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Comparative Study: The Impact Of Domestic Structure And Trade Cooperation On Exports Of Developed And Developing Countries In Asia

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Abstract: *The intensification of globalization has driven greater economic integration through various international trade agreements such as FTA, CEPA, and RTA, particularly in Asia, which is the region with the highest number of trade agreements in the world. However, the benefits of such integration have not been evenly distributed between developed and developing countries. This study aims to comparatively analyze the impact of domestic structures reflected through labor, capital, HDI, exchange rate, and trade cooperation on exports in developed and developing countries in Asia. This research employs a quantitative approach using panel data from 17 countries (5 developed and 12 developing) over the 2004–2023 period, analyzed using the Error Correction Model (ECM). The results reveal that, in the long run, all variables significantly affect exports in developing countries except for trade cooperation, which shows no significant impact. In developed countries, only labor has no significant effect on exports, while other variables exhibit significant influences. These findings indicate that developed countries tend to be capital-intensive, whereas developing countries are more labor-intensive. In the short run, only labor and HDI significantly affect exports in developing countries, while in developed countries, capital and exchange rate have significant effects on exports. Furthermore, the existence of cointegration suggests an adjustment process from the short run to the long run, with the speed of adjustment in developing countries being relatively slower than in developed ones.*

Keywords: *Exports; Domestic Structure; Trade Cooperation; Developed and Developing Countries; Asia; Dynamic Model*

INTRODUCTION

Globalization has intensified over recent decades, driven by deeper economic integration, technological advancements, and increased cross-border mobility. Data from *Our World in Data (2025)* show that the global globalization index rose from 19.82% in 1947 to 55.87% in 2019, despite temporary slowdowns during the 2008 financial crisis and the 2020 global pandemic. One of the most prominent manifestations of this process is the proliferation of international trade agreements. According to *WTO (2025)*, 652 trade agreements were active worldwide by 2024, with Asia recording the highest number at 216. This reflects the region's strong commitment to strengthening cooperation through frameworks such as Free Trade Agreements (FTAs),

Comprehensive Economic Partnership Agreements (CEPAs), and Preferential Trade Agreements (PTAs).

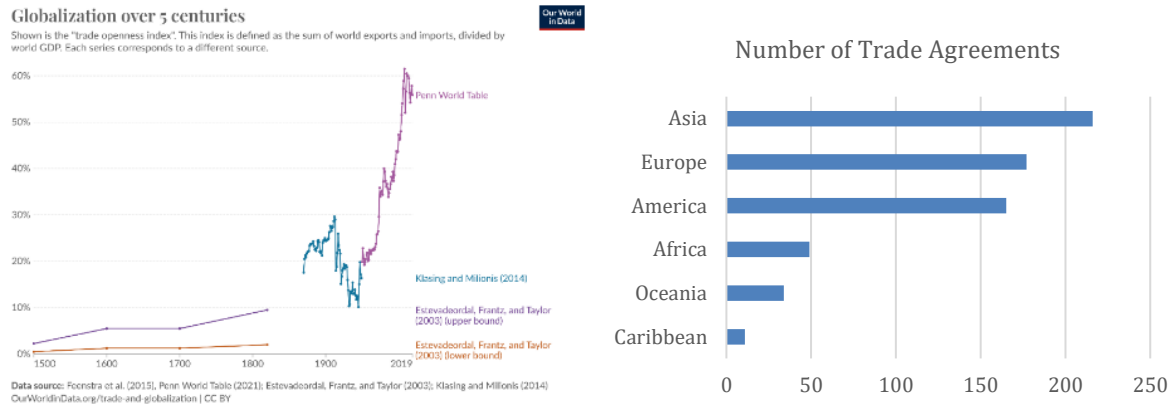


Figure 1. Globalization Level Worldwide & Number of Trade Agreements by Region

Source: *Our World in Data (2025); WTO (2025)*

However, this massive expansion of global cooperation has failed to translate into equitable economic outcomes. Disparities between developed and developing countries remain significant, *WorldBank (2025)* data show that despite some convergence, the GDP gap between developed and developing Asian economies remained substantial, reaching USD 18 trillion in 2023. Developing countries have increased their export participation , from USD 1.75 trillion in 2005 to USD 3.97 trillion in 2023 *(TradeMap ITC, 2025)* yet structural weaknesses persist, including reliance on primary commodities, limited technological capability, and slow transition to advanced manufacturing (Figure 2). These disparities indicate that improvements in export performance among developing countries remain more quantitative than qualitative.

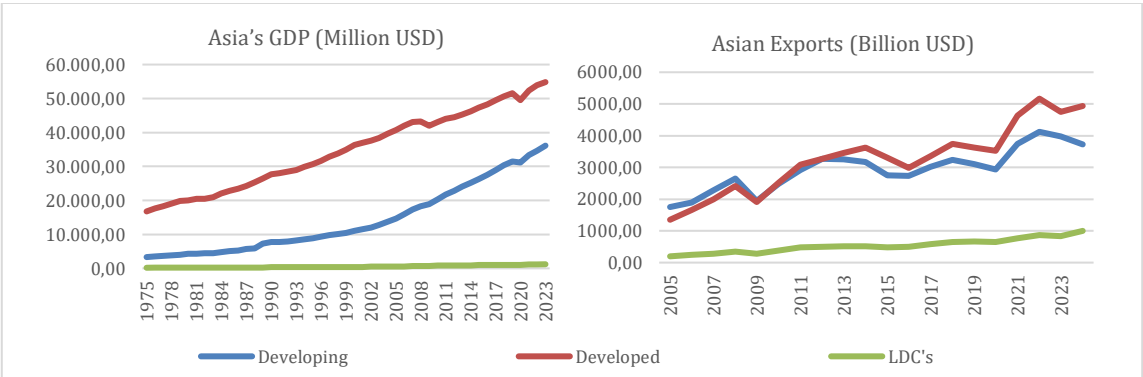


Figure 2. Asian GDP's & Exports by Development Classification (Trillion & Billion USD)

Source: WorldBank (2025); ITC (2025)

he primary objective of this study is to empirically examine which factors influence

exports, and critically assess whether trade cooperation effectively enhances exports across two distinct groups: developed and developing countries. To address these aspects, the study utilizes the Heckscher-Ohlin (H-O) Theory as its foundation, which posits that countries export goods intensively using factors they have in relative abundance, explaining why developing countries are often labor-intensive exporters while developed nations dominate capital- and technology-intensive industries *(Robert, 2019*; *Mankiw, 2022)*. Extensions of this model incorporate human capital *(Mankiw, Romer, & Weil, 1992)* and institutional quality *(North, 1990; Acemoglu et al., 2001)* as critical determinants of trade and growth.

