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PAPER

Temporal Causality between Human Capital, Trade, FDI, and Economic Growth in Cointegrated Framework. Empirical Evidence from Pakistan

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Abstract We investigate causal links between human capital, foreign direct investment (FDI), trade openness, domestic investment, and economic growth for the case of Pakistan. In a multivariate vector autoregressive (VAR) framework, we apply Johansen and Juselius co-integration, Granger causality, and vector error correction model (VECM) using annual data from 1980 to 2017. Results of the co-integration analysis indicate the positive association among human capital, trade openness, foreign direct investment, and economic growth for the long run. Granger causality reveals that bidirectional causality exists between human capital and trade openness, human capital and economic growth, and foreign direct investment and trade openness. The unidirectional results of Granger causality analysis reveal that human capital and domestic investment influence economies growth through FDI, and trade openness influences economic growth through domestic investment. The most obvious finding to emerge from this empirical investigation is that human capital and trade openness enhance domestic and foreign investment, which leads to the economic growth of Pakistan.

Keywords: Trade; Human Capital; Economic Growth; Co-integration; Granger Causality.

JEL Classification: F14; J24; O47.

1. Introduction

The key objective of every economy is to ensure the sustainable improvement in the living standard of their general public, which is achieved through the consistent improvement in the economic growth (Azam & Ahmed, 2015).[1] Amongst many,

[1] This key objective is consistent with couple of sustainable development goals including SDG 8 (decent

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human capital (Benhabib & Spiegel, 1994; Romer, 1989; Gemmell, 1996), trade (Shahbaz, 2012; Kalaitzi, 2015), and foreign direct investment (Borensztein, Gregorio & Lee, 1998; Li, Liu & Rebelo, 1998)[2] are the important factors contributing to the economic growth, especially in developing countries (Marwah & Klein, 1998; Gemmell, 1996).[3] Through technological innovations, human capital has developed a foundation of the new concepts for the endogenous growth of the economy.[4] In particular, Glomm and Ravikumar (1992) reveal that investment in human capital through formal schooling is the engine of growth in any economy.[5] Human capital, help an economy as the main actor of growth, also plays its role as a key input besides labour and capital. Development in human capital increases the marginal return to capital which mounts the local as well as the foreign investment demand (Zhang and Markusen, 1999; Youssef, 2017).

One of the key roles of foreign direct investment (FDI) is that it stimulates local investment and contributes to enhancing human capital in host countries.[6] In the presence of local and foreign investment, trade facilitates the efficient production of goods and is an important source of economic growth (Frankel and Romer, 1999; Zulkifli et al., 2018).[7] Trade improves in the stock of human capital and contributes to the growth of the economy (Haq et al., 2014). The existing literature provides empirical pieces of evidence on these economic association (see Benhabib & Spiegel, 1994; Romer, 1989; and Gemmell, 1996). However, there is a substantial lake of empirical evidence from the developing economies like Pakistan. The current study tries to investigate the causal links between human capital, foreign direct investment (FDI), trade openness, domestic investment, and economic growth for Pakistan.

Pakistan is important for trading nations in many goods among many others. The period of 1951-1990 observed extraordinary growth in Pakistan's international trade. The increase in the production of profitable crops like wheat, cotton, and rice was mainly due to the success in trade—export trade. Foreign direct investment and human capital play a significant role in the growth of the Pakistani economy (Rehman, 2016). However, this economic phenomenon needs empirical investigation. Therefore, the objective of this research is to analyse the causal links between human capital, foreign direct investment (FDI), trade openness, domestic investment, and economic growth for Pakistan for the period of 1980–2017. This research objective is twofold. First, this study attempts

work and economic growth), SGD 1 (no poverty), SGD 2 (zero hunger), and SGD 9 (industry, innovation and infrastructure). For further details, see Robert, Parris, & Leiserowitz, 2005).

[2] For further details on this nexus, also see Lim and McAleer (2002), Liu (2002), Makki and Somwaru (2004), Ramirez (2000), and Sun (1998).

[3] Also see Hanushek (2013) for the role of school attainment and cognitive skills for the economic growth in developing economies.

[4] Human capital plays a distinct role in economic activity and progress of economy in technological entrepreneurship (see Wright, Hmieleski, Siegel, & Ensley, 2007).

