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Trade, Human Capital and Economic Growth in BRICS and EU Economies

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Abstract: This paper examines the impact of both trade and human capital on economic growth of the European Union and BRICS. Over the period 2010-2020, the estimated model is based on endogenous growth theory. Our theoretical model is estimated for the EU and BRICS economies using error correction approach since cointegration is detected. Despite using only one equation, our econometric technique deals with simultaneity problem created by the interdependence of variables. Data from 28 EU and 5 BRICS countries are pooled for the period of analysis. There is no contradiction in the empirical results for the BRICs and EU economies. They show existence of significant bi-directional relationship running from real exports *(X)* with positive coefficient, real imports *(M)* with negative coefficient and human capital *(HK)*, represented by secondary school enrolment, with positive coefficient to economic growth, represented by real *GDP per capita*, in both short run and long run (but not for *M* in the long run for BRICS); confirming a robust causation among these four variables. Another bi-directional correlation appears between real exports *(X)* and human capital *(HK)* for the EU. For the BRICS, however, a unidirectional causation running from human capital *(HK)* to real exports *(X)* has been detected as well as a unidirectional causality running from real imports *(M)* to human capital *(HK)*.

Keywords: BRICS, EU, Economic Growth, Human Capital, Trade, Causality test, Unit Root test, Cointegration test, Vector Error Correction Model.

1. Introduction

Based on the theory of endogenous growth, Lucas (1988) and Romer (1990) argued that both trade (especially exports) and human capital represent the growth engines.

There are four perspectives on the relationship between exports and economic growth. To begin, the neoclassical growth theory suggests the export-led growth (ELG) hypothesis; meaning that the causal relationship is running from exports to economic growth (Balassa, 1978 and Feder, 1983). This direction is driven by greater increasing returns to scale as a result of increased exports, which leads to an increase in productivity, and exporters' exposure to international patterns of consumption, which results in higher-quality production (Liu *et al.*, 1997).

Second, the economic growth causes exports (GLE) which is established by Vernon (1966). Vernon's (1966) explanation is that economic growth brings innovation and technological progress, which leads to well developed markets; improving the exports performance in the sector of trade. According to Kaldor (1967), this is attributed to the reduction in the costs of production that result from higher productivity (economic growth), which facilitates the process of exports, making the products exported to be more affordable to their importers.

Increased domestic production relative to demand explains the influence of economic growth on exports (Sharma and Dhakal, 1994). As a result, there is a surplus that is sold on the international market. It is believed that the failure of the market and as a consequence the government intervention would lead to growth led exports (Giles and Williams, 2000).

The third viewpoint is that there is a bi-directional causal relationship between exports and economic growth (Kunst & Marin, 1989). Finally, there is no causal relationship between economic growth and exports; rather, both are development and structural change result (Pack, 1988).

On the other hand, human capital, represented in education, is regarded a production input (Appleton and Teal, 1998). The productivity of individuals is improved by education causative to growth and thus fosters the long run rate of growth, according to Lee and Barro (1993). The idea is that individual human capital stock is increased by education. Barro (2001) added that through two channels the higher human capital initial stock resulting in a higher ratio of human to physical capital increases growth. The first channel is that the ascending in human capital, for secondary and higher schooling levels, facilitates the superior technologies absorption from developed countries.

The second one is that the nation starting with a high human to physical capital ratio grows quicker by adjusting upward the physical capital quantity. This is clear in the consequences of a war that destroys chiefly physical capital. Others like Bils and

Klenow (2000) argued that growth itself promotes education through the technological change skill-bias. Human capital low levels may worse the economy ability to absorb information and one of the great merits of education is that it makes workers more flexible. So, human capital works as a cause and result of economic growth.

Causation between human capital and exports exists as well. Exports, according to Chuang (1998, 2000), can help developing countries accumulate human capital. Trade, entirely, provides opportunities for human capital. For example, technical knowledge learning and diffusion is promoted by export growth including marketing, management, and skills of production.

Opening up and the expanding exports based on knowledge externalities improve competitiveness, as well as well-organized styles of management, better organizational forms, and training of labour. Equally, human capital improvements promote exports. Human capital enhances the labour quality and therefore increases factor productivity, creating comparative advantage in additional exports.

According to Chuang's (2000), the best understanding of the growth real sources is required to examine the trade-human capital-growth nexus. The causality test is attempted to be analyzed to investigate the exports, human capital and economic growth relationship. In so doing, it will be focused mainly on both variables as the main engines influencing economic growth and influencing each other. Nevertheless, to study the trade and economic growth relationship, imports must not be ignored. Failing to incorporate imports along with exports results in spurious conclusions concerning the export led growth hypothesis.

For exports and domestic production, Riezman *et al.*, (1996) considered capital goods imports as inputs. Export growth, according to Herzer *et al.* (2006), offers more foreign currency. This relieves the constraint of foreign exchange and allows capital goods import to foster economic growth. So, foreign exchange provision allowing for the capital imports expansion is considered as the indirect consequence of export extension on growth. Here, this indirect effect can be controlled by incorporating the imports of capital goods into the estimating equation.

Attempting to find out the impact of both trade and human capital on economic growth, i.e. whether trade, results in or from economic growth, similarly, whether human capital results in or from economic growth, a contribution is made to the literature by applying causality test using BRICS and European Union panel data.

Both represent ideal cases when investigating the trade, human capital and economic growth relationship.

Since 2001, BRICS, began as BRIC, generated about 30% of the world's growth; 15% of worldwide trade, and 40% of reserves of foreign currency (For more detail, see statista.com). For this study period, their gross domestic product (GDP), in billion U.S. dollars, rose from 11328 in 2010 (added up by the author based on data available at: treasury.gov.za) to 16642.32 in 2020 (statista.com). At the same period, European Union's GDP, in trillion Euros, rose from 10.98 in 2010 to 13.31 in 2020 (wits.worldbank.org). Coming to worldwide trade, the EU is in main position. It accounts for around 15% of the world's trade in goods and has 70.21, in billion U. S. dollars, as foreign currency reserves (ec.europa.eu).

Also, it is noteworthy that a growing literature exists on the relationship between, on one side, economic growth and trade and, on the other side, separately, economic growth and human capital; however, few have analyzed trade, human capital and economic growth relationship. This will be indicated in the next section.

Considering causality on the relationship between trade, human capital and economic growth, this paper remainder is organized as follows: section 2 reviews some theoretical and empirical studies of the mentioned relationship. In the third section, methodology is illustrated, in detail, by testing both intergrated and cointegrated properties. Then, causality test is applied under Vector Autoregressive or Vector Error Correction Model, based on the cointegration test results. Finally, we establish our results and conclude.

