International Journal of Innovative Research and Scientific Studies, 8(3) 2025, pages: 1299-1311

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

The conditional impact of trade openness on economic growth in ASEAN: Governance, ICT, human capital, and natural resources as moderators

Thanh Thi Nguyen[1], Tinh Thi Nguyen[2*]

[1]*Faculty of International Business and Economics, Thuongmai University, Hanoi, Vietnam.*
[2]*Faculty of Law, Thuongmai University, Hanoi, Vietnam.*

Corresponding author: Tinh Thi Nguyen (*Email: nguyenthitinh@tmu.edu.vn*)

Abstract

This study investigates the conditional impact of trade openness on economic growth in ASEAN countries over the period 2000–2023, employing advanced panel data econometrics. The main estimation technique used is the Prais-Winsten regression with Panel-Corrected Standard Errors (PCSE), which effectively addresses the issue of cross-sectional dependence an inherent challenge in regional panel datasets due to economic interlinkages among countries. To ensure the robustness of the findings and to address potential endogeneity, the study further applies the Instrumental Variables Two-Stage Least Squares (IV-2SLS) estimation technique. The empirical results reveal that trade openness has a significantly positive effect on economic growth only when accompanied by strong governance, high information and communication technology (ICT) penetration, and robust human capital. Conversely, the growth benefits of trade openness are weakened or even reversed in countries with high dependence on natural resources, aligning with the resource curse hypothesis. These findings highlight the importance of complementary structural policies, including institutional strengthening, digital and educational investment, and economic diversification to maximize the developmental gains from trade liberalization in ASEAN.

Keywords: ASEAN, Economic growth, IV-2SLS, PCSE, Trade openness.

DOI: 10.53894/ijirss.v8i3.6779
Funding: This research is funded by Thuongmai University, Hanoi, Vietnam.
History: Received: 20 March 2025 / **Revised:** 24 April 2025 / **Accepted:** 29 April 2025 / **Published:** 06 May 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

Trade openness, the extent to which a country engages in international trade, has long been a subject of debate regarding its impact on economic growth. In the context of the Association of Southeast Asian Nations (ASEAN), this relationship is particularly relevant due to the region's increasing integration into the global economy.

From theoretical perspectives, when a country opens up to trade, specialization and concentration in industries where the country has a comparative advantage will lead to more efficient resource allocation, thereby promoting economic growth. Yet, some argue that trade openness can hinder economic growth, especially in developing countries, because emerging industries may struggle to compete with established foreign firms and greater integration into the global economy can make countries more susceptible to external shocks [1].

The empirical evidence on the relationship between trade openness and economic growth is mixed. Some studies have found a positive and significant relationship [2-6] while others have found no significant relationship or even a negative one [1, 7, 8]. These mixed results may be due to differences in sample selection, estimation methodology, the specific estimation techniques employed and the time frame under consideration.

ASEAN countries have pursued different trade liberalization strategies, with some being more open than others. The region has also experienced rapid economic growth in recent decades, making it an interesting case study for examining the relationship between trade openness and economic growth. Figure 1 illustrates the general upward trajectory of GDP per capita within the ASEAN region. Singapore exhibited the most substantial growth, maintaining its position as the leading nation in terms of GDP per capita, increasing from $34,890 in 2000 to $65,422 in 2023, representing a near doubling over the period. Brunei, while ranking second in GDP per capita ($37,510 in 2000), experienced a decline to $28,725 by 2023. The majority of the remaining ASEAN member states presented GDP per capita figures below $10,000.

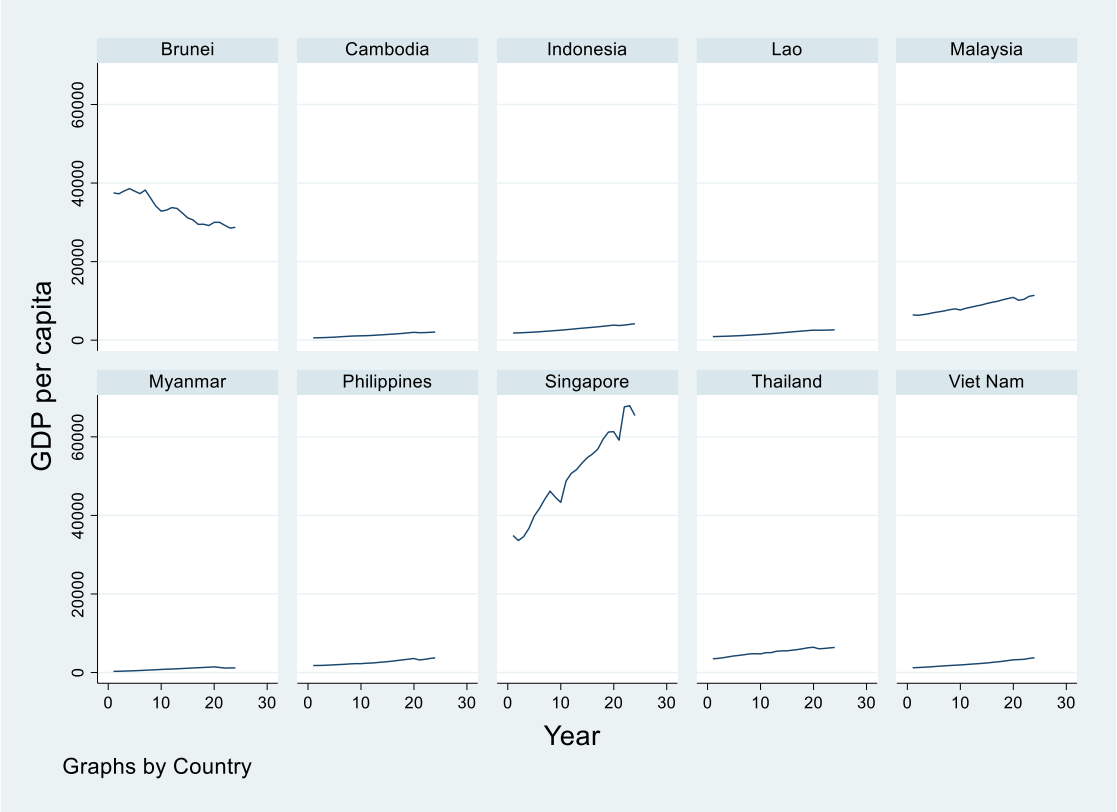

Figure 1.
GDP per capita (constant 2015 US$) of ASEAN countries from 2000-2023.

In terms of trade openness, Singapore exhibits the highest level of openness, but it experienced relatively large fluctuations during the study period, with a downward trend from 364% in 2000 to 311% in 2023. Similarly, Malaysia, characterized by high trade openness at the beginning of the period (about 220%), recorded a sharp decrease to 132% by 2023. Indonesia has a relatively low level of trade openness compared to its regional counterparts and recorded a slight decrease. Meanwhile, countries such as Brunei, Cambodia, Laos, and especially Vietnam recorded an increasing trend. Countries such as Myanmar, the Philippines, and Thailand have relatively large fluctuations but do not change much compared to the beginning of the study period. Figures 1 and 2 suggest an ambiguous correlation between trade openness and economic growth across the ASEAN region. Further research is needed to better understand this relationship and to identify the policies that can maximize the benefits of trade openness for ASEAN countries.