[5] Glomm and Ravikumar (1992) developed the overlapping generational model with the heterogeneous agents. In this framework, they provide useful insights on the benefits of public education. They report that income inequaltiy declines abruptly with the public education.

[6] See Ram and Zhang (2002) for the cross-country evidences on this nexus.

[7] Also see Zafar (2007) for some evidences on this linkage from China and Sub-Saharan Africa.

to examine the long-run association between human capital, foreign direct investment (FDI), trade openness, domestic investment, and economic growth. Second, this research attempts to explore the effect of human capital, the openness of trade, foreign and domestic investment on economic growth. We also attempt to examine the direction of causality, unidirectional or bidirectional, among the selected variables.

Study in the next sections is arranged as follows. In the second section, we discuss the literature related to human capital, the openness of trade and growth. Next section provides some detail on data and methods applied in the research. Section four describes the results and analysis. In the last section, we provide some suggestions and recommendations.

2. Literature Review

Existing empirical literature examines the association among human capital and economic growth under the framework of growth accounting (Barro, 1991; Cavalcanti, 2017; Benhabib & Spiegel, 1994) and endogenously determined growth models (Grossman and Heolpman, 1991; Romer, 1989).[8] This literature suggests that the level of education increases the efficiency of human capital[9] which ultimately contributes to economic growth (Strulik, 2005; Gemmell, 1996). Later, different researchers extend this empirical literature by incorporating the role of physical capital (Caballe & Santos, 1993) and technology (Foster & Rosenzweig, 1996) in this nexus. More specifically, Foster and Rosenzweig (1996) and Rehman (2016) reveal that technology adoption driven human capital accelerates economic growth. Another strand of the literature reveals the causality relationship between human capital and economic growth. For instance, In and Doucouliagos (1997) observe the causal relationship between human capital and economic growth in a bivariate context. Likewise, Meulemeester and Rochat (1995) examine the Granger causality among variables like education and economic growth in different countries. Applying Granger causality in a cointegrated VAR framework, Narayan and Smyth (2004) investigate the linkages between human capital, trade and the economic growth for the case of China. They report a unidirectional Granger causality running from human capital to income in the long run, and the unidirectional causality running from income to human capital in the short run.

Most of these empirical studies are conducted in developed economies. However, Khan et al. (1991) observe unidirectional causality between knowledge and output of Pakistani labour. Apart from this empirical evidence, there is a substantial lack of literature analysing the causal association among human capital and economic growth—in the developing country like Pakistan. This transmission mechanism works through different channels, including trade openness (export and imports) and technological innovations (Chuang, 2000; Haq et al., 2014; and Foster & Rosenzweig, 1996).

The higher level of export concentration improves the human capital stock in the

[8] See Schultz (1961) for the policy related discussion on the investment in human capital.

[9] See Berry and Glaeser (2005) for the divergence of human level across the cities. They present a model where entrepreneurial innovation drives the clustering of educated people in metropolitan areas.

developing economies (Agosin, Alvarez, & Bravo-Ortega, 2012) in different ways.[10] Firstly, the state-of-the-art technology transmits from advanced to developing nations through trade openness (Kalaitzi, 2018). Technology adoption by the human capital further attracts the foreign direct investment especially in the developing economies which ultimately leads to the economic growth (see Gholami, Tom Lee, & Heshmati, 2006; Marwah & Klein, 1998; Borensztein, Gregorio & Lee, 1998; Makki & Somwaru, 2004; Pissarides, 1997; Foster & Rosenzweig, 1996; and Rehman, 2016). These empirical studies suggest that FDI has a positive impact on the economic growth of developing economies. For instance, Li, Liu and Rebelo (1998), Sun (1998), Liu (2002) provide the similar evidences from China; Ramirez (2000) from Mexico; Lim and McAleer (2002) from Singapore; Marwah and Klein (1998) from India; Borensztein, Gregorio and Lee (1998) and Makki & Somwaru, 2004 for the cross-countries analysis from developing economies.

