustainable economic growth.

Keywords: Trade openness, Economic growth, Human capital, Panel threshold model

INTRODUCTION

Trade openness has garnered widespread attention in the literature on scaling up productivity levels and driving economic growth. The relationship between trade openness and economic growth has attracted considerable scholarly attention, given the pivotal role of international trade in driving economic performance (Grossman & Helpman, 1991; Zahonogo, 2016; Omoke & Opuala–Charles, 2021). Trade openness—characterised by the reduction or elimination of trade barriers—is presumed to enhance economic efficiency by reallocating resources to more productive sectors, promoting competition, facilitating technology transfer, and increasing market access (Islam, Alsaif, & Alsaif, 2022; Nguyen & Bui, 2021). Despite these theoretical arguments, empirical results remain inconclusive, reflecting significant variability across different economic contexts and developmental stages (Jalil & Rauf, 2021; Sheikh & Malik, 2021).

One major issue underlying these inconclusive results is the assumption that the relationship between trade openness and economic growth is uniformly linear. Recent studies have suggested that this relationship is nonlinear, contingent upon specific economic thresholds and domestic conditions such as infrastructure, institutional frameworks, and particularly human capital (Nguyen & Bui, 2021; Zahonogo, 2016; Kinfack & Bonga-Bonga, 2023). Zahonogo (2016), for instance, established that excessive openness—beyond 134.21% of GDP—might adversely impact economic growth in sub-Saharan Africa, highlighting the significance of identifying optimal trade thresholds. These insights underscore the importance of examining threshold conditions that can either amplify or mitigate the benefits derived from trade openness.

Human capital, specifically, emerges as a critical factor influencing the effectiveness of trade openness on economic growth. Endogenous growth theory posits that economies with high-quality human capital are better equipped to absorb and utilise technological spillovers resulting from trade integration (Fatima, Chen, Ramzan, & Abbas, 2020; Soukiazis & Antunes, 2012). Conversely, countries with lower levels of human capital may struggle to capitalise on these advantages, potentially rendering openness policies ineffective or counterproductive. For example, empirical

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evidence suggests that nations with higher educational attainment and human capital tend to achieve better economic outcomes from increased trade openness (Gharsallah & Trabelsi, 2024; Nam & Ryu, 2024).

Despite widespread recognition of human capital's theoretical significance, empirical literature has inadequately quantified the specific human capital thresholds essential to realising trade openness benefits, especially within the West African context. West African countries generally exhibit modest GDP per capita levels, averaging USD 1,036.41, with substantial variability (USD 137 to USD 4,287), highlighting significant economic disparities and structural challenges (Author's computation, 2025). Additionally, these nations often face issues of underdeveloped financial systems, low foreign direct investment inflows averaging merely 2.3878% of GDP, and inadequate infrastructure—all factors that compound human capital deficiencies (Author's computation, 2025; Asafo-Agyei & Kodongo, 2022; Denwi, Gbanador, & Nenbee, 2022).

Addressing these research gaps, this study specifically investigates the threshold effects of human capital in the trade openness-economic growth nexus within West African countries, using a panel threshold model approach (Hansen, 1999). By empirically identifying the critical human capital threshold levels that significantly influence economic outcomes through trade openness, the study provides policymakers with actionable insights. These insights underscore the importance of enhancing human capital—such as improving educational access and quality—as a prerequisite for fully capturing the potential growth benefits of trade liberalisation (Fatima et al., 2020; Omoke & Opuala–Charles, 2021; Gharsallah & Trabelsi, 2024).

This research makes a significant contribution to the existing empirical literature by examining the non-linear relationship between trade openness and economic growth, with a focus on the moderating role of human capital within the West African context. Prior studies, such as Zahonogo (2016), Nguyen and Bui (2021), and Kinfack and Bonga-Bonga (2023), established the importance of specific thresholds or conditions that shape the effectiveness of trade openness on economic growth. However, few explicitly focus on the quality of human capital as a critical threshold factor in West African countries. By identifying a precise human capital threshold level (38.9090%), this study offers practical evidence that trade openness enhances economic growth only when a country's human capital surpasses a certain threshold, thereby emphasising the significance of human capital development policies as prerequisites for achieving growth benefits from trade liberalisation in the region (Fatima et al., 2020; Soukiazis & Antunes, 2012; Gharsallah & Trabelsi, 2024).

