

The Role of Human Capital and Export Diversification in the Growth Performance of Emerging and Developing Asian Countries

*Sunil Dash**

International Affairs Division, KKUIC, Khon Kaen University, Thailand.

Nazmullah Bin Tariq

Department of Economics, University of Rajshahi, Bangladesh.

Received 15 August 2025, Received in revised form 27 March 2026,

Accepted 30 March 2026, Available online 4 September 2026

Abstract

Using balanced panel data of 14 emerging and developing Asian countries over the period 1980-2013, this paper examines the importance of human capital in the relationship between export diversification, margins, and growth. Estimates from the Arellano-Bond panel GMM estimator reveal that at the aggregate level, export concentration has a positive impact on economic growth. The interaction coefficient between export diversification and human capital reveals that a higher level of human capital magnifies the positive impact of export concentration on growth. At the margin level, we found that the intensive margin of concentration has an overall positive impact on growth. The interaction coefficient between the extensive margin and human capital reveals that a higher level of human capital magnifies the positive impact of the extensive margin of diversification on growth. The complementarity between the intensive margin of diversification and human capital in impacting growth is inconclusive. Our findings are robust when an alternative estimate, such as the fixed effects estimator, is used. We also assess the credibility of statistical conclusions by testing whether the estimated relationships are sensitive to the choice of the dependent variable. Similar outcomes are obtained when growth in GDP per capita is used as an alternate indicator of economic growth in place of GDP growth. To fully benefit from knowledge spillovers within the framework of growth returns from international trade, it is recommended that policymakers in the sampled countries focus more on the development of their human capital.

Keywords: Export Diversification, Margins, Economic Growth, Human Capital.

JEL Classifications: F1, F14, F15

* Corresponding author: Email: sunidas@kku.ac.th

1. Introduction

According to the theoretical prediction, international trade promotes the sharing of knowledge and ideas among countries, and over time, this kind of trade-related knowledge spillover results in economic growth (Grossman & Helpman, 1991). Although international trade is one of the channels through which ideas, knowledge, and cutting-edge technology are transferred, it is unclear how much of this information that flows can be utilized by recipient countries engaged in such activities. One of the channels that makes it convenient for technology to be adopted internationally is human capital. Human capital is commonly defined as the pool of knowledge and skills inherent in the capacity to do labor to generate economic value (O'Sullivan et al., 2003), or as a fundamental source of economic productivity (Romer, 1990b). From the standpoint of production, there are two types of human capital. First, humans are used as a factor of production, and second, they are viewed as creators who frame knowledge, skills, experience, and competences (Kwon, 2009). Through a variety of pathways, the second type is thought to be one of the key elements that facilitates international trade and subsequently leads to economic growth (Aditya & Acharyya, 2013; Badinger & Tondl, 2003; Fatima et al., 2020; Haq & Luqman, 2014; Levin & Raut, 1997; Neeliah & Seetanah, 2016; Noura & Saafi, 2022). The role of human capital and trade in driving economic growth has been examined by several researchers, and the consensus is that the stock of human capital is one of the key factors that supports international trade in improving economic growth (Agosin, 2009; Badinger & Tondl, 2003; Bhavan, 2017; Fatima et al., 2020; Haq & Luqman, 2014; Levin & Raut, 1997; Noura & Saafi, 2022; Soukiazis & Antunes, 2012).

In international trade, “export diversification” is a crucial strategy, especially for countries that depend on a limited number of products in their export baskets to maintain steady export earnings and reduce their vulnerability to external shocks such as global demand shocks or price instability (Cadot et al., 2011; Canh & Thanh, 2022; Dennis & Shepherd, 2011; Giri et al., 2019). Export earnings will be less volatile the more diversified the country is (Agosin, 2009). This is accomplished by either increasing the export volumes through traditional products or by adding new export products to their basket of export offerings. While the latter is known as the extensive margins of diversification, the former is known as the intensive margins of diversification (Cadot et al., 2011; Jongwanich, 2020; Young, 2024). When new export products are added to the export basket, the extensive margin of diversification increases. On the other hand, the intensive margin of diversification rises when exports are dispersed more equally along traditional products (Cadot et al., 2011, pp. 595-596). While examining the determinants of export diversification, there is substantial evidence that human capital is one of the important factors that affect export diversification positively (Agosin et al., 2012; Espoir, 2020; Handoyo & Ibrahim, 2021). The empirical findings support the theoretical prediction of Hidalgo and Hausmann (2009), which holds that a high level of human capital, defined as the accumulation of capabilities, knowledge, and skills, has a significant impact on a country's economic complexity and economic diversification (Hidalgo & Hausmann, 2009).

More recently, empirical literature has begun to pay close attention to the different margins of export diversification and their differential effects on economic output; however, the role of human capital in complementing export diversification and the margins of diversification in affecting output have not received their due share of attention. The topic of which of these margins is more significant in promoting economic

growth is the subject of extensive research in the margins' literature. On one hand, several studies have concluded that intensive margin is the primary driver of export and economic growth as economies increase the traditional export products in greater quantities (Bista & Sheridan, 2021; Brunner & Calì, 2006). The other strand of literature suggests that the extensive margin or export of new products plays a crucial role in economic growth (Amurgo-Pacheco, 2008; Gao et al., 2014; Mau, 2016; Mora & Olabisi, 2021; Rondeau & Roudaut, 2014; Vakataki'Ofa et al., 2016). A novelty of this paper is to test the hypotheses that complementarities between export diversification, two margins of diversification, and human capital conclusively affect economic growth.

Why is human capital important for achieving greater export diversification? It takes a certain amount of labor specialization and increased abilities to navigate the structure and demand of the export market, whether using better technology in manufacturing or acquiring more competitive power in the export market through improved strategy (Badinger & Tondl, 2003; Haq & Luqman, 2014a; Luqman & Soytas, 2023). High-skilled personnel, for instance, might be better equipped to adjust to the rapid changes in manufacturing and advanced technologies needed to remain competitive in global marketplaces. Better governance and more efficient institutions are linked to higher human capital, and these factors foster an atmosphere that supports diverse export growth (Bhattacharjee & Haldar, 2015; Bhavan, 2017; M & Sridharan, 2022). It is more probable that knowledgeable policymakers will create and carry out policies that support export diversification (Nouira & Saafi, 2022). In order to move from a "single-source" economy to a strong, knowledge-based one that is fueled by the accumulation of human capital, economic policies often prioritize export diversification and human capital. Human capital, which encompasses worker health, knowledge, and skills, is thought to be the most crucial component of successful export diversification. The two are closely related: diversification into complex products or industries is impossible without sufficient and competent human capital.