Economic Integration theory further explains the mechanisms of trade cooperation. Integration progresses through stages such as Free Trade Area, Customs Union, Common Market, Economic Union, and Full Integration. Key effects include Trade Creation, which improves efficiency and welfare, and Trade Diversion, which may cause price distortions within the bloc *(Salvatore, 2020)*. In Asia, agreements such as ASEAN and RCEP aim to increase member countries' export efficiency and market access. Conversely, Dependency Theory highlights structural inequalities, arguing that developing nations often remain dependent on primary commodity exports while importing manufactured goods from developed countries, consistent with the Prebisch-Singer hypothesis *(Myrdal in Jhingan, 2018)*.

Empirical studies on the effects of trade cooperation provide mixed and partial evidence. Some studies suggest that trade agreements may worsen trade deficits in developing countries *(Khalid, et al., 2021; Adika, 2022; Singh, 2021)*, whereas others report positive, country-specific outcomes, particularly for Indonesia *(Putro, et.al., 2024; Taufiqqurrachman & Handoyo, 2021)*. However, these studies largely employ static models and examine trade cooperation agreements in isolation, leaving uncertainty about their cumulative impact on export performance across countries.

Furthermore, comparative analyses between developed and developing countries by using dynamic models in this context is still scarce. Most previous research does not explore how domestic factors such as labor, capital, and human resource quality (HDI), with trade cooperation to influence exports differently across countries at varying development stages. This limitation is significant, as the effectiveness of trade agreements may depend on a country's structural capacity and level of development. While studies such as Martínez-Zarzoso, et al. (2009) and Santos-Paulino (2002) adopt dynamic panel approaches to capture short- and long-run effects of trade policies within the framework of the Heckscher-Ohlin theory, they generally do not provide comparative analyses between developed and developing countries. In contrast, prior studies in the Asian context, such as Afonso *et al.* (2025); *Putro, et.al., (2024)*; *Taufiqqurrachman & Handoyo,*

(2021), remain confined to static frameworks, overlooking the intertemporal dynamics of exports.

Based on this background and the identified gaps, the present study aims to comprehensively compare the impact of domestic structural factors (including labor, capital, HDI, and exchange rate) together with trade cooperation, while explicitly accounting for dynamic short and long-term effects, on export performance in both developed and developing Asian countries.

METHOD

This study applies a quantitative approach to empirically examine the determinants of exports in Asian economies through econometric analysis. The population covers 49 Asian countries, categorized as developed or developing based on income level (World Bank) and Human Development Index (HDI) (UNDP). Developed countries are those with high income and HDI above 0.8, while developing countries have middle-to-low income and HDI below 0.8.

Using purposive sampling, 17 countries were selected—12 developing (Azerbaijan, India, Indonesia, Iran, Jordan, Kazakhstan, Kyrgyzstan, Malaysia, Pakistan, Philippines, Thailand, and Viet Nam) and 5 developed (Singapore, Japan, South Korea, Israel, and Hong Kong). The selection considered trade cooperation participation, regional diversity, and data completeness. The study covers the 2004–2023 period, employing secondary data from official sources such as the World Bank (WDI), UNCTAD, IMF, ADB, and ITC.

The operational definition of the variables includes Exports (EXPR) as the dependent variable, measured by the total export of goods and services (constant 2015 thousand USD). The independent variables are: Labor (LBR) in millions of people; Human Development Index (HDI) as an index value (0–1); Gross Fixed Capital Formation (GFCF) in constant 2015 thousand USD; Exchange Rate (EXC) in Local Currency Unit per USD (LCU/USD); and Trade Cooperation (RTA) measured by the number of cooperation units. The RTA variable is measured using a cumulative index of all formal trade agreements signed and implemented by each country. This includes *Free Trade Agreements (FTAs)*, *Comprehensive Economic Partnership Agreements (CEPAs)*, *Economic Partnership Agreements (EPAs)*, *Preferential Trade Agreements (PTAs)*, and broader *regional integration frameworks*. The classification follows WTO's Regional Trade Agreements Database and UNESCAP Asia-Pacific Trade Agreement datasets. The index increases cumulatively over time: for example, if a country has two active agreements by 2018 and signs a new CEPA with Chile in 2019, the RTA value increases from 2 to 3. This cumulative approach captures both the *depth* and *expansion* of trade cooperation, reflecting the progressive institutional integration that

can influence exports.

The study employs a log-log model structure, transforming all variables into their natural logarithm (ln) to align with the Cobb-Douglas production function framework. This transformation ensures that the estimated coefficients can be directly interpreted as elasticities, representing the percentage change in exports due to a one-percent change in the respective independent variable. The basic model for Developed coutries model as $\boldsymbol{lnEXPR_{dev} = \beta_0 lnA_{it-dev} + \beta_1 lnLBR_{it-dev} + \beta_2 lnGFCF_{it-dev} + \beta_3 lnEXC_{it-dev} + \beta_4 lnRTA_{it-dev} + \beta_5 lnHDI_{it-dev} + \varepsilon_{it-dev}}$ Developing coutries model as $\boldsymbol{lnEXPR_{it-dep} = \beta_0 lnA_{it-dep} + \beta_1 lnLBR_{it-dep} + \beta_2 lnGFCF_{it-dep} + \beta_3 lnEXC_{it-dep} + \beta_4 lnRTA_{it-dep} + \beta_5 lnHDI_{it-dep} + \varepsilon_{it-dep}}$.

Data analysis will be conducted separately for the developed and developing country groups to distinctly identify the differing impacts of the variables on their respective exports. Estimation is performed using EViews 12, following a structured sequence of steps. Initially, descriptive statistics are calculated. This is followed by stationarity testing (ADF-Fisher test) and cointegration testing (Pedroni, Kao, and Johansen-Fisher tests) to identify the long-run equilibrium relationships between the variables *(Gujarati & Porter, 2008)*. The results of these tests determine the appropriate econometric model. The Error Correction Model (ECM) is utilized if all variables are I(1) and cointegrated, The model is formulated as $\boldsymbol{\Delta Y_{it} = \alpha + \sum_{k=1}^{P} \gamma_k \Delta X_{it-k} + \lambda ECT_{it-1} + \varepsilon}$. If all variables are stationary [I(0)] or non-cointegrated, the Vector Autoregressive (VAR) model is used $\boldsymbol{Y_{it} = \alpha + \sum_{j=1}^{P} \phi_k Y_{it-j} + \varepsilon}$ When variables are a combination of I(0) and I(1), the Autoregressive Distributed Lag (ARDL) model is $\boldsymbol{Y_{it} = \alpha + \sum_{j=1}^{P} \phi_k Y_{it-j} + \sum_{k=1}^{q} \gamma_k X_{it-k} + \varepsilon}$

Panel estimations are conducted separately for developed and developing countries to capture structural heterogeneity. The empirical specification is based on a long-run export function, estimated using panel models (Common, Fixed, and Random Effects). Model selection follows standard procedures using the Chow, Hausman, and LM tests.Once the optimal model is selected, a battery of classic assumption tests is performed, including multicollinearity (correlation between variables < 0.8), heteroskedasticity (Breusch-Pagan Test), autocorrelation (Durbin-Watson test), and normality (Jarque-Bera test).