The remainder of the study is structured as follows: Section 2 provides a brief review of existing theoretical and empirical literature; Section 3 presents the data source and methodology, and the results are presented in Section 4. Section 5 concludes the paper, offering policy recommendations.

LITERATURE REVIEW

The theoretical mechanism through which trade openness fosters economic growth is primarily articulated by the comparative advantage theory, advanced by David Ricardo, and further developed by the Heckscher-Ohlin (H-O) framework. Ricardo's comparative advantage theory, emerging as a refinement of Adam Smith's absolute advantage, emphasises that nations can mutually benefit from international trade if each specialises in producing goods where it incurs the lowest opportunity cost, thereby enhancing productivity and elevating overall economic performance globally. The theory argues explicitly that through trade openness, countries reallocate their scarce resources from inefficient sectors towards more productive ones, which amplifies aggregate output and supports sustainable economic growth. Ricardo (1817) particularly highlights that international trade integration allows for resource optimisation, which, according to Zahonogo (2016), facilitates higher productivity, greater efficiency, and consequently, improved standards of living. Nevertheless, Ricardo's theoretical approach does not sufficiently elaborate on the underlying determinants that provide nations with these comparative advantages.

Addressing this limitation, the Heckscher-Ohlin theory, developed by Eli Heckscher (1919) and Bertil Ohlin (1933), introduces clarity by positing factor endowment differentials—specifically, variations in labour, capital, and other productive resources—as fundamental sources of comparative advantage. Heckscher-Ohlin asserts that countries tend to export commodities whose production heavily utilises their abundant and relatively cheap factors. In contrast, they import goods that rely on scarce and costlier inputs, resulting in increased overall economic efficiency and growth. Jhingan (2012) underscores that these factor-endowment differences shape the relative prices of

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commodities and consequently drive international trade patterns. Further theoretical justification is derived from the Solow (1939) growth model, which posits that economic expansion fundamentally arises from increased inputs of labour and capital, combined with technological progress, albeit exogenously determined. Thus, by fostering the efficient allocation and utilisation of these inputs across international borders, trade openness can potentially stimulate sustained economic growth. Despite these coherent theoretical justifications, the practical relationship between trade openness and economic growth remains contentious, with existing theoretical and empirical studies still yielding mixed and inconclusive outcomes, warranting continued scholarly exploration.

Raghutla (2020) investigated the influence of trade openness on economic growth in five emerging economies between 1993 and 2016. Utilising the Johansen-Fisher method, the study confirmed a long-run equilibrium among trade openness, financial development, labour force participation, inflation, technology, and economic growth. The results, derived from the fully modified ordinary least squares (FMOLS) method, indicate that economic growth responds positively to increased trade openness, enhanced financial sector development, technological advancements, and higher labour force participation. Additionally, the Dumitrescu and Hurlin causality test showed a one-way causality from economic growth to financial development, while a two-way causality was evident between inflation and economic growth. Supporting similar positive outcomes, Silajdzic and Mehic (2018) studied the Central and Eastern European (CEE) transition economies from 1992 to 2014, using a least squares dummy variable estimator. They consistently found that greater openness, measured through total trade, exports, and imports as a share of GDP, significantly contributed to economic growth in these nations.

Nguyen and Bui (2021), however, provided nuanced evidence suggesting that trade openness has a nonlinear effect on economic growth. Using the fixed-effect panel threshold approach for six ASEAN countries from 2004 to 2019, they identified the existence of a trade Laffer Curve, wherein economic growth promotion from trade openness is robust only at openness levels up to 129.873% of GDP, weaker between 129.873% and 147.842%, and negligible beyond 147.842%. This nonlinear relationship indicates diminishing returns from excessive openness. Jalil and Rauf (2021), analysing data for 82 countries over the period 1960–2019, confirmed a predominantly positive impact of trade openness on growth through both system generalised method of moments (GMM) and common correlated effects mean group (CCEMG) estimators, reinforcing that financial development, physical capital, and human capital significantly bolster growth outcomes.

Nam and Ryu (2024), examining the ASEAN region, confirmed the growth-enhancing role of trade openness. Their fixed-effects panel data results revealed that increased trade volumes have a positive impact on economic growth. Intriguingly, they also suggested that higher trade barriers, specifically tariffs, can marginally promote economic growth, though not significantly. Their results further highlighted that financial development, exports, imports, and enhanced phone usage underpin economic growth, while inflation exerts a dampening effect. The interaction terms used in their analysis notably revealed that higher trade barriers amplified the positive relationship between trade volume and economic growth. In contrast, Malefane and Odhiambo (2021), who studied Lesotho using an autoregressive distributed lag (ARDL) approach for the period 1979–2013, found no significant long-run or short-run impact of trade openness on economic growth. Instead, growth was primarily driven by increased financial sector development and government expenditure.