For improving the intensive margin, there is a need to achieve economies of scale, which is in line with the comparative advantage of economies. Availability of specialized human capital enables research and development to adapt and improve current technologies and products, ultimately leading to economies of scale in production (Agosin, 2009; Jongwanich, 2020). There is conclusive evidence that low-value, differentiated products account for the majority of the export diversification along the extensive margin in developing countries (Cadot et al., 2011). Skilled human capital may allow countries to migrate from low-value products such as raw material exports to higher-value products such as intermediate exports (Wu et al., 2021; Zhou, 2018).

The IMF's categorization of countries into emerging and developing Asia is used in this paper (IMF, 2025), which utilizes data from 14 emerging and developing countries between 1980 and 2013 for examining the significance of human capital in the relationship between export diversification, margins, and growth. The baseline results from the Arellano-Bond generalized method of moments (GMM) estimator show that overall export concentration and intensive margin of concentration positively affect the growth of the sampled countries; however, the interactive terms between export diversification & human capital and extensive margin & human capital reveal an intriguing indirect relationship between export diversification, extensive margin, and growth. The interaction coefficient between export diversification and human capital reveals that a higher level of human capital magnifies the positive impact of export concentration on growth. At the margin level, we found that there is a positive effect of export diversification on growth through the extensive margin. The interaction coefficient between extensive margin and human capital reveals that a higher level of human capital magnifies the positive impact of extensive margin of diversification on

growth. Such findings on the complementarity between the intensive margin and human capital in influencing growth are inconclusive.

The rest of the paper is structured as follows. In the next section, we provide our theoretical motivations and a brief background on emerging and developing Asian countries concerning exports and export diversification in Section 3. We present the material and methods in Section 4. Results and discussion are presented in Section 5, followed by Section 6, which concludes the work.

2. Theoretical Motivations

We draw our theoretical motivations from the seminal works of Grossman & Helpman (1991) and Hidalgo & Hausman (2009). According to the theoretical model presented by Grossman & Helpman (1991), international trade with foreign partners raises the levels of human capital in the origin country and fosters innovation. This information transfer encourages economic growth and technical advancement, particularly in less developed countries that are technologically inferior (Grossman & Helpman, 1991). However, the benefits of such cross-border exchange depend on a country's ability to comprehend and use new knowledge, which is determined by its human capital. Hidalgo & Hausman (2009) predicted that structural obstacles and capability limitations affect any country's development. Growth involves more than simply capital and technology; it also involves what a country can produce and, more crucially, what it can learn to produce in the future, utilizing its capabilities, which include human capabilities. A country's ability to make many different high-quality products is connected to the knowledge and skills it has built up over time. Human capital includes not just education but also the skills and efficiency of people, and it plays a big part in these abilities. The Economic Complexity Index (ECI), created by the authors, gauges the complexity and diversity of a country's exports. A wide variety of complex products are produced by countries with high ECI, demonstrating their extensive range of capabilities. On the other hand, countries that exclusively export a small number of low-value products, such as raw materials, are perceived as having limited capability (Hidalgo & Hausmann, 2009).

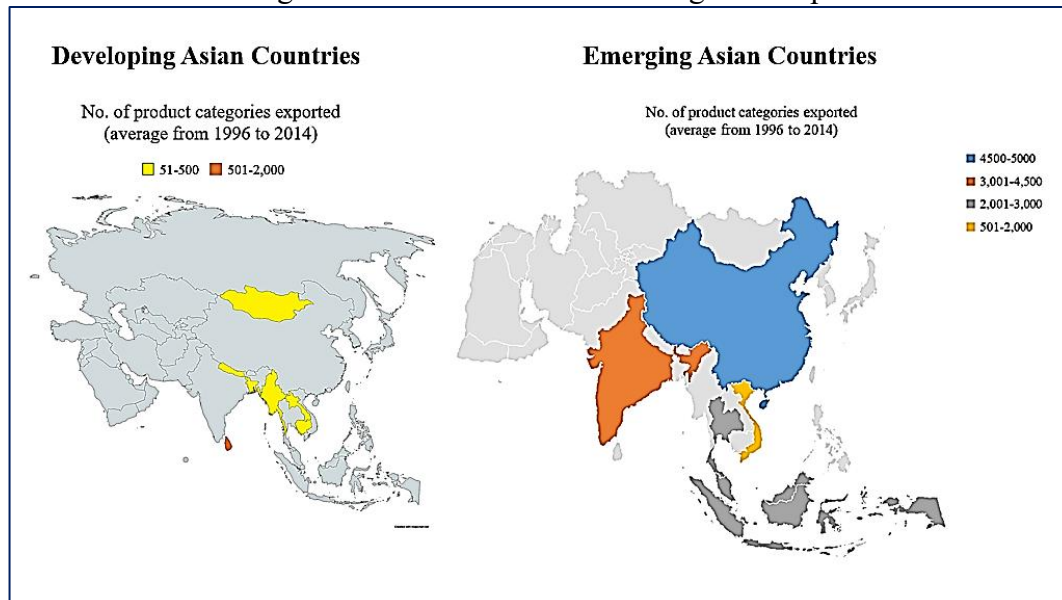
3. Background on Emerging and Developing Asia

More recently, emerging and developing Asian countries have outperformed other emerging and developing countries in terms of GDP growth and GDP per capita (Deb, 2022). Developing countries, including Bangladesh, Cambodia, and Lao PDR in the region, are mostly reliant on labor and low-skilled industries (Chang & Zach, 2019, pp. 187-188). A number of emerging and fast-industrializing countries, including China, India, Thailand, and Vietnam, are also part of the region. These emerging countries have made deliberate efforts to shift their reliance from the primary sector to industries requiring medium and high levels of skill and technology (Anand et al., 2014; Chang & Zach, 2019, pp. 195-196). However, as a whole, the countries in the region have seen structural change recently, with traditional industries like forestry, fisheries, and agriculture seeing a decline in aggregate output share and non-traditional industries like manufacturing witnessing a rise (Deb, 2022).

Larger countries export a far wider variety of products than smaller countries, according to the World Trade Organization's special study on export diversification (WTO, 2017). Except for China and India, which export roughly 4,500-5,000 and 3,001-4,500 products, respectively, emerging Asian countries export between 2,001 and 3,000

products of the 5,000 or so items listed in the HS classification. On the other hand, developing Asian countries mostly export 51 to 500 products, except for Sri Lanka, which exports 501-2,000 products, on average. The graphical illustration comparing the developing and emerging Asian countries is presented in Figure 1.