Concurrently, the Robust Test is employed to confirm the robustness of the estimates against assumption violations, particularly heteroskedasticity. The Huber-White estimator or sandwich estimator is used in cases of detected heteroskedasticity (e.g., *F*-statistic probability > 0.05$ in the Breusch-Pagan or White test). This approach corrects the standard error values without altering the coefficient values, ensuring that the estimates remain reliable even if the homoskedasticity assumption is violated *(Gujarati & Porter, 2008)*.

Given the long period observed and the potential for non-stationary macroeconomic variables, panel unit root tests (ADF-Fisher) and cointegration tests (Pedroni and Kao) are applied to identify long-run relationships. When cointegration is present, an Error Correction Model (ECM) is estimated to capture both short- and long-run dynamics. In cases where variables exhibit mixed integration orders, the study adopts a panel ARDL framework. These econometric choices are applied pragmatically and reported without excessive technical derivation *(Gujarati, 2015)*.

To ensure robust inference, classic diagnostic tests are conducted. If heteroskedasticity or serial correlation is detected, the analysis applies GLS or heteroskedasticity-robust standard errors. This treatment follows standard empirical practices and is used solely to strengthen estimator reliability rather than as a methodological exposition.

This study acknowledges the potential for endogeneity in key variables particularly RTA participation, capital formation (GFCF), and exchange rates. Countries with higher exports may be more likely to join RTAs, creating reverse causality. Likewise, macroeconomic fundamentals may simultaneously influence both exports and exchange-rate movements, generating simultaneity bias. To mitigate these risks, several strategies are employed: (1) separating developed and developing countries to reduce structural heterogeneity bias; (2) applying fixed effects to control for unobserved, time-invariant country characteristics that might correlate with the explanatory variables; (3) performing the Hausman test to assess potential endogeneity due to time-invariant omitted variables (OVB). while these measures substantially reduce, but cannot entirely eliminate, the risk of endogeneity, particularly in pathways involving reverse causality or contemporaneous feedback (simultaneity). Recognizing this limitation improves the transparency and strengthens both the robustness and policy significance of the study's conclusions.

RESULT

Based on World Bank and UNDP data (2004–2023), no significant change occurred in the classification of developed and developing countries in Asia. The descriptive analysis of data from 2004 to 2023 reveals a persistent structural polarity between developed (DEP) and developing (DEV) countries in Asia. The stagnation of development status is evident: although some DEV nations like Malaysia, Thailand, and Kazakhstan recorded significant Human Development Index (HDI) progress (surpassing 0.8), they failed to exit the middle-income trap. Conversely, DEP countries firmly maintained their high-status classification (final HDI 0.9364). This disparity is amplified in export trends. While both groups grew, the export gap widened sharply after the

2009 crisis, with DEP exports substantially surpassing DEV in 2024. This trend signals DEP's strong recovery and a superior export structure focused on high value-added and technology-intensive products, contrasting with DEV's constraints imposed by reliance on commodities and basic manufacturing.

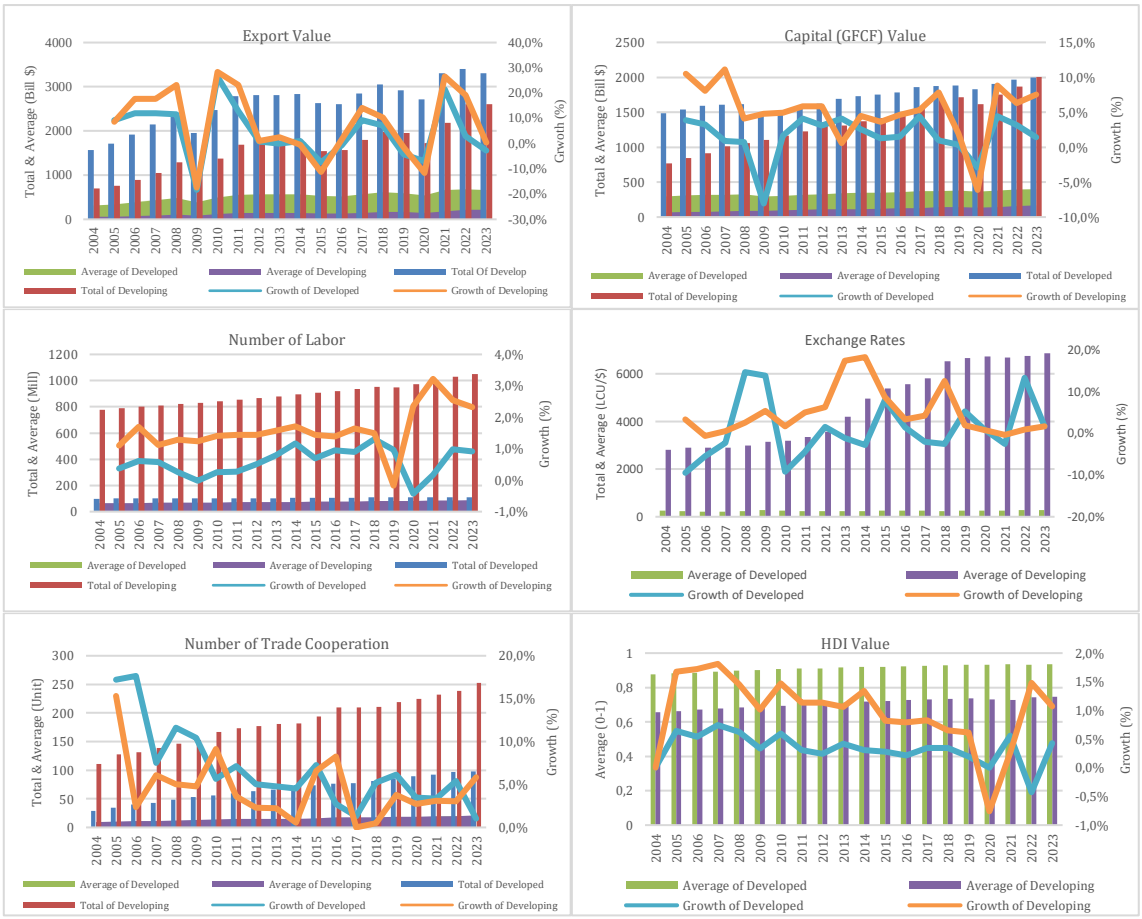


Figure 3. Export Value of Developed and Developing Countries in Asia

Source: TradeMap-ITC (2025); World Bank (2025); UNDP (2025)

The structural differences are further corroborated by key production factors. In terms of Labor (LBR) quantity, DEV dominates with a massive aggregate workforce, reaching 1,051 million people in 2023 compared to just 110 million in DEP, underscoring DEV's comparative advantage in labor-intensive industries. However, for Capital (GFCF), despite DEV's lead in total aggregate investment (reaching USD 2,005.8 billion by 2023), DEP holds a commanding lead in average GFCF per country, registering an average of USD 399.4 billion compared to USD 167.2 billion for DEV. This average value signifies DEP's superior capital efficiency, where investment is likely channeled into high-tech R&D, crucial for generating competitive export output.