Further complexity was evident in studies by Nam, Bang, and Ryu (2023) and Bunje, Abendin, and Wang (2022). Nam et al. (2023), employing a fixed-effects approach for 10 ASEAN countries between 2001 and 2021, found that although trade openness positively stimulated economic growth, it had a negative impact on human development outcomes, albeit mitigated by good governance practices. Conversely, Bunje et al. (2022) documented mixed regional outcomes in their study of 52 African countries from 2000 to 2018. They observed that while trade openness fostered growth in Northern and Central Africa, it impeded growth in Eastern, Southern, and Western African regions, with fixed-effect estimates generally underscoring a negative overall impact across the continent. Similarly, Rakshit (2022) identified a negative long-term relationship between trade openness and economic growth in India, despite the positive impacts of foreign direct investment (FDI). Kinfack and Bonga-Bonga (2023) further nuanced these findings, demonstrating through a panel smooth regression for 38 African countries (1970– 2019) that trade openness has a significant positive influence on economic growth, particularly when accompanied by high investment ratios, especially in higher-income contexts.

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Despite numerous empirical studies examining the relationship between trade openness and economic growth, significant gaps persist in understanding the conditional mechanisms—particularly those related to human capital—that enable or hinder the effectiveness of openness on growth. Existing research often focuses on linear relationships or uses generalised conditions, neglecting specific thresholds that explicitly link human capital quality to economic performance (Sheikh & Malik, 2021; Ajayi et al., 2024). Additionally, much of the current literature predominantly emphasises developed or rapidly developing Asian economies, with comparatively fewer studies centred on West African countries. Consequently, the unique economic structures, socioeconomic conditions, and specific threshold levels required in West African contexts remain insufficiently addressed, underscoring the need for research tailored explicitly to the human capital dynamics of this region (Denwi, Gbanador, & Nenbee, 2022; Bunje, Abendin, & Wang, 2022).

METHODS

The data used for this essay are economic growth (EG), trade openness (TPN), foreign direct investment (FDI), financial development (FD), inflation (INF), labour force participation (LFP), exchange rate (EXC), human capital (HUC) and population growth (POP) for 13 West African countries, investigated from 1990 – 2023. The 13 West African countries are: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Data availability served as the basis for including these countries in the panel setup, and the literature informed the selection of variables. Economic growth is measured as real gross domestic product per capita to account for population differences among the countries. The trade openness measure used is total trade (exports plus imports) as a percentage of GDP. Foreign direct investment is measured as net FDI inflows as a percentage of GDP. The composite financial development index is used to measure financial development, as it addresses the complexity and multidimensionality of financial sector development. Human capital, which is used as the threshold variable and measured by gross secondary enrolment, describes the quality of human capital in each country.

The historical data on employed variables are collected from the United Nations Conference on Trade and Development (UNCTAD), the World Bank's World Development Indicators (WDI), and the International Monetary Fund (IMF) database. The data for EG, INF, FDI, and POP were extracted from the UNCTAD database, and the data for TPN, LFP, and EXC are from the WDI. Data on the measure of human capital and financial development were obtained from the IMF database.

Model Specification

The study adopted the Hansen (1999) panel regression model. This model was used to examine the impact of trade openness on economic growth across various levels of human capital.

The model setup is given below:

$$eg_{it} = \lambda_0 + \vartheta_i + \gamma_1 tpn_{it} I(huc_{it} \leq \varphi) + \gamma_2 tpn_{it} I(huc_{it} > \varphi) + \alpha Z'_{it} + \varepsilon_{it} \quad (1)$$

Here $I(.)$ represent the indicator function and the value determined by the threshold variable of human capital and the estimated threshold value (φ). If HUC is less than φ, $I(huc_{it} \leq \varphi) = 1$ and $I(huc_{it} \leq \varphi) = 0$ when HUC is greater than φ.