2. Trade, Human Capital, and economic Growth Relationship: Theory and Empirical Evidence

International trade theory provides slight guidance to the trade influences on economic growth. Many theoretical models, such as the Ricardian model of comparative advantage, representing the view of classical growth, focused on the static gains from international trade, and did not investigate the effect on growth. Furthermore, it is worth stating that the monetary or balance of trade payments consequences are ignored by the trade theories built on classical ideas, like real trade theory, in spite of the robust role such consequences play in connecting exports and growth.

Theoretical growth literature gives attention to the trade policies and growth relationship rather than trade volume and growth relationship. At best, a very multifaceted relationship between trade restrictions and growth was proposed by the theoretical growth models.

On studying trade, human capital, and economic growth relationship, this paper will employ a theoretical model which is estimated built on an endogenous growth model. Based on endogenous growth theory there are four drivers of trade's impact on growth which are human capital accumulation (see Lucas, 1988), technological progress (see Romer, 1990), knowledge spillover (see Grossman and Helpman, 1991), and physical capital accumulation (see Rebello, 1991).

Lucas (1988) examines three endogenous growth models: the first emphasizes physical capital accumulation and technological change; the second, which has gotten the most attention, emphasizes human capital accumulation through education; and, finally, the third emphasizes specialized human capital accumulation through learning-by-doing. Lucas (1988) shows how human capital contributes to international trade and hence to growth using a two-sector model of accidental learning by doing.

Workers gain and accumulate knowledge through their work experience, according to the paradigm. As a result, while people do not choose organizations with an explicit goal of learning or accumulation human capital, they do so by accident as a by-product of the skills and knowledge they acquire throughout their work. Lucas expanded on his 1988 research to look at the impact of international trade on productivity in small economies in his 1993 paper. He began by questioning what contemporary economic theory has to say about the East Asia's growth miracles, arguing that economic growth theory alone is insufficient to explain the East Asian miracle.

He relied on a different explanation for these countries' development, one based on the notion of learning by doing. This theory offers a key link between trade and growth, claiming that these high growth rates are the result of interface between learning by doing, with spillover effects on old to new goods, and augmented openness in these countries.

According to Lucas (1993), human capital accumulation-of knowledge- is the major engine of growth and disparities in human capital are the main differences source in living standards of the nations. His conclusion is that, in autarky, each country will specialize fully in a good in which it has a comparative advantage. When country practises trade liberalization, it acquires and accumulate the human capital that is discrete for the type of good it produces.

Technological advancement, according to Romer (1990), was endogenously determined as the engine of economic expansion. Via the augmented one-sector neoclassical model with technological change, Romer (1990) found an endogenous explanation of the technological change model source. According to Romer (1990), growth is fuelled by technological progress as a result of profit-maximizing agents' deliberate investment decisions.

The following are the key grounds in considering the technological change importance in Romer's model:

1. Technological change, or the methods improved for using inputs to produce output, is essential to economic growth.
2. Technological change is not an exogenous process, but it does reflect economic actors choices. Furthermore, these actors (inventors) are market responders, not social planners whose goal is to maximize social welfare.

To summarize, the process of generating technological change should, in general, look like the process of producing other commodities. Using improved methods in production characterizing technical advancement incurs no additional expenses. Capital, labour, human capital, and technology level index are the key inputs to Romer's approach. Capital is measured in units of consumption commodities, labour services are abilities like eye-hand coordination that can be acquired from healthy physical body (Romer, 1990, S79); measured by people counts.

The cumulative effect of formal education and on-the-job training represent human capital. Romer (1990) model's production function is an extension of the production function of Cobb-Douglas. According to Romer 1990, S81), the only difference is that the assumption of Romer's production function is about the degree to which different capital goods kinds are substitutes for each other. To boost countries' economic growth, Romer's model concludes that policies recommended are:

1. Encouraging investment in innovation (new research), and
2. Subsidizing total human capital accumulation.

Moreover, a number of noteworthy implications have been identified. Romer (1990) found that trade openness may support growth and technological development. He argued that an economy with a larger total human capital stock will experience faster growth, implying that free trade can act to accelerate growth.

According to Romer (1990), low human capital levels can help explain why a less developed economy with a large population may benefit from economic integration with the world economy, whereas closed economies do not.

Grossman and Helpman (1991) promote a knowledge-driven model in which the pace of economic growth is dictated by the growth rate of new products innovation which, in turn, is determined by both the existing knowledge base and employment scale in the R&D sector. As a result, we can conclude that the rate of economic growth is dictated by the current state of knowledge or by the amount of labour committed to R& D sector.

When there is no knowledge spillover, that is, when there is no exchange of ideas, each country's knowledge base remains constant. In this situation, economic growth is boosted by an increase in the number of workers allocated to the R&D sector, creating new ideas. Assume one of two scenarios: trade is present or trade is absent. In the absence of trade, we discover that the manufacturing sector's machinery and equipment (capital goods) must equal the amount produced domestically. When trade prevails, the amount of capital goods used approaches twice that which would be used if trade did not exist.

As a result, in the long term, researchers in the two countries will specialize in distinct sorts of designs, preventing duplication of invented goods and leading to a global stock of capital goods being doubled, boosting the marginal productivity of human capital in manufacturing sector. Furthermore, when trade prevails, the market for newly developed products is twice as vast as it was previously.

As a result, patent prices double, as will the return on human capital investments. Trade in goods has no effect on the employment scale because human capital returns in the manufacturing and R&D sectors are doubled. So, when trade prevails, the economy's balanced growth rate is unaffected. Grossman and Helpman (1991) propose a model of trade in which knowledge spillover is allowed to examine the drivers of the patterns of specialization and trade in a world economy with national spillovers of technical knowledge in chapter 8 of their work.

They believed that A and B, two trading countries, produce a homogenous product as well as a variety of horizontally diversified commodities. Labour is used as the only production factor. Before manufacturing can begin, new designs and equipment must be developed in the research lab. It is thought that one labour unit can be used to one traditional good unit or one high-tech product unit, or to enlarge the producible variations set using knowledge capital per unit time stock (Grossman and Helpman, 1991, 208).

The traditional good is made in the lowest-cost-of-production location. Grossman and Helpman (1991) model compares each country's knowledge stock and its activities of research. It envisages several steady-state equilibria. Two scenarios are proposed, first, if country A has a bigger share of the high-tech goods market and producing conventional or traditional goods costs the same in both countries, R&D activity will be assumed to limited to country A, and both countries produce traditional goods.

The second steady-state scenario occurs when one country specializes in R&D while the other country focuses on traditional goods production. Based on this pattern, traditional goods production should be cheaper or at least no dearer in country B than or equal to the production cost in country A. The conclusion of Grossman and Helpman is that history played a significant role in deciding the long-term outcomes.