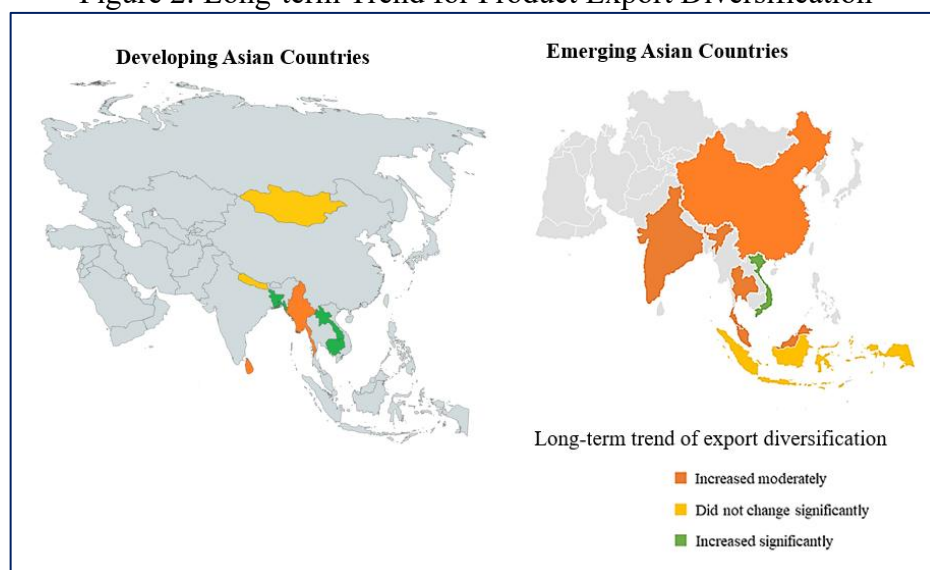
Figure 1: Number of Product Categories Exported



Source: WTO, (2017)

Even though China and India export a relatively large number of products, their export diversification has not changed much over time, according to the long-term trend of export diversification, considering emerging Asian countries. But over time, diversification grew considerably for countries like Vietnam and Malaysia. On the other hand, most of the developing Asian countries experienced a significant increase in export diversification, while for others, there was a moderately increased trend (WTO, 2017). Figure 2 shows the long-term trends of product diversification for developing and emerging Asian countries.

Figure 2: Long-term Trend for Product Export Diversification



Source: WTO, (2017)

4. Materials and Methods

4.1 Methodology

To examine the relationship between export diversification, human capital, and economic growth, we assume that an extended aggregate production function can be expressed as (Haq & Luqman, 2014; Nourira & Saafi, 2022; Romer, 1990c):

$$Y_{it} = K_{it}^{\alpha} HC_{it}^{\beta} (A_{it} L_{it})^{1-\alpha-\beta} \quad (1)$$

where, $0 < \alpha < 1$, Y_{it} is economic growth (real GDP growth), K_{it} is physical capital, HC_{it} is human capital accumulation, L_{it} is labor input, A_{it} is the technical efficiency of country i at time t . α and β are the parameters measuring the share of physical capital and human capital on output, respectively. Within the framework of the endogenous growth theory, it is assumed that our theoretical technical efficiency factor (A_{it}) can be expressed as a function of export diversification, trade openness, foreign direct investment, and inflation. Hence, following other similar studies in the literature, our proposed reduced form of the growth equation is as follows (Fatima et al., 2020; Kalaitzi, 2018; Young, 2024):

$$Y_{it} = \beta_0 + \beta_1 KL_{it} + \beta_2 \ln D_{it} + \beta_3 \ln HC_{it} + \beta_4 \ln TO_{it} + \beta_5 FDI_{it} + \beta_6 INF_{it} + \varepsilon_{it} \quad (2)$$

where: KL_{it} , D_{it} , HC_{it} , TO_{it} , FDI_{it} , and INF_{it} and denote respectively, capital-to-labor ratio, Theil export diversification index, human capital index, trade openness, net inflow of foreign direct investment as a percentage of GDP, and inflation of country i at time t . ε_{it} is the error term. To avoid multicollinearity issues, we prefer to use the capital-to-labor ratio in the reduced form of the growth equation instead of using capital and labor as separate variables.

Our key hypothesis related to the complementarity between export diversification and human capital in affecting growth is tested by estimating the following equation (Eq. 3):

$$Y_{it} = \beta_0 + \beta_1 KL_{it} + \beta_2 \ln D_{it} + \beta_3 \ln HC_{it} + \beta_4 \ln TO_{it} + \beta_5 FDI_{it} + \beta_6 INF_{it} + \beta_7 (\ln D_{it} \times \ln HC_{it}) + \varepsilon_{it} \quad (3)$$

where, $(\ln D_{it} \times \ln HC_{it})$ represents the interactive term between export diversification and human capital. In this approach, the coefficient associated with the interaction term represents how the elasticity of the dependent variable with respect to $\ln D_{it}$ changes with a 1% change in $\ln HC_{it}$.

We investigate the separate effects of export margins of diversification in affecting growth by estimating the following equation (Eq. 4):

$$Y_{it} = \beta_0 + \beta_1 KL_{it} + \beta_2 \ln EXT_{it} + \beta_3 \ln INT_{it} + \beta_4 \ln HC_{it} + \beta_5 \ln TO_{it} + \beta_6 FDI_{it} + \beta_7 INF_{it} + \varepsilon_{it} \quad (4)$$

where, EXT_{it} and INT_{it} refer to extensive and intensive margins of diversification, respectively.

Likewise, the complementarities between margins of diversification and human capital in affecting output are tested by estimating the following equation (Eq. 5):

$$Y_{it} = \beta_0 + \beta_1 KL_{it} + \beta_2 \ln EXT_{it} + \beta_3 \ln INT_{it} + \beta_4 \ln HC_{it} + \beta_5 \ln TO_{it} + \beta_6 FDI_{it} + \beta_7 INF_{it} + \beta_8 (\ln EXT_{it} \times \ln HC_{it}) + \beta_9 (\ln INT_{it} \times \ln HC_{it}) + \varepsilon_{it} \quad (5)$$

where, $(\ln EXT_{it} \times \ln HC_{it})$ and $(\ln INT_{it} \times \ln HC_{it})$ represent interactive terms between extensive and intensive margins and human capital, respectively.

By reviewing earlier pieces of literature, the following control variables have been included along with the main variables of interest, i.e., export diversification and margins of diversification.

Capital Intensity (Alvarez-Cuadrado et al., 2017; Keho, 2017; Romer, 1990a): Capital intensity has been shown to significantly affect growth, particularly in developing economies, where improvement in capital intensity is important in equipping workers with better tools and technology, raising output per worker, and making production more efficient.