Besides the core variable of trade openness, there is a host of other variables that may potentially affect economic growth, and their absence from the empirical model used to capture the sequence of economic growth may create a spurious relationship. In lieu of this, this study selected certain control variables inspired by empirical studies, namely, inflation (INF), financial development (FD), foreign direct investment (FDI), population (POP), exchange rate (EXC) and labour force participation (LFP). Eqn. (1) is re-constructed to capture these variables, and the model is specified below:

$$eg_{it} = \lambda_0 + \vartheta_i + \gamma_1 tpn_{it} I(huc_{it} \leq \varphi) + \gamma_2 tpn_{it} I(huc_{it} > \varphi) + \gamma_3 inf_{it} + \gamma_4 fd_{it} + \gamma_5 fdi_{it} + \gamma_6 pop_{it} + \gamma_7 exc_{it} + \gamma_8 lfp_{it} + \varepsilon_{it} \quad (2)$$

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This study applied the threshold model proposed by Hansen (1999) to examine the impact of trade openness on economic growth in the 13 West African countries and to investigate whether this effect varies with the quality of human capital.

In estimating Eqn. (2) The first step entails testing for a threshold effect or nonlinearity. This requires testing the hypothesis that:

$H_o: \gamma_1 = \gamma_2$; against the alternative of

$H_1: \gamma_1 \neq \gamma_2$

Cross-sectional dependence (CSD)

The presence of cross-sectional dependency in the panel setup poses a serious problem if not checked before the constructed model is estimated. This phenomenon is triggered by globalisation, common shocks such as the crude oil price and financial crises, and growing integration of countries through economic, financial, and social channels. Presuming that the cross-sections are independent without a formal test, and the appearance of CSD in the panel data could render estimators inconclusive, with estimated coefficients that provide inferential information bias and inconsistency (Yang et al., 2022). Therefore, this study, which tests the appearance of CSD in panel data, adopted the procedure proposed by Pesaran (2004).

Slope Homogeneity (SH)

Another issue in the panel analysis of the nonlinear effect of trade openness on economic growth at different levels of human capital is whether the slope coefficients in the empirical model is homogeneous or not. If the slope coefficients are assumed to be homogeneous without any empirical analysis suggesting such, then the country-specific effects, which connotes heterogeneity, will not be captured. Where the issue of cross-sectional heterogeneity is ignored and not checked, assuming slope homogeneity when the coefficients are heterogeneous will yield misleading outcomes (Breitung, 2005).

The study employed the homogeneity test method proposed by Pesaran and Yamagata (2008) to verify whether the series of interest exhibit homogeneous characteristics. Pesaran and Yamagata (2008) test proposed the delta ($\tilde{\Delta}$) and adjusted delta ($adj.\tilde{\Delta}$) tests and the test statistics are obtained from estimating the equations below:

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}}\right) \quad (3)$$

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{iT})}{\sqrt{var(\tilde{z}_{iT})}}\right) \quad (4)$$

Panel Unit Root Test

Before estimating the panel threshold model to decipher how trade openness affects economic growth under different qualities of human capital, there is a need to first perform a unit root test. Determining the stability of the variables is necessary to avoid erroneously concluding on the relationship between the sets of regressors and economic growth, as hypothesis statistics such as t-ratios and R^2 are inflated when nonstationary series are included in a model and not accounted for appropriately. Since panel data tend to be nonstationary, checking for stationarity is necessary to obtain pristine results. Since the panel contains properties of cross-sectional dependency, stationarity of the data was checked using the methods proposed by Levin, Lin and Chu (LLC) (2002) and Im, Pesaran and Shin (IPS) (2003).

In determining if the variable is steady using the LLC (2002), the specification below is estimated to retrieve the LLC statistics:

$$\Delta X_{it} = \delta_i X_{it-1} + \sum_{r=1}^{r} \vartheta_{ir}\, \Delta X_{i,t-r} + d'\theta_i + \mu_{it} \quad (5)$$

Here; X_{it} is series of interest; μ_{it} is I(0) stochastic term; d' is the deterministic term.

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Retrieving the IPS statistics in order to determine the stability of the series requires estimating the equation below:

$$\Delta X_{it} = \alpha_i + \varphi_i X_{it-1} + \sum_{j=1}^{p} \theta_{ij} \Delta X_{it-j} + \gamma_i t + \epsilon_{it} \quad (6)$$