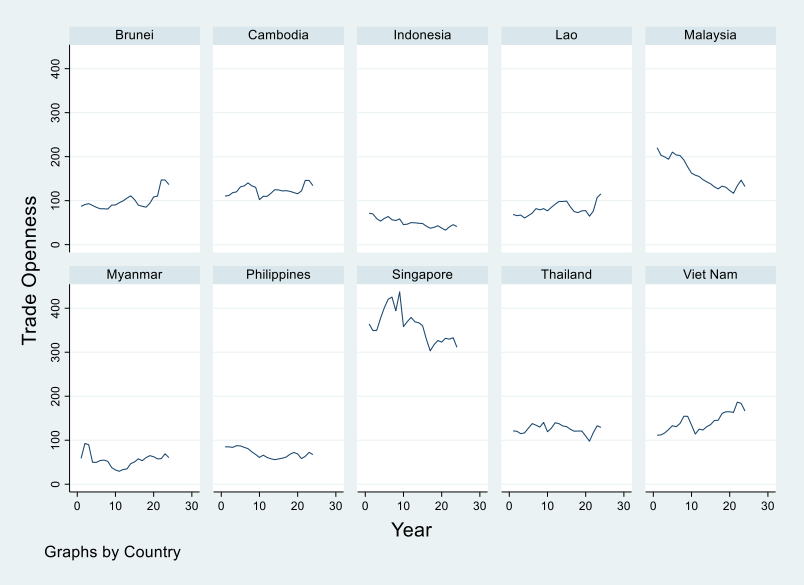

Figure 2.
Trade (% of GDP) of ASEAN countries from 2000-2023.

This study investigates the influence of trade openness on economic growth in ASEAN countries while also examining the role of other potential factors that can moderate this relationship. Our research primarily contributes in two directions. First, to reflect the whole region's scenario and not just the chosen countries, we consider the latest available panel data set for ASEAN nations from 2000 to 2023. Furthermore, this study has taken into account the problems of cross-sectional dependence, heteroscedasticity, autocorrelation, and the biases created by endogeneity, which were mostly absent in previous studies. Therefore, the findings of this research are new contributions to the existing literature.

2. Literature Review

The relationship between trade openness and economic growth has been extensively studied in both the theoretical and empirical literature, yielding mixed results. The theoretical underpinnings of this relationship are primarily explained by comparative advantage and endogenous growth theories. Comparative advantage theory posits that specialization in the production and export of goods or services for which a nation possesses relatively superior factor endowments leads to increased production and, consequently, economic growth [9]. Endogenous growth theory emphasizes the positive link between trade and growth arising from enhanced access to and diffusion of international technology and knowledge. This perspective suggests that greater trade openness facilitates access to advanced technologies, thereby stimulating output growth [3].

Many studies in the existing literature have illustrated that trade openness indeed positively influences economic growth Asamoah et al. [2], Idris et al. [3], Ramzan et al. [4], Silajdzic [5], Soomro et al. [6] and Sakyi et al. [7]. Idris et al. [3] explore the linkage between openness and economic growth in 86 developing and OECD countries from 1977 to 2011. The empirical findings reveal that openness generally promotes economic growth in both developing and OECD countries. However, the magnitude of trade openness to enhance growth is higher in developing countries than in OECD countries. Silajdzic [5] investigate the impact of trade openness on economic growth in CEE (Central-Eastern European) countries over the 1995–2013 period, using panel-corrected standard errors (PCSE) and dynamic least squares dummy variable (LSDVC) estimation methods. They provide robust evidence that trade intensity measures are positively associated with economic growth, pointing to the benefits of trade integration through not only exports but also increasing imports from technologically innovative EU countries to less-advanced CEE economies. Ramzan, et al. [4] explore the impact of trade openness on GDP growth in 82 countries spanning the period 1980–2014, using the system Generalized Method of Moments (GMM) estimator. They argue that the positive relationship between trade openness and GDP growth stems from several key mechanisms operating on both the export and import sides. On the export side, improved resource allocation, technology and knowledge spillovers, and other positive externalities are cited as primary drivers. Similarly, on the import side, spillovers through embodied knowledge and other assets are considered crucial factors contributing to the positive influence of trade on growth.

Meanwhile, other studies showed no robust evidence and even negative relationship. For instance, Nhan [1] examines the impact of free trade on economic growth in ASEAN countries, specifically in 5 countries with similarities in development level and economic growth scale (Vietnam, Thailand, Malaysia, Indonesia, Philippines) in the period from 1995 to 2016, using Pooled OLS, Fixed effects and Random effects. The study result suggests that excessive trade liberalization can be detrimental to economic growth. Increased reliance on international markets, a consequence of greater free trade implementation, can heighten a nation's vulnerability to global economic fluctuations, particularly if its domestic economy lacks the resilience and robustness to absorb external shocks. Tien and Hang [8] also point out that opening up trade can sometimes lead to a surge of imports, which can make it tougher for local businesses to compete. This could then have a negative impact on the domestic economy. For low-income countries (LICs), Sakyi et al. [7] found insufficient evidence to support a long-run cointegration relationship between trade openness and income levels.

The effects of trade openness on economic growth can also be conditioned by other factors. Ramzan et al. [4] find that trade openness positively influences GDP per capita growth, with this effect amplified by higher levels of total factor productivity (TFP) development. However, trade can negatively impact GDP growth in countries with low TFP development. This suggests a critical threshold of TFP development: trade demonstrably contributes to growth only after a minimum level of TFP is achieved. Fetahi-Vehapi, et al. [10] examine the effects of openness to trade on economic growth of 10 South East European (SEE) countries using S-GMM method, and they summarize that the positive effects of trade openness on economic growth are conditioned by the initial income per capita and other explanatory variables, otherwise there is not robust evidence between these two variables. Moreover, trade openness is more beneficial to countries with a higher level of initial income per capita, as well as trade openness favors countries with a higher level of FDI and with higher gross fixed capital formation. Sakyi et al. [7] found that the link between openness and income is stronger for upper-middle-income countries (UMICs) than for lower-middle-income countries (LMICs).

Last but not least, control variables such as government effectiveness, ICT, human capital, natural rents, foreign direct investment, gross fixed capital formation, and inflation are included in the analysis. These additional controls are adopted because the existing literature has shown that they are highly correlated with the main variable of interest. For instance, Asamoah et al. [2] found a positive correlation of trade openness, natural resources, human capital, and quality institutions on economic growth. In countries where natural resources are limited, quality institutions and human capital form growth-enhancing factors. Besides, the evidence suggests that trade openness is linked to stronger economic growth, particularly in countries with well-functioning institutions. Institutional quality is a significant driver of economic growth [11] and this quality can be represented by five key governance indicators, namely control of corruption, government effectiveness, political stability, regulatory quality and rule of law represent the quality of institutions. Soomro et al. [6] examined the dynamic relationship between FDI, ICT, trade openness and economic growth and found that a 1% increase in ICT development (fixed-broadband subscriptions, mobile broadband subscriptions, and mobile cell subscriptions) would lead to a 0.04 to 0.56 percent growth in GDP per capita.