Human Capital (Haq & Luqman, 2014; Mincer, 1984; Nourira & Saafi, 2022): One of the main forces behind economic growth is human capital, which includes the expertise, experience, and knowledge of the workforce. Increased productivity, creativity, and eventually economic growth are the results of having a workforce that is well educated and skilled.

Trade Openness (Awokuse, 2008; Keho, 2017; Raghutla, 2020): By enabling greater trade volumes and access to international markets, trade openness typically fosters economic growth by increasing productivity and innovation. Excessive trade restrictions, however, might impede development, especially in developing countries.

FDI (Borensztein et al., 1998; Golo, 2023; Li & Liu, 2005) By bringing in foreign investment, transferring cutting-edge technology, generating employment, and increasing productivity, foreign direct investment (FDI) improves economic growth in host countries. It usually promotes industrialization and increases overall efficiency by increasing competitiveness and the integration of local companies into global value chains.

Inflation (Baharumshah et al., 2016): Maintaining strong economic growth and low inflation is one of the goals of macroeconomic strategies in both developed and developing countries. This is due to the fact that excessive inflation interferes with a market economy's ability to operate smoothly. However, inflationary pressures can affect long-term economic growth trajectories and investment choices in developing countries.

4.2 Data

To measure the level of diversification, we employ the Theil index (Theil, 1972), which is proportional to the level of concentration and has an inverse association with the level of export diversification (Cadot et al., 2011, pp. 591-595; IMF, 2024; Jongwanich, 2020). The Theil indices are obtained from the IMF's export diversification database covering the period 1979-2014 (IMF, 2024). Data on real GDP growth, GDP per capita growth, foreign direct investment net inflows, trade openness, and inflation are accessed from the World Development Indicators (World Bank, 2025). For some years of missing

data on measures of trade openness, we relied on the statistics provided by the United Nations Conference on Trade and Development (UNCTAD). Human capital index (years of schooling and returns to education), capital stock, and labor population are collected from the Penn World Table (PWT) 10.1 (Feenstra et al., 2015).

Table 1 presents the variable definitions, abbreviations, sources, and descriptive statistics of all variables used in this paper.

Table 1: Definition, Abbreviation, Sources, and Descriptive Statistics of Variables

Variable	Abbreviation	Source	Obs.	Mean	Std. Dev.	Min	Max
Real GDP growth, in percentage	Y	WDI	476	5.38	4.22	-34.81	21.53
GDP per Capita growth, in percentage	Y	WDI	476	3.48	4.32	-39.20	16.49
Capital-to-Labor Ratio	KL	PWT	476	16,219.59	15,629.14	1,313.83	79,345.48
Human capital index, Years of schooling and returns to education	HC	PWT	476	2.02	0.46	1.09	2.95
Export Diversification (Theil)	D	IMF	476	3.19	0.86	1.74	4.94
Intensive margin of export diversification	INT	IMF	476	2.90	0.85	1.56	4.88
Extensive margin of export diversification	EXT	IMF	476	0.29	0.35	0.00	2.48
Trade Openness, (Exports+ Imports) as a share of GDP	TO	WDI	476	72.52	43.54	8.89	220.41
Foreign direct investment, net inflow in percentage of GDP	FDI	WDI	476	0.02	0.04	-0.04	0.54
Inflation rate, in percentage	INF	WDI	476	20.42378	46.34733	-31.2	453.5

Source: Author's compilation.

5. Results and Discussion

We used data spanning 34 years, from 1980 to 2013; hence, we have a total of $14 \times 34 = 476$ observations. First, each variable's stationary property was examined. The Levin-Lin-Chu (LLC) unit root tests were used to verify each variable's stationary property prior to moving on to the in-depth estimation and analysis of equation (2). The dependent variable and all other explanatory and control variables are stationary at the level. So, all variables used in the regression are at the level. The unit root test results are provided in the appendix section (Appendix-2).

We employ Arellano and Bond's (1991) panel Generalized Method of Moments (GMM) regression to estimate the growth equation. The Arellano-Bond estimator is a linear dynamic panel-data model in which the lags of the dependent variable are correlated with unobserved panel-level effects (Arellano & Bond, 1991). The fundamental design of this estimator accounts for individual fixed effects; heteroskedasticity and autocorrelation within individuals but not across them; independent variables that are not strictly exogenous—that is, correlated with past and plausibly current values of the error; and a dynamic dependent variable that depends on its own past values. It is known as “difference GMM” because the estimate method begins by converting all regressors, typically via differencing. To determine the validity of the null hypothesis of overidentifying constraints, we use the Sargan test after the estimation.

Empirical results for equations (2) to (5) are presented in Table 2 in columns (1) to (4), respectively. This study's primary objective is to investigate how a country's

accumulation of human capital affects the link between export diversification, margins, and growth. Using the GMM estimator, Columns 1 and 3 report the results without interactive terms, whereas Columns 2 and 4 present the findings with interactive terms between export diversification, margins, and human capital, respectively.

Our findings from Column (1) indicate that the coefficient associated with overall Theil is positive and statistically significant. This suggests that higher export concentration has a positive effect on the output level. To be more specific, a 1 percent increase in export concentration is associated with a 6.854 percentage point increase in growth. From Column 2, the coefficient of the interactive term between the Theil index and human capital is positive and significant at the 5% level. This reveals that the impact of export diversification on growth may be magnified by the presence of human capital. However, the coefficient associated with the first variable in the interaction term is not statistically significant (Column 2). Analyzing the diversification at the margin levels, we found that the coefficient associated with the intensive margin is positive and statistically significant. This suggests that intensive margin concentration has a positive effect on growth (Column 3). To be more specific, a 1 percent increase in the intensive margin of concentration is associated with an 8.08 percentage point increase in GDP growth. This is in line with other empirical studies that find the relative importance of the intensive margin in affecting output when compared to the extensive margin (Bista & Sheridan, 2021; Brunner & Calì, 2006). The empirical result of the extended model with two interactive terms is shown in Column 4. From the estimates, we found that there is a positive effect of export diversification on GDP growth through the extensive margin. The interaction coefficient between the extensive margin and human capital reveals that a higher level of human capital magnifies the positive impact of the extensive margin of diversification on GDP growth. Such findings on the complementarity between the intensive margin and human capital in improving GDP growth are inconclusive.