RESULTS AND DISCUSSION

The descriptive statistics presented in Table 1 highlight key economic indicators across the regional panel of countries studied. The average GDP per capita, serving as the proxy for economic growth, stands at USD 1,036.407, within a broad range from USD 137 to USD 4,287. This suggests relatively modest economic performance and indicates generally low standards of living and limited purchasing power among the countries. The standard deviation of 738.935, slightly lower than the mean, further implies uneven economic growth across these nations, with notable disparities between better-performing and poorer-performing economies. Additionally, trade openness averaged 55.5171% of GDP, with a wide range from 16.3521% to 131.4854%, reflecting the presence of restrictive trade policies hindering greater international integration. Foreign Direct Investment (FDI) inflows remained modest, averaging 2.3878% of GDP, with extremes of 20.2207% at the highest inflow and -2.5745% at the lowest outflow. The financial development index, averaging just 0.1154 and ranging from 0.0319 to 0.2923, signals that financial institutions in these countries remain underdeveloped, potentially constraining economic expansion due to limited access to credit and investment.

Table 1: Descriptive Statistics

	EG	TPN	HUC	FDI	FD	INF	LFP	EXC	POP
Mean	1036.41	55.517	34.398	2.388	0.115	7.987	64.164	658.297	2.59
Median	760	53.96	31.628	1.525	0.103	4.4	64.144	478.634	2.63
Maximum	4287	131.485	101.391	20.721	0.292	110.9	83.93	9840.6	5.91
Minimum	137	16.352	5.55	-2.575	0.032	-5.91	45.49	0.0326	-1.9
Std. Dev.	738.935	19.251	20.119	2.948	0.048	12.329	8.062	1474.0	0.823
Skewness	1.8705	0.879	0.907	2.110	1.251	3.874	0.190	4.666	-1.116
Kurtosis	6.6909	3.918	3.477	9.581	4.394	25.014	2.560	24.974	7.719
Jarque-Bera	508.637	72.482	61.841	1125.58	142.13	10031	6.229	10496.6	501.93
Prob.	0.0000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.000
Obs.	442	442	422	442	416	442	442	442	442

Source: Author's computation (2025)

Moreover, inflation averaged 7.9867%, with substantial variability from a deflationary low of -5.91% to a high inflation rate of 110.9%, suggesting considerable price volatility over the period from 1990 to 2023. Labour force participation averaged 64.1636% but experienced dramatic fluctuations, with extremes ranging from 45.49% to 83.93%, indicating variability in employment opportunities and productivity. Exchange rates exhibited marked volatility, ranging from 0.0326 to 9,840.598, and highlighting persistent currency instability that, paradoxically, could potentially benefit economic growth by enhancing export competitiveness, provided trade infrastructure is robust. Population growth averaged 2.5903%, with a wide divergence across countries, ranging from -1.9% to 5.91%, underscoring demographic pressures and their varying implications for regional economic sustainability and growth.

Table 2: Correlation Matrix

	EG	TPN	HUC	FDI	FD	INF	LFP	EXC	POP
EG	1.000								
TPN	0.388*	1.000							
HUC	0.640*	0.458*	1.000						
FDI	0.224*	0.346*	0.466*	1.000					

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FD	0.832*	0.290*	0.495*	0.118*	1.000				
INF	0.010	0.015	-0.093	-0.023	-0.077	1.000			
LFP	-0.319*	-0.238*	-0.390*	-0.141*	-0.125*	0.017	1.000		
EXC	-0.115*	0.287*	-0.056	0.061	-0.173*	0.017	-0.187*	1.000	
POP	-0.511*	-0.353*	-0.429*	-0.160*	-0.315*	-0.164*	0.282*	0.014	1.000

Note: * represents significance at 5% level

Source: Author's computation (2025)

The study reports the results of the correlation analysis in Table 2. Table 2 reveals a moderate correlation, and the study found a a positive correlation between TPN and economic growth. This result supports the traditional trade notion that countries can gain from openness and that countries that are more open grow faster than their counterparts that are autarkic and implement protectionist and trade-restrictive policies. The study observed that HUC, FDI, and FD are positively correlated with EG, supporting the conventional wisdom that predicts the growth-enhancing effects of high-quality human capital, increased inflow of FDI, and a well-developed financial system. Additionally, the correlation coefficients among the regressors are low and less than 0.80, indicating that collinearity among the regressors is not of actionable concern and the issues that plague correlated regressors are avoided in the study.