While extensive literature explores the trade openness-economic growth nexus globally, and some studies touch upon ASEAN economies, a comprehensive investigation that specifically focuses on the ASEAN region, considering its unique economic integration dynamics and simultaneously accounting for key moderating factors like governance, ICT, human capital, and natural resource rents, remains relatively underexplored. This study aims to fill this gap by providing a robust and nuanced analysis of the conditional impact of trade openness on economic growth across ASEAN countries using the most recent data and advanced panel econometric techniques.

3. Methodology

3.1. Model Settings

Based on the theoretical and empirical literature review, we design the following baseline equation for estimation.

$$\ln G_{it} = \alpha + \beta_m TO_{it} + \beta_n X_{it} + \varepsilon_{it} \quad (1)$$

Where G_{it} is the logarithm of real GDP per capita (a proxy of economic growth) of country i at year t; TO_{it} denotes the trade openness, which is proxied by the ratio of the total value of imports and exports to GDP; X_{it} represents a vector of control variables (determinants of growth) including foreign direct investment (FDI_{it}), gross fixed capital formation ($GFCF_{it}$), government effectiveness (GE_{it}), inflation (INF_{it}), mobile cellular subscriptions (ICT_{it}), human capital (HC_{it}), natural resource rents (NR_{it}), and dummy variable (d).

To investigate whether the impact of trade openness on economic growth is moderated by other factors, we extend our baseline model by incorporating interaction terms (TO_{it} x Z_{it}), as shown in Equation (2). Z_{it} represents moderator variables including government effectiveness (GE), ICT, human capital (HC), and natural resource rents (NR). The interaction terms (TO x GE, TO x ICT, TO x HC, TO x NR) are the focal point of these models, as their coefficients will reveal whether and how the relationship between trade openness and economic growth is altered or conditioned by the level of government effectiveness, ICT penetration, human capital stock, or natural resource dependence. A significant interaction term β_3 will demonstrate that the effect of trade openness is not uniform, but rather varies depending on the magnitude of the moderating variable.

$$\ln G_{it} = \beta_0 + \beta_1 . TO_{it} + \beta_2 . Z_{it} + \beta_3 . (TO_{it} \text{ x } Z_{it}) + \beta_4 . X'_{it} + \mu_{it} + \varepsilon_{it} \quad (2)$$

Trade Openness (TO): A vast body of empirical literature supports a positive relationship between trade openness and economic growth. Studies across various countries and time periods, including those by Dollar [12]; Sachs and Warner [13] and Frankel and Romer [14] have found that more open economies tend to grow faster. More recently, studies focusing on developing countries and ASEAN continue to find evidence of this positive link [3, 11].

Foreign Direct Investment (FDI): Numerous empirical studies have demonstrated a positive impact of FDI on economic growth, particularly in developing countries. Borensztein et al. [15] found that FDI is growth-enhancing when the host country has sufficient absorptive capacity (human capital). Studies focusing on ASEAN and similar regions generally support a positive link between FDI inflows and economic growth [6, 8, 16].

WTO Membership Dummy (d): WTO membership can reduce trade barriers, increase trade flows, enhance policy credibility, and improve the investment climate, thereby fostering economic growth [17]. Several studies have examined the impact of WTO/GATT membership on trade and economic outcomes. Tomz et al. [18] find a significant increase in trade after joining GATT/WTO. While the direct impact on growth is more debated, many argue that WTO membership creates a more predictable and stable environment conducive to long-term economic development [7].

Gross Fixed Capital Formation (GFCF): Capital accumulation is a cornerstone of traditional growth models like the Solow growth model [19]. GFCF, representing investment in physical capital (machinery, equipment, infrastructure), directly

increases the capital stock, a key input in the production function. Studies consistently find a positive correlation between investment rates (often measured by GFCF as a percentage of GDP) and economic growth across countries and over time [16, 20].

Government Effectiveness (GE): New Institutional Economics [21] emphasizes the crucial role of institutions and governance in economic development. Government effectiveness, capturing the quality of public services, civil service, policy formulation, and government credibility, is a key dimension of institutional quality. Empirical studies consistently demonstrate a strong positive relationship between government effectiveness and economic growth. Kaufmann et al. [22] and many subsequent studies using the World Bank's governance indicators (including Government Effectiveness) have shown that countries with better governance tend to experience higher economic growth rates [2, 11, 23].

Inflation (INF): While moderate inflation might be considered acceptable, high and volatile inflation is generally detrimental to economic growth. High inflation creates uncertainty, distorts price signals, reduces investment, discourages savings, and can lead to macroeconomic instability[24]. Classical and Keynesian economics both recognize the negative effects of uncontrolled inflation. Empirical studies generally find a negative relationship between inflation and economic growth, particularly at higher inflation rates. Barro [25] and Fischer [24] are classic studies showing this negative association. However, the relationship may be non-linear, with low inflation potentially having no significant or even slightly positive effects, but high inflation being clearly harmful [8, 11, 16].

Information and Communication Technology (ICT): ICT facilitates faster and cheaper communication, improves information dissemination, reduces transaction costs, fosters innovation, and enables the adoption and diffusion of new technologies [26]. It is also crucial for knowledge spillovers and network externalities. Furthermore, ICT can improve market efficiency, facilitate trade, and enhance human capital development through improved access to education and information [27]. A substantial and growing body of empirical literature supports the positive impact of ICT on economic growth. Studies have used various proxies for ICT, such as internet penetration, mobile phone subscriptions, and broadband access, and consistently found a positive association with GDP growth [6, 28, 29]. Meta-analyses, like Stanley et al. [26] also confirm the overall growth-enhancing effect of ICT. Mobile cellular subscriptions, as used in this study, are a widely recognized and relevant indicator of ICT development, especially in developing economies where mobile technology often leapfrogs fixed-line infrastructure.

Human Capital (HC): Human capital enhances a country's absorptive capacity, allowing it to benefit more from trade, FDI, and technological spillovers [30]. Secondary school enrollment serves as a broad indicator of the level of secondary education attainment in a country, reflecting the potential skill base of the workforce. Empirical studies consistently demonstrate a positive association between human capital and economic growth. Mankiw et al. [31] famously augmented the Solow growth model with human capital and showed its significant role in explaining cross-country income differences. Subsequent studies using various measures of education and skills have confirmed the growth-enhancing effect of human capital [32, 33]. While the specific measure (secondary enrollment) might capture quantity over quality, it is a widely used and readily available proxy in cross-country growth regressions.

Natural Resource Rents (NR): The inclusion of natural resource rents is motivated by the "resource curse" or "paradox of plenty" hypothesis [34, 35]. This theory suggests that, counterintuitively, countries abundant in natural resources may experience lower economic growth than resource-scarce countries. While natural resources can provide initial capital and revenue, over-reliance on them can hinder long-term sustainable development [2]. Total natural resources rents (% of GDP) captures the economic significance of natural resource extraction in a country, and thus its potential exposure to the resource curse. The empirical evidence on the resource curse is mixed and nuanced, but a significant body of research suggests a negative or conditional relationship between natural resource abundance and economic growth [36-38]. Some studies find a direct negative effect, while others show that the resource curse is conditional on institutional quality, governance, or economic diversification [39]. Even if natural resources are not always a "curse," including this variable is crucial to test for its potential negative or moderating influence, especially in resource-rich ASEAN economies, and to account for potential omitted variable bias if resource wealth is correlated with other included variables.