Furthermore, macroeconomic vulnerabilities in DEV are highlighted by the Exchange Rate (EXC). DEV's average exchange rate is significantly more volatile, spiking from 2,814 to 6,866 LCU

per USD, in contrast to the relative stability of DEP currencies, which only rose from 254 to 292 per USD. This instability suggests underlying weaknesses in monetary systems and lower market confidence. In their strategic response, DEV nations have shown more aggressive participation in Regional Trade Agreements (RTAs), increasing their agreements substantially from 111 to 253 during the study period. This intensive RTA formation reflects DEV's strong push for market access, yet its actual effectiveness remains a critical question given the enduring structural deficits.

Finally, the Human Development Index (HDI) data reveals a process of convergence: while DEP's HDI remains significantly higher, DEV exhibits a faster relative annual growth rate (averaging 0.6%–1.2% per year, compared to DEP's 0.2%–0.7%). This acceleration indicates active investment in human capital as a key driver for DEV to potentially transition away from low-value exports. Collectively, the descriptive data establishes the premise that DEP benefits from structural advantages in capital efficiency and macroeconomic stability, while DEV is characterized by labor quantity and rapid human capital growth, but is constrained by macroeconomic volatility and low structural preparedness. The subsequent econometric analysis will dynamically test how these structural factors and RTA participation differentially influence the export performance of each country group.

The econometric analysis began with stationarity and cointegration tests. The stationarity test results (ADF-Fisher) show that all variables for both developed (DEP) and developing (DEV) country groups are non-stationary at level I(0) but become stationary after first differentiation I(1) (as seen in Table 1, where all I(1) probabilities are < 0.05).

Table 1. Unit Root and Johansen cointegration test Result

Unit Root Test				**Cointegration test**				
Model	**Variabel**	**I(0)**	**I(1)**	**Hipotesis H_0**	***Max-Eigenvalue***	**Prob.**	**Trace Statistic**	**Prob.**
DEP	LHDI	0,1726	0,0000*	None	62,534	0,000*	137,04	0,000*
	LnEXC	0,7736	0,0001*	At most 1	35,342	0,043*	74,507	0,076
	LnEXPR	0,094	0,0000*	At most 2	27,506	0,068	39,165	0,513
	LnGFCF	0,3671	0,0000*	At most 3	6,499	0,990	11,659	0,995
	LnLBR	0,3274	0,0000*	At most 4	4,489	0,928	5,159	0,978
	LnRTA	0,8441	0,0000*	At most 5	0,671	0,985	0,671	0,985
DEV	LHDI	0,0648	0,0355*	None	58,770	0,000	108,17	0,025
	LnEXC	0,0506	0,0000*	At most 1	24,445	0,488	49,395	0,870
	LnEXPR	0,1034	0,0000*	At most 2	13,359	0,912	24,950	0,987
	LnGFCF	0,3933	0,0004*	At most 3	8,981	0,905	11,592	0,995
	LnLBR	0,6699	0,0174*	At most 4	2,513	0,997	2,611	1,000
	LnRTA	0,1764	0,001*	At most 5	0,098	1,000	0,098	1,000

Source: Author's computation.

The Johansen cointegration test (Table 1) indicates that both country groups have a long-run relationship between the variables. Developing countries show 1–2 cointegrating vectors

(Trace Statistic Prob. < 0.05 for "None"), while developed countries show 1 cointegrating vector. This confirms the existence of a long-term equilibrium between exports and the explanatory variables, validating the use of the Error Correction Model (ECM).

Model selection tests (Chow, Hausman, and LM) definitively chose the Fixed Effect Model (FEM) for both groups, implying that unobservable, fixed country-specific characteristics significantly drive export variations.

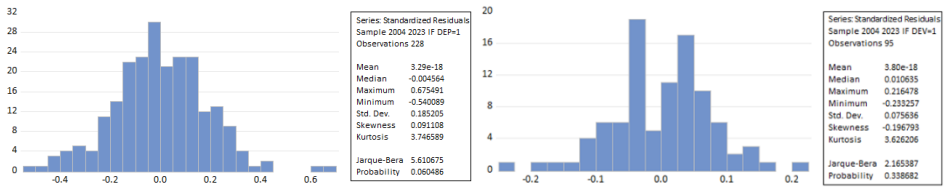
Table 2. Model Selection Test Result

Model	Chow	LM	Hausman	Conclusion
DEP	0,0000*	0,0000*	0,0009*	FEM
DEV	0,0000*	0,0000*	0,0022*	FEM

Source: Author's computation.

After selecting the FEM, The results of the classical assumption tests indicate that the model satisfies most of the required statistical criteria. The data are normally distributed (p > 0.05) for both developing (p-value = 0.0604) and developed countries (p-value = 0.3386), suggesting that the residuals follow a normal distribution.

Figure 4. Normalitay Test Result



Source: Author's computation.

In addition, the multicollinearity test results demonstrate that there are no multicollinearity problems in either group, as all VIF values remain below the threshold of 10. This implies that the independent variables used in the model are not highly correlated with each other.

Table 3. Multikolinearitas Test Result

Variable	Developed Country			Developing Country		
	Coef. Variance	Uncentered VIF	Centered VIF	Coef. Variance	Uncentered VIF	Centered VIF
C	9,3991	128663,20	-	7,7212	61408,57	-
LNLBR	0,0696	245793,80	6,9372	0,0192	44045,61	2,5680
LNGFCF	0,0129	63013,29	5,9410	0,0060	14782,40	4,7902
LNEXC	0,0107	1387,55	1,1960	0,0028	483,12	1,5516
LNRTA	0,0005	42,36	1,7673	0,0084	476,40	5,4828
LNHDI	0,5012	60,55	3,6483	0,3954	394,04	4,3183

Source: Author's computation.