Table 3: Slope Homogeneity Test Result

	Statistics	**Prob.**
Delta	12.102	0.000
Adjusted Delta	14.604	0.000

Note: *, ** and *** is used to represent significance at 10%, 5% and 1% levels, respectively

Source: Author's computation (2025)

Table 3 displays the results of the slope homogeneity test based on the approach proposed by Pesaran and Yamagata (2008). From the results presented in Table 3, it is clear that the coefficients are heterogeneous, as the delta and adjusted delta statistics of 12.102 and 14.604, respectively, are significant at the 5% level. Thus, the null hypothesis that $\beta_i = \beta$ for all i is rejected, and the alternative that $\beta_i \neq \beta_j$ is accepted. The rejection of the null hypothesis of slope homogeneity implies that the slope varies across all i or countries in the panel setup. Consequently, the issue of heterogeneity was accounted for in the subsequent econometric method used in the study.

Table 4: Cross-sectional dependence Test Result

Test	**Statistics**	**Prob.**	**Decision**
Pesaran (2004)	-1.405	0.1599	Independence

Source: Author's computation (2025)

This study employed the Pesaran (2004) CD method to empirically assess the emergence of CSD among the 13 West African countries, presenting the findings in Table 4. Table 4 demonstratess that the Pesaran CD statistics of -1.405 are not significant at 5%, and the null hypothesis cannot be rejected, indicating that any shock that occurs in one of the West African countries does not influence the economies of other countries in the panel setup. In the presence of cross-sectional independence, the stationarity properties of employed series are best checked using first-generation unit root tests, such as Levin et al. (2002) and Im et al. (2003).

Table 5: Panel Unit Root Test Result

	LLC		IPS		
Variables	Levels	1st Diff.	Levels	1st Diff.	Remark
$lneg_{i,t}$	0.1074	-6.6690***	3.8114	-7.9592***	I(1)
$tpn_{i,t}$	-0.9834	-11.8711***	-1.6139	-13.9904***	I(1)
$fdi_{i,t}$	-3.2572***	-	-3.5151***	-	I(0)

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$fd_{i,t}$	-0.1855	-10.6271***	-0.3074	-13.3582***	I(1)
$inf_{i,t}$	-6.5156***	-	-7.7636***	-	I(0)
$lfp_{i,t}$	-2.3193**	-	1.6188	-6.8765***	I(U)
$lnexc_{i,t}$	-2.3678***	-	-2.4242***	-	I(0)
$pop_{i,t}$	-4.7761***	-	-5.5392***	-	I(0)

Note: *, ** and *** is used to represent significance at 10%, 5% and 1% levels, respectively; I(U) = stability is unverified; 1st Diff. = first difference

Source: Author's computation (2025)

One of the fundamental steps in studying how trade openness affects economic growth at different levels of human capital is checking the order of stationarity of the threshold regression variables. The LLC and IPS test results are displayed in Table 5, with both tests chosen based on the CSD test, as they appropriately check for stationarity properties when the cross-sections are independent. The study's findings, based on the LLC and IPS tests, indicate that FDI, INF, EXC, and POP are stationary at their respective levels. The results displayed in Table 5 suggest that EG, TPN and FD have stationarity problems in their level form, but become stationary once the first difference of each series is taken. For LFP, the hypothesis that a unit root exists in the level values was rejected, and the series, based on the test conducted using the LLC approach, is stable in its original form. Based on the IPS test, it is observed that LFP is not stationary in levels; however, the non-stationarity of the series is not a problem once the first difference is taken. Summarily, the results displayed in Table 5 reveal that the panel variables have an integration process of 0 or 1, according to the LLC and IPS tests.

Threshold Analysis

To estimate the threshold model and determine the role of human capital in the relationship between trade openness and economic growth, a test of the threshold effect is necessary. The study employed the bootstrap method in constructing the likelihood ratio statistic LR and testing for nonlinearity. Before proceeding to modelling the nonlinear moderating effect of human capital in how trade openness affects economic growth, the study first conducted the threshold test to determine the existence of threshold or nonlinearity, ascertain the number of thresholds and estimate the threshold value(s). The study used human capital as the threshold variable. In line with Hansen (1999), the study tests the model under two assumptions. First, no threshold level of human capital exists. Second, there is a single threshold for human capital. In deriving the F-statistics and associated p-value used to experiment with the null hypothesis, the study employed 500 iterations for the bootstrap tests.