3.2. Estimation Approach

The empirical analysis starts with the application of the cross-sectional dependence test among the countries to determine the suitable methods to apply. The risk of cross-sectionally dependent panel is very high due to the close proximities of the units and given the possibility of sharing common features. In the event of cross-sectional dependence (CSD) in the data, biased estimates and inferences will occur [40]. To forestall such, the study engages the Pesaran [40] test for cross-sectional dependence (CD) which can be applied to small and large panels. The null hypothesis of no cross-sectional dependence or no connection between the data from different countries is expressed as

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \qquad (3)$$

Where T is the number of time periods, N is the number of cross-sectional units, $\hat{\rho}_{ij}$ is the pairwise correlation of the residual as defined above.

The presence of dependence motivates the application of second-generation panel unit root tests, specifically the CIPS test [41] to assess the stationarity properties of the variables. The CIPS test is expressed as.

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} t_i\,(N,T) \qquad (4)$$

where N and T are the numbers of cross-sections and years, respectively. The left-hand side of Equation (4) is the unit root test for heterogeneous panels, while on the right-hand side, the term t_i is the ordinary least squares (OLS) t-ratios employed in cross-sectional averaged augmented Dickey-Fuller (ADF) regression.

Thereafter, we assess whether a long-run relationship exists among the variables using the second-generation panel cointegration tests proposed by Westerlund [42]. This technique is suitable in the presence of CSD in the data, and the null hypothesis is no cointegration.

Finally, given the presence of cross-sectional dependence in the data and cointegration among the variables, the Prais-Winsten regression model with panel-corrected standard errors (PCSE), which also controls for heteroscedasticity and serial correlation, is used to estimate all the models. For robustness checks and to observe the consistency of the results, we deploy the instrumental variables two-stage least squares (IV-2SLS) techniques.

3.3. Data and Variable Description

This section describes the data used in the empirical analysis, which is based on an annual panel data set of 10 ASEAN countries for the period 2000-2023. All the variables used in this study are sourced from World Bank's World Development Indicators Database [43]. The missing values problem can be handled by missing values imputation methods, including last value carried forward and regression method [44]. Table 1 presents the descriptive statistics for all variables used in our analysis, providing the number of observations, standard deviations, means, minimum, and maximum values.

Table 1.
Descriptive statistics.

Variable	Obs.	Mean	Std. dev.	Min.	Max.
G	240	10948.751	16518.86	298.59	67948.893
TO	240	126.773	87.844	29.43	437.327
FDI	240	5.235	6.301	-2.757	34.949
d	240	0.9	0.300627	0	1
GFCF	240	26.354	5.00	13.416	40.891
GE	240	52.919	28.163	1.914	100
INF	240	4.71	6.626	-2.315	57.075
ICT	240	87.018	53.477	0.029	181.767
HC	240	77.263	22.1	19.074	126.036
NR	240	7.237	7.786	0	37.407

As shown, GDP per capita (G) in our sample exhibits substantial variation across ASEAN countries, with a wide range from a minimum of $298.59 to a maximum of $67,948.89 (constant 2015 US$), reflecting the diverse levels of economic development within the region. The average GDP per capita across the sample period is approximately $10,948.75.

Trade openness (TO), measured as a percentage of GDP, also shows considerable heterogeneity among ASEAN members, ranging from a relatively low 29.43% to a very high 437.33%. The mean trade openness for the ASEAN countries in our sample is 126.77%, indicating a generally open trade regime, but with significant differences across countries.

Foreign direct investment (FDI) net inflows, as a percentage of GDP, average 5.24% across the sample, but are quite volatile, with values ranging from negative inflows (-2.76%) to substantial inflows reaching almost 35% of GDP. This indicates varying degrees of FDI attraction and investment flows within ASEAN.

The WTO membership dummy (d) reveals that 90% of the observations are WTO members (mean of 0.9), reflecting the high level of trade integration and commitment to multilateral trade rules within ASEAN for the majority of the sample period.

Gross fixed capital formation (GFCF) as a percentage of GDP, representing investment, averages 26.35% across the sample, with a range from 13.42% to 40.89%. This suggests a generally healthy level of investment within ASEAN economies, although there is variation in investment rates.

Government effectiveness (GE), measured as a percentile rank, demonstrates a wide spectrum across ASEAN, from a very low rank of 1.91 to a perfect score of 100. The average government effectiveness rank is approximately 52.92, indicating a mixed level of governance quality across the region, with some countries exhibiting significantly stronger government effectiveness than others.

Inflation (INF), measured as annual consumer price changes, has a mean of 4.71%, but shows considerable volatility, ranging from deflation (-2.32%) to periods of high inflation (57.08%). This highlights the varying macroeconomic stability and inflationary pressures experienced by ASEAN economies during the sample period.

Mobile cellular subscriptions (ICT) per 100 people average 87.02, with a substantial range from near zero to over 180 subscriptions per 100 people. This wide range indicates the rapid expansion of mobile technology in ASEAN, but also persistent digital divides and varying levels of ICT penetration across member states.

Human capital (HC), proxied by secondary school enrollment (% gross), averages 77.26%, ranging from a low of 19.07% to exceeding 126% (gross enrollment can exceed 100% due to students outside the typical age range). This reflects the progress in secondary education across ASEAN, but also the remaining disparities in educational attainment levels.

Natural resource rents (NR), as a percentage of GDP, average 7.24%, ranging from zero in some countries to a maximum of 37.41%. This highlights the varying degrees of reliance on natural resources within ASEAN economies, with some countries being significantly more dependent on resource rents than others.

4. Empirical Results and Discussions

4.1. Pre-Estimations

4.1.1. Cross-Sectional Independence Test

The results from pre-estimations are presented in Table 2. The results of the Pesaran [40] CD test reject the null hypothesis of no cross-sectional dependence at the 1% significance level for all variables, suggesting that any shock in one country maybe transmitted to other ASEAN countries. This finding is not surprising given the close economic and geographical ties within ASEAN. It implies that economic growth and the determinants of growth are not independent across ASEAN countries, and that shocks or unobserved common factors are likely influencing the region as a whole.

The confirmed presence of cross-sectional dependence is a critical finding that necessitates the use of econometric techniques that are robust to CSD. Traditional panel methods like Pooled OLS, Fixed Effects (FEM), and Random Effects (REM) that assume cross-sectional independence would be inappropriate and yield unreliable results in this context. Therefore, the rejection of the null hypothesis of no CSD justifies our choice of employing the Panel Corrected Standard Errors (PCSE) regression model. This method is specifically designed to provide valid inference in the presence of cross-sectional dependence, as it allows for correlated errors across countries.