Furthermore, the autocorrelation test results also show no indication of serial correlation in the residuals. The Durbin-Watson (DW) values for both developing (DEP) and developed (DEV) country models are close to 2, and fall within the acceptable range (dU < dW < 4 - dU), with values of 1.95 and 1.82 respectively. This confirms that the assumption of no autocorrelation is fulfilled, meaning that the residuals are independent over time and do not exhibit systematic patterns.

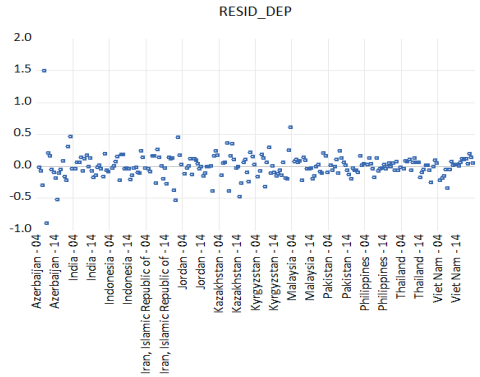
Table 4. Durbin Watson & Heteroskedasticity (Breusch–Pagan) Test Result

Model	Autocorelation (DW)						Heteroskedasticity (B-P)		
	Var (k)	Obs (n)	dW	dU	Criteria	**Conclu -sion**	Prob. (F-stat)	Criteria	**Conclu -sion**
DEP	7	228	1,95	1,765	1,765<1,95<2,235	**Passed**	0.0430	> 0.05	**Not Passed**
DEV		95	1,82	1,690	1,69<1,82<2,31	**Passed**	0.211	> 0.05	**Passed**

Source: Author's computation.

However, the heteroskedasticity test reveals different outcomes across the two groups. The Breusch–Pagan test indicates the presence of heteroskedasticity in the developing country model (p-value = 0.0430 < 0.05), while the developed country model passes the test (p-value = 0.211 > 0.05). This result implies To further examine this issue, a residual plot analysis was conducted to observe the distribution pattern of the residuals. The plot shows that the residuals are linearly dispersed around the zero value and do not form any specific pattern, suggesting that the heteroskedasticity problem is not severe and that the model remains reasonably consistent.

Figure 5 . Heteroskedasticity Residual Plot & Robustness Test for Developing Countries



Variable	Without Robust			Robust (White)			Concl-usion
	Std. Error	t-Stat	Prob.	Std. Error	t-Stat	Prob	
C	0.017	1.043	0.298	0.019	0.877	0.382	Remains
D(LnLBR)	0.469	2.054	0.041	0.422	2.281	0.024	Remains
D(LnGFCF)	0.113	1.657	0.099	0.108	1.728	0.085	Remains
D(LnEXC)	0.080	-1.493	0.137	0.180	-0.665	0.507	Remains
D(LnRTA)	0.150	-0.728	0.467	0.137	-0.793	0.429	Remains
D(LnHDI)	1.189	4.475	0.000	1.364	3.899	0.000	Remains
ECT_DEP (-1)	0.053	-6.029	0.000	0.052	-6.083	0.000	Remains

Source: Author's computation.

To ensure the robustness of the estimation results, a robustness test was conducted using the White diagonal correction approach. The comparison between non-robust and robust (White) estimations indicates that the results remain stable and do not experience significant changes in standard errors or statistical significance. After correction, the variables labor, HDI, and the error correction term (ECT(-1)) remain statistically significant, while capital, exchange rate, and trade cooperation remain insignificant. This finding confirms that the model's estimation is robust and

the results are valid for further interpretation and policy analysis.

After confirming that the model satisfies the classical assumption tests, the analysis proceeds to the interpretation of the estimation results and the comparative assessment between developed and developing countries.

Table 5. Comparison of Long-Run Estimation Results

Variable	Developing Countries			Developed Countries		
	Coefficient	t-Statistic	Probability	Coefficient	t-Statistic	Probability
C	10.162	3.657	0.000*	11.865	3.870	0.000*
LnLBR	0.484^{T}	3.496	0.001*	0.093	0.354	0.724
LnGFCF	0.188	2.432	0.016*	0.433^{T}	3.819	0.000*
LnEXC	-0.244	-4.619	0.000*	-0.426^{T}	-4.124	0.000*
LnRTA	-0.106	-1.152	0.251	0.058^{T}	2.565	0.012*
LnHDI	6.651^{T}	10.578	0.000*	5.996	8.470	0.000*

*Notes: * indicates significance at the 5% level; T indicates a larger effect.*
Source: Author's computation.

The estimated long-run model for developing and developed countries is as follows:

$$\mathbf{LnEXPR}_{DEP} = \mathbf{10.162} + \mathbf{0.484LnLBR} + \mathbf{0.188LnGFCF} - \mathbf{0.244LnEXC} - \mathbf{0.105LnRTA} + \mathbf{6.651LnHDI} + \boldsymbol{\mu_i} + \boldsymbol{\varepsilon_{it}}$$

$$\mathbf{LnEXPR}_{DEV} = \mathbf{11.864} + \mathbf{0.093LnLBR} + \mathbf{0.433LnGFCF} - \mathbf{0.426LnEXC} + \mathbf{0.0581LnRTA} + \mathbf{5.996LnHDI} + \boldsymbol{\mu_i} + \boldsymbol{\varepsilon_{it}}$$

The long-run analysis reveals a fundamental structural divergence in export drivers, validating the Heckscher-Ohlin (H-O) Theory by showing that factor endowments align with development status. For Developing Countries (DEV), Labor (LnLBR) is significantly positive (0.484), confirming their reliance on a labor-intensive comparative advantage. Conversely, the impact of Physical Capital (LnGFCF) is significantly stronger in Developed Countries (DEP) (0.433) than in DEV (0.188). This signifies that capital in DEP drives high-value export competitiveness through technology and R&D investments, while DEV's growth relies more heavily on labor quantity. The Exchange Rate (LnEXC) has a negative and significant influence on both, but is more sensitive in DEP (-0.426), suggesting higher susceptibility of their sophisticated exports to price competitiveness changes. Crucially, Human Development Index (LnHDI) is a highly significant, universal driver, with a slightly larger impact in DEV (6.651), highlighting its role as the exponential factor for DEV to transition away from low-value exports and escape the middle-income trap.

The most critical finding relates to regional cooperation and structural preparedness. Trade Cooperation (LnRTA) is found to be significantly positive (0.058) only in DEP, while it is insignificant and negative in DEV (-0.106). This result underscores a major structural gap:

developed nations possess the necessary institutional and infrastructural capacity to fully translate RTA benefits into effective export growth through Trade Creation. For developing economies, the insignificant outcome suggests that the potential benefits of RTA are neutralized by persistent structural impediments and low absorption capacity. This confirms that the effectiveness of economic integration is fundamentally conditional upon a country's level of development and structural readiness, with DEP leveraging cooperation for growth and DEV struggling to convert cooperation into sustainable export performance.