Part II of Table 6 presents the linearity test results for the single threshold model of human capital, obtained after conducting the bootstrap procedure 500 times. From the results shown in Part II of Table 6, the study rejects the null hypothesis of linearity in the relationship between trade openness and economic growth, as the F-statistic value of 66.74 is highly significant at 5% significance level. The significance of the single threshold for human capital indicates that the threshold value for human capital can be estimated. As shown in Table 6, the single threshold value for human capital is 38.9090% (gross secondary enrolment), with a lower limit of 37.6315% and an an upper limit of 39.4720%. This means that the effect of trade openness on economic growth varies depending on the quality of human capital. Based on the outcome of the linearity test, the sample is divided into two groups: countries with low and high quality of human capital. To display the existence of the threshold effect, the study used the likelihood ratio function to determine the confidence interval of the estimated human capital threshold value. Figure 1 displays the LR test results. As shown in Figure 1, regardless of the level of human capital, the study observed that the single threshold effect of human capital on how trade openness affects economic growth is highly significant.

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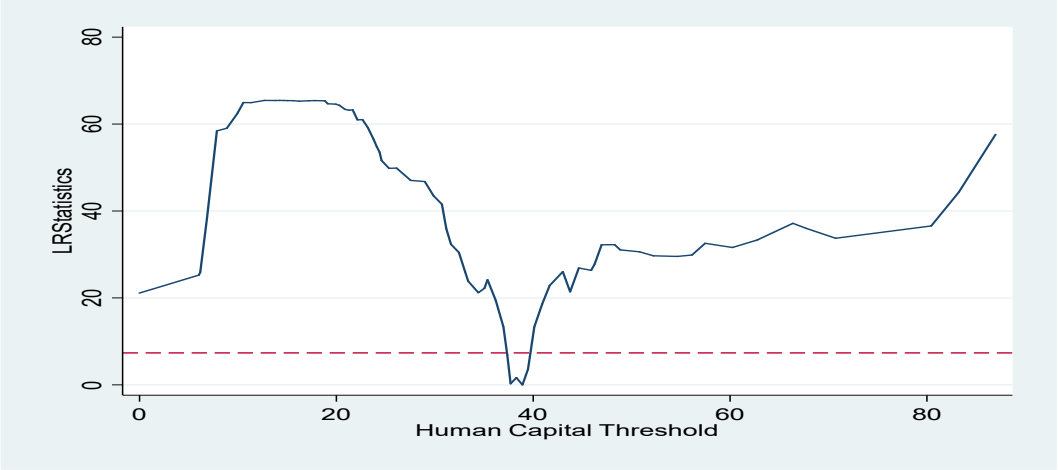

Figure 1: Threshold parameters of human capital

The results of the threshold estimation are presented in Table 6. The findings suggest that foreign direct investment (FDI) has a positive impact on economic growth, as indicated by a positive coefficient. Specifically, Table 6 shows that a 1% increase in FDI corresponds to a 0.0043% increase in real GDP per capita in the countries studied. However, the observed increase in GDP per capita from rising foreign investment was insignificant. This weak association could be attributed to the low magnitude and sectoral allocation of FDI flowing into West African countries. Table 1 highlights that the average FDI level across the 13 countries studied, measured as a percentage of GDP, is merely 2.3878%. According to Asafo-Agyei and Kodongo (2022), FDI below certain thresholds fails to drive meaningful economic growth in African economies.

Table 6: Panel Threshold Result

Human capital threshold level (φ) [confidence limits]		38.9090 [37.6315, 39.4720]		
Var.	***coef.***	***st.Err.***	***t***	***p > |t|***
c	8.4594	0.3242	26.09	0.000
$fdi_{i,t}$	0.0043	0.0043	0.99	0.323
$fd_{i,t}$	-0.5084*	0.2919	-1.74	0.082
$inf_{i,t}$	0.0009	0.0010	0.91	0.365
$lfp_{i,t}$	-0.0307***	0.0040	-7.58	0.000
$lnexc_{i,t}$	0.0432**	0.0168	2.57	0.010
$pop_{i,t}$	-0.0281*	0.0166	-1.69	0.092
TPN Regimes				
$huc_{i,t} \leq \varphi$	0.0013	0.0009	1.46	0.146
$huc_{i,t} > \varphi$	0.0052***	0.0010	5.10	0.000
Linearity/Threshold Test				
Threshold	RSS	MSE	F-stat	Prob.
Single	18.7877	0.0460	66.74	0.0480
Model Diagnostic				
Obs.			442	
Units			13	
R^2			0.2110	
F-stat[prob.]			111.10[0.000]	

Note: *, ** and *** is used to represent significance at 10%, 5% and 1% levels, respectively
Source: Author's computation (2025)

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Additionally, much of the FDI directed into these countries is concentrated in the extractive sector, limiting its wider developmental impact. Emako, Nuru, and Menza (2022) have argued against assuming equal growth effects of FDI inflows across different sectors, emphasising that spillover opportunities and economic linkages vary significantly by industry. Jana, Sahu, and Pandey (2019) notably found that FDI in manufacturing and service sectors has more pronounced effects on economic growth. Furthermore, inconsistencies between the observed results and theoretical expectations may stem from inadequate absorptive capacities within West African countries. Asafo-Agyei and Kodongo (2022) note that foreign investors typically hesitate to invest in countries plagued by trade barriers, limited human capital, underdeveloped financial markets, and inadequate infrastructure.