4.1.2. Panel Unit Root Test

Given the presence of cross-sectional dependence, we utilize the second-generation Cross-sectionally augmented Im, Pesaran, and Shin (CIPS) panel unit root test developed by Pesaran [41]. Traditional panel unit root tests (like first-generation tests such as Im-Pesaran-Shin or Levin-Lin-Chu) are invalidated by cross-sectional dependence. The null hypothesis of the CIPS test is "all panels contain a unit root (variables are non-stationary)". The CIPS test results in Table 2 indicate that FDI, INF, and ICT are stationary at level I (0). However, for LnG, TO, GFCF, GE, HC, and NR, we fail to reject the null hypothesis at levels, suggesting that these variables become stationary after first differencing I (1).

4.1.3. Panel cointegration Test (Westerlund Test)

Given that several of our variables are found to be I (1) and we have confirmed cross-sectional dependence, we employ the Westerlund panel cointegration test. This is a second-generation cointegration test that is robust to the presence of CSD. Cointegration tests examine whether a group of non-stationary variables move together in the long run, implying a stable equilibrium relationship despite short-term fluctuations. The null hypothesis of the Westerlund cointegration test is "no cointegration among the variables."

The Westerlund cointegration test results, as shown in Table 2, present statistically significant variance ratios for both "All panels are cointegrated" and "Some panels are cointegrated" options (p-value < 0.01). This leads us to reject the null hypothesis of no cointegration. This provides strong evidence of panel cointegration among the variables in our model. It implies that despite the non-stationarity of individual variables like GDP per capita and trade openness, there is a stable long-run relationship between economic growth and its determinants in the ASEAN region, including trade openness and the moderating factors.

Table 2.
Cross-sectional dependence, panel unit root, cointegration tests.

Variables	**CSD test Stensnes [45]**	**CIPS Pesaran [41]**	
		Level	**1st Difference**
LnG	19.555***	-2.637	-4.240***
TO	2.822***	-1.608	-4.073***
FDI	3.789***	-3.499***	
GFCF	2.198**	-2.185	-4.041***
GE	7.693***	-2.692	-5.443***
INF	10.427***	-3.091**	
ICT	29.128***	-3.066 **	
HC	11.801***	-1.039	-3.319***
NR	15.607***	-2.347	-4.846***
Westerlund [42] cointegration test			
Variance ratio (All panels are cointegrated) = 2.5254*** (p-value = 0.0058)			
Variance ratio (Some panels are cointegrated) = 2.6076*** (p-value = 0.0046)			

Note: ***p<0.01, **p<0.05.

4.2. Estimation Results using Panel Corrected Standard Errors (PCSE) Method

In the baseline PCSE model (column 1, Table 3), the coefficient of TO is positive and statistically significant at the 1% level (0.00294), indicating that a 1-unit increase in TO is associated with a 0.294% increase in GDP per capita. This result aligns with theoretical predictions and empirical findings that suggest trade openness contributes to economic growth by facilitating specialization, knowledge diffusion, and technological adoption [3, 4, 6]. However, when interaction terms are added (columns 2 to 5), the direct effect of TO becomes statistically insignificant or even negative, underscoring the importance of moderating variables in influencing this relationship.

Table 3.
Estimation results using Panel Corrected Standard Errors (PCSE) method.

Variables	(1)	(2)	(3)	(4)	(5)
	lnG	lnG	lnG	lnG	lnG
TO	0.00294***	-0.00253*	0.000156	-0.00650***	0.00369***
	(0.000503)	(0.00131)	(0.000866)	(0.00237)	(0.000487)
GE	0.0264***	0.0213***	0.0268***	0.0292***	0.0289***
	(0.00216)	(0.00245)	(0.00229)	(0.00234)	(0.00229)
FDI	0.0107***	0.00839**	0.00841**	0.0107***	0.00825**
	(0.00411)	(0.00394)	(0.00372)	(0.00410)	(0.00385)
d	0.108	0.101	0.109	0.136	0.109
	(0.0874)	(0.0787)	(0.0846)	(0.0836)	(0.0853)
GFCF	0.00672	0.00731	0.00861	0.00731	0.00724
	(0.00555)	(0.00546)	(0.00555)	(0.00540)	(0.00516)
INF	-0.00527**	-0.00388	-0.00465*	-0.00485*	-0.00487*
	(0.00245)	(0.00248)	(0.00239)	(0.00268)	(0.00279)
ICT	0.00274***	0.00315***	-0.000224	0.00341***	0.00305***
	(0.000736)	(0.000729)	(0.00108)	(0.000740)	(0.000714)
HC	0.00520***	0.00382*	0.00556***	-0.00756*	0.00342*
	(0.00194)	(0.00209)	(0.00197)	(0.00425)	(0.00200)
NR	0.0342***	0.0353***	0.0334***	0.0380***	0.0776***
	(0.00503)	(0.00489)	(0.00498)	(0.00460)	(0.0104)
TO*GE		6.30e-05***			
		(1.47e-05)			
TO*ICT			2.57e-05***		
			(6.61e-06)		
TO*HC				9.31e-05***	
				(2.34e-05)	
TO*NR					-0.000395***
					(8.41e-05)
Constant	5.384***	5.883***	5.594***	6.293***	5.240***
	(0.182)	(0.219)	(0.182)	(0.307)	(0.168)
Observations	240	240	240	240	240
R-squared	0.945	0.948	0.948	0.946	0.949
Number of Country MH	10	10	10	10	10

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The interaction term between TO and government effectiveness (TO × GE) is positive and significant (6.30e-05, $p < 0.01$). This suggests that stronger governance enhances the positive impact of trade openness on growth. Countries with more effective public institutions, regulatory quality, and government services are better positioned to manage trade-induced changes and benefit from globalization [2, 11, 45]. These studies argue that well-functioning institutions and effective governance are crucial for efficient resource allocation, investment climate, contract enforcement and property rights, reduced corruption and red tape. Complementary institutional reforms are often necessary for countries to fully reap the growth effects of trade openness. Government effectiveness is a key indicator of the capacity to implement and manage these reforms [45].

The interaction term TO × ICT is also positive and significant (2.57e-05, $p < 0.01$). This indicates that higher ICT penetration (proxied by mobile cellular subscriptions) strengthens the growth effect of trade openness. This finding is strongly supported by a growing body of literature that highlights the complementary role of ICT in enhancing the benefits of trade and globalization [6, 26, 28]. These studies emphasize that ICT infrastructure, particularly mobile and internet technologies, significantly reduces communication costs, information search costs, and transaction costs associated with international trade. This makes trade more efficient and accessible, especially for SMEs. ICT is the backbone of e-commerce and digital trade, enabling businesses to engage in online transactions, reach global customers, and participate in digital value chains. Trade openness combined with strong ICT infrastructure allows ASEAN countries to tap into the rapidly growing digital economy.

The TO × HC interaction is positive and significant (9.31e-05, $p < 0.01$). This signifies that the positive impact of trade openness on economic growth is stronger in ASEAN countries with higher levels of human capital (secondary school enrollment). Conversely, the growth-enhancing effect of trade openness is weaker in countries with lower levels of human capital development. Previous studies [11, 33] highlight that human capital is increasingly becoming a key determinant of comparative advantage in modern trade, particularly in knowledge-intensive industries. Trade openness is more beneficial for countries with a comparative advantage in sectors that rely on skilled labor. Human capital facilitates innovation and the adoption of new technologies that are often transferred through international trade. A skilled workforce is essential to adapt, implement, and improve upon imported technologies, maximizing their productivity-enhancing effects. Trade openness,

combined with human capital, can drive structural transformation towards higher value-added sectors, shifting economies away from reliance on low-skill industries or primary commodities. This structural upgrading is a key pathway for sustained economic development.