Considering all regressions, the coefficients of the control variables of capital-to-labor ratio are negative and statistically significant. When the labor force expands more quickly than the stock of physical capital or when capital investment falls precipitously, the capital-to-labor ratio in developing countries experiences negative growth, leading to slower long-term GDP growth rates (Otani & Villanueva, 1989). Human capital level and FDI are also positive and statistically significant, indicating their positive impact on GDP growth, which is in line with other similar studies (Agrawal & Khan, 2011; Fatima et al., 2020; Golo, 2023; Herzer & Klasen, 2008; Mincer, 1984; Neeliah & Seetanah, 2016; Soukiazis & Antunes, 2012). Numerous studies have shown that inflation has a detrimental impact on economic growth. (Adaramola & Dada, 2020; Bittencourt, 2012; Kasidi & Mwakanemela, 2013; Mkhatshwa et al., 2015). Increased inflation can have detrimental effects on domestic production and favor imported goods in a country. It can also lead to a decline in purchasing power and dissatisfaction among manufacturing workers, both of which can have a negative impact on economic growth (Chude & Chude, 2015; Eggoh & Khan, 2014). Consistent with the aforementioned studies, the countries included in this study also experienced double-digit levels of inflation during some of the study period years, as well as fluctuating inflation (World Bank, 2026), which may cause negative effects on economic growth for these countries, which is consistent with the above-mentioned studies. Across regressions, the coefficients associated with trade openness are negative and statistically significant. This indicates that greater trade openness has an adverse effect on GDP growth of the sampled countries, which is in line with the previous studies examining the relationship between trade openness and economic growth or income (Fatima et al., 2020; Kim et al., 2011). A possible reason for such a result is that a country behind the technology frontier may be driven by trade to specialize in traditional products and experience a reduction in its long-run growth.

Table 2: Estimation Results

Particulars	(1) GMM	(2) GMM	(3) GMM	(4) GMM
LagY _{it}	0.161*** (0.046)	0.152*** (0.046)	0.152*** (0.046)	0.147*** (0.046)
KL _{it}	-0.0001** (0.000)	-0.0007* (0.0004)	-0.0001** (0.000)	0.0008** (0.0004)
lnHC _{it}	9.630** (4.140)	-5.239 (8.256)	0.867* (0.096)	17.006** (8.643)
lnD _{it}	6.854*** (1.981)	-0.832 (4.191)		
lnD _{it} × lnHC _{it}		11.959** (0.132)		
lnEXT _{it}			0.220 (0.247)	-1.070** (0.487)
lnINT _{it}			8.088*** (1.908)	8.835* (4.937)
lnEXT _{it} × lnHC _{it}				2.368** (0.804)
lnINT _{it} × lnHC _{it}				-1.540 (6.235)
lnTO _{it}	-1.499** (0.704)	-1.247* (0.711)	-1.695** (0.707)	-2.082** (0.748)
FDI _{it}	0.088** (0.041)	0.082** (0.041)	0.083** (0.041)	0.076* (0.041)
INF _{it}	-0.012** (0.005)	-0.010* (0.005)	-0.011** (0.005)	-0.015** (0.005)
Obs.	448	448	448	448
Wald chi2	58.93	63.78	65.38	72.98
Prob > chi2	0.000	0.000	0.000	0.000
Sargan test	377.99	376.97	374.07	369.37
Prob > chi2	0.20	0.21	0.24	0.30

Notes: ***, **, and * indicate significance at 0.01, 0.05, and 0.1 levels, respectively. Dependent variable: Real GDP growth, in percentage

Source: Author's estimates

We also assess the credibility of statistical conclusions by testing whether the estimated relationships are sensitive to the choice of the dependent variable. Similar outcomes are obtained when growth in GDP per capita is used as an alternate indicator of economic growth in place of GDP growth. As outlined in Table 3, overall export concentration positively affects economic growth. At the margin level, we find that the intensive margin of concentration has an overall positive effect on the growth of GDP per Capita for the sampled countries. The complementarity between the intensive margin of diversification and human capital in affecting the growth of GDP per Capita is inconclusive. The interaction coefficient between extensive margin and human capital reveals that a higher level of human capital magnifies the positive impact of the extensive margin of diversification on the growth of GDP per Capita.

Table 3: Estimation Results

Particulars	(1) GMM	(2) GMM	(3) GMM	(4) GMM
LagY _{it}	0.217*** (0.046)	0.209*** (0.046)	0.204*** (0.046)	0.184*** (0.046)
KL _{it}	-0.0001** (0.000)	-0.0001** (0.000)	-0.0001** (0.000)	-0.0001** (0.000)
lnHC _{it}	14.602*** (4.058)	3.879 (8.223)	15.124*** (4.053)	31.619*** (8.702)
lnD _{it}	4.326*** (1.892)	-1.537 (4.341)		
lnD _{it} × lnHC _{it}		8.812 (5.888)		
lnEXT _{it}			0.085 (0.255)	-1.844*** (0.521)
lnINT _{it}			5.982*** (1.843)	13.190** (5.288)
lnEXT _{it} × lnHC _{it}				3.257** (0.816)
lnINT _{it} × lnHC _{it}				-7.211 (6.433)
lnTO _{it}	-1.500** (0.716)	-1.305* (0.725)	-1.847** (0.723)	-2.708*** (0.781)
FDI _{it}	0.040 (0.040)	0.035 (0.040)	0.031 (0.041)	0.039 (0.040)
INF _{it}	-0.017** (0.006)	-0.015** (0.006)	-0.014** (0.006)	-0.016** (0.005)
Obs.	448	448	448	448
Wald chi2	72.08	74.85	78.40	98.41
Prob > chi2	0.000	0.000	0.000	0.000
Sargan test	377.44	379.77	375.79	369.34
Prob > chi2	0.18	0.18	0.22	0.30

Notes: ***, **, and * indicate significance at 0.01, 0.05, and 0.1 levels, respectively. Dependent variable: Real GDP per Capita growth, in percentage

Source: Author's estimates

To check the robustness of our findings, we used a fixed-effect estimator as an alternate method of estimation. We tested whether the random-effects specification or the fixed-effects specification is appropriate for our model. Under the current specification, our hypothesis that the random effects model is consistent can be rejected. Hence, we opted for the fixed effect estimation technique for estimating the parameters. The Hausman test results comparing both specifications are presented in Appendix 3. The fixed effect estimation results show that our findings on the key explanatory variables are conclusive (Table 4). Overall, export concentration positively and significantly affects GDP growth. At the margin level, we found that the intensive margin of concentration has an overall positive effect on GDP growth for the sampled countries. The interaction coefficient between the extensive margin and human capital reveals that a higher level of human capital magnifies the positive impact of the extensive margin of diversification on GDP growth.