In the short run, based on the estimation test results, it can be observed that the influence of each variable on exports shows different dynamics between developed and developing countries.

Table 6. Comparison of Short-Run Estimation Results

Variable	Developing Countries			Developed Countries		
	Coefficient	t-Statistic	Probability	Coefficient	t-Statistic	Probability
C	0.0173^{T}	1.042	0.298	0.0066	0.509	0.612
ΔLnLBR	0.964^{T}	2.053	0.041*	-0.228	-0.319	0.749
ΔLnGFCF	0.187	1.657	0.098	0.801^{T}	5.617	0.000*
ΔLnEXC	-0.120	-1.493	0.136	-0.524^{T}	-3.840	0.0002*
ΔLnRTA	-0.109	-0.728	0.467	0.071^{T}	1.014	0.314
ΔLnHDI	5.321^{T}	4.475	0.000*	3.554	1.825	0.0715
ECT(-1)	-0.320	-6.029	0.000*	-0.501^{T}	-5.205	0.000*

*Notes: * indicates significance at the 5% level; T indicates a larger effect.*
Source: Author's computation.

The estimated short-run model for developing countries is expressed as:

$$\Delta(\mathbf{LnEXPR})_{DEP} = \mathbf{0,0173} + \mathbf{0,964}\Delta(\mathbf{LnLBR}) + \mathbf{0,187}\Delta(\mathbf{LnGFCF}) - \mathbf{0,120}\Delta(\mathbf{LnEXC}) - \mathbf{0,109}\Delta(\mathbf{LnRTA}) + \mathbf{5,320}\Delta(\mathbf{LnHDI}) - \mathbf{0,320ECT\_DEP}(-\mathbf{1}) + \boldsymbol{\mu_i} + \boldsymbol{\varepsilon_{it}}$$

$$\Delta(\mathbf{LnEXPR})_{DEV} = \mathbf{0,007} - \mathbf{0,228}\Delta(\mathbf{LnLBR}) + \mathbf{0,801}\Delta(\mathbf{LnGFCF}) - \mathbf{0,524}\Delta(\mathbf{LnEXC}) + \mathbf{0,071}\Delta(\mathbf{LNRTA}) + \mathbf{3,554}\Delta(\mathbf{LnHDI}) - \mathbf{0,501ECT\_DEV}(-\mathbf{1}) + \boldsymbol{\mu_i} + \boldsymbol{\varepsilon_{it}}$$

The short-run estimation results, derived from the Error Correction Model (ECM), highlight crucial differences in how structural changes and external shocks are immediately transmitted to exports in both groups. For Developing Countries (DEP), the mobilization of Labor (ΔLnLBR) has an immediate, highly significant, and large positive impact (0.964) on exports, yet its effect in Developed Countries (DEV) is insignificant. This confirms that DEP's export sector is labor-intensive and highly responsive to immediate changes in labor availability. Conversely, Physical Capital (ΔLnGFCF) shows a significant and dominant impact in DEV (0.801) but is only marginally significant in DEP (0.187). This indicates that new investment in DEV likely directed at technology and capacity expansion, translates rapidly into exportable output, whereas capital investment in DEP has a slower, weaker short-term effect, possibly due to longer implementation

periods for infrastructure projects. The change in the Exchange Rate (ΔLnEXC) is significant and negative only in DEV (-0.524), showing that developed nations' exports face quicker and harsher consequences from short-term currency appreciation due to immediate price sensitivity.

A key aspect of the short-run model is the adjustment mechanism toward the long-run equilibrium. The Error Correction Term (ECT(-1)) is negative and highly significant for both groups, confirming the existence of a stable long-run relationship. However, the speed of adjustment is significantly faster in DEV (-0.501) compared to DEP (-0.320). This suggests that after a short-term shock or deviation (e.g., a sudden change in global demand or exchange rate), DEV economies restore their export equilibrium much more quickly than DEP, reflecting superior macroeconomic and structural resilience. Furthermore, short-run changes in Trade Cooperation (ΔLnRTA) remain insignificant for both, indicating that the benefits of integration are not instantaneous and primarily manifest as long-run structural advantages. Similarly, while the change in HDI (ΔLnHDI) has a large and significant short-run impact in DEP (5.321), it is insignificant in DEV, confirming that human capital improvements provide an immediate productivity boost in developing economies where the baseline quality is lower.

DISCUSSION

The influance Labor (LBR) on Export Between Developing and Developed Countries

In the long-run estimation, labor (LnLBR) exerts a positive and significant influence on exports in developing countries, with a coefficient of 0.484 (p = 0.001). This indicates that a 1% increase in labor force contributes to a 0.484% rise in exports, emphasizing the pivotal role of abundant labor in supporting export-oriented production. Such a result aligns with the Heckscher-Ohlin theory, which postulates that countries tend to export goods that intensively utilize their abundant production factors (*Paul, et, al. 2023*). In many developing economies, particularly those still dominated by labor-intensive manufacturing such as textiles and footwear, labor remains the primary driver of export competitiveness (*Akther, et. al. 2022*). Conversely, in developed countries, the long-run effect of labor is statistically insignificant (coefficient 0.093, p = 0.724), reflecting the transition toward technology- and innovation-based industries where productivity and efficiency outweigh the quantity of labor. These findings suggest that exports in developed economies are shaped more by capital intensity and technological advancement than by labor expansion (*Choi, 2024; Paul, et, al. 2023)*.

In the short-run model, the change in labor (D(LnLBR)) also exhibits a positive and significant impact on exports in developing countries, with a coefficient of 0.964 (p = 0.041). This nearly proportional response highlights the short-term dependence of export sectors on direct

labor availability, particularly in flexible, labor-intensive industries (Viegelahn, et. al, 2023). Rapid increases in the workforce allow production to scale up quickly without major capital investment or technological adaptation. In contrast, the short-run effect in developed countries is negative and insignificant (coefficient –0.228, p = 0.749), suggesting that fluctuations in labor quantity do not substantially influence exports. This outcome reflects the dominance of high-technology, automated, and capital-intensive industries in advanced economies, where short-term export performance relies more on innovation and systemic efficiency than on workforce expansion (*Choi, 2024; Navarro Zapata, et.atl., 2024*).