They anticipated that a country that starts with knowledge accumulation expands its productivity over time and then exports new technology commodities. They suggest that the only exceptions to this rule are when the country's economy is significantly larger than its trading partner's, or when the government intervenes in the research facility.

According to Grossman and Helpman (1991), a country with a low human capital endowment will see a decrease in rewards to skilled labour and underfunding of R&D, affecting economic growth. Grossman and Helpman, on the other hand, argue that having good human capital endowment might slow growth since skilled earnings rise. So, we can conclude that international trade can only boost economic growth if R&D is more closely linked to the exporting sector rather than import-competing sector. The market size expansion, as a result of a nation's opening up trade, can boost R&D sector returns by, for example, lowering the cost of imports required for R&D sector investment. Moreover, when trade dominates, countries can avoid investing in the same kind of inventive activities, which would result in product duplication.

Rebello (1991) investigated growth using the AK model (with infinitely lived households). Given adequate substitutability between reproducible capital and fixed production factors, he concluded that decreasing returns might be comparable to constant returns and therefore capable of sustaining long run growth. Rebello (1991) examined a model in which growth is endogenous in spite of the lack of increasing returns due to the existence of a capital goods core produced without direct or indirect factors contribution that cannot be accumulated like land.

He developed a two-sector model in which the increasing returns to in the production of capital goods are enough to overwhelmed the growth-stifling consequences of decreasing returns in the final output. Capital is the only input in the production function used which is linear in it. So, there are both constant returns to scale and to capital, $Y = F(K, L) = AK$, where, A is exogenous constant and K is aggregate capital largely defined encompassing not only physical capital but human capital as well.

In spite of Rebello's study did not resolve the question of whether the type of increasing returns and externalities is the key to understanding the process of growth, it does present two reasons to reconsider these traits play in the growth models (Rebello, 1991, 519). To begin with, increasing returns and externalities are not essential to cause endogenous growth.

That is endogenous growth is consistent with production technologies that display constant returns to scale as long as there is a capital goods "core" whose production does not require non reproducible factors (Rebello, 1991, 519). Second, notwithstanding the externalities' absence, labour, but not capital, has a proclivity to migrate among countries in search for better payment. Our endogenous growth model derived from Rebello (1991) model will be elaborated later, with more details, in the methodology section.

To investigate the relationship of trade, human capital, and economic growth empirically, to the best of my knowledge, numerous studies have explained, separately, trade and human capital for economic growth. Few papers, on the other hand, described the relationship between the three variables collectively.

The former studies conducted to evaluate the relationship between trade and economic growth suggested three possible interactions, the first being a positive role of trade on economic growth as reported by Alam & Sumon (2020), Kong *et al.* (2020), Alkhateeb *et al.* (2016), Zahonogo (2016), Kasman & Duman (2015), Abbas (2012), and Yanikkaya (2003). The second proposed a negative role of trade on economic growth as described by Bibi *et al.* (2014). And finally, the third suggested a bidirectional relationship between trade and economic growth as concluded by Mehrara & Firouzjaee (2011), Findlay (1984), and Vernon (1966).

As for the latter studies that analyzed the relationship between human capital and economic growth, on one hand, some demonstrated a positive relationship as reported by Ogundari & Awokuse (2018), Pelinescu (2015), Agiomirgianakis *et al.* (2002), and Fernandez & Mauro (2000), while others like Abdullah (2013) illustrated an adverse one.

In the following lines, studies that examined trade and human capital, jointly, for economic growth are summarized.

Intisar *et al.* (2020) applied on nineteen Asian countries for the period 1985-2017. Using causality test, they conclude that both trade openness and human capital have positive effect on economic growth in Southern Asia.

Causality tests on the concerned relationship were conducted using a vector error correction framework. Using the mentioned framework, Dar *et al.* (2016) investigated the economic growth relationship with FDI, human capital and trade openness for the economy of Pakistan over the period 1980-2913. A long run relationship between the variables was found.

Using the same framework of the vector error correction, Tanna and Topaiboul (2014) used Thai quarterly data over the period 1973-2000 to investigate the above relationship. Their finding is that trade openness has a more significant effect than FDI in affecting economic growth of Thailand. They found the potential interacting of FDI with human capital in affecting the Thai economy future development.

Haq and Luqman (2014) employed the extended Neo-classical growth model to find out the international trade contribution to economic growth via human capital accumulation. They tried to reflect some features of the endogenous growth model. They used a data-set of nine Asian countries over the period 1972-2012. They found that international trade enhances the accumulation of human capital and contributes to economic growth positively through human capital accumulation.

Based on Granger causality test, Chaudhry *et al.* (2010) explored the relationship between trade liberalization, human capital, and economic growth of Pakistan for the period 1972- 2007. The result of their study confirmed the existence of long run relationship between human capital, represented by education, and trade to economic growth.

Gould and Ruffin (1995) tried to investigate our considered relationship empirically as well. On examining human capital, trade, and economic growth relationship, they detached the influence of human capital into its role as production input and as a technological progress determinant to get evidence of the two roles importance. Depending on data obtained from the United Nations between 1960 and 1988, they estimated human-capital- augmented Solow model of growth. The study finding is that the relationship between human capital external impacts and economic growth differs based on trade regime.

Reviewing the literature on the relationship of interest, it is worth noting that the EU and BRICS, as mentioned, represent ideal cases for exploring the causal relationship between trade, human, and economic growth. Nonetheless, there is a gap in the literature on this causal relationship's relevance to both.

3. Methodology

3.1. Theoretical Framework of the Model.

Our theoretical framework is based on the endogenous growth models. Their key is the absence of diminishing returns to the accumulated inputs. Without any diminishing returns to physical capital, an introduction of human capital makes it possible for economies to grow continually.

Following Rebelo (1991), Bhattarai (2021), a simplified model is considered. This model is characterized by one-sector economy, standard preferences and a linear production function. It is assumed that output can be used for consumption and human capital accumulation. Output or production is linearly related to human capital input. So, the fundamental assumption of Rebelo type linear production function is written as follows:

$$P_t = T_t H_t = C_t + K_{H_t} \tag{1}$$

Where T represents the technology level and market clearing is: $P_t = C_t + K_{H_t}$.

For the purpose of this paper, it is not needed to model parameter (T_t).

It is believed that human capital will be improved by trade. Countries can import for investment in human capital (K_H) or they can export of human capital. These inflows and outflows of capital connect trade with growth in the present model. Moreover, lacking of modeling the parameter T_t, as mentioned, we can argue that the exogenous total factor productivity reflects open economy technology-human capital overflow effects.