The interaction between TO and Natural Resource Rents (TO × NR) is negative and significant (-0.000395, $p < 0.01$). This indicates that in resource-rich ASEAN countries, trade openness has a reduced or even adverse effect on economic growth. This aligns with the "resource curse" hypothesis, suggesting that trade openness in such contexts might exacerbate dependence on volatile, low-productivity sectors [36-38, 46]. Increased trade and specialization based on resource extraction can further concentrate economic activity in the resource sector, crowding out manufacturing and other potentially more dynamic and diversified sectors. Trade openness, in this context, might worsen structural imbalances. Trade openness, when heavily reliant on resource exports, can expose economies to greater volatility in commodity prices and external shocks. This volatility can hinder long-term planning, investment, and sustainable growth. For resource-rich ASEAN countries, trade openness alone is not a sufficient growth strategy and can even be counterproductive without complementary policies to diversify their economies, manage resource wealth responsibly, and strengthen their institutions.

Overall, the findings indicate that trade openness alone is not sufficient to guarantee economic growth; rather, its impact is conditional on the presence of complementary factors. Specifically, trade openness tends to have a positive effect on economic growth when it is accompanied by strong governance, well-developed information and communication technology (ICT) infrastructure, and high levels of human capital. These elements enhance a country's ability to absorb the benefits of international trade, such as technology transfer, productivity gains, and market expansion. Conversely, in the presence of high natural resource dependence, the growth-enhancing effects of trade openness are either diminished or potentially negative, reflecting the risks associated with the "resource curse." These nuanced findings offer important insights for policymakers in ASEAN, underscoring the need to tailor trade and development strategies to national contexts by investing in institutional quality, digital infrastructure, education, and economic diversification.

4.3. Robustness Checks with IV-2SLS Estimation

To ensure the robustness of our findings, we employed Instrumental Variables Two-Stage Least Squares (IV-2SLS) estimation to address potential endogeneity concerns, particularly regarding foreign direct investment (FDI). The Durbin–Wu–Hausman (DWH) test confirms that FDI is endogenous (p-value = 0.0000), meaning it is correlated with the error term, potentially biasing OLS and PCSE estimates. Other variables like trade openness (TO), government effectiveness (GE), inflation (INF), ICT, human capital (HC), and natural resource rents (NR) are shown to be exogenous (p-values > 0.05), and hence suitable for inclusion without instrumenting.

Table 4.
Tests of endogeneity, p-value.

Variables	**TO**	**FDI**	**GE**	**INF**	**ICT**	**HC**	**NR**
H0	Variables are exogenous						
Durbin (score) chi2	0.1408	0.0000	0.0831	0.7264	0.4453	0.7527	0.3773
Wu-Hausman	0.1499	0.0000	0.0900	0.7329	0.4564	0.7586	0.3889
Conclusion	Accept H0	Reject H0	Accept H0	Accept H0	Accept H0	Accept H0	Accept H0

We use lagged FDI and the interaction term between trade openness and FDI as valid instruments. The Sargan-Hansen test of overidentifying restrictions consistently indicated that the instruments were exogenous and appropriate, with p-values exceeding the 0.1 threshold in all model specifications.

Table 5.
Robustness checks with IV-2SLS.

	(1)	(2)	(3)	(4)	(5)
Variables	**lnG**	**lnG**	**lnG**	**lnG**	**lnG**
TO	0.000127	-0.00615***	-0.00248**	-0.0145***	0.00230***
	(0.000618)	(0.00122)	(0.000976)	(0.00203)	(0.000569)
FDI	0.0622***	0.0379***	0.0490***	0.0375***	0.0313***
	(0.00702)	(0.00668)	(0.00744)	(0.00631)	(0.00667)
GE	0.0297***	0.0228***	0.0302***	0.0336***	0.0339***
	(0.00200)	(0.00209)	(0.00192)	(0.00184)	(0.00181)
d	0.228**	0.178**	0.241***	0.234***	0.186**
	(0.0958)	(0.0876)	(0.0919)	(0.0839)	(0.0827)
GFCF	-0.000182	0.00190	0.00363	0.00198	0.00581
	(0.00551)	(0.00501)	(0.00539)	(0.00483)	(0.00479)
INF	-0.0230***	-0.0241***	-0.0249***	-0.0250***	-0.0228***
	(0.00432)	(0.00393)	(0.00417)	(0.00379)	(0.00372)
ICT	0.00200***	0.00339***	-0.000989	0.00383***	0.00295***
	(0.000704)	(0.000669)	(0.00109)	(0.000653)	(0.000615)
HC	0.00361*	-0.000744	0.00280	-0.0199***	-0.00172
	(0.00210)	(0.00201)	(0.00203)	(0.00348)	(0.00191)
NR	0.0549***	0.0529***	0.0533***	0.0521***	0.109***
	(0.00378)	(0.00344)	(0.00365)	(0.00333)	(0.00743)
TO*GE		8.49e-05***			
		(1.34e-05)			
TO*ICT			2.82e-05***		
			(8.02e-06)		
TO*HC				0.000155***	
				(1.98e-05)	
TO*NR					-0.000590***
					(7.20e-05)
Constant	5.500***	6.307***	5.750***	7.242***	5.404***
	(0.185)	(0.213)	(0.191)	(0.277)	(0.160)
Sargan (p-value)	0.2969	0.2442	0.9612	0.1132	0.6571
Endogeneity (p-value)	0.0000	0.0004	0.0000	0.0030	0.0002
Observations	230	230	230	230	230
R-squared	0.926	0.939	0.932	0.943	0.945

The IV-2SLS results further validate the conditional nature of the trade openness–growth relationship identified in the baseline Panel Corrected Standard Errors (PCSE) models. Specifically, the interaction terms between trade openness and key structural variables remain statistically significant and directionally consistent. Government effectiveness (TO × GE), information and communication technology (TO × ICT), and human capital (TO × HC) all positively moderate the relationship between trade openness and economic growth. These findings underscore that trade openness alone is insufficient to guarantee growth and must be accompanied by strong institutions, digital infrastructure, and an educated workforce to maximize benefits. In contrast, the interaction between trade openness and natural resource rents (TO × NR) yields a negative and significant coefficient, suggesting that in resource-rich ASEAN economies, trade openness may exacerbate structural vulnerabilities associated with resource dependence.

Overall, the IV-2SLS robustness checks reinforce the central argument of this study: the growth effects of trade openness in ASEAN are not uniform but are critically shaped by domestic structural conditions. This emphasizes the need for targeted complementary reforms to enhance institutional quality, ICT development, human capital investment, and economic diversification, particularly in resource-dependent economies.

5. Conclusions, Implications, and Limitations

5.1. Conclusions

This study investigated the conditional impact of trade openness on economic growth across ASEAN countries from 2000 to 2023. Employing robust panel data econometrics and addressing key methodological challenges, our analysis reveals a nuanced picture of the trade openness-growth nexus in this dynamic region.