Table 4: Fixed Effect Estimation Results

Particulars	(1) FE	(2) FE	(3) FE	(4) FE
KL _{it}	-0.0001** (0.000)	-0.0009** (0.0003)	-0.0001** (0.0004)	-0.0007** (0.0003)
lnHC _{it}	10.511** (3.173)	0.027 (6.853)	9.457** (3.182)	14.188** (6.851)
lnD _{it}	5.457*** (1.524)	-0.231 (3.631)		
lnD _{it} × lnHC _{it}		8.944* (5.185)		
lnEXT _{it}			0.308 (0.214)	-0.892** (0.456)
lnINT _{it}			4.341** (1.392)	3.730* (4.249)
lnEXT _{it} × lnHC _{it}				1.876** (0.707)
lnINT _{it} × lnHC _{it}				2.859 (5.545)
lnTO _{it}	-0.916 (0.575)	-0.727 (0.584)	-0.770 (0.570)	-0.833 (0.632)
FDI _{it}	0.0006 (0.037)	0.010 (0.038)	0.002 (0.038)	0.013 (0.038)
INF _{it}	-0.015** (0.004)	-0.013* (0.004)	-0.014** (0.004)	-0.017** (0.005)
Obs.	476	476	476	476
R-Squared Within	0.078	0.084	0.074	0.137
R-Squared Between	0.085	0.148	0.067	0.025
R-Squared Overall	0.0004	0.0001	0.0001	0.012

Note: ***, **, and * indicate significance at 0.01, 0.05, and 0.1 levels, respectively. Dependent variable: Real GDP growth, in percentage

Source: Author's estimates

In summary, the findings show that export concentration has an overall positive effect on GDP growth for the sampled countries. At the margin level, we found that the intensive margin of concentration has an overall positive effect on GDP growth for the sampled countries. The complementarity between the extensive margin of diversification and human capital in affecting GDP growth is conclusive. In order to fully benefit from knowledge spillovers within the framework of growth returns from trading globally with overseas partner countries, it is recommended that policymakers in the sampled source countries focus more on the development of their human capital. Training programs, apprenticeships, and vocational education can help the labor force gain the skills they need for changing and challenging foreign market environments. Policymakers in these economies may develop, design, and implement such programs so that the workers learn new skills and improve existing ones and, most importantly, can keep up with new technologies and the needs of different industries in reaching foreign markets and fulfilling necessary demands.

6. Conclusion

The trade literature has begun to pay close attention to the different margins of export diversification and their differential effects on economic output; however, the role of human capital in complementing export diversification and the margins of diversification in affecting economic growth have not received the due scholarly attention. We address a mechanism through which export diversification can affect the output of economies using human capital as an intervening variable. Navigating the structure and demands of the export market requires a certain level of labor specialization and enhanced skills, whether it be through improved strategy to gain more competitive power in the foreign market or the use of superior technology in manufacturing. The advantages of cross-border knowledge exchange rely on a country's capacity to absorb and use new information, which is based on its human capital accumulation (Grossman & Helpman, 1991). A country's ability to make many different high-quality products is connected to the knowledge and skills it has built up over time (Hidalgo & Hausmann, 2009).

Using a balanced panel of 14 emerging and developing Asian countries over the period 1980-2013, this paper examines the significance of human capital in the relationship between export diversification, margins, and growth. Our main explanatory factors include the human capital variable and the three Theil indices, i.e., export diversification, extensive, and intensive margins. We used the Arellano-Bond linear dynamic panel-data model, also known as "difference GMM," to estimate the parameters of interest. The baseline results show that overall export concentration positively affects the output of the sampled countries. We further examine the differential effect of extensive and intensive margins of diversification on growth separately. The results suggest that intensive margins of concentration have a positive effect on growth. The complementary relationship between export diversification and human capital was studied in depth by adding two interactive terms between the extensive margin, the intensive margin, and human capital. The interaction coefficient between extensive margin and human capital reveals that a higher level of human capital magnifies the positive impact of extensive margin of diversification on GDP growth. Such findings on the complementarity between the intensive margin and human capital in improving GDP growth are inconclusive. Such findings on the complementarity between the intensive margin and human capital in influencing growth are inconclusive. Our findings are robust when an alternative estimate, such as the fixed effects (FE) estimator, is used. We also assess the credibility of statistical conclusions by testing whether the estimated relationships are sensitive to the choice of the dependent variable. Similar outcomes are obtained when growth in GDP per capita is used as an alternate indicator of economic growth in place of GDP growth. From a policy perspective, our research shows that the development of human capital must be given high priority in policymaking so that countries that engage in international trade will benefit from knowledge spillovers. Human capital may serve as a vital "absorptive capability" that enables a country to successfully assimilate and adapt foreign knowledge and technology that transcends national boundaries. Countries may forego significant knowledge spillovers that are communicated through trade channels if they do not have an adequate stock of human capital, which would limit their potential for economic growth.

References

- Adaramola, A. O., & Dada, O. (2020). Impact of inflation on economic growth: Evidence from Nigeria. *Investment Management & Financial Innovations*, 17(2), 1-13.
- Aditya, A., & Acharyya, R. (2013). Export diversification, composition, and economic growth: Evidence from cross-country analysis. *The Journal of International Trade & Economic Development*, 22(7), 959-992.
- Agosin, M. R. (2009). Export diversification and growth in emerging economies. *Cepal Review*, 97(April 2009), 115-131.
- Agosin, M. R., Alvarez, R., & Bravo-Ortega, C. (2012). Determinants of export diversification around the world: 1962–2000. *The World Economy*, 35(3), 295-315.
- Agrawal, G., & Khan, M. A. (2011). Impact of FDI on GDP: A comparative study of China and India. *International Journal of Business and Management*, 6(10), 71-80.
- Alvarez-Cuadrado, F., Van Long, N., & Poschke, M. (2017). Capital–labor substitution, structural change, and growth. *Theoretical Economics*, 12(3), 1229-1266.
- Amurgo-Pacheco, A. (2008). *Patterns of export diversification in developing countries*. Policy Research Working Paper No. 4473. World Bank Publications. Washington, D.C.
- Anand, R., Cheng, M. K. C., Rehman, S., & Zhang, M. L. (2014). Potential growth in emerging Asia. Working Paper No.2014/002. International Monetary Fund. Washington, D.C.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277-297.
- Awokuse, T. O. (2008). Trade openness and economic growth: Is growth export-led or import-led?. *Applied Economics*, 40(2), 161-173.
- Badinger, H., & Tondl, G. (2003). Trade, human capital and innovation: The engines of European regional growth in the 1990s. In: Fingleton, B. (eds). *European regional growth* (pp. 215-239). Springer, Berlin, Heidelberg.
- Baharumshah, A. Z., Slesman, L., & Wohar, M. E. (2016). Inflation, inflation uncertainty, and economic growth in emerging and developing countries: Panel data evidence. *Economic Systems*, 40(4), 638-657.
- Bhattacharjee, J., & Haldar, S. (2015). Economic growth of selected South Asian countries: Does institution matter. *Asian Economic and Financial Review*, 5(2), 356-370.
- Bhavan, T. (2017). Human capital as a pushing factor of export: The case of four South Asian economies. *Asian Development Policy Review*, 5(4), 299-306.
- Bista, R., & Sheridan, B. J. (2021). Economic growth takeoffs and the extensive and intensive margins of trade. *Review of Development Economics*, 25(3), 1373-1396.
- Bittencourt, M. (2012). Inflation and economic growth in Latin America: Some panel time-series evidence. *Economic Modelling*, 29(2), 333-340.
- Borensztein, E., De Gregorio, J., & Lee, J.-W. (1998). How does foreign direct investment affect economic growth?. *Journal of International Economics*, 45(1), 115-135.
- Brunner, H.-P., & Calì, M. (2006). The dynamics of manufacturing competitiveness in South Asia: An analysis through export data. *Journal of Asian Economics*, 17(4), 557-582.

- Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011). Export diversification: What's behind the hump?. *Review of Economics and Statistics*, 93(2), 590-605.
- Canh, N. P., & Thanh, S. D. (2022). The dynamics of export diversification, economic complexity and economic growth cycles: Global evidence. *Foreign Trade Review*, 57(3), 234-260.
- Chang, H.-J., & Zach, K. (2019). Industrialization and development. In K. S. Jomo, A. Chowdhury, A. K. M. A. Azad, & G. M. A. W. C. (Eds.), *Asian transformations: An inquiry into the development of nations* (pp. 67–100). Helsinki, Finland: UNU-WIDER.
- Easton, B. (2008). Does poverty affect health? In K. Dew & A. Matheson (Eds.), *Understanding health inequalities in Aotearoa New Zealand* (pp. 97–106). Dunedin, New Zealand: Otago University Press.
- Chude, D. I., & Chude, N. P. (2015). Impact of inflation on economic growth in Nigeria (2000-2009). *International Journal of Business and Management Review*, 3(5), 26-34.
- Deb, K. (2022). Trade structure and economic growth in emerging and developing Asia: A dynamic panel analysis. *Journal of Quantitative Economics*, 20(3), 601-628.
- Dennis, A., & Shepherd, B. (2011). Trade facilitation and export diversification. *The World Economy*, 34(1), 101-122.
- Eggoh, J. C., & Khan, M. (2014). On the nonlinear relationship between inflation and economic growth. *Research in Economics*, 68(2), 133-143.
- Espoir, L. M. (2020). Determinant of export diversification: An empirical analysis in the case of SADC countries. *International Journal of Research in Business and Social Science*, 9(7), 130-143.
- Fatima, S., Chen, B., Ramzan, M., & Abbas, Q. (2020). The nexus between trade openness and GDP growth: Analyzing the role of human capital accumulation. *Sage Open*, 10(4).
- Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). The next generation of the Penn World Table. *The American Economic Review*, 105(10), 3150-3182.
- Gao, Y., Whalley, J., & Ren, Y. (2014). Decomposing China's export growth into extensive margin, export quality and quantity effects. *China Economic Review*, 29, 19-26.
- Giri, R., Quayyum, M. S. N., & Yin, R. (2019). *Understanding export diversification: Key drivers and policy implications*. Working Paper No. 19/105. International Monetary Fund. Washington, D.C.
- Golo, Y. N. (2023). Foreign direct investment, human capital and export diversification in Africa: A panel smooth transition regression (PSTR) model analysis. *The Journal of International Trade & Economic Development*, 33 (7), 1371-1396.
- Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European Economic Review*, 35(2-3), 517-526.
- Handoyo, R. D., & Ibrahim, K. H. (2021). Determinants of export diversification in developing countries. *Industrial Engineering & Management Systems*, 20(4), 720-731.
- Haq, M., & Luqman, M. (2014). The contribution of international trade to economic growth through human capital accumulation: Evidence from nine Asian countries. *Cogent Economics & Finance*, 2(1).
- Herzer, D., & Klasen, S. (2008). In search of FDI-led growth in developing countries: The way forward. *Economic Modelling*, 25(5), 793-810.
- Hidalgo, C. A., & Hausmann, R. (2009). The building blocks of economic complexity. *Proceedings of the National Academy of Sciences*, 106(26), 10570-10575.

- IMF. (2024). *Export Diversification and Quality*. Retrieved from [https://www.imf.org/external/datamapper/datasets/SPRLU#:~:text=The%20tool%20kit%20includes%20indices%20of,version%20of%20Hallak%20\(2006\)](https://www.imf.org/external/datamapper/datasets/SPRLU#:~:text=The%20tool%20kit%20includes%20indices%20of,version%20of%20Hallak%20(2006))
- IMF. (2025). *Classification of economies in the World Economic Outlook (WEO)*. Retrieved from <https://www.imf.org/en/Publications/WEO/weo-database/2025/april/groups-and-aggregates#da>
- Jongwanich, J. (2020). Export diversification, margins and economic growth at industrial level: Evidence from Thailand. *The World Economy*, 43(10), 2674-2722.
- Kalaitzi, A. S. (2018). The causal effects of trade and technology transfer on human capital and economic growth in the United Arab Emirates. *Sustainability*, 10(5).
- Kasidi, F., & Mwakanemela, K. (2013). Impact of inflation on economic growth: A case study of Tanzania. *Asian Journal of Empirical Research*, 3(4), 363-380.
- Keho, Y. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics & Finance*, 5(1).
- Kim, D. H., Lin, S. C., & Suen, Y. B. (2011). Nonlinearity between trade openness and economic development. *Review of Development Economics*, 15(2), 279-292.
- Kwon, D.-B. (2009). *Human capital and its measurement*. Paper presented at the 3rd OECD World Forum on "Statistics, Knowledge and Policy": Charting Progress, Building Visions, Improving life. Paris, France. Retrieved from https://www.academia.edu/24595168/The_3rd_OECD_World_Forum_on_Statistics_Knowledge_and_Policy_HUMAN_CAPITAL_AND_ITS_MEASUREMENT_KWON_DAE_BONG
- Levin, A., & Raut, L. K. (1997). Complementarities between exports and human capital in economic growth: Evidence from the semi-industrialized countries. *Economic Development and Cultural Change*, 46(1), 155-174.
- Li, X., & Liu, X. (2005). Foreign direct investment and economic growth: An increasingly endogenous relationship. *World Development*, 33(3), 393-407.
- Luqman, M., & Soytaş, U. (2023). Asymmetric role of human capital and trade liberalization in the economic growth of Pakistan: Fresh evidence from the nonlinear analysis. *The Journal of International Trade & Economic Development*, 32(3), 475-493.
- M, S., & Sridharan, P. (2022). Determinants of export diversification: Evidence from fractional logit estimation model. *Foreign Trade Review*, 57(2), 160-177.
- Mau, K. (2016). Export diversification and income differences reconsidered: the extensive product margin in theory and application. *Review of World Economics*, 152(2), 351-381.
- Mincer, J. (1984). Human capital and economic growth. *Economics of Education Review*, 3(3), 195-205.
- Mkhatshwa, Z., Tijani, A., & Masuku, M. (2015). Analysis of the relationship between inflation, economic growth and agricultural growth in Swaziland from 1980-2013. *Journal of Economics and Sustainable Development*, 6(18), 189-204.
- Mora, J., & Olabisi, M. (2021). Economic development and the margins of trade: Are the least developed countries different?. *Economic Inquiry*, 59(2), 600-621.
- Neeliah, H., & Seetanah, B. (2016). Does human capital contribute to economic Growth in Mauritius?. *European Journal of Training and Development*, 40(4), 248-261.
- Nouira, R., & Saafi, S. (2022). What drives the relationship between export upgrading and growth? The role of human capital, institutional quality, and economic development. *Journal of the Knowledge Economy*, 13(3), 1944-1961.
- O'Sullivan, A., Sheffrin, S. M., & Swan, K. (2003). *Prentice Hall Economics: Principles in Action*. New Jersey, United States: Prentice-Hall, Inc.