The influance Capital (GFCF) on Export Between Developing and Developed Countries

In the long-run estimation, Gross Fixed Capital Formation (LnGFCF) shows a positive and significant impact on exports in both developing and developed countries, though with differing magnitudes. In developing economies, the coefficient of 0.188 (p = 0.016) indicates that a 1% increase in capital investment leads to a 0.188% rise in exports, reflecting the importance of expanding production capacity through infrastructure, machinery, and industrial facilities. Such capital accumulation supports export-oriented manufacturing and agriculture, consistent with classical growth and Heckscher-Ohlin (H-O) theories emphasizing capital as a key production factor (*Peiris, 2021*; *Adika, 2022*). In developed countries, the long-run effect is even stronger and highly significant (coefficient 0.433, p < 0.01), suggesting that capital investment enhances not only capacity but also technological sophistication and value-added quality. Capital in these economies is primarily directed toward R&D, automation, and advanced production systems, yielding competitive high-tech exports. This aligns with the H-O theory, which posits that capital-rich countries gain from producing and exporting technology- and capital-intensive goods (*Paul, et, al. 2023*; *OECD, 2025*,). Connecting to GVCs, GFCF in DEV is often linked to attracting Foreign Direct Investment (FDI) aimed at integrating into regional supply chains, especially those feeding into final assembly centers, often involving large economies like China. However, if this capital is concentrated only in low-value assembly tasks, its impact on overall *national* export value remains limited.

In the short-run, changes in capital (D(LnGFCF)) exhibit a positive but insignificant effect on exports in developing countries (coefficient 0.187, p = 0.098), implying that short-term capital inflows contribute modestly to export growth. The weak response reflects time lags in capital utilization due to bureaucratic delays and infrastructure constraints, meaning that the benefits of investment are realized gradually (*Wamalwa & Were, 2021*). Conversely, in developed countries, short-run capital effects are strong and significant (coefficient 0.801, p = 0.000), indicating that even a 1% increase in investment can directly boost exports. This robust link underscores the

efficiency of capital allocation, rapid technological absorption, and advanced financial systems in developed economies. Supported by *Navarro Zapata et.al. (2024)*, this finding highlights that capital, rather than labor, remains the primary short-run driver of high-technology exports, reinforcing the structural advantages of capital-intensive production in advanced economies. the lower coefficient of developing country suggests that institutional inefficiencies (e.g., poor protection of property rights or regulatory uncertainty) can hinder the productive utilization of capital, diminishing its long-run impact on export sophistication.

The influance Exchange Rate (EXC) on Export Between Developing and Developed Countries

In the long-run estimation, the exchange rate (LnEXC) exerts a negative and significant effect on exports in both developing and developed countries, though the magnitude and mechanisms differ. In developing countries, the coefficient of -0.244 ($p = 0.000$) indicates that currency appreciation reduces export volume, while depreciation should theoretically enhance competitiveness. However, high import dependence for raw materials and intermediate inputs often offsets the benefits of a weaker currency, raising production costs and compressing profit margins (*Paul, et, al. 2023*; *Sugiharti, et.al., 2020; Urgessa, 2024*). High exchange rate volatility also creates uncertainty, further hindering export growth (*United Nations Conference on Trade and Development, 2015)*. In developed countries, the long-run coefficient is even larger (-0.426, $p < 0.01$), reflecting greater sensitivity to currency fluctuations. Exports from these nations consist largely of high value-added goods and services with elastic demand, so appreciation reduces price competitiveness and global demand more strongly. Nevertheless, sophisticated financial systems and hedging mechanisms help mitigate these adverse effects (*Mankiw, 2022*; *Upadhyaya, et. al., 2020*).

In the short run, changes in the exchange rate (D(LnEXC)) have differential impacts. In developing countries, the effect is negative but insignificant (coefficient -0.12, $p = 0.136$), likely due to structural rigidities, limited infrastructure, and slow sectoral adjustment, with government interventions further dampening immediate effects (*Oyinlola, et.al., 2023*; *Thorbecke & Sengonul, 2023*; *Rojid & Rojid, 2024*). Conversely, developed countries experience a strong and significant negative short-run impact (coefficient -0.524, $p = 0.0002$), where currency depreciation immediately enhances export price competitiveness. High-value, demand-elastic exports combined with advanced production and logistics systems allow developed economies to respond quickly, generating immediate increases in export volume, consistent with classical trade theory (*Blanchard, 2021*; *Nduka et al., 2025*).

The influance Trade Cooperation (RTA) on Export Between Developing and Developed Countries

In the long run, Regional Trade Agreements (RTAs), including PTA, CEPA, and FTA, exhibit a negative and statistically insignificant effect on exports in developing countries (coefficient -0.106, p = 0.251). This limited impact is largely due to structural and institutional constraints: local firms often have low capacity to utilize the agreements effectively because of bureaucratic complexities, certification hurdles, and lack of awareness (*institutional barrier*). The insignificance is compounded by the implementation gap where RTA commitments are slow to be adopted at the domestic level, leading to high transaction costs that nullify the tariff benefits. (*Utomo, 2023*; *UNESCAP, 2023)*. The regional context further suggests that DEV exports, which are heavily integrated into the Asia-Pacific Global Value Chains (GVCs), often face intense competition from or rely on inputs supplied by large regional manufacturing hubs like China. This structure means that trade gains from small regional agreements may be overshadowed by the sheer volume and competitiveness of the established GVC architecture. Consequently, despite expanded market access, the expected gains in export volume are muted by underdeveloped trade infrastructure, logistics inefficiencies, and limited product competitiveness. In contrast, developed countries demonstrate a positive and significant long-run impact of RTA participation (coefficient 0.058, p = 0.012). Their advanced production systems, technological capabilities, and high-value-added export products enable them to fully exploit trade agreements. Strategic engagement in RTA negotiations, often including higher standards and WTO-X provisions, allows developed nations to achieve substantial trade creation and maintain a competitive edge, confirming the view that RTAs disproportionately benefit countries with stronger trade infrastructure and product competitiveness (*Zeng, et.al., 2025*; *Jhingan, 2018*; *Utomo, 2023*).

In the short run, changes in RTAs (D(LnRTA)) show negative and insignificant effects on exports in developing countries (coefficient -0.109, p = 0.467). This reflects the slow adaptation of domestic businesses to new policies, persistent bureaucratic obstacles (institutional constraints), and the predominance of low value-added exports, which limit immediate benefits from trade agreements (UNCTAD, 2015; *Hannan, 2016*). By contrast, developed countries experience a positive but statistically insignificant short-run impact (coefficient 0.071, p = 0.314). While the trend suggests that increased trade cooperation supports exports, the immediate effect is modest because established trade networks already provide substantial market access, and the complex nature of agreementsincluding technical regulations, intellectual property, and standards requires time for full implementation. Overall, these results highlight that the benefits of RTAs are conditional: they are more evident in the long run, particularly for developed

countries with robust institutional capacity, whereas developing nations require significant complementary domestic and institutional improvements to bridge the implementation gap and realize export gains. (*Utomo, 2023*; *Shah, et.al., 2022; Adika, 2022*).