Secondly, trade encourages learning by doing (Chuang, 2000; Haq et al., 2014) which develops the human capital stock of any economy, especially of the developing economies (Young, 1993). Thirdly, exports enhance the technological-based management, marketing and production skill that can uphold the efficiency of physical capital and labour force (Kim, 1995). Considering all this literature, exports enhance economic growth in multiple ways. Furthermore, export-led growth theories assume that the capital accumulation (Kavoussi, 1984), technological advances (Foster & Rosenzweig, 1996) and the creation of employment (Fields, 1984) improves the distribution and production process which leads to the economic growth (Feder, 1983; Zulkifli et al., 2018).[11] Economic growth theoretically roots trade. Firstly, variations of models about trade possess the extended concept that economic growth causes trade openness (Kalaitzi, 2015; Findlay, 1984). Secondly, growth devices can well explain the progress of exports. Thirdly, new models having the economy of scale with path-dependent are reliable with economic growth producing exports.[12]

Some empirical investigations reveal the unidirectional causality running from foreign direct investment to economic growth in the long-run and bidirectional causality between these variables over the short-term period (Ghazali, 2010). Working on the role of export-growth linkage in Pakistan, India, the Philippines, Malaysia and Thailand, Vohra (2001) reports that exports have a positive and significant impact on economic growth. She further reveals that this positive impact is significant when a country achieves some level of economic development. Applying Granger causality in a cointegrated VAR framework, Narayan and Smyth (2004) investigate the linkages

[10] Improves human capital further improves labor productivity. However, the human resource management policies matter in this interaction. For further details, see Koch and McGrath (1996).

[11] Also see Abou-Stait (2005), Al-Yousif (1997), Balassa (1978), Feder (1982), Michaely (1977) and Vohra (2001).

[12] The interested readers can see the Evald, Klyver, and Christensen (2011). The focus of this study is on the effects of human capital, social capital and perceptual values on the exporter's intentions of nascent entrepreneurs. However, they also discuss the limited causality on this relationship. Also see Benhabib and Spiegel (1994) for the further details on the effects of openness and trade orientation on the factor productivity.

between economic growth, human capital and trade for the case of China. They report a unidirectional Granger causality running from human capital to income in the long run, and the unidirectional causality running from income to human capital in the short run. Significant impact is reported on the growth of the economy by investment at the local level and openness in trade in Thailand (Tanna and Topaiboul, 2005). While for Chen and Gupta (2009) inspected the impact on economic growth by openness in trade and outcomes support the view that openness in trade strongly influences the growth of an economy.

3. Econometric Methodology

This research analyses the causal links between human capital, foreign direct investment (FDI), trade openness, domestic investment, and economic growth for Pakistan for the period of 1980–2017. For this purpose, we extract the data on human capital, trade openness (exports and imports), domestic investment, foreign direct investment and the economic growth from WDI dataset for Pakistan from 1980 to 2017. For this empirical investigation, we start our analysis with the following specification (Borensztein et al., 1998; Barro, 1991; Barro & Sala-i-Martin, 1995).[13]

$$EG_t = \beta_0 + \beta_1 HC_t + \beta_2 OPT_t + \beta_3 FDI_t + \beta_4 EXR_t + \beta_5 DOMI_t + \varepsilon \tag{3.1}$$

Where *EG, HC, OPT, FDI, EXR and DOMI* are the economic growth rate, human capital, the openness of trade, foreign direct inward investment, exchange rate and gross domestic capital formation respectively. We define human capital as spending on education. The openness of trade is defined as the sum of imports and exports as the per cent of gross domestic product. In this setting, we investigate the role of exogenous factors in the growth of the economy. We use gross domestic capital formation as a proxy for the investment at the domestic level.

We conduct this empirical investigation in different stages. Before estimating Granger causality, we ensure that all variables are integrated of the same order. Therefore, in the first stage, we perform the Augmented Dickey-Fuller (ADF) unit root test to check whether selected variables possess unit-roots. We use these results for the co-integration analysis in the next stage. Then, we utilise the Johansen co-integration method for identifying the nature and strength of the long-run association among the selected variables. The existence of a cointegration relationship among these economic variables indicates that there must be Granger causality in at least one direction. However, the results of Johansen co-integration does not indicate the direction of the temporal causality between the variables (Narayan & Smyth, 2004). Therefore, we extend our analysis by applying Granger Causality test. Engle and Granger (1987) reveal that the Granger causality test is misleading in certain cases in the presence of a cointegrating relationship between the variables. Granger causality within the first difference vector autoregressive model is misleading, and Engle and Granger (1987) proposed that an error-correction term should be included in the dynamic model to

[13] Also see section 'The empirical model' from the Tanna and Topaiboul (2005, June).

capture the equilibrium relationship between the cointegrating variables.