Our findings demonstrate that while trade openness exhibits a positive association with economic growth in ASEAN under certain specifications, its growth-enhancing effect is not uniform. Instead, we find that the impact of trade openness is significantly moderated by crucial contextual factors inherent to each ASEAN member state. Government effectiveness emerges as a critical positive moderator. ASEAN countries with stronger governance structures consistently experience a more pronounced positive impact of trade openness on their economic growth. This highlights the essential role of effective

institutions in translating trade liberalization into tangible economic benefits. Similarly, ICT infrastructure acts as a significant positive moderator. Countries with higher levels of ICT penetration, as proxied by mobile cellular subscriptions, are better positioned to leverage trade openness for economic growth. This underscores the synergistic relationship between trade and technology in the modern digital economy. Human capital, measured by secondary school enrollment, also positively moderates the trade openness-growth nexus. A more educated workforce enhances a nation's capacity to absorb knowledge, innovate, and compete effectively in global markets, thereby amplifying the gains from trade.

Conversely, natural resource rents exert a negative moderating effect. In resource-rich ASEAN countries, the growth-enhancing impact of trade openness is diminished, and potentially reversed. This finding provides empirical support for the "resource curse" phenomenon in the context of trade, suggesting that trade liberalization alone is insufficient for sustainable growth in resource-dependent economies.

5.2. Implications and Policy Recommendations

The conclusions of this research carry significant implications for policymakers in ASEAN nations seeking to foster sustainable and inclusive economic growth through trade. Our findings suggest a shift from a simplistic view of trade openness to a more nuanced, context-specific approach.

Firstly, strengthening governance should be a paramount policy priority. ASEAN governments are urged to focus on improving institutional quality, enhancing public sector efficiency, and combating corruption. These governance reforms are crucial preconditions for maximizing the benefits of trade liberalization.

Secondly, strategic investments in ICT infrastructure and digital literacy are essential. Policymakers should prioritize expanding broadband access, promoting mobile technology adoption, and developing digital skills within the workforce. These investments will enable ASEAN countries to fully participate in and benefit from the digital global economy.

Thirdly, continued investment in human capital development and education quality is vital. Focus should be placed on improving secondary and higher education, promoting vocational training, and aligning education policies with national trade and industrial strategies to create a skilled and adaptable workforce.

For resource-rich ASEAN economies, diversification strategies are critical to mitigate the negative moderating effect of natural resource dependence. Policies should promote non-resource sectors, reinvest resource revenues strategically, and strengthen resource governance to foster more balanced and sustainable economic development.

Finally, a tailored approach to trade policy is recommended. ASEAN countries should consider their specific contexts – levels of governance, ICT infrastructure, human capital, and resource dependence – when formulating and implementing trade liberalization policies. Complementary policies addressing these moderating factors are crucial for optimizing the outcomes of trade openness.

5.3. Limitations and Future Research

While this study offers valuable insights, it is important to acknowledge certain limitations that suggest avenues for future research. Firstly, our measure of trade openness, proxied by the ratio of total exports and imports to GDP, while a widely utilized and readily available metric, may oversimplify the multifaceted nature of trade policy and integration. Future research could benefit from employing more disaggregated and qualitative indicators of trade openness to provide a richer and more nuanced analysis.

Secondly, while we have strived to utilize a comprehensive panel dataset, the inherent challenges of missing data and potential inconsistencies in statistical reporting across different ASEAN countries and time periods cannot be entirely eliminated. Despite employing missing value imputation techniques, data limitations may introduce some degree of measurement error and potentially affect the precision and robustness of our estimates. Future research endeavors should prioritize the use of higher quality and more consistently reported data sources, as data availability improves over time, and consider sensitivity analyses to assess the impact of data limitations on the findings.

Finally, the analysis of ASEAN as a homogeneous bloc, while providing valuable regional-level insights, may mask significant heterogeneity among individual member states. ASEAN encompasses a diverse group of nations with varying economic structures, political systems, levels of development, resource endowments, and cultural contexts. Consequently, the experiences of individual countries with trade openness and its interaction with moderating factors may diverge substantially from the regional average. Future research should consider disaggregated, country-specific analyses or explore sub-regional groupings within ASEAN to account for this inherent heterogeneity and provide more tailored and context-specific policy recommendations for member states at different stages of development and with distinct economic characteristics.

References

[1] L. H. H. Nhan, "The impact of FDI capital flows and free trade on economic growth in ASEAN countries," Master's Thesis, Ho Chi Minh City University of Economics, 2018

[2] L. A. Asamoah, E. K. Mensah, and E. A. Bondzie, "Trade openness, FDI and economic growth in sub-Saharan Africa: Do institutions matter?," *Transnational Corporations Review,* vol. 11, no. 1, pp. 65-79, 2019.

[3] J. Idris, Z. Yusop, and M. S. Habibullah, "Openness and economic growth in developing and OECD countries," *International Journal of Economics & Management,* vol. 12, no. 2, pp. 317-332, 2018.

[4] M. Ramzan, B. Sheng, M. Shahbaz, J. Song, and Z. Jiao, "Impact of trade openness on GDP growth: Does TFP matter?," *The Journal of International Trade & Economic Development,* vol. 28, no. 8, pp. 960-995, 2019. https://doi.org/10.1080/09638199.2019.1649157