The accumulation condition for human capital is:

$$\dot{H}_t = K_{H_t} - \delta H_t \tag{2}$$

The current value Hamiltonian is written as follows:

$$V = u(C)e^{-\rho t} + \varphi(K_{H_t} - \delta H_t) + \mu(TH_t - C_t - K_{H_t}) \tag{3}$$

Utility function is written as follows:

$$u(C) = \frac{C_t^{1-\vartheta} - 1}{1-\vartheta} \tag{4}$$

Differentiating the current value Hamiltonian for C and K_H, first order conditions can be obtained as follows:

$$\frac{\partial V}{\partial C} = \frac{(1-\vartheta)C^{1-\vartheta-1}}{(1-\vartheta)} e^{-\rho t} - \mu = C^{-\vartheta} e^{-\rho t} - \mu = 0 \tag{5}$$

$$\frac{\partial V}{\partial K_H} = \phi - \mu = 0 \tag{6}$$

$$\dot{\varphi} = -\frac{\partial V}{\partial H} \tag{7}$$

The above first order conditions are used to solve the values $H, P, C \,\&\, \varphi$ and revealed how greatly economy can grow at a steady growth over time.

From equation (6)

$$\varphi - \mu = 0 \Rightarrow \varphi = \mu \tag{8}$$

Where φ is shadow price of human capital.

$$\dot{\varphi} = -\frac{\partial V}{\partial H} = -(-\varphi\delta + \mu T) = \varphi\delta - T\mu \tag{9}$$

From equations (5) and (6)

$$C^{-\vartheta} e^{-\rho t} = \mu \text{ and } \varphi = \mu \text{ so,}$$

$$C^{-\vartheta} e^{-\rho t} = \varphi \tag{10}$$

Taking log both sides of equation 10,

$$-\vartheta \ln C - \rho t = \ln \varphi \tag{11}$$

And by differentiating both sides of equation 11 with respect to time and substituting $\dot{\varphi}$,

$$-\vartheta \frac{\dot{C}}{C} - \rho = \frac{\dot{\varphi}}{\varphi} = \frac{\varphi\delta - T\mu}{\varphi} \tag{12}$$

From equation (8) $\varphi = \mu$ So,

$$-\vartheta \frac{\dot{C}}{C} = \frac{\varphi\delta - T\mu}{\varphi} + \rho \tag{13}$$

$$\frac{\dot{C}}{C} = -\frac{1}{\vartheta}(\delta - T + \rho) \tag{14}$$

So,

$$C_{growth} = \frac{1}{\vartheta}(T - \rho - \delta) \tag{15}$$

Equation 15 represents the conditions for the consumption growth.

Inside the brackets of equation 15 the first and the third terms represent the net marginal product of human capital as:

From production function, $P_t = T_t H_t$, we can obtain the following:

For human capital,

$$\frac{\partial P}{\partial H} = T \tag{16}$$

And so $\frac{\dot{\varphi}}{\varphi} = \frac{\varphi\delta - \mu T}{\varphi} = \delta - T$ (as from (8) $\varphi = \mu$) (17)

Returning to equation 15, investment may take place in human capital, with cost, in terms of output. For that reason, the marginal product of human capital is written as follows:

$$MP_H = T \tag{18}$$

In the steady state, the human capital ratio is constant where there are no diminishing returns to human capital, when human capital is taken into concern.

The steady state,

$$g = \frac{\dot{P}}{P} = \frac{\dot{C}}{C} = \frac{\dot{H}}{H} = \frac{\dot{\varphi}}{\varphi} \tag{19}$$

On the assumption that total factor productivity (TFP) remains constant, $\frac{\dot{T}}{T} = 0$

Trade raises human capital, an input for the gross domestic output (product) of the economy's sectors, and the export sector, to advanced skill through foreign direct investment and/or import is possible with trade, the workers skill level increases (Basu and Bhattarai (2012), Negem, 2008).

Based on the endogenous model the production function can be specified as:

$$P = f(HK, E) \qquad (20)$$

Where, P is real GDP per capita (economic growth), HK is human capital (input) and E is an index of trade. The above human capital model is augmented by the E variable. E is represented by real exports and real imports.

According to Lucas (1988), labour force effectiveness is proxied by education; with concentrating on labour augmenting technical progress; a type of technological knowledge needed to be captured through the specified model for causality between real exports and real GDP per capita. Focusing on human capital with ignoring physical capital, the aggregate production function is:

$$GDP = f(X, M, HK) \qquad (21)$$

Taking the logarithm:

$$\log GDP_t = \psi_0 + \psi_1 \log X_t + \psi_2 \log M_t + \psi_3 \log HK_t + \varepsilon_t \qquad (22)$$

Where the coefficients ψ_1, ψ_3, ψ_2 are elasticity parameters with $\psi_3 > 0$, $\psi_1 > 0$ and $\psi_2 < 0$.

3.2. Causality Test

3.2.1. Unit Root Test

This paper uses Im, Pesaran and Shin's, IPS, panel unit root test technique to determine the order of integration (for more detail, see Im, Pesaran and Shin, 1998). The t-bar statistics method, one of methods of this technique, is used. Testing for stationarity involves two steps. The first step is to carry out a standard Augmented Dickey-Fuller (ADF) unit root test for each country (independent ADF regression). The second one is to compute the t-values average obtained from first step.

Our unit root test, ADF, is based on the following equation:

$$\Delta X_{it} = \pi_i + \partial_i X_{i,t-1} + \sum_{g=1}^{l} \nu_{ij} \Delta X_{i,t-g} + e_{it}$$

Where, I =1,2,3……..,N countries and t = 1,2,3………,T (time period), ”is the first order difference operator, X_{it} is variable of concern, $g = 1,……, l$ ADF lags, l is the lag length number of ΔX_{it} needed to obtain residuals of white noise residuals, and finally ν_i is the coefficients estimated vector on the augmented lagged differences.

The highest possible lag order will be started with and tested down to obtain the optimal order of lag.

3.2.2. Cointegration test

To confine the long run relationships among our model variables, we examine for the existence or the absence of cointegration. The cointegration test of our panel is specified as follows:

$$Z_{it} = \pi_i + \partial_t + \nu_i G_{it} + e_{it}$$

Where export, import and human capital are represented by Z_{it}, and growth is represented by G_{it}, π_i is country specific. It represents a fixed effect allowed to vary across individual cross-sectional units. ∂_t is a time specific error term capturing either short-run external effects or long-run ones. These global effects cause each country variables to move jointly over time. Finally, e_{it} denotes an error term.

Like intercept terms, both slope coefficients ν_i and ∂_t can be modelled heterogeneously (Pedroni, 1999). The residuals of the above equation are used to construct an Augmented Dickey-Fuller, ADF, based group mean panel cointegration test.