3.1 Unit Root Test

To avoid spurious regression, we ensure that the economic variables are stationary or cointegrated. For this purpose, we apply Augmented Dickey-Fuller unit test to test the stationary of all series including economic growth rate, human capital, the openness of trade, foreign direct inward investment, exchange rate and gross domestic capital formation. We apply ADF unit root test at a level as well as at first differenced series by utilising three models.

The first model is with no trend and constant.

$$\Delta w_t = \gamma w_{t-1} + \sum_{i=1}^{k} \beta_t \Delta w_{t-i} + \varepsilon_t \tag{3.1.1}$$

The second model is with constant and no trend.

$$\Delta w_t = \alpha_0 + \gamma w_{t-1} + \sum_{i=1}^{k} \beta_t \Delta w_{t-i} + \varepsilon_t \tag{3.1.2}$$

The third model is with both constant and trend.

$$\Delta w_t = \alpha_0 + \alpha_{2t} + \gamma w_{t-1} + \sum_{i=1}^{k} \beta_t \Delta w_{t-i} + \varepsilon_t \tag{3.1.3}$$

Where $\Delta w_t = w_t + w_{t-1}$ refers series w_t first difference and $\Delta w_{t-1} = (w_{t-1} - w_{t-2})$ is the first difference w_{t-1}. Further, α, β and γ represent parameters which are estimated, and ε represent stochastic disturbance term.

3.2 Johansen-Juselius Cointegration Test

The series are cointegrated if two economic series are integrated of the first order, but their linear combinations are stationary at level. To test the long-term association between the growth rate, human capital, the openness of trade, foreign direct inward investment, exchange rate and gross domestic capital formation, we use Johansen-Juselius method which is based on the maximum likelihood estimation technique (Johansen & Juselius, 1990). This method determines the number of cointegrating vectors in the presence of cointegration. In the Johansen and Juselius (1990) procedure, we estimate the vector auto-regressive (VAR) model to examine the long-run association between our selected economic variables. In this framework, the autoregressive model of Z_t (5 X 1) vector is expressed as follows.

$$Z_t = \mu + \delta_1 Z_{t-1} + \delta_2 Z_{t-2} + \ldots\ldots\ldots + \delta_k Z_{t-k} + \varepsilon_t \tag{3.2.1}$$

The Z vector consists of the economic variables including growth rate, human capital, the openness of trade, foreign direct inward investment, exchange rate and gross domestic capital formation. The rank of δ determines the number of cointegrating vectors. Moreover, the cointegrating rank is presented in Equation 3.2.2, in the presence of cointegration.

$$\delta = \alpha\beta' \tag{3.2.2}$$

Where α and β represent the matrixes of parameters indicating the convergence speed and cointegrating vectors, respectively. The rows of $\beta'(6\ X\ r)$ forms the r cointegrating vector when (β'_j) is the $(j^{th} row\ of\ \beta', \beta'_j\ \ Z_t \sim I(0))$ To test the number of cointegrating rank in this system, the Johansen and Juselius (1990) procedure provide two maximum likelihood test statistics, including trace statistics and maximum Eigenvalues as follows.

$$\lambda_{trace} = -T\sum_{i=r+1}^{n} \ln(1-\lambda_i) \tag{3.2.3}$$

$$\lambda_{\max} = -T\ln(1-\lambda_{r+1}) \tag{3.2.4}$$

In Equation 3.2.3 and 3.2.4, T and λ indicate the number of observations and the estimated Eigenvalues, respectively. These test statistics are compared with the critical values to decide about the null hypothesis of no integration between the variables.