[5] S. Silajdzic, & Mehic, E., *Trade openness and economic growth: Empirical evidence from transition economies. In Trade and Global Market*. IntechOpen. https://doi.org/10.5772/intechopen.75708, 2018.
[6] A. N. Soomro, J. Kumar, and J. Kumari, "The dynamic relationship between FDI, ICT, trade openness, and economic growth: Evidence from BRICS countries," *The Journal of Asian Finance, Economics and Business,* vol. 9, no. 2, pp. 295-303, 2022. https://doi.org/10.13106/jafeb.2022.vol9.no2.0295
[7] D. Sakyi, J. Villaverde, and A. Maza, "Trade openness, income levels, and economic growth: The case of developing countries, 1970–2009," *The Journal of International Trade & Economic Development,* vol. 24, no. 6, pp. 860-882, 2015. https://doi.org/10.1080/09638199.2014.971422
[8] H. T. Tien and T. X. Hang, "The interactive effects of tax and trade openness on economic growth - a case study of low-income and lower-middle-income countries," *Journal of Commercial Science,* vol. 169, pp. 39-48, 2022.
[9] B. C. Beaudreau, "Competitive and comparative advantage: Towards a unified theory of international trade," *International Economic Journal,* vol. 30, no. 1, pp. 1-18, 2016. https://doi.org/10.1080/10168737.2015.1136664
[10] M. Fetahi-Vehapi, L. Sadiku, and M. Petkovski, "Empirical analysis of the effects of trade openness on economic growth: An evidence for South East European countries," *Procedia Economics and Finance,* vol. 19, pp. 17-26, 2015. https://doi.org/10.1016/S2212-5671(15)00004-0
[11] A. Jalil and A. Rauf, "Revisiting the link between trade openness and economic growth using panel methods," *The Journal of International Trade & Economic Development,* vol. 30, no. 8, pp. 1168-1187, 2021. https://doi.org/10.1080/09638199.2021.1938638
[12] D. Dollar, "Outward-oriented developing economies really do grow more rapidly: Evidence from 95 LDCs, 1976-1985," *Economic Development and Cultural Change,* vol. 40, no. 3, pp. 523-544, 1992. https://doi.org/10.1086/451959
[13] J. D. Sachs and A. Warner, *Natural resource abundance and economic growth*. Cambridge, Mass, USA: National Bureau of Economic Research, 1995.
[14] J. A. Frankel and D. Romer, *Does trade cause growth? In J. Kirton (Ed.), global trade*. USA: Routledge, 2017.
[15] E. Borensztein, J. De Gregorio, and J.-W. Lee, "How does foreign direct investment affect economic growth?," *Journal of International Economics,* vol. 45, no. 1, pp. 115-135, 1998. https://doi.org/10.1016/S0022-1996(97)00033-0
[16] I. Mohamed Sghaier, "Trade openness, financial development and economic growth in North African countries," *International Journal of Finance & Economics,* vol. 28, no. 2, pp. 1729-1740, 2023. https://doi.org/10.1002/ijfe.2503
[17] A. Subramanian and S.-J. Wei, "The WTO promotes trade, strongly but unevenly," *Journal of International Economics,* vol. 72, no. 1, pp. 151-175, 2007. https://doi.org/10.1016/j.jinteco.2006.07.007
[18] M. Tomz, J. L. Goldstein, and D. Rivers, "Institutions and the determinants of trade policy," *Quarterly Journal of Political Science,* vol. 2, no. 1, pp. 1–23, 2007. https://doi.org/10.1561/100.00006031
[19] R. M. Solow, "A contribution to the theory of economic growth," *The Quarterly Journal of Economics,* vol. 70, no. 1, pp. 65-94, 1956. https://doi.org/10.2307/1884513
[20] L. Burange, R. R. Ranadive, and N. N. Karnik, "Trade openness and economic growth nexus: A case study of BRICS," *Foreign Trade Review,* vol. 54, no. 1, pp. 1-15, 2019. https://doi.org/10.1177/0015732518810902
[21] D. C. North, *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press, 1990.
[22] D. Kaufmann, A. Kraay, and P. Zoido-Lobatón, *Aggregating Governance Indicators*. Washington, D.C: World Bank Publications, 1999.
[23] D. Acemoglu, S. Johnson, and J. A. Robinson, "Institutions as a fundamental cause of long-run growth," *Handbook of Economic Growth,* vol. 1, pp. 385-472, 2005.
[24] S. Fischer, "The role of macroeconomic factors in growth," *Journal of Monetary Economics,* vol. 32, no. 3, pp. 485-512, 1993. https://doi.org/10.1016/0304-3932(93)90027-D
[25] R. J. Barro, "Inflation and growth," *Review-Federal Reserve Bank of Saint Louis,* vol. 78, pp. 153-169, 1996.
[26] T. D. Stanley, H. Doucouliagos, and P. Steel, "Does ICT generate economic growth? A meta-regression analysis," *Journal of Economic Surveys,* vol. 32, no. 3, pp. 705-726, 2018.
[27] World Bank, *World development report 2016: Digital dividends*. Washington, D.C: World Bank Publications, 2016.
[28] T. Niebel, "ICT and economic growth–Comparing developing, emerging and developed countries," *World Fevelopment,* vol. 104, pp. 197-211, 2018. https://doi.org/10.1016/j.worlddev.2017.11.024
[29] L.-H. Röller and L. Waverman, "Telecommunications infrastructure and economic development: A simultaneous approach," *American Economic Review,* vol. 91, no. 4, pp. 909-923, 2001. https://doi.org/10.1257/aer.91.4.909
[30] W. M. Cohen and D. A. Levinthal, "Absorptive capacity: A new perspective on learning and innovation," *Administrative Science Quarterly,* vol. 35, no. 1, pp. 128-152, 1990.
[31] N. G. Mankiw, D. Romer, and D. N. Weil, "A contribution to the empirics of economic growth," *The Quarterly Journal of Economics,* vol. 107, no. 2, pp. 407-437, 1992.
[32] S. Klasen and F. Lamanna, "The impact of gender inequality in education and employment on economic growth: New evidence for a panel of countries," *Feminist Economics,* vol. 15, no. 3, pp. 91-132, 2009.
[33] E. U. Osiobe, "A literature review of human capital and economic growth," *Business and Economic Research,* vol. 9, no. 4, pp. 179-196, 2019.
[34] R. Auty, *Sustaining development in mineral economies: The resource curse Thesis*. London: Routledge, 2002.
[35] J. D. Sachs, A. Warner, A. Åslund, and S. Fischer, "Economic reform and the process of global integration," *Brookings Papers on Economic Activity,* vol. 1995, no. 1, pp. 1-118, 1995. https://doi.org/10.2307/2534573
[36] O. Asiamah, S. K. Agyei, B. Ahmed, and E. A. Agyei, "Natural resource dependence and the Dutch disease: Evidence from Sub-Saharan Africa," *Resources Policy,* vol. 79, p. 103042, 2022. https://doi.org/10.1016/j.resourpol.2022.103042
[37] T. Havranek, R. Horvath, and A. Zeynalov, "Natural resources and economic growth: A meta-analysis," *World Development,* vol. 88, pp. 134-151, 2016. https://doi.org/10.1016/j.worlddev.2016.07.020
[38] M. A. Nawaz, A. Azam, and M. A. Bhatti, "Natural resources depletion and economic growth: Evidence from ASEAN countries," *Pakistan Journal of Economic Studies,* vol. 2, no. 2, pp. 155-172, 2019.
[39] J. Isham, M. Woolcock, L. Pritchett, and G. Busby, "The varieties of resource experience: Natural resource export structures and the political economy of economic growth," *The World Bank Economic Review,* vol. 19, no. 2, pp. 141-174, 2005.

[40] M. H. Pesaran, "General diagnostic tests for cross section dependence in panels. Cambridge Working Papers," *Economics,* vol. 1240, no. 1, pp. 1-6, 2004.
[41] M. H. Pesaran, "A simple panel unit root test in the presence of cross-section dependence," *Journal of Applied Econometrics,* vol. 22, no. 2, pp. 265-312, 2007.
[42] J. Westerlund, "Testing for error correction in panel data," *Oxford Bulletin of Economics and Statistics,* vol. 69, no. 6, pp. 709-748, 2007.
[43] World Bank, *World development indicators (WDI) database*. Washington, D.C: World Bank, 2024.
[44] D. A. Bennett, "How can I deal with missing data in my study?," *Australian and New Zealand Journal of Public Health,* vol. 25, no. 5, pp. 464-469, 2001.
[45] K. Stensnes, *Trade openness and economic growth: Do institutions matter? (Report No. 702-2006)*. Oslo: Norwegian Institute of International Affairs, 2006.
[46] J. A. Frankel, *The natural resource curse: A survey of diagnoses and some prescriptions. In Commodity price volatility and inclusive growth in low-income countries*. Washington, D.C: World Bank, 2012.