3.2.3. Vector Autoregressive (VAR)

Based on the previous step there will be two cases; either the absence or the presence of cointegration. In the absence of cointegration among the model variables the causal relationship between the variables under consideration is examined using VAR that can be expressed as follows:

$$V_{ijt} = \varphi_1 V_{ij,t-1} + \varphi_2 V_{ij,t-2} + \varphi_n V_{ij,t-n} + \upsilon_{ij} + \gamma_{ijt}$$

Where *V* denotes a four-component vector (*V*= $GDP, X, M, HK)$, i is for variable and j is for country.

Our model VAR can be written as follows:

$$\begin{bmatrix} V_{1jt} \\ V_{2jt} \\ V_{3jt} \\ V_{4jt} \end{bmatrix} = \begin{bmatrix} \phi_1 \\ \phi_2 \\ \phi_3 \\ \phi_4 \end{bmatrix} + \begin{bmatrix} \varphi_{11}(l) & \varphi_{12}(l) & \varphi_{13}(l) & \varphi_{14}(l) \\ \varphi_{21}(l) & \varphi_{22}(l) & \varphi_{23}(l) & \varphi_{24}(l) \\ \varphi_{31}(l) & \varphi_{32}(l) & \varphi_{33}(l) & \varphi_{34}(l) \\ \varphi_{41}(l) & \varphi_{42}(l) & \varphi_{43}(l) & \varphi_{44}(l) \end{bmatrix} * \begin{bmatrix} V_{1jt} \\ V_{2jt} \\ V_{3jt} \\ V_{4jt} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{bmatrix}$$

Where, our four endogenous variables are represented by V_{ijt}, $\varphi_{i,j}(l)=\sum_{t=1}^{n}\varphi_{i,j}l^{t}$, $\varphi_{ij}(l)$ polynomial degree, l is the lag operator, index j is for the country, ϕ_i (i = 1,2,3,4) are constants, e_{1t}, e_{2t}, e_{3t} & e_{4t} are the error terms that follow the process of white noise with mean equals zero and variance is constant. t is for the time period (t = 1,…,n). The model residuals above reflect the relationships among the variables. It is concluded that Z_{it} Granger causes Z_{jt} if and only if $\varphi_{ji}(l) \neq 0$ and Z_{jt} Granger causes Z_{it} if and only if $\varphi_{ij} \neq 0$. A bi-directional relationship occurs if Z_{it} Granger causes Z_{jt} and vice versa happens on the other direction simultaneously. Z_{it} Granger causes Z_{jt} indirectly if Z_{it} Granger causes Z_{kt} and if Z_{kt} Granger causes Z_{jt}.

3.2.4. Vector Error Correction Model (VECM)

Once detecting cointegration, we must determine the relationship or causality direction within a vector error correction model (VECM) context (for more detail, see Granger, 1988). Representing a special case of VAR, VECM imposes cointegration on its variables to let distinction between short-run and long-run causality. Error correction terms (*ECT*s), incorporated in VAR, enable to avoid misspecification.

Our VECM can be specified as follows:

$$\Delta\log GDP_{it} = \beta_1 + \varphi_1 ECT_{i,t-1} + \sum_{j=1}^{k}\delta_{11j}\Delta\log GDP_{i,t-j} + \sum_{j=0}^{k}\delta_{12j}\Delta\log X_{i,t-j} + \sum_{j=0}^{k}\delta_{13j}\Delta\log M_{i,t-j} + \sum_{j=0}^{k}\delta_{14,j}\Delta\log HK_{i,t-j} + e_{1it}$$

$$\Delta\log X_{it} = \beta_2 + \varphi_2 ECT_{i,t-1} + \sum_{j=1}^{k}\delta_{21j}\Delta\log X_{i,t-j} + \sum_{j=0}^{k}\delta_{22j}\Delta\log GDP_{i,t-j} + \sum_{j=0}^{k}\delta_{23j}\Delta\log M_{i,t-j} + \sum_{j=0}^{k}\delta_{24,j}\Delta\log HK_{i,t-j} + e_{2it}$$

$$\Delta \log M_{it} = \beta_3 + \varphi_3 ECT_{i,t-1} + \sum_{j=1}^{k} \delta_{31j} \Delta \log M_{i,t-j} + \sum_{j=0}^{k} \delta_{32j} \Delta \log GDP_{i,t-j} + \sum_{j=0}^{k} \delta_{33j} \Delta \log X_{i,t-j} + \sum_{j=0}^{k} \delta_{34,j} \Delta \log HK_{i,t-j} + e_{3it}$$

$$\Delta \log HK_{it} = \beta_4 + \varphi_4 ECT_{i,t-1} + \sum_{j=1}^{k} \delta_{41j} \Delta \log HK_{i,t-j} + \sum_{j=0}^{k} \delta_{42j} \Delta \log GDP_{i,t-j} + \sum_{j=0}^{k} \delta_{43j} \Delta \log X_{i,t-j} + \sum_{j=0}^{k} \delta_{44,j} \Delta \log M_{i,t-j} + e_{4it}$$

The first-difference operator is represented by Δ, the term $ECT_{i,t-1}$, previous period disequilibrium, = $GDP_{it-1} - \hat{\beta}_i - \hat{\vartheta} X_{it-1} - \hat{\lambda} M_{it-1} - \hat{\gamma}\ HK_{it-1}$. It is the error correction term derived from the long run cointegrating relationship. In other words residuals from the cointegration equation can be used as error correction terms. The adjustments of ΔGDP, ΔX, ΔM, and ΔHK, towards long-run equilibrium, are captured by The *ECT* coefficients; φ_1, φ_2, φ_3 & φ_4.

In the presence of cointegration, at least one of the φ parameters is significant, i.e, at least one of φ_{1i}, φ_{2i}, φ_{3i} & φ_{4i} is non zero when a long run relationship exists among the variables. The error correction term (*ECT*) importance is that while how far the variables are from the equilibrium relationship (disequilibrium) is represented by the error term e_{it-1} in the VAR equation, the error correction term estimates how this disequilibrium causes the variables under study to adjust towards equilibrium to keep the long run relationship intact.

The VECM is estimated following two steps: First, Johansen's (1988) maximum likelihood procedure is used to estimate the long run relationship among *GDP, X, M,* and *HK* formulated in the VAR. Second, the estimated cointegration relationship, obtained from the previous step, is used to construct the disequilibrium term and then VECM is estimated for each variable of concern based on the VECM equations stated above. The *ECT* coefficients must be negative to show the convergence of the system to the long-run equilibrium.