3.3 VECM Model

The existence of a cointegration relationship among these economic variables indicates that there must be Granger causality in at least one direction. However, the results of the Johansen co-integration do not indicate the direction of the temporal causality between the variables (Narayan & Smyth, 2004; Maddala & Kim, 1998). Therefore, we extend our analysis by applying Granger Causality test. Engle and Granger (1987) reveal that the Granger causality test is misleading in certain cases in the presence of a cointegrating relationship between the variables. In particular, the Granger causality within the first difference vector autoregressive model is misleading. To overcome this econometric issue, Engle and Granger (1987) suggested that an error-correction term should be included in the dynamic model to capture the equilibrium relationship between the cointegrating variables. In this set-up, we use the following vector error correction models for this empirical investigation.

$$\Delta HC_t = \alpha_1 + \sum_{i=k}^{k} \alpha_{11}\Delta HC_{t-i} + \sum_{i=1}^{k} \alpha_{12}\Delta OPT_{t-i} + \sum_{i=1}^{k} \alpha_{13}\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{14}\Delta DOMI_{t-i} + \sum_{i=1}^{k} \alpha_{15}\Delta GDPR_{t-i} + \beta_1 D_t + \varphi_1 EC_{t-1} + \mu_{HC} \tag{3.3.1}$$

$$\Delta OPT_t = \alpha_2 + \sum_{i=k}^{k} \alpha_{21}\Delta OPT_{t-i} + \sum_{i=1}^{k} \alpha_{22}\Delta HC_{t-i} + \sum_{i=1}^{k} \alpha_{23}\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{24}\Delta DOMI_{t-i} + \sum_{i=1}^{k} \alpha_{25}\Delta EG_{t-i} + \beta_2 D_t + \varphi_2 EC_{t-2} + \mu_{OPE} \tag{3.3.2}$$

$$\Delta FDI_t = \alpha_3 + \sum_{i=k}^{k} \alpha_{31}\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{32}\Delta OPT_{t-i} + \sum_{i=1}^{k} \alpha_{33}\Delta HC_{t-i} + \sum_{i=1}^{k} \alpha_{34}\Delta DOMI_{t-i} + \sum_{i=1}^{k} \alpha_{35}\Delta EG_{t-i} + \beta_3 D_t + \varphi_1 EC_{t-3} + \mu_{OPE} \tag{3.3.3}$$

$$\Delta DOMI_t = \alpha_4 + \sum_{i=k}^{k} \alpha_{41}\Delta DOMI_{t-i} + \sum_{i=1}^{k} \alpha_{42}\Delta OPT_{t-i} + \sum_{i=1}^{k} \alpha_{43}\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{44}\Delta HC_{t-i} + \sum_{i=1}^{k} \alpha_{45}\Delta EG_{t-i} + \beta_4 D_t + \varphi_4 EC_{t-4} + \mu_{DOMI} \tag{3.3.4}$$

$$\Delta EG_t = \alpha_5 + \sum_{i=k}^{k} \alpha_{51}\Delta EG_{t-i} + \sum_{i=1}^{k} \alpha_{52}\Delta OPT_{t-i} + \sum_{i=1}^{k} \alpha_{53}\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{54}\Delta DOMI_{t-i} + \sum_{i=1}^{k} \alpha_{55}\Delta HC_{t-i} + \beta_5 D_t + \varphi_5 EC_{t-5} + \mu_{EG} \tag{3.3.5}$$

Where all the variables are the same as defined in Equation 3.1 above. The term ε_{t-1} is the error correction term. D_t, α_t and β_t are defined as the centred seasonal dummy and

parameters. Δ and μ are the first difference operator and the white noise disturbance terms, respectively.

4. Empirical Results

Table 1 presents the results of the ADF unit root test for all selected variables. Column 1 to 3 of Table 1 presents the results of model 1 (Equation 4.1.1), model 2 (Equation 4.1.2) and model 3 (Equation 4.1.3), respectively. The results of Table 1 indicate that all six variables are non-stationary at a level except the gross domestic capital formation series. Table 1 further reveals that gross domestic capital formation is also non-stationary at level using model 1 (γ = 0.78, p >.05) and model 2 (γ = -1.02, p >.05). However, this series is stationary using model 3 (γ = -4.15, p <.01). Then, we extend our unit root analysis by taking first differences of all series using all three models. The bottom part of Table 1 indicates that all time-series variables become stationary at first differences using all three models. Thus, it is determined that variables of time series are integrated of the same level.