The influance Human Development Index (HDI) on Export Between Developing and Developed Countries

In the long run, Human Development Index (HDI) is a highly significant and dominant factor influencing exports in both developing and developed countries. In developing nations, HDI shows a very strong positive effect (coefficient 6.651, p = 0.000), indicating that even marginal improvements in education, health, and well-being can substantially increase export performance. Enhanced human capital raises labor productivity, promotes innovation, improves management efficiency, and facilitates technology adoption, enabling a structural shift from primary commodities to higher value-added products (*Todaro and Smith, 2020*; *Lukman, et.al., 2023*). Similarly, developed countries also experience a significant positive impact (coefficient 5.996, p = 0.000), where improvements in human capital strengthen competitiveness in high-value sectors such as IT, pharmaceuticals, professional services, and digital innovations. Continuous HDI enhancement supports research and development, technological entrepreneurship, and workforce creativity, which are critical for sustaining knowledge-based export growth (*World Bank, 2023*; *Kumar, et. al., 2025*).

In the short run, changes in HDI (D(LnHDI)) also have a strong positive impact on exports in developing countries, with a coefficient of 5.321 (p = 0.000). This indicates that immediate improvements in human capital—through better education, health, and living standards—can rapidly enhance export capacity by increasing labor productivity, accelerating technological innovation, and improving production efficiency. The magnitude of this effect highlights the potential for quick gains in export performance when human development policies are effectively implemented (*UNDP, 2023*; *Cetinguc, et. al., 2023)*). For developed countries, although short-run effects are not explicitly reported here, the long-term evidence suggests that HDI improvements consistently support innovation-driven exports, confirming human capital as a key determinant of sustained export competitiveness.

The Error Correction Term (ECT) Between Developing and Developed Countries

In the short run, the ECT reflects the speed at which deviations from long-run equilibrium are corrected. In developing countries, the ECT is negative and significant (coefficient -0.32; p=0.000), meaning that approximately 32% of previous period export disequilibria are corrected each year, aligning with the Error Correction Model theory *(Engle & Granger, 1987 in Gujarati &*

Porter, 2008). This indicates that developing economies can adjust to short-term shocks, though the adjustment is relatively slow due to limited market efficiency and structural flexibility *(Jhingan, 2018)*.

In developed countries, the ECT is also negative and significant (coefficient -0.501; p=0.000), suggesting that about 50.1% of export disequilibria are corrected annually. The higher value compared to developing countries reflects faster adjustment, enabled by a more efficient economic system, stable macroeconomic policies, and stronger market integration *(OECD, 2025)*. Therefore, developed countries are more responsive in correcting short-term deviations toward long-run equilibrium.

This difference in adjustment speed is directly linked to institutional quality and structural flexibility. Developed Countries superior macroeconomic stability, efficient financial markets, and strong regulatory predictability allow economic agents to respond quickly to shocks, minimizing deviations. Crucially, deep and strategic integration into Global Value Chains (GVCs) enables DEP to reallocate resources, adjust production schedules, and mitigate supply disruptions rapidly, as their firms often occupy high-value, control points within the GVC. This structural efficiency, reinforced by GVC participation, enhances the speed of convergence. Conversely, DEV's slower adjustment reflects structural rigidities, including bureaucratic inertia and less efficient credit allocation. Although DEV participates in GVCs, they typically occupy lower-value, less flexible stages of production, leaving them more exposed to prolonged external shocks and slower in their ability to restore equilibrium (Jhingan, 2018).

CONCLUSION

Based on the short-run and long-run analysis, this study finds that labor (LBR) remains a key driver of exports in developing countries, reflecting their reliance on labor-intensive sectors, whereas developed countries emphasize efficiency, technology, and capital. Human Development Index (HDI) positively and significantly affects exports in both groups, with a slightly stronger long-run impact in developing nations, highlighting the strategic importance of improving human capital quality for export competitiveness. Physical capital (GFCF) positively influences exports in both groups, but its effect is more pronounced in developed countries, underscoring the role of investment, infrastructure, and technology-intensive industries in driving high-value exports.

The exchange rate (EXC) negatively affects exports, with developed countries more sensitive to currency fluctuations due to their integration into global trade. Trade cooperation (RTA) benefits developed countries in the long run but has limited or insignificant effects for developing nations, reflecting differences in industrial readiness and institutional capacity.

Finally, the Error Correction Term (ECT) confirms the existence of a mechanism toward long-run equilibrium, with faster adjustment in developed countries, indicating higher economic efficiency. Overall, the findings suggest that developed countries gain more from capital and trade integration, while developing countries depend on labor and human capital as the primary drivers of export growth.

This research offers three distinct scientific contributions to the literature on international trade. First, by employing the dynamic ECM approach, the study provides novel empirical validation of the Heckscher-Ohlin (H-O) theory, distinguishing the qualitative transmission mechanism of factor endowments (labor vs. capital) in both the short and long run. Second, the study quantifies the effect of RTA, conclusively establishing a Structural Readiness Gap by demonstrating that the benefits of trade cooperation are conditional on institutional quality, as evidenced by the insignificance of RTA for DEP exports. Third, the analysis identifies HDI as an Exponential Transformation Factor for DEP, given its high long-run elasticity (6.651), offering a critical methodological and policy focus distinct from traditional growth factors.

Based on these contributions, specific policy recommendations are formulated for developing countries. DEP governments must: (1) Prioritize High-Quality Human Capital Investment by aligning vocational and technical education systems with the demands of high-value-added sectors to effectively utilize the high HDI elasticity. (2) Address RTA Implementation Barriers through specific institutional reforms, such as streamlining bureaucracy, creating centralized *single window* systems for export documentation, and standardizing *Rules of Origin (ROO)* procedures to eliminate transaction costs that nullify tariff benefits. (3) Enhance Macroeconomic Resilience by promoting domestic industrial deepening and diversification to reduce import dependency and mitigate the cost-push effects of currency depreciation.

For future researchers, studies can expand by incorporating variables such as innovation, institutional quality, trade digitalization, and export infrastructure to capture global dynamics more comprehensively. Comparative analyses across regions (e.g., Asia and Africa) or sectors (manufacturing, agriculture, and services) are also recommended. A key limitation of this study was the inability to perform specific endogeneity testing, which potentially limits the estimation's validity. Methodologically, while the Error Correction Model (ECM) has proven effective in explaining both short- and long-term relationships, the use of Generalized Method of Moments (GMM) or Instrumental Variables (IV) is highly recommended to address potential endogeneity and generate significantly more valid and unbiased estimates. Furthermore, PMG/ARDL, nonlinear models, or VAR/VECM approaches may better capture cross-country heterogeneity, bidirectional causality, and offer deeper insights. These directions are expected to provide more

comprehensive contributions to the literature and inform international trade policy, particularly in the context of developing countries.

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