4. Data and Empirical Results

The empirical work in this paper uses panel data from both BRICS and EU countries for the period 2010-2020 to evaluate the relationship between trade, human capital, and economic growth. BRICS5 AND EU28 countries are included in the sample, with excluding the UK data of 2020. The major variables of interest are: economic growth, as a dependent variable, is represented by real GDP per capita. The sources of this dependent variable are World Development Indicators (WDI) available at: databank.worldbank.org, IMF Data available at: data.imf.org, data.oecd.org, and CIA FACTBOOK available at: cia.gov. The explanatory variables of trade are *X*, represented by real exports, and *M*, represented by real imports, both, are obtained from the same sources mentioned. The other explanatory variable is Human capital which is represented by education, more specifically, secondary school enrolment. It is obtained using the global economy.com available at: theglobaleconomy.com, data.worldbank.org, and UNICEF Data available at: data.unicef.org. We employ the appropriate tests detailed above using GiveWin, Pc-Give.

4.1. Unit Root Test Results

Table 1: Unit root test results (2010-2020)

	L				*F. D.*			
	GDP	*X*	*M*	*HK*	*ΔGDP*	*ΔX*	*ΔM*	*ΔHK*
BRICS	-1.83*	-1.32	-1.22	-1.12	-5.98**	-3.84**	-4.49**	-3.87**
EU	-3.64**	-3.29**	-1.94*	-1.63	-15.27**	-12.34**	-8.34**	-6.73**

Notes: (1) Logarithmic form is used for all data.
(2) * and ** signify unit root hypothesis rejection at the 5% and 1% levels, respectively.
(3) L denotes for level and F.D. denotes for the first difference.

Table 1 suggests that *GDP*, *X, M* and *HK,* for BRICS and the EU, are integrated of the first order. On the level form, the IPS test results show, for some variables (X_{BRICS}, M_{BRICS}, HK_{BRICS} and HK_{EU}), a breakdown to reject the null of non-stationarity; however, they do reject the null as all first differenced become stationary at the 1% significance level. Having established that the *GDP*, *X*, *M*, and *HK* are I (1), the second step is to test for a long run relationship between the variables, i.e. the presence or absence of cointegration. The next subsection reports the results of the cointegration test.

4.2. Cointegration Test Results

As indicated in table 1 the variables under consideration are integrated of order one, becoming stationary when firstly differenced. These variables represent candidates for insertion in a long-run relationship. This subsection tests Cointegration based on residuals for the null of no cointegration in the Pedroni's (1997) spirit procedure. Detecting the stationarity of the residuals, we confirm that the variables are cointegrated. The error term is examined for stationarity, i.e. Augmented Dickey-Fuller (ADF) for residuals. The error term is stationary with the presence of cointegration among the variables and it has a unit root in case of cointegration absence. The error term is estimated from the next equation:

$$GDP_{it} = \phi + \varphi_i X_{it} + \gamma_i M_{it} + \lambda_i HK_{it} + e_{it}$$

$t = 1,........,T,$ and $i = 1,.........,I$ represent indexes of the time series and cross-sectional dimensions, respectively. Table 2 reports the cointegration results:

Table 2: Cointegration Test Results

	Augmented Dickey-Fuller (ADF) statistics				
	Lag order				
	$l_i = 1$	$l_i = 2$	$l_i = 3$	$l_i = 4$	$l_i = 5$
BRICS	-1.22	-2.34	-2.89	-4.76*	-6.56*
EU	-1.89	-3.01	-5.97*	8.45*	-11.87*

* signifies that the existence of unit root hypothesis of residuals (or no cointegration hypothesis) is rejected at 1%.

Since the proof of cointegration increases with higher lag order, five years lag length is authorized. The results of ADF statistics, reported in table 2, indicate the stationarity of the residuals, i.e. the existence of a long-run relationship. Hence, the variables under consideration are cointegrated. Once detecting cointegration, we examine the export, human capital and growth relationship using Vector Error Correction Model.

4.3. Vector Error Correction Model Results

Detecting a long run relationship in both groups (BRICS and EU), the cointegration test previuosly verifyies the presence of causality in at least one direction among the variables. Vector Error Correction Model (VECM) examines the short-run dynamics. Table 3 presents the short-run coefficients got using the VECM. These coefficients are supposed to incorporate the speed of adjustment to long run equilibrium using (Error Correction Term, *ECT,* coefficient) and the short-run interactions.

Table 3: X, M, HK,&GDP Causality based on VECM for BRICS& EU

Dependent Variables	*ΔGDP*	*ΔX*	*ΔM*	*ΔHK*	*ECT*	
	Wald test-statistics	*(P-value)*			*Coefficient*	*t-ratio*
BRICS						
Δ*GDP*	-	13.83 (0.00)*	20.74 (0.00)*	15.22 (0.00)*	-0.013	12.09
Δ*X*	9.26 (0.01)*	-	3.76 (0.12)	9.15 (0.02)*	-0.257	8.43
Δ*M*	15.28 (0.00)*	0.83 (0.34)	-	1.93 (0.74)	-0.072	0.97
Δ*HK*	19.23 (0.00)*	2.73 (0.16)	10.42 (0.00)*	-	-0.153	5.62
EU						
Δ*GDP*	-	17.42 (0.00)*	30.81 (0.00)*	18.92 (0.00)*	-0.065	20.67
Δ*X*	14.29 (0.00)*	-	12.36 (0.00)*	15.38 (0.00)*	-0.017	13.62
Δ*M*	9.23 (0.00)*	0.12 (0.22)	-	7.34 (0.01)*	-0.365	3.95
Δ*HK*	20.35 (0.00)*	11.47 (0.00)*	2.91 (0.31)	-	-0.187	7.28

Notes: Δ represents the first operator
- * denotes statistically at 1% level
- t-statistics evaluates the significance of the error correction term (*ECT*).
- Wald test tests the lagged values jointly significance of independent variables.
- The parentheses contain the P-values.

Within the framework of the vector error correction model, table 3 reports the results of the causality test using panel data for BRICS and the EU. The panel data of BRICS shows the existence of significant bi-directional relationship running from real exports *(X)* with positive coefficient, real imports *(M)* with negative coefficient and human capital *(HK)* with positive coefficient to economic growth *(GDP)* in both short run and long run (but not for *M* in the long run). The same bi-directional relationship is detected for the panel data of the EU. This confirms the strong causality relationship between these four variables. For the EU, bidirectional causality also exists between real exports *(X)* and human capital (*HK*). However, for BRICS, a unidirectional causality running from human capital *(HK)* towards real exports *(X)* is detected as well as a unidirectional causality running from real imports *(M)* to human capital *(HK)*. Table 4 summarises the Wald test null hypothesis that is based on the statistics obtained from estimated VECM.