Table 1. ADF Test for Checking Unit Roots

Variables	Model-1 (1) With no constant and no trend	Model-2 (2) With constant and no trend	Model-3 (3) With constant and trend
ADF on level			
HC	2.64	2.62	-1.21
OPT	3.52	2.50	0.54
FDI	6.59	5.59	3.05
DOMI	0.78	-1.02	-4.15***
EG	-3.30	2.17	-0.95
EXR	0.93	0.79	-2.30
ADF test on 1st difference			
HC	-4.11***	-4.69***	-4.01***
OPT	0.00***	-4.89***	3.89**
FDI	1.16 ***	0.408***	-5.29***
DOMI	-3.86***	-4.11***	-3.97**
EG	-1.12***	-2.96**	-4.05***
EXR	0.34***	-0.64 ***	-5.93*

*Note: ***, **, * denotes significance at the 1 per cent, 5 per cent and 10 per cent levels.*

The results of unit root analysis reveal that all the economic variables are integrated of the same order. Therefore, we proceed to test the long-run association between the variable using Johansen and Jessulius (1992) approach as elaborated in Section 3.2 above. We apply the Akaike Information Criterion (AIC) criterion for the appropriate lag section. Table 2 present the outcomes of the rank test indicating the existence of 2 vectors co-integration for 1% and 5 % level, respectively. This shows all five variables are associated in the long run, which is consistent with the different previous empirical shreds of evidence. For the similar empirical evidences, see the Tanna and Topaiboul (20015), Benhabib and Spiegel (1994), Romer (1989), Gemmell, (1996), Shahbaz (2012), Kalaitzi (2015), Borensztein et al. (1998), Li et al. (1998), Lim and McAleer (2002), Liu (2002), Makki and Somwaru (2004), Ramirez (2000, and Sun (1998).

Table 2. The Test of Johansen Co-integration

Null-H_0	Alternative-H_1	λ (trace)	5% CV	λ (max)	5% CV
Rank = 0	r ≥ 1	141.66**	68.81	72.03**	33.87
Rank ≤ 1	r ≥ 2	69.63**	47.85	37.19**	27.58
Rank ≤ 2	r ≥ 3	32.43**	29.79	24.99**	21.13
Rank ≤ 3	r ≥ 4	7.44	15.49	6.90	14.26
Rank ≤ 4	r ≥ 5	0.53	3.84	0.53	3.84

*Note: * and ** denote null hypothesis rejection at 5 per cent and 1 per cent.*

Following our econometric methodology, we extend our analysis to discover causal association among stationary time series (i.e. first difference for human capital, foreign direct investment, the openness of trade, gross domestic capital formation, exchange rate and economic growth). Table 3 offers results of Pairwise Granger Causality Test using five lags. For the appropriate lag selection, we apply the Akaike Information Criterion (AIC) criterion throughout this empirical investigation. The results of Table 3 reveal that bidirectional causality exists between (1) human capital and trade openness, (2) human capital and economic growth, and (3) foreign direct investment and trade openness. Table 3 further confirms that unidirectional causality running from (1) human capital to foreign direct investment, (2) trade openness to domestic investment, (3) trade openness to economic growth, (4) foreign direct investment to economic growth, (5) domestic investment to foreign direct investment, (6) domestic investment to economic growth, and finally (7) economic growth to human capital in the long run.

Table 3. Results of Granger Causality Test among HC, OPT, FDI, DOMI, EG and EXR

DV	ΔHC	ΔOPT	ΔFDI	ΔDOMI	ΔEG	ΔEXR
(1)	(2)	(3)	(4)	(5)	(6)	(7)

DV	ΔHC	ΔOPT	ΔFDI	ΔDOMI	ΔEG	ΔEXR
ΔHC		24.09***	1.81	0.50	3.58*	8.77***
ΔOPT	6.98***		14.53***	1.30	0.79	4.29**
ΔFDI	22.64***	91.98***		4.16**	1.32	4.46**
ΔDOMI	1.77	11.44***	1.68		0.59	4.19*
ΔEG	6.75***	5.45**	6.37***	12.62***		2.82*
ΔEXR	9.58***	13.59***	7.12***	9.66***	2.00	

*Note: * and ** reject the null hypothesis at 5 per cent and 1 per cent, respectively. Δ is the first difference parameter. DV indicates the dependent variable.*