- Otani, I., & Villanueva, D. (1989). Theoretical aspects of growth in developing countries: External debt dynamics and the role of human capital. *IMF Staff Papers*, 36(2), 307-342.
- Raghutla, C. (2020). The effect of trade openness on economic growth: Some empirical evidence from emerging market economies. *Journal of Public Affairs*, 20(3).
- Romer, P. M. (1990a). Capital, labor, and productivity. *Brookings Papers on Economic Activity: Microeconomics*, 1990, 337-367.
- Romer, P. M. (1990b). Endogenous technological change. *Journal of Political Economy*, 98(5, Part 2), S71-S102.
- Romer, P. M. (1990c). Human capital and growth: Theory and evidence. *Carnegie-Rochester Conference Series on Public Policy*, 32(1), 251-286.
- Rondeau, F., & Roudaut, N. (2014). What diversification of trade matters for economic growth of developing countries. *Economics Bulletin*, 34(3), 1485-1497.
- Soukiazis, E., & Antunes, M. (2012). Foreign trade, human capital and economic growth: An empirical approach for the European Union countries. *The Journal of International Trade & Economic Development*, 21(1), 3-24.
- Vakataki‘Ofa, S., Spence, M., & Mevel, S. (2016). Export diversification and intra-industry trade in Africa. In S. Kayizzi-Mugerwa, A. Shimeles, A. Lusigi, & A. Moummi (Eds). *Inclusive growth in Africa* (pp. 142-175). Routledge. London
- World Bank. (2026). *World development indicators* [DataBank]. Retrieved from The World Bank <https://databank.worldbank.org/source/world-development-indicators>
- World Bank. (2025). *World development indicators* [DataBank]. Retrieved from The World Bank <https://databank.worldbank.org/source/world-development-indicators>
- World Trade Organization. (2017). *Special topic: Export diversification*. Retrieved from https://www.wto.org/english/res_e/statis_e/wtp2017_special_topic_e.pdf
- Wu, L., Chen, G., & Peng, S. (2021). Human capital expansion and global value chain upgrading: Firm-level evidence from China. *China & World Economy*, 29(5), 28-56.
- Young, A. O. (2024). Intensive and extensive margins of export diversification as strategies for sustainable economic growth: Evidence from the Nigerian economy. *Foreign Trade Review*, 59(2), 187-224.
- Zhou, Y. (2018). human capital, institutional quality and industrial upgrading: Global insights from industrial data. *Economic Change and Restructuring*, 51(1), 1-27.

Appendices

Appendix-1: The Correlation Matrix

Variable	Capital	Labor	Human Capital	Export Diversification	Extensive Margin	Intensive Margin	Trade Openness	FDI	Inflation
Capital	1								
Labor	0.884	1							
Human Capital	0.268	-0.114	1						
Export Diversification	-0.717	-0.613	-0.195	1					
Extensive Margin	-0.043	-0.018	-0.089	0.117	1				
Intensive Margin	-0.663	-0.559	-0.183	0.93	-0.180	1			
Trade Openness	-0.076	-0.406	0.656	0.084	-0.299	0.143	1		
FDI	0.566	0.437	0.394	-0.33	-0.210	-0.214	0.304	1	
Inflation	-0.285	-0.21	-0.113	0.201	0.109	0.100	-0.188	-0.41	1

Source: Author's Estimates

Appendix-2: Levin-Lin-Chu Unit Root Test Results

Variables	At level	At first difference	Comments
	Levin-Lin-Chu Adjusted t* Statistics	Levin-Lin-Chu Adjusted t* Statistics	
Y_{it} (GDP Growth)	-7.828***	--	Stationary
Y_{it} (GDP per Capita Growth)	-6.111***	--	Stationary
KL_{it}	-3.003***	--	Stationary
$\ln HC_{it}$	-1.475*	--	Stationary
$\ln D_{it}$	-3.218**	--	Stationary
$\ln EXT_{it}$	-3.546***	--	Stationary
$\ln INT_{it}$	-2.198**	--	Stationary
$\ln TO_{it}$	-2.915***	--	Stationary
FDI_{it}	-1.295*	--	Stationary
INF_{it}	-6.648***	--	Stationary

Note: ***, ** indicating significance at 0.001, 0.05, and 0.1 levels, respectively.

Source: Author's Estimates

Appendix-3: Hausman Test Results

Correlated Random Effects–Hausman Test				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob>Chi-Sq.
		49.77	6	0
Test Comparisons				
	RE	FE	Var (Diff.)	S.E.
Capital-to-Labor Ratio	-5.4E-05	-0.0001	0.00005	0.00002
Human Capital	0.778	1.121	-0.342	0.080
Export Diversification	3.552	5.457	-1.9053	0.968
Trade Openness	-0.443	-0.916	0.473	0.274
FDI	-0.05175	0.0006	-0.052	0.012
Inflation	-0.00174	-0.015	0.013	0.0009

Source: Author's Estimates

Appendix-4: List of Sampled Countries

Emerging Asian Countries:
China, India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam
Developing Asian Countries:
Bangladesh, Cambodia, Fiji, Lao People's Democratic Republic, Mongolia, Nepal, and Sri Lanka.

Source: Author's Compilation