Table 4: Wald test for BRICS and EU samples

	Coefficient sign
BRICS sample	
For *GDP* equation:	
H_0: *X* does not cause *GDP*…………………………………...rejected	(+)
H_0: *M* does not cause *GDP*………………………………….rejected	(-)
H_0: *HK* does not cause *GDP*……………………………….rejected	(+)
For *X* equation:	
H_0: *GDP* does not cause X…………………………………...rejected	(+)
H_0: *M* does not cause *X*……………................failed to be rejected	(+)
H_0: *HK* does not cause X………………………………….rejected	(+)
For *M* equation:	
H_0 : *GDP* does not cause M………………………………rejected	(+)
H_0 : *X* does not cause *M*……………………..…..failed to be rejected	(+)
H_0 : *HK* does not cause *M*…………………....failed to be rejected	(-)
For *HK* equation:	
H_0: *GDP* does not cause HK…………………………..…..rejected	(+)
H_0: *X* does not cause *HK*……………………..failed to be rejected	(+)
H_0: *M* does not cause HK…………………………………rejected	(+)
EU sample	
For *GDP* equation:	
H_0: *X* does not cause GDP……………………..………..rejected	(+)
H_0: *M* does not cause GDP………………………………..rejected	(-)
H_0: *HK* does not cause GDP……………………….……rejected	(+)
For *X* equation:	
H_0: *GDP* does not cause X……………………...………rejected	(+)
H_0: *M* does not cause X……………………………………rejected	(+)
H_0: *HK* does not cause X………………………………...rejected	(+)
For *M* equation:	
H_0 : *GDP* does not cause M……………………………..rejected	(+)
H_0 : *X* does not cause *M*……………………..failed to be rejected	(+)
H_0 : *HK* does not cause M………………………...…….rejected	(+)
For *HK* equation:	
H_0: *GDP* does not cause HK……………………...…….rejected	(+)
H_0: *X* does not cause HK………………………………..rejected	(+)
H_0: *M* does not cause *HK*………….…………failed to be rejected	(+)

Note: The null rejection is based on the statistics in table 3 obtained from the VECM estimation.

The results can be summarized in the following table where the arrow (→) refers to the causal relationship between two variables, Y means yes, & N means no.

Table 5: The Causality Tests Summary

	BRICS	*EU*
X→GDP	(Y)	(Y)
M→GDP	(Y)	(Y)
HK→GDP	(Y)	(Y)
GDP→X	(Y)	(Y)
M→X	(N)	(Y)
HK→X	(Y)	(Y)
GDP→M	(N)	(Y)
X→M	(Y)	(N)
HK→M	(N)	(Y)
GDP→HK	(Y)	(Y)
X→HK	(N)	(Y)
M→HK	(Y)	(Y)

5. Conclusions

An essentially open question addressed in this paper is whether there are any causal impacts between trade, human capital, and economic growth. Until now, it has yet to be determined if the first two variables result in or from the third variable. A model derived from endogenous growth theory was developed to analyse the relationship between trade, human capital, and economic growth.

The empirical work of paper evaluates the mentioned relationship using panel data from both BRICS and EU countries for the period 2010-2020. A panel data approach was utilised to boost the power of our analyses. The sample includes both BRICS5 and EU28 countries, with the exception of UK data from 2020.

The main variables of concern are: economic growth, which is represented by real GDP per capita as a dependent variable, real exports, real imports, and secondary school enrolment representing human capital. The Vector Error Correction Model (VECM) framework is used to conduct our paper. The data's integration and cointegration properties are both detected leading to a VECM analysis.

Based on the VECM, the results show a significant bi-directional (feedback) relationship between real exports (X) with a positive coefficient, real imports (M) with a negative coefficient, and human capital (HK), represented by secondary school enrolment, with a positive coefficient, and economic growth, represented by real GDP per capita, in both the short and long run (but not for real imports in the long run for BRICS).

This supported both the export-led growth (ELG) and growth-led export (GLE) hypotheses as explained in Basu and Bhattarai (2012) Bhattarai (2021). For the EU, there is another bidirectional correlation between real exports (X) and human capital (HK). However, a unidirectional causality running from human capital (HK) to real exports (X) as well as a unidirectional causality running from real imports (M) to human capital (HK) has been discovered for the BRICS. The error correction term (ECT) has a negative coefficient, which confirms that the variables in the model are truly cointegrated when their coefficients are statistically significant.

References

ABBAS, S., (2012), "Causality between Exports and Economic Growth: Investigating Suitable Trade Policy for Pakistan", *Eurasian Journal of Business and Economics,* 10, NO.5: 91-98.

ABDULLAH, A.J., (2013), Education and Economic Growth in Malaysia: The Issues of Education Data, *Procedia Econ. Finance*, 156, 48-52.

AGIOMIRGIANAKIS, G. M., ASTERIOU, D. & MONASTIRIOTIS, V., (2002), "Human Capital and Economic Growth revisited: A dynamic panel data study", *International Advances in Economic Research,* 8, NO.3: 177-187.

ALAM, K. J. & SUMON, K. K.,(2020), "Causal Relationship between Trade Openness and Economic Growth: A Panel Data Analysis of Asian Countries", *International Journal of Economics and Financial Issues,* 10, NO.1: 118-126.

ALKHATEEB, T. T., MAHMOOD, H. & SULTAN, Z.,(2016), "The Relationship between Exports and Economic Growth in Saudi Arabia", *Asian Social Science,* 124, 117-124.

APPLETON, S. & TEAL, F.,(1998), *Human Capital and Economic Development*, The African Development Report, University of Oxford, 1-29.

BALASSA, B.,(1978), "Export and Economic Growth: Further Evidence", *Journal of Development Economics,* 5, 181-189.

BARRO, R.J., (2001), "Human Capital: Growth, History, and Policy- A Ssession to Honour Stanly Engerman", *The American Economic Review*, 91, No.2:12-17.

Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed.). MIT Press.

Basu P. and K. Bhattarai (2012). Cognitive Skills, Openness and Growth, *Economic Record*, 88: 280: March, 18-38.

Bhattarai, K. (2021). India Led Growth in South Asia: Empirical Analyses. *Journal of Development Economics and Finance*, 1(2), 401-415.

BIBI, S., AHMAD, S. T. & RASHID, H.,(2014), "Impact of Trade Openness, FDI, Exchange Rate and Inflation on Economic Growth: A Case Study of Pakistan", *International Journal of Accounting and Financial Reporting,* 4, NO.2: 236.

BILS, M. & KLENOW, P.,(2000), "Does Schooling Cause Growth", *American Economic Review,* 90, NO.5: 1160-1183.

CHAUDHRY, I.S., MALIK, A. & FARIDI, M.Z. (2010), Exploring the Causality Relationship Between Trade Liberalization, Human Capital and Economic Growth: Empirical Evidence from Pakistan, *Journal of Economics & International Finance,* 8, No. 2, 175-182.

CHUANG, Y., (2000), "Human Capital, Exports and Economic Growth: A Causality Analysis for Taiwan 1952-1995", *Review of International Economics,* 8, NO.4: 712-720.