These results reveal that human capital and domestic investment influence economic growth through FDI. These results are consistent with the previous studies (see Carkovic & Levine, 2005; Hermes & Lensink, 2003; Benhabib & Spiegel, 1994; Romer, 1989; Gemmell, 1996 Borensztein, Gregorio & Lee, 1998; Li, Liu & Rebelo, 1998; Lim & McAleer, 2002; Liu, 2002; Makki & Somwaru, 2004; Ramirez, 2000; and Sun, 1998). More specifically, Hermes and Lensink (2003) focused on the economic growth of the recipient country. We use inflow of foreign development investment for this empirical investigation. This channel also works through the enhancement of technological changes through the spillover effects of human capital development (Engelbrecht, 2002). These theoretical aspects are also evident from the first part of our empirical investigation where we find the long-term association between human capital, foreign direct investment, trade and the economic growth (also see Alfaro, Chanda, Kalemli-Ozcan & Sayek, 2004). The second most obvious finding to emerge from the analysis is that trade openness influences economic growth through domestic investment. These pieces of evidence are consistent with the existing literature (see Shahbaz, 2012; Kalaitzi, 2015; Makki & Somwaru, 2004). Further, the economic growth Granger causes human capital in Pakistan in the long run.

Table 4 presents the results of the temporal causality derived from the vector error correction model. These results indicate that none of the statistics found significant at 5 per cent level of significance. In all cases, the test statistic falls in the non-rejection region, indicating that the system model is correctly specified. R-squared statistics are 87 per cent, 95 per cent, 83 per cent, 86 per cent and 65 per cent for models (6), (7), (8), (9) and (10) respectively. For the appropriate lag selection, we Akaike information criteria and Schwartz information criteria, and five lags are the appropriate lags.

Table 4. Results of Temporal Causality VECM

Dependent variables	ΔHC_t	ΔOPT_t	$\Delta DOMI_t$	ΔFDI_t	ΔEG_t
Adj-R^2	0.87	0.95	0.83	0.86	0.65

Autocorrelation test
LM (1), $\chi_9^2 = 47.13$, P value = 0.04; LM (8), $\chi_9^2 = 54.53$, P Value = 0.06
Test of Normality $\chi_3^2 = 27.30$, P value = 0.02

*Note: * and ** reject the null hypothesis at 5 per cent and 1 per cent, respectively. Δ is the first difference parameter.*

The present results are significant in at least two major respects — first, human capital larger influence on growth as compared to the investment. Second, high growth will create more employment opportunities, a higher level of income and earnings, which leads to more investment for human capital. Results indicate that trade openness has a significant impact on domestic investment and growth; the same results are reported by Warner (1997). This result leads to support the theory that human capital can have an important impact on openness and investment, also long-run economic growth positively related to human capital, FDI, and trade openness. These results are consistent with Majid and Karimzadeh (2013). Domestic investment is found one of the key factors for promoting long-run economic growth in Pakistan, and these findings are in line with the findings of Tawiri (2010).

5. Conclusion

This paper investigates causal links between human capital, foreign direct investment (FDI), trade openness, domestic investment, and economic growth for Pakistan. For this purpose, we apply Johansen and Juselius co-integration, Granger causality, and vector error correction model (VECM) using annual data from 1980 to 2017 in a multivariate VAR framework. The findings conclude that many factors affecting the growth of the economy for Pakistan, especially trade with other countries, human capital, domestic and foreign investment. The study verifies the hypothesis that human capital brings an inflow of foreign direct investment, and trade enhances domestic investment, which in turn brings economic prosperity in the economy. Having skilled and expert human capital and opening borders for the trade brings stable growth in the economy. So, it is clear from the results of this empirical investigation that human capital and trade openness increases domestic and foreign investment and leads to economic growth. Therefore, proper policies should be adopted to simulate the impact of human capital on economic growth. More specifically, the government should focus on education at the local as well as the federal level. Vocational institutions in Pakistan need more attention to play their positive roles in the development of human skills. The government should focus on creating a favourable environment for foreign investors.

There is abundant room for further progress in determining the causal links between these economic variables and the economic growth at the provincial levels since the economic and social diversity exists in Pakistan. Further, this analysis can be extended to investigate the short-run association between these economic variables and the economic growth using quarterly data.

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