Regarding financial sector development, Table 6 presents an unexpected negative effect on economic growth. Specifically, a 1% increase in financial development is associated with a 0.5084% reduction in per capita income, although the relationship is statistically insignificant. This result suggests that financial sector development has not effectively promoted economic growth across West African countries, likely due to the underdeveloped nature of the financial institutions. Accessibility of credit remains constrained for households and businesses, exacerbated by stringent lending criteria imposed by deposit money banks, thereby restricting household consumption and entrepreneurial activities. Furthermore, the shallow nature of the capital markets and financial institutions' preference for lending to governments rather than private entities also undermines the productive potential of financial development.

Surprisingly, inflation exhibited a positive, albeit insignificant, relationship with economic growth, as shown in Table 6. While economic theory is divided on the relationship between inflation and growth, some arguments maintain that moderate inflation can stimulate economic activity by reducing real interest rates and countering deflationary pressures. However, others suggest that higher inflation creates uncertainty, discourages investment, lowers real incomes, and diminishes household consumption. Nonetheless, the data from this study did not substantiate these negative claims for the sampled West African countries. Labour force participation, another control variable, had a negative influence on economic growth. Table 6 indicates that a 1% rise in labour force participation significantly decreased economic growth by 0.0307%. This finding contradicts traditional assumptions that increased workforce engagement inevitably boosts productivity. Factors explaining this phenomenon include the prevalence of informal employment, widespread unemployment and underemployment, limited access to technology, skill-based emigration, inadequate capital investment, and significant income disparities among populations.

The results from Table 6 also highlight a significant positive influence of exchange rate depreciation on economic growth, with an elasticity of 0.0432. A 1% depreciation of the local currency is estimated to increase output growth by 0.0432%, primarily through enhanced net exports, as exports become relatively cheaper and imports more costly. Conversely, population growth was found to have a marginally negative effect on economic growth, reducing it by 0.0281%, although this effect was statistically insignificant. Finally, the analysis employing Hansen's (1999, 2000) threshold approach demonstrates a critical role for human capital in moderating the relationship between trade openness and economic growth. From the threshold value, the sample was divided into low human capital level (HUC≤38.9090) and high human capital level (HUC>38.9090). When human capital was below or equal to the threshold value of 38.9090% (HUC≤38.9090), trade openness generated a modest, statistically insignificant increase in economic growth (0.0013%). However, once human capital surpassed this threshold (HUC > 38.9090), the positive impact of trade openness significantly increased to 0.0052%. This result suggests that the productivity benefits of international trade are maximised only when sufficient levels of human capital are present, specifically above the identified threshold. Thus, only West African countries with gross secondary enrolment rates exceeding 38.9090% effectively capture the economic benefits of enhanced trade integration.

CONCLUSIONS

This study examined the nonlinear relationship between trade openness and economic growth across 13 West African countries from 1990 to 2023, with an emphasis on the moderating role of human capital. The findings confirm a threshold effect of human capital, indicating that the economic benefits of trade openness significantly depend on the quality of human capital. Specifically, trade openness does not translate into meaningful economic growth in environments characterised by low human capital. Conversely, economies with higher levels of human capital

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experience substantial growth benefits from increased openness, underscoring the critical role of human capital as a catalyst in actualising the potential advantages of international trade.

Given these insights, policymakers in West Africa should prioritise strategic interventions aimed at human capital development to maximise the growth-enhancing effects of trade openness. It is recommended that governments substantially increase investments in education, particularly at secondary and tertiary levels, and harness information and communication technologies to improve educational outcomes and skills development. Additionally, efforts should focus on enhancing infrastructure and fostering conducive business environments to stimulate industrial and manufacturing activities, thereby strengthening the capacity of these economies to integrate more effectively into global markets and sustainably boost economic growth.

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