CHUANG, Y. C., (1998), "Learning by Doing, The Technology Gap, and Growth", *International Economic Review,* 39, NO.3: 697-721.

GOULD, D. M. & RUFFIN, R. J. (1995), Human Capital, Trade, and Economic Growth, *Weltwirtschaftliches*, 131, 425-445.

DAR, A. A., MUHAMMAD, T. & MEHMOOD, B.,(2016), "Is There A Relationship Between Foreign D irect Investment, Human Capital, Trade Openness and Economic Growth of Pakistani Economy?" *Sci.Int (Lahore),* 28, NO. 1: 715-719.

FEDER, G., (1983), "On Exports and Economic Growth", *Journal of Development Economics,* 12, NO.1/2: 59-73.

FERNANDEZ, E. & MAURO, P.,(2000), "The Role of Human Capital in Economic Growth: The Case of Spain", *IMF working paper,* 1-27.

FINDLAY, R.,(1984), "Growth and Development in Trade Models", *Handbook of International Economics,* 1, 185-236.

GILES, J. A. & WILLIAMS, C. L.,(2000), "Export-Led Growth: A Survey of the Empirical Literature and Some Non-Causality Results, Part 1", *Journal of International Trade and Economic Development,* 9, NO.4: 265-341.

GROSSMAN, G. & HELPMAN, E.,(1991), *Innovation and Growth in the Global Economy,* Cambridge, MA, MIT Press.

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, NO.1, *Available at: https://doi.org/10.1080/23322039.2014.947000.*

HERZER, D., NOWAK-LEHMANN, D. F. & SILIVERSTOVS, B., (2006), "Export-led Growth in Chile: Assessing the Role of Export Composition in Productivity Growth", *Developing Economies,* XLIV-3, No. September: 306-328.

IM, K. S., PESARAN, M. H. & SHIN, Y., (1998), *Testing for Unit Roots in Heterogeneous Panels, Dept. of Applied Economics, Cambridge University.*

INTISAR, R. A., YASEEN, M. R., KOUSAR, R., USMAN, M. & MAKHDUM, M. S.,(2020), "Impact of Trade Openness and Human Capital on Economic Growth: A Comparative Investigation of Asian Countries", *Sustainability,* 12, 2-19.

JOHANSEN, S., (1988), "Statistical Analysis of Cointegration Vectors", *Journal of Economic Dynamics and Control,* 12, NO.2-3: 231-254.

KALDOR, N.,(1967), *strategic Factors in Economic Development,* New York, Cornell University.

KASMAN, A. & DUMAN, Y., (2015), "CO2 emissions, Economic Growth, Energy Consumption, Trade and Urbanization in New EU member and Candidate Countries: A Panel Data Analysis, "Economic Modlling"", *Elsevier,* 44, NO. C: 97-103.

KONG, Q., PENG, D., NI, Y. & JIANG, X., (2020), "Trade Openness and Economic Growth Quality of China: Empirical Analysis Using Ardl Model", *Finance Research Letters,* 38, NO.1.

KUNST, R. M. & MARIN, D., (1989), "On Exports and Productivity: A Causal Analysis", *Review of Economics and Statistics,* 71, 699-703.

LEE, J.-W. & BARRO, R., (1993), "International Comparisons of Educational Attainment", *Journal of Monetary Economics,* 32, NO.3: 363-394.

LIU, X., SONG, H. & ROMILLY, P., (1997), "An Empirical Investigation of the Causal Relationship between Openness and Economic Growth in China", *Applied Economics,* 29, NO.12: 1679-1686.

LUCAS, R., (1993), "Making a Miracle", *Econometrica,* 61, NO.2: 251-272.

LUCAS, R. E., (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics,* 22, NO.1: 3-42.

MEHRARA, M. & FIROUZJAEE, B., (2011), "Granger Causality Relationship between Export Growth and GDP Growth in Developing Countries: Panel Cointegration Approach", *International Journal of Humanities and Social Science,* 1, NO.16: 223-231.

NEGEM, S., (2008), Free Trade and Economic Growth of Egypt, PhD thesis, Hull University, UK. OGUNDARI, K. & AWOKUSE, T. O.,(2018), "Human Capital Contribution to Economic Growth in Sub-Saharan Africa: Does Health Status Matter more than Education", *Economic Analysis and Policy,* 58, 131-140.

PACK, H.,(1988), Industrialisation and Trade. in CHENERY, H. & SRINIVASAN, T. N. (Eds.) *Handbook of Development Economics.* Amesterdam, Elsevier.

PEDRONI, P.,(1999), "Critical Values for Cointegration tests in Heterogeneous Panels with multiple Regressors", *Oxford Bulletin of Economics and Statistics,* 61, 653-670.

PEDRONI, P., (1997), Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series Tests, with an Application to the PPP hypothesis: New Results, India University.

PELINESCU, E., (2015), "The Impact of Human Capital and Economic Growth", *Procedia Economics and Finance,* 22, 184-190.

REBELO, S., (1991), "Long-Run Policy Analysis and Long-Run Growth", *Journal of Political Economy,* 99, No. 3: 500-521

RIEZMAN, R. G., WHITEMAN, C. H. & SUMMERS, P. M., (1996), "The Engine of Growth or Its Handmaiden? A Time Series Assessment of Export-Led Growth", *Empirical Economics,* 21, NO.1: 77-113.

ROMER, P.,(1990), "Human Capital and Growth: Theory and Evidence", *Carnegie Rochester Conference series on public policy,* 32, 251-285.

SACHS, J. D., (1987), Trade and Exchange Rate Policies in Growth-Oriented Adjustment Programs. in CORBO, V., GOLDSTEIN, M., AND KHAN, M. (Ed.) *Growth Oriented adjustment Programms.* Washington, DC: IMF.

SHARMA, S. C. & DHAKAL, D., (1994), "Causal Analysis between Exports and Economic Growth in Developing Countries", *Applied Economics,* 26, 1145-1157.

STOKEY, N. L., (1991), "Human Capital, Product, and Growth", *Quarterly Journal of Economics,* 105, 587-616.

TANNA, S. & TOPAIBOUL, K.,(2014), "Human Capital, Trade, FDI and Economic Growth in Thailand: What Causes What?" *Coventry University, UK.*

VERNON, R., (1966), "International Investment and International Trade in the Product Cycle", *Quarterly Journal of Economics,* 80, 190-207.

YANIKKAYA, H., (2003), "Trade Openness and Economic Growth: A Cross- Country Empirical Investigation", *Journal of Development Economics,* 72, 57-89.

ZAHONOGO, P.,(2016), "Trade and Economic Growth in Developing Countries: Evidence from Sub-Saharan Africa", *Journal of African Trade,* 3, No. 1-2: